

ACCESS PRACTICAL PROBLEMS IN GROUNDWATER HYDROLOGY MANUAL

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Practical Problems In Groundwater Hydrology Manual Introduction

A Practical Manual on Groundwater Modelling

Due to the increasing demand for adequate water supply caused by the augmenting global population, groundwater production has acquired a new importance. In many areas, surface waters are not available in sufficient quantity or quality. Thus, an increasing demand for groundwater has resulted. However, the residence of time of groundwater can be of the order of thousands of years while surface waters is of the order of days. Therefore, substantially more attention is warranted for transport processes and pollution remediation in groundwater than for surface waters. Similarly, pollution remediation problems in groundwater are generally complex. This excellent, timely resource covers the field of groundwater from an engineering perspective, comprehensively addressing the range of subjects related to subsurface hydrology. It provides a practical treatment of the flow of groundwater, the transport of substances, the construction of wells and well fields, the production of groundwater, and site characterization and remediation of groundwater pollution. No other reference specializes in groundwater engineering to such a broad range of subjects. Its use extends to: The engineer designing a well or well field The engineer designing or operating a landfill facility for municipal or hazardous wastes The hydrogeologist investigating a contaminant plume The engineer examining the remediation of a groundwater pollution problem The engineer or lawyer studying the laws and regulations related to groundwater quality The scientist analyzing the mechanics of solute transport The geohydrologist assessing the regional modeling of aquifers The geophysicist determining the characterization of an aquifer The cartographer mapping aquifer characteristics The practitioner planning a monitoring network

The Handbook of Groundwater Engineering

With an emphasis on methodology, this reference provides a comprehensive examination of water movement as well as the movement of various pollutants in the earth's subsurface. The multidisciplinary approach integrates earth science, fluid mechanics, mathematics, statistics, and chemistry. Ideal for both professionals and students, this is a practical guide to the practices, procedures, and rules for dealing with groundwater.

Ground Water Manual

This new edition adds several new chapters and is thoroughly updated to include data on new topics such as hydraulic fracturing, CO₂ sequestration, sustainable groundwater management, and more. Providing a complete treatment of the theory and practice of groundwater engineering, this new handbook also presents a current and detailed review of how to model the flow of water and the transport of contaminants both in the unsaturated and saturated zones, covers the protection of groundwater, and the remediation of contaminated groundwater.

Ground Water Manual

The over-exploitation of groundwater and marked changes in climate over recent decades has led to unacceptable declines in groundwater resources. Under the likely scarcity of available water resources in the near future, it is critical to quantify and manage the available water resources. With increasing demand for potable water for human consumption, agriculture, and industrial uses, the need to evaluate the groundwater development, management, and productivity of aquifers also increases. *Laboratory Manual for Groundwater, Wells, and Pumps* serves as a valuable resource and provides a multi-disciplinary overview for academics, administrators, scientists, policymakers, and professionals involved in managing sustainable groundwater development programs. It includes practical guidance on the measurement of groundwater flow, soil properties, aquifer properties, wells and their design, as well as the latest state-of-the-art information on pumps and their testing, and groundwater modeling. Features: Covers basics of groundwater engineering, advanced methodologies, and their applications and groundwater modeling Examines groundwater exploration, planning and designing, and methods for formulating strategies for sustainable management and development Serves as a reference for practitioners on practical applications and frequently occurring issues of groundwater investigations, development, and management.

Ground Water Manual

For courses in Groundwater/Hydrogeology or Ocean and Water Resources. This is the first groundwater hydrology book composed entirely of genuine, applied problems that cover the range of concepts addressed in most groundwater hydrology courses. Twenty-one exercises help develop students' quantitative skills, require data analysis and concept exploration, and incorporate current image and graphic technologies to enhance learning.

Subsurface Hydrology

This manual has been prepared as a guide to field personnel in the more practical aspects and commonly encountered problems of ground-water investigations, development, and management. Information is presented concerning such aspects as ground-water occurrence and movement, well-aquifer relationships, ground-water investigations, aquifer test analyses, estimating aquifer yield, data collection, and geophysical investigations. In addition, permeability tests, well design, dewatering systems, well specification and drilling, well sterilization, pumps, and other aspects have been discussed. An extensive bibliography has also been included. The manual has been developed over a period of years, and its many contributors have diversified technical backgrounds. Contributors include personnel from the JBureau of Reclamation Engineering and Research Center (now Technical Service Center) and field offices, other agencies, foreign governments, and many individual scientists and engineers.

