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Unsaturated Groundwater Flow beneath Upper Mortandad Canyon, Los Alamos, New Mexico

Author(s):

David Carl Dander

Water Quality and Hydrology Group,

ESH-18,

Los Alamos National Laboratory

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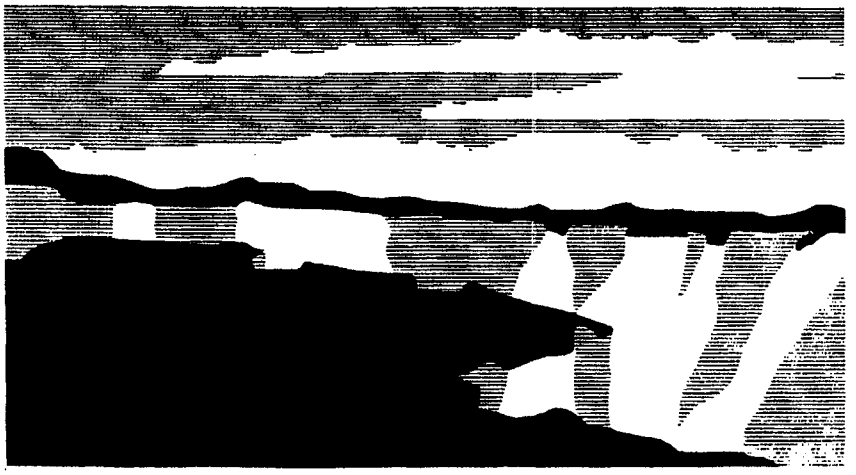

Los Alamos
NATIONAL LABORATORY

UNSATURATED GROUNDWATER FLOW BENEATH UPPER MORTANDAD CANYON, LOS ALAMOS, NEW MEXICO

by

David Carl Dander

A Thesis Submitted to the Faculty of the

DEPARTMENT OF HYDROLOGY AND WATER RESOURCES

In Partial Fulfillment of the Requirements

For the Degree of

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In the Graduate College

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ABSTRACT

Mortandad Canyon is a discharge site for treated industrial effluents containing radionuclides and other chemicals at Los Alamos National Laboratory, New Mexico. This study was conducted to develop an understanding of the unsaturated hydrologic behavior below the canyon floor. The main goal of this study was to evaluate the hypothetical performance of the vadose zone above the water table. Numerical simulations of unsaturated groundwater flow at the site were conducted using the Finite Element Heat and Mass Transfer (FEHM) code. A two-dimensional cross-section along the canyon's axis was used to model flow between an alluvial groundwater system and the regional aquifer approximately 300 m below. Using recharge estimated from a water budget developed in 1967, the simulations showed waters from the perched water table reaching the regional aquifer in 13.8 years, much faster than previously thought. Additionally, simulations indicate that saturation is occurring in the Guaje pumice bed and that the Tshirege Unit 1B is near saturation. Lithologic boundaries between the eight materials play an important role in flow and solute transport within the system. Horizontal flow is shown to occur in three thin zones above capillary barriers; however, vertical flow dominates the system. Other simulations were conducted to examine the effects of changing system parameters such as varying recharge inputs, varying the distribution of recharge, and bypassing fast-path fractured basalt of uncertain extent and properties. System sensitivity was also explored by changing model parameters with respect to size and types of grids and domains, and the presence of dipping stratigraphy.

STATEMENT BY AUTHOR

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SIGNED: _____

APPROVAL BY THESIS DIRECTORS

This thesis has been approved on the date shown below:

_____ _____

Dr. James E. Smith
Adjunct Assistant Professor
of Hydrology and Water Resources

Date

_____ _____

Dr. Thomas Maddock III.
Professor of Hydrology and Water Resources

Date

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Contributors	Affiliation	Summary of Contribution
James Smith	UA, HWR	Thesis supervisor, committee member
Thomas Maddock III	UA, HWR	Academic supervisor, committee member
Arthur Warrick	UA, SWES	Thesis committee member
David Rogers	LANL, ESH-18	Research advisement/supervisor, committee member
Steve Rae	LANL, ESH-18	Funding arrangements
Bruce Gallaher	LANL, ESH-18	Funding arrangements, Hydrology guidance
Steve McLin	LANL, ESH-18	Hydrology guidance
Ernestine Martinez	LANL, ESH-18	Clerical assistance
Chris McLean	LANL, ESH-18	Computing and editorial assistance
Ramon Naranjo	LANL, ESH-18	Technical and editorial assistance
Larry Pratt	LANL, ESH-18	Technical and editorial assistance
William Turney	LANL, ESH-18	Technical and editorial assistance
Bill Purtymun	LANL, ESH-18	Research and x-section development assistance
Carl Gable	LANL, EES-5	Grid, code output, and FEHM assistance
Katherine Birdsell	LANL, EES-5	Hydrology and modeling knowledge
Andy Wolfsburg	LANL, EES-5	FEHM code support, Modeling guidance
George Zyvoloski	LANL, EES-5	FEHM code support
Bruce Robinson	LANL, EES-5	FEHM code support
Lynn McDonald	LANL, EES-5	Computing assistance
Phil Stauffer	LANL, EES-5	FEHM code support, Modeling guidance
Daniel Tartakovsky	LANL, EES-5	Grid and modeling assistance
Guy Romer	LANL, EES-5	FEHM code support, Modeling guidance
Alan Stoker	LANL, SAIC	Research and x-section development assistance
Richard Koch	LANL, SAIC	Research and x-section development assistance
Patrick Longmire	LANL, CST-7	Research and cross-section development assistance
David Broxton	LANL, EES-1	Research and cross-section development assistance
Josh Smith	LANL, CST-DO	Technical editing and illustration assistance
Corrie Thies	UA, HWR	Editing Assistance
Terrie Thompson	UA, HWR	Academic Advisement and Clerical assistance
Carol Johnson	Friend, PC support	Assistance with home computing problems
Robert & Carla Dander	Parents, family	Financial assistance, use of computer/other resources