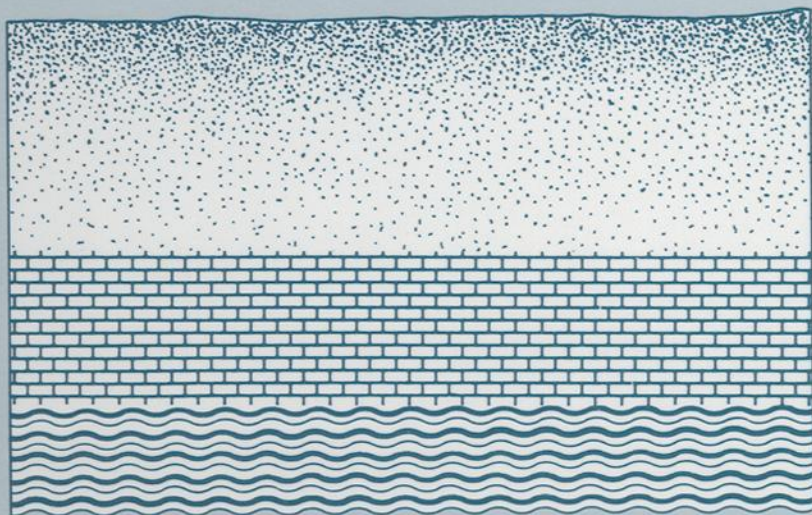


# GROUND WATER AND VADOSE ZONE MONITORING



NIELSEN/JOHNSON, *editors*

 STP 1053

**STP 1053**

# ***Ground Water and Vadose Zone Monitoring***

*David M. Nielsen and A. Ivan Johnson, editors*



ASTM  
1916 Race Street  
Philadelphia, PA 19103

## **Library of Congress Cataloging-in-Publication Data**

Ground water and vadose zone monitoring / David M. Nielsen and A. Ivan Johnson, editors.

(STP ; 1053)

Papers presented at an ASTM symposium held in Albuquerque in Jan. 1988.

ISBN 0-8031-1275-0

1. Water, Underground—Quality—Measurement—Congresses. 2. Zone of aeration—Congresses. I. Nielsen, David M. II. Johnson, A.

I. (Arnold Ivan), 1919- . III. American Society for Testing and Materials. IV. Series: ASTM special technical publications ; 1053.

TD426.G68 1989

628.1'61—dc20

89-17992

CIP

**Copyright © by AMERICAN SOCIETY FOR TESTING AND MATERIALS 1990**

### **NOTE**

The Society is not responsible, as a body,  
for the statements and opinions  
advanced in this publication.

### **Peer Review Policy**

Each paper published in this volume was evaluated by three peer reviewers. The authors addressed all of the reviewers' comments to the satisfaction of both the technical editor(s) and the ASTM Committee on Publications.

The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of these peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution of time and effort on behalf of ASTM.

Printed in Ann Arbor, MI  
January 1990  
Second Printing, Philadelphia, PA  
May 1992

## Foreword

This publication, *Ground Water and Vadose Zone Monitoring*, contains papers presented at the symposium on Standards Development for Ground Water and Vadose Zone Monitoring Investigations, which was held on 27–29 Jan. 1988 in Albuquerque, New Mexico. The symposium was sponsored by ASTM Subcommittee D18.21 on Ground Water Monitoring, a subcommittee of ASTM Committee D-18 on Soil and Rock, and was developed in cooperation with the U.S. Environmental Protection Agency's Environmental Monitoring Systems Laboratory and the U.S. Geological Survey's Office of Water Data Coordination. David M. Nielsen, of Blasland, Bouck & Lee, presided as chairman of the symposium and also served as editor of this publication. In addition, A. Ivan Johnson, of A. Ivan Johnson, Inc., also served as editor of this publication.