Ground Water Manual

Dramatically Improve Your Hydrogeology Field Skills and Master New Advances in Groundwater Science The Second Edition of *Hydrogeology Field Manual* provides the latest information on applied applications in groundwater sampling and water-quality assessment, aquifer characterization, contamination issues, karst applications, and more. The book includes actual procedures, real-world decisions, and many examples and case studies to help you understand the occurrence and movement of groundwater in a variety of geologic settings. Filled with tips, tricks-of-the-trade, and anecdotes from seasoned field hydrogeologists, the book explains how to gain instant expertise in most field methodologies and expand your abilities for data interpretation ...and other essential skills. The Second Edition of *Hydrogeology Field Manual* features: Sage advice on how to collect hydrogeologic field data Guidance on drilling methods, safety, and work with drilling contractors A practical description of slug testing Effective site characterization methods Expert advice on monitoring-well design Over 250 skills-building illustrations and photos Two new chapters on karst hydrogeology, including characterization and performing dye tracer tests All chapters have new

material, including more examples and worked problems. If you are still in college, a recent graduate, or a working professional needing a ready reference to assist you with field-related matters, this is your book. Experienced hydrogeologists and those in related fields will also welcome the practical time-saving and trouble-avoidance tips. Capitalize on Cutting-Edge Techniques of Field Hydrogeology • Field Hydrogeology • The Geology of Hydrogeology • Aquifer Properties • Basic Geophysics of the Shallow Subsurface • Groundwater Flow • Groundwater/Surface Water Interaction • Water Chemistry Sampling and Results • Drilling and Well Completion • Pumping Tests • Aquifer Hydraulics • Slug Testing • Vadose Zone • Karst Hydrogeology • Tracer Tests • Dye Trace Testing

The Handbook of Groundwater Engineering, Third Edition

Practical Handbook of Ground Water Monitoring covers the complete spectrum of state-of-the-science technology applied to investigations of ground water quality. The emphasis of the book is on the practical application of current technology, and minimum theory is discussed. The subject of ground water monitoring is covered in great detail, from the Federal regulations that require monitoring to the various direct and indirect methods of investigating the subsurface - to the analysis and interpretations of complex sets of water quality data. All aspects of ground water quality investigations, including site assessment techniques, health and safety considerations and equipment decontamination, are dealt with in a logical order that will allow the reader to follow along in the same thought progression as a field project. The experiences and expertise of more than 30 practicing scientists and engineers combine to make this book the most comprehensive reference compiled on the topic of ground water monitoring.

Laboratory Manual for Groundwater, Wells, and Pumps

Although microorganisms can be found virtually anywhere on our planet, from clouds to soils to oceans, they are often poorly understood when examining issues related to groundwater and water wells. Focusing on the impact of microorganisms on groundwater and water wells, Practical Manual of Groundwater Microbiology, Second Edition presents over 75% new material to offer a comprehensive, up-to-date guide on the subject. The first eight chapters provide an overview of microbiology and its importance in groundwaters, exploring natural filters that develop around wells, various bacteria, molds, viruses, sampling procedures, biofouling, biofilms, sequestration strategies, rehabilitation/regeneration practices, and flooding risks. The book also contains a chapter that functions as a self-contained guide, with 79 descriptive illustrations of important concepts integral to the understanding of microbes in groundwater. Numerous appendices, some new to this edition, supply detailed information on more specialized topics, such as microbiological test methods, water sample protocols, regulatory considerations concerning the use of phosphorus in wells, and the application of vegetable oil to lubricate pumps. Chronicling the significant progress made in the field since the publication of its predecessor, this edition provides practical approaches for evaluating the effects of microorganisms and their activities on groundwater and water wells.

Practical Problems in Groundwater Hydrology

Groundwater Science, Second Edition—winner of a 2014 Textbook Excellence Award (Texty) from The Text and Academic Authors Association—covers groundwater's role in the hydrologic cycle and in water supply, contamination, and construction issues. It is a valuable resource for students and instructors in the geosciences (with focuses in hydrology, hydrogeology, and environmental science), and as a reference work for professional researchers. This interdisciplinary text weaves important methods and applications from the disciplines of physics, chemistry, mathematics, geology, biology, and environmental science, introducing you to the mathematical modeling and contaminant flow of groundwater. New to the Second Edition: New chapter on subsurface heat flow and geothermal systems Expanded content on well construction and design, surface water hydrology, groundwater/ surface water interaction, slug tests, pumping tests, and mounding analysis. Updated discussions of groundwater modeling, calibration, parameter estimation, and uncertainty Free software tools for slug test analysis, pumping test analysis, and aquifer modeling Lists of key terms and

chapter contents at the start of each chapter Expanded end-of-chapter problems, including more conceptual questions Winner of a 2014 Texty Award from the Text and Academic Authors Association Features two-color figures Includes homework problems at the end of each chapter and worked examples throughout Provides a companion website with videos of field exploration and contaminant migration experiments, PDF files of USGS reports, and data files for homework problems Offers PowerPoint slides and solution manual for adopting faculty

Ground Water Manual : A Water Resources Technical Publication

Linking theory and application in a way that is clear and understandable, *Groundwater Lowering in Construction: A Practical Guide to Dewatering, Second Edition* uses the authors' extensive engineering experience to offer practical guidance on the planning, design, and implementation of groundwater control systems under real conditions. Discover engineering methods that can help you improve working conditions, increase project viability, and reduce excavation costs. In the decade since publication of this book's first edition, groundwater lowering and dewatering activities have been increasingly integrated into the wider ground engineering schemes on major excavations to help provide stable and workable conditions for construction below groundwater level. Consequently, many engineering ventures now require a more in-depth assessment of potential environmental impacts of dewatering and groundwater control, and this book details the latest best practices to evaluate and address them. Includes New Chapters Covering: Cutoff methods used for groundwater exclusion Issues associated with permanent or long-term groundwater control systems Groundwater control technologies used on contaminated sites Methods needed to understand, predict, and mitigate potential environmental impacts of groundwater control works Updated to reflect the crucial technological and application advances shaping construction processes, this book contains valuable direction that can give you a true competitive advantage in the planning and execution of temporary and permanent dewatering works. The authors cover cutting-edge methods and key subjects, such as the history of dewatering, working on contaminated sites, site investigation techniques, and operation and maintenance issues, including health, safety, and legal aspects. Written for practising engineers and geologists as well as postgraduate engineering students, this updated manual on design and practice provides numerous case histories and extensive references to enhance understanding.

Ground-water Hydrology and Hydraulics

A practical guide to problems of ground water control. Starts with a theoretical discussion based on soil mechanics, hydrology, geology, and fluid mechanics. Covers all practical aspects including costs, specifications, and contracts. Thoroughly illustrated with reference tables and charts.

Groundwater Manual

This laboratory manual is comprised of 14 laboratory experiments, covering topics of water quality, water treatment, groundwater hydrology, liquid static force, pipe flow, and open channel flow. These experiments are organized with a very logical flow to cover the related topics of environmental and hydraulics engineering within university-level courses. This state-of-the-art manual is divided into two sections--environmental engineering experiments and hydraulic engineering experiments--with seven experiments for each section. It provides the basic hands-on training for junior-year civil and environmental engineering students. In each experiment, fundamental theories in the topic area are revisited and mathematic equations are presented to guide practical applications of these theories. Tables, figures, graphs, and schematic illustrations are incorporated into the context to give a better understanding of concept development, experimental design, and data collection and recording. Each experiment ends with discussion topics and questions to help students better understand the content of the experiment. This manual mainly serves as a textbook for an environmental and hydraulics engineering laboratory course. Professionals and water/wastewater treatment plant managers may also find this manual of value for their daily jobs. In addition, students in related areas can use this manual as a reference and the general public may use it to

educate themselves on water quality testing and water flow.

Hydrogeology Field Manual, 2e

This handbook deals with the general field of groundwater from an engineering perspective, covering the several disciplines concerned with the design and control of flow and contaminant transport in groundwater. Each chapter is authored by a specialist in the topic treated, and special care has been taken to keep the literature up-to-date with recent developments and research in the field. An essential reference for advanced undergraduate and graduate students, for professional engineers and professionals in government regulatory agencies.