# Contents

<b>Overview</b>	<b>1</b>
-----------------	----------

## VADOSE ZONE MONITORING

<b>Methods for Sampling Fluids in the Vadose Zone—</b> L. G. WILSON	<b>7</b>
<b>Monitoring of Immiscible Contaminants in the Vadose Zone—</b> THOMAS P. BALLESTERO, SUSAN A. McHUGH, AND NANCY E. KINNER	<b>25</b>
<b>Tensiometers—Theory, Construction, and Use—</b> DAVID I. STANNARD	<b>34</b>

## DRILLING, DESIGN, DEVELOPMENT, AND REHABILITATION OF MONITORING WELLS

<b>Monitor Well Drilling and Testing in Urban Environments—</b> STEPHEN A. SMITH	<b>55</b>
<b>Rationale for the Design of Monitoring Well Screens and Filter Packs—</b> RONALD SCHALLA AND WALLACE H. WALTERS	<b>64</b>
<b>Experimental Screen Design for More Sediment-Free Sampling—</b> CHARLES A. RICH AND BRUCE M. BECK	<b>76</b>
<b>Monitoring Well Development—Why and How—</b> DAVID L. KILL	<b>82</b>
<b>Monitoring Well Rehabilitation Using the Surge Block Technique—</b> JOHN E. SEVEE AND PETER M. MAHER	<b>91</b>
<b>Monitoring Wells: Maintenance, Rehabilitation, and Abandonment—</b> DUANE L. WINEGARDNER	<b>98</b>
<b>Sorption of Aromatic Hydrocarbons by Materials Used in Construction of Ground-Water Sampling Wells—</b> ROBERT W. GILLHAM AND STEPHANIE F. O'HANNESIN	<b>108</b>

## AQUIFER HYDRAULIC PROPERTIES AND WATER-LEVEL DATA COLLECTION

<b>Selection of Single-Well Hydraulic Test Methods for Monitoring Wells—</b> CURTIS A. KRAEMER, JOHN B. HANKINS, AND CARL J. MOHRBACHER	<b>125</b>
--	------------

<b>Hydraulic Conductivity Determinations in Unlithified Glacial and Fluvial Materials—KENNETH R. BRADBURY AND MAUREEN A. MULDOON</b>	138
<b>Comparison of Slug Test Methodologies for Determination of Hydraulic Conductivity in Fine-Grained Sediments—BEVERLY L. HERZOG AND WALTER J. MORSE</b>	152
<b>Methods for Evaluating Short-Term Fluctuations in Ground Water Levels—STEVEN P. SAYKO, KAREN L. EKSTROM, AND RUDOLPH M. SCHULLER</b>	165
<b>Water Level Monitoring—Achievable Accuracy and Precision—H. RANDY SWEET, GERRITT ROSENTHAL, AND DOROTHY F. ATWOOD</b>	178
<b>Presentation of Water Level Data—ROGER J. HENNING</b>	193

#### MONITORING WELL PURGING AND GROUND-WATER SAMPLING

<b>A Comparison of Two Multiple-Level Ground-Water Monitoring Systems—W. R. RIDGWAY AND D. LARSEN</b>	213
<b>Total Versus Dissolved Metals: Implications for Preservation and Filtration—JAMES D. PENNINO</b>	238
<b>How Flat Is Flat?—Termination of Remedial Ground-Water Pumping—G. M. SPREIZER, D. MAXIM, N. VALKENBURG, AND M. HAUPTMANN</b>	247
<b>Flexible Selection of Statistical Discrimination Tests for Field-Monitored Data—EDWARD A. McBEAN AND FRANK A. ROVERS</b>	256
<b><i>In Situ</i> Analysis of Benzene, Ethylbenzene, Toluene, and Xylenes (BTEX) Using Fiber Optics—WAYNE CHUDYK, KENNETH POHLIG, KOSTA EXARHOULAKOS, JEAN HOLSINGER, AND NICOLA RICO</b>	266

#### MONITORING IN KARST

<b>Special Problems of Ground-Water Monitoring in Karst Terranes—JAMES F. QUINLAN</b>	275
---	-----

#### INDEXES

<b>Author Index</b>	307
<b>Subject Index</b>	309

ISBN 0-8031-1275-0