Practical Handbook of Ground-Water Monitoring

In recent years, the focus in groundwater studies has expanded to also include groundwater contamination and remediation studies as a part of resource evaluations. While there are other books on the subject, *Field Hydrogeology-A Guide for Site Investigations and Report Preparation* provides the first integrated presentation of the American Society of Testing Materials (ASTM) standards, US Geological Survey (USGS), and US Environmental Protection Agency (EPA) field techniques. It also includes access to a Web site that contains software for designing aquifer tests and aquifer-recharge experiments. Written by an author with more than 40 years of experience in hydrology and geology, this reference treats the subject from a field standpoint. Useful as a field guide and a textbook, it contains standard methods for planning and undertaking hydrogeologic investigations. It incorporates case studies, contains a glossary of field-hydrogeology technical terms, and provides a detailed list of ASTM standards and key hydrologic Web sites. The guide is based on ASTM standards, EPA, and US Department of Interior (DOI) field technical manuals. The text covers hydrogeologic fundamentals, conceptual models, planning an investigation, surface investigations, subsurface investigations, field inventory, stream flow measurements, water quality measurements, and report preparation. It includes more recent groundwater evaluation techniques such as tracing and isotope techniques. *Field Hydrogeology* will allow students and seasoned professionals to have a vast array of clearly written descriptive materials and an extensive source of references available at their fingertips. About the Author: John E. Moore, Ph.D., is a hydrogeologist at the USEPA Region 8 in Denver, Colorado. Dr. Moore is also an adjunct professor of hydrology at Metro State College in Denver and a consulting hydrologist. He has more than 40 years of experience in hydrogeology and geology as a researcher, teacher, and consultant. He is internationally recognized as an expert in these fields. Dr. Moore was deputy assistant chief hydrologist and field scientist with the USGS and served as a technical advisor to the USEPA and the U.S. House of Representatives. He is past president of the International Association of Hydrogeologists (IAH) and the American Institute of Hydrology (AIH) and is the chairman of the IAH Education Commission.

Practical Manual of Groundwater Microbiology, Second Edition

Existing and impending water shortages argue for improving water quantity and quality management. *Groundwater Optimization Handbook: Flow, Contaminant Transport, and Conjunctive Management* helps you formulate and solve groundwater optimization problems to ensure sustainable supplies of adequate quality and quantity. It shows you how to more effecti

Groundwater Science

Ground water is a source for drinking and industrial water supply and pollution created by active industrial sites which often cause social, health, and environmental problems. This groundwater eventually drains into adjacent water sources. *Filtration Materials for Groundwater: A Guide to Good Practice* presents the up-to-date technology of purification of polluted ground water, its treatment for industrial and human needs and the remediation of polluted sites. The book examines: Types of pollutants in ground water including the main inorganic and organic pollutants and their behaviour. Filtration materials for water treatment and principles

of their choice. How to choose suitable filtration materials according to targeted compounds and estimate its efficiency. Technologies for ground water treatment. Cost and risks estimation of treatment facilities. Lifetime, risks and cost estimation of technology. Examples of modern ongoing facilities for ground water treatment and polluted sites remediation. This book is of interest to scientists and engineer who deal with the problem of purification of ground water for different purposes and the remediation of polluted sites.

Groundwater Lowering in Construction

Well rehabilitation techniques have been the focus of major advancements in recent times. Environmental engineers can keep pace with those changes with the book *Water Well Rehabilitation*. Written from a microbiological viewpoint, the text outlines proven solutions to production problems in all types of wells. That perspective frequently yields new ideas and concepts, contrary to prevalent thoughts in mainstream literature on the subject. This is especially true in discussion of iron related bacterial sources, and details concerning unsafe bacterial samples and the contamination of wells.

Construction Dewatering

A synthesis of years of interdisciplinary research and practice, the second edition of this bestseller continues to serve as a primary resource for information on the assessment, remediation, and control of contamination on and below the ground surface. *Practical Handbook of Soil, Vadose Zone, and Ground-Water Contamination: Assessment, Prevention, and Remediation, Second Edition* includes important new developments in site characterization and soil and ground water remediation that have appeared since 1995. Presented in an easy-to-read style, this book serves as a comprehensive guide for conducting complex site investigations and identifying methods for effective soil and ground water cleanup. Remediation engineers, ground water and soil scientists, regulatory personnel, researchers, and field investigators can access the latest data and summary tables to illustrate key advantages and disadvantages of various remediation methods.

Environmental and Hydraulic Engineering Laboratory Manual

The purpose of this book is to bring together under one cover the principles of groundwater engineering. The concise format has produced a handy, comprehensive manual for professionals working in the groundwater industry. The author places emphasis on the application of theory and practical aspects of groundwater engineering. Well-cited references throughout the text guide you through the technology, scientific principles, and theoretical background of groundwater engineering. Exhaustive appendices contain quantitative data necessary for in-groundwater flow and contaminant migration equations. *Principles of Groundwater Engineering* is the state-of-the-art book that bridges the gap between groundwater theory and groundwater problem solving.

Handbook of Groundwater Engineering

Focusing on modeling applications, this outstanding reference provides a step-by-step, non-mathematical approach to constructing and using realistic workable groundwater models on a daily basis. Extensive detailed drawings, case studies, practical examples, and sample models illustrate important concepts. Includes data on hydrogeologic features and pollutants plus a glossary of terms.

Field Hydrogeology

Understanding the issues that have been encountered at other sites, and the steps that have led to successful resolution of these issues, can provide great help to those considering, planning, or implementing new groundwater recharge projects. Recent technical advances and operational experience have demonstrated that

well recharge is a feasible and cost effective method of artificially recharging natural aquifers. This practical guide reviews the technical constraints and issues that have been addressed and resolved through research and experience at many sites. The book presents aquifer storage recovery (ASR) technology and traces its evolution over the past 25 years in the United States. Procedures for groundwater recharge are presented, and selected case studies are examined. Drinking water quality standards and conversion factors are provided in the appendix for easy reference.

Solutions Manual to Accompany Groundwater Hydrology

An introduction to the principles and practices of soil and groundwater remediation Soil and Groundwater Remediation offers a comprehensive and up-to-date review of the principles, practices, and concepts of sustainability of soil and groundwater remediation. The book starts with an overview of the importance of groundwater resource/quality, contaminant sources/types, and the scope of soil and groundwater remediation. It then provides the essential components of soil and groundwater remediation with easy-to-understand design equations/calculations and the practical applications. The book contains information on remediation basics such as subsurface chemical behaviors, soil and groundwater hydrology and characterization, regulations, cost analysis, and risk assessment. The author explores various conventional and innovative remediation technologies, including pump-and-treat, soil vapor extraction, bioremediation, incineration, thermally enhanced techniques, soil washing/flushing, and permeable reactive barriers. The book also examines the modeling of groundwater flow and contaminant transport in saturated and unsaturated zones. This important book: Presents the current challenges of remediation practices Includes up-to-date information about the low-cost, risk-based, sustainable remediation practices, as well as institutional control and management Offers a balanced mix of the principles, practices, and sustainable concepts in soil and groundwater remediation Contains learning objectives, discussions of key theories, and example problems Provides illustrative case studies and recent research when remediation techniques are introduced Written for undergraduate seniors and graduate students in natural resource, earth science, environmental science/engineering, and environmental management, Soil and Groundwater Remediation is an authoritative guide to the principles and components of soil and groundwater remediation that is filled with worked and practice problems.

Groundwater Optimization Handbook

Master the latest advances in hydrogeology using this fully updated resource This thoroughly revised guide clearly explains cutting-edge hydrogeology techniques that can be applied in the field. Featuring contributions from leading experts, Practical Hydrogeology: Principles and Field Applications, Third Edition, shows how to plan and conduct site investigations, avoid pitfalls in the field, interpret a wide array of data types gathered, and prepare water-quality reports. You will get complete coverage of key procedures, including aquifer testing, groundwater sampling, water-quality assessment, aquifer characterization, and tracer tests. This third edition has been reorganized and expanded with up-to-date information, a new chapter, review questions, and real-world examples. Coverage includes:•Field hydrogeology•The geology of hydrogeology•Aquifer properties•Groundwater flow•Pumping tests•Slug testing•Aquifer hydraulics•Water chemistry sampling•Groundwater/surface-water interaction•Vadose-zone analysis•Karst hydrogeology and tracer tests•Drilling and well completion

Filtration Materials for Groundwater

Praise for the Second Edition: \"This is the book that the dewatering sector really needs – it is reliably based on sound theory and profound understanding of the physical processes, yet is presented in a very accessible and user-friendly manner. It draws on many, many decades of experience, and yet is utterly up to date. . . . It is a one-stop shop for the dewatering practitioner – who can nonetheless rest assured that the theoretical basis of the methods presented is flawless.\" — Professor Paul L. Younger, FGS, FICE, C.Geol., C.Eng., FEng, University of Glasgow, Scotland, UK \"The best reference on this topic available . . . and will prove useful to

a wide variety of readers ranging from junior construction engineers or dewatering contractors to theoretical hydrogeologists and environmental managers. It is rare that a book is able to bridge the gap between theoretical design guidance and practical application." — S.N. Sterling, University of Waterloo, Canada

The extensively updated *Groundwater Lowering in Construction: A Practical Guide to Dewatering*, 3rd Edition offers practical advice on all phases of groundwater control systems, from planning and design, through installation and maintenance, and ultimately decommissioning. The expertise provided in this book can help you improve working conditions, increase project viability, save time and reduce excavation costs. Designers and managers of construction and engineering projects are given the tools necessary to effectively control groundwater. The content is divided into three sections – Principles, Design and Construction. The Principles section explains the fundamentals of groundwater flow as it relates to civil engineering excavations. The Design section explores in extensive detail site investigation, permeability assessment methods and groundwater control strategies. Chapters in the Construction section describe dewatering and exclusion techniques, and examine the complete life cycle of a groundwater control scheme, including monitoring, maintenance and decommissioning. This section incorporates eleven case histories from the authors' casebook. The 3rd edition has been greatly revised and updated, and contains more than 200 new illustrations. The new content covers: Permeability of soils and rocks Groundwater problems for excavations in rock Groundwater control for tunnelling projects, such as shafts and cross passages Methods for assessing permeability Decommissioning of dewatering systems Optimisation of groundwater control schemes. The new, expanded content offers valuable direction that can give you a true competitive advantage in the planning and execution of temporary and permanent dewatering works for excavation and tunnelling. Written for practising engineers, geologists and construction managers, as well as postgraduate engineering students, this revamped manual on design and practice presents numerous case studies and extensive references to enhance understanding. Martin Preene is a groundwater consultant, based in the UK. He has more than 30 years' experience working on dewatering and groundwater control projects worldwide. The late Pat Cashman was the leading British exponent of groundwater control for his generation, championing a practical and straightforward approach for more than forty years.

Water Well Rehabilitation

Rainfall-Runoff Modelling: The Primer, Second Edition is the follow-up of this popular and authoritative text, first published in 2001. The book provides both a primer for the novice and detailed descriptions of techniques for more advanced practitioners, covering rainfall-runoff models and their practical applications. This new edition extends these aims to include additional chapters dealing with prediction in ungauged basins, predicting residence time distributions, predicting the impacts of change and the next generation of hydrological models. Giving a comprehensive summary of available techniques based on established practices and recent research the book offers a thorough and accessible overview of the area. *Rainfall-Runoff Modelling: The Primer Second Edition* focuses on predicting hydrographs using models based on data and on representations of hydrological process. Dealing with the history of the development of rainfall-runoff models, uncertainty in model predictions, good and bad practice and ending with a look at how to predict future catchment hydrological responses this book provides an essential underpinning of rainfall-runoff modelling topics. Fully revised and updated version of this highly popular text Suitable for both novices in the area and for more advanced users and developers Written by a leading expert in the field Guide to internet sources for rainfall-runoff modelling software

Practical Handbook of Soil, Vadose Zone, and Ground-Water Contamination

Understanding groundwater recharge is essential for successful management of water resources and modeling fluid and contaminant transport within the subsurface. This book provides a critical evaluation of the theory and assumptions that underlie methods for estimating rates of groundwater recharge. Detailed explanations of the methods are provided - allowing readers to apply many of the techniques themselves without needing to consult additional references. Numerous practical examples highlight benefits and limitations of each method. Approximately 900 references allow advanced practitioners to pursue additional information on any

method. For the first time, theoretical and practical considerations for selecting and applying methods for estimating groundwater recharge are covered in a single volume with uniform presentation. Hydrogeologists, water-resource specialists, civil and agricultural engineers, earth and environmental scientists and agronomists will benefit from this informative and practical book. It can serve as the primary text for a graduate-level course on groundwater recharge or as an adjunct text for courses on groundwater hydrology or hydrogeology. For the benefit of students and instructors, problem sets of varying difficulty are available at http://wwwbrr.cr.usgs.gov/projects/GW_Unsat/Recharge_Book/

Measurement of Hydraulic Conductivity Distributions

This rigorous and comprehensive text provides fundamental information geared to students in either engineering or natural sciences courses dealing with groundwater. The first four chapters consider subsurface fluid flow, while the remaining twelve chapters cover subsurface contamination and pollutant transport. Charbeneau views the application of groundwater hydraulics and pollutant transport as a quantitative field. Although quantitative methods are exact, the fields of study are usually homogeneous; laboratory and field methods provide estimates for ideal (not real) fields. What impact does the use of ideal fields have on model predictions? The unknown answer places the study of subsurface flow of water and chemical mass transport in a prime position for continued research and this readily accessible text opens the door to that research. Outstanding features include: Comprehensive, rigorous, and highly accessible coverage Includes information on groundwater flow, well hydraulics, field methods for parameter estimation, hydrologic relationships between surface water and groundwater hydrology, mass transport of contaminants by advection, diffusion and dispersion, and special problems posed by nonaqueous phase liquids (oils). Strong focus on applications Empowers readers with knowledge and methodologies that they can use in real, day-to-day practices. Includes 66 worked examples and 178 problems integrated throughout. Examination of standard software being used in the industry today Exposes readers to the USGS MODFLOW model (the most widely used numerical simulation model for groundwater flow) and the USGS MOC3D. These models, together with a user interface (MFI), can be downloaded from the Internet.

Hydraulics of Wells

Aquifere (Grundwasserleiter) sind die Hauptquelle für Trinkwasser auf der ganzen Welt, und diese Wasserreserven vor Erschöpfung oder Verunreinigung zu schützen ist ein zentrales Anliegen. Dieses Buch kann als Lehrbuch oder Nachschlagewerk genutzt werden und bietet eine umfassende Einführung in die Hydraulik von wasserführenden Schichten und das Messen von deren Parametern. Es vermittelt Schritt für Schritt einen Einblick in Auslegung, Durchführung und Analyse einer kompletten Reihe von Tests, die üblicherweise verwendet werden. Es werden detaillierte Anwendungsbeispiele zu einer breiten Palette von Methoden zur Quelluntersuchung gegeben sowie praktische Anweisungen zur Analyse der gewonnenen Daten. Ein unverzichtbares, praxisorientiertes Nachschlagewerk für Experten und Studenten, die sich mit dem Problem der Grundwasserqualität und -quantität beschäftigen. (01/98)

Principles of Groundwater Engineering

The definitive practical guide to understanding and solving seepage and drainage problems Now in its third edition, this unique resource offers simple methods for analyzing and designing seepage and groundwater control systems for all major types of civil engineering works. Complete with solid coverage of seepage principles and flow net construction, this book is an invaluable aid to engineering professionals and students in mastering this vital subject. Seepage, Drainage, and Flow Nets, Third Edition, features: * Clear explanations of Darcy's law, permeability, and other core concepts * Seepage analyses and drainage designs for earth dams, levees, foundations, earth slopes, roads, airfields, streets, parking lots, and more * Information on contemporary topics, including "wick" drains, "fin" drains, and the protection of groundwaters from contamination * An assessment of computer solutions to seepage and drainage problems * Over 100 examples of flow nets, ranging from the simple to the complex --accompanied by step-by-step instructions *

Useful chapter references to facilitate further study.

A Practical Guide to Groundwater and Solute Transport Modeling

Groundwater Recharge and Wells

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