Course Description

Conducting aquifer tests in complex hydrogeologic settings such as heterogeneous or fractured media is a key element to site characterisation, water resources assessment and remediation system design.

Even when you are confident of the geologic conditions, you may have difficulty designing effective aquifer tests, running field equipment or selecting the best available model to analyze the test data. Despite proper planning, aquifer testing programs can lead to suspect data or unanswered questions after the field work is completed. Where can you turn to improve your approach and skills for aquifer testing?

Register now for this powerful three-day training course on aquifer testing design, field methods and data analysis techniques. This course will provide you with the knowledge to master aquifer testing from beginning to end.

Master State-of-the-Art Field and Analysis Procedures

- Learn to design effective aquifer test programs for a wide range of conditions (including low permeability confining units and fractured bedrock)
- Gain an advantage during your next aquifer test by mastering new procedures
- Discover new techniques for anticipating and resolving aquifer testing problems
- Review the hydrogeologic relationships by confident boring log correlations.

Learn Up-To-Date Slug Testing Procedures

- Learn to select and apply appropriate slug test models for different hydrogeologic settings and well configurations
- Maximize tests conducted in wells screened across the water table
- Find out how to recognize and account for the effects of noninstantaneous (noisy) test initiation and wellbore skin
- Discover the latest strategies for designing, conducting and analyzing tests in high-K media including oscillatory responses
- Master new approaches for decreasing test duration in low-K media
- Learn data collection and transfer using transducers and data loggers

Discover Recent Advances in Pumping Test Methods

- Learn to design, conduct and analyze pumping tests in confined, leaky, unconfined and fractured aquifers
- Master strategies for dealing with variable pumping rates, wellbore storage, partial penetration, well losses, wellbore skin and other issues
- Discover powerful diagnostic methods including derivative analysis that help you select appropriate pumping test models
- Gain an advantage by applying Agarwal's analysis method of recovery data
- Master the best procedures for field monitoring a pumping test
- Learn tips for analyzing constant-rate, step-drawdown and recovery tests

Instructors

Jim Butler, Ph.D., is the 2007 National Ground Water Association Darcy Lecturer and author of "The Design, Performance, and Analysis of Slug Tests" (Lewis Pub., 1998). Jim is Chief of the Geohydrogy Section at the Kansas Geological Survey.

Glenn Duffield is a hydrogeologist and the president of HydroSOLVE, Inc. He is the author of AQTESOLV, which for over 18 years has been the world's leading software for the analysis of aquifer tests.

Dan Kelleher, PG, CIPM, is a hydrogeologist and the president of Midwest GeoSciences Group.

Jim, Glenn and Dan are co-authors of the *Field Guide for Slug Testing and Data Analysis* (MidwestGeo, 2009), which is quickly becoming the standard reference at many companies and agencies for procedures for conducting slug tests. Each course attendee receives a free copy of the field guide.

Testimonials *(from previous courses in USA and Canada)*

"The entire course was extremely helpful. I learned more about aquifer testing in two days than in many years of practice. Excellent course. Excellent Instructors. Great Presentations. Engaging Speakers."
- Anthony Harding, Schnabel Engineering

"This workshop greatly helps to understand the application of the equations and models - it emphasizes practicality."
- Julie Weatherington-Rice, Bennett & Williams

"As a geologist, I have performed dozens – if not hundreds – of slug tests and aquifer pumping tests…. This course has tied together a lot of loose ends for me and I have gained valuable insight and knowledge. The (course session) about the set up of slug tests and aquifer tests and common problems and considerations was extremely helpful for me."
- Britt Callahan, PG, Senior Geologist

"Having my questions answered by the guys who wrote the book and developed the software was most valuable to me. "
- Thai Hubbard, Hydrogeologist, ARCADIS

"All-in-all, one of the best courses I've ever taken."
- Cynthia Gefvert, South Florida Water Management District

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Advances in Aquifer Testing for Improved Site Characterisation

New Concepts, Field Methods and Data Analysis Procedures

03 - 05 March 2010
(3 days) in Melbourne, Victoria

A professional education course

offered by
ACLCA Vic and the Midwest GeoSciences Group

Instructors Jim Butler, Ph.D., Glenn Duffield and Dan Kelleher

Advances in Aquifer Testing for Improved Site Characterisation

New Concepts, Field Methods and Data Analysis Procedures

Day 1: 03 March 2010

7:30-8:00 Registration
8:00-8:15 Introduction and Welcome
8:15-8:30 **Well Tests: What, When, Where and How**
- In-Situ Estimation of Hydraulic Conductivity
- Application to Hydrogeologic Site Characterisation

8:30-9:30 **General Design Guidelines for Slug Tests**
- Initiation Methods
- General Principles of Test Design
- Impact and Recognition of Incomplete Development

9:30-10:15 **Design of Tests in Low-K Media**
- New Approaches for Decreasing Test Duration

10:15-10:30 Morning Break
10:30-11:00 **Design of Tests in High-K Media**
- Inertia-Induced Response (Overdamped to Underdamped)
- Dependence on Slug Size
- Transducer Placement

11:00-11:20 **Tests in Direct Push Equipment**
- Small-Diameter Well Corrections

11:20-12N **Slug Tests: Additional Issues**
- Wells Screened Across the Water Table
- Fractured Formations
- Layered Formations

12N-1:00 Lunch
1:00-1:45pm **Major Methods of Data Analysis for Slug Tests**
- Confined and Unconfined Formations
- High-K Formations

1:45-2:30 **Data Collection: Transducers and Data Loggers**
- Equipment Overview
- Step-by-Step Instructions

2:30-2:45 Afternoon Break
2:45-3:30 **Performance of Slug Tests**
- General Equipment Overview
- Data Processing and Analysis Strategies

3:30-4:30 **Analysis Demonstrations and Exercises**
4:30-5:00 **Q & A Session / Discussion**
5:00 Adjourn for Day 1

Day 2: 04 March 2010

8:00-10:00 **Introduction to Pumping Tests**
- Major Applications
- Overview of Procedures & Design Guidelines
- Common Problems and How to Handle Them

10:00-10:15 Morning Break
10:15-12N **Diagnostic Methods**
- Description of Flow Regimes
- Diagnostic Flow Plots and Their Application
- Derivative Analysis

12N-1:00 Lunch

Day 2: 04 March 2010 (cont.)

1:00-2:30 **Pumping Tests in Confined Aquifers**
- Wellbore Storage, Partial Penetration, Well Loss, Wellbore Skin
- Single-Well Tests
- Step-Drawdown Tests
- Image Well Theory and Bounded Aquifers
- Useful Examples / Case Studies

2:30-2:45 Break
2:45-3:45 Recovery Tests
- Principle of Superposition
- Techniques for Recovery Analysis Including Agarwal Method
- Case History

3:45-4:30 **Analysis Demonstrations and Exercises**
4:30-5:00 **Q & A Session / Discussion**
5:00 **Adjourn for Day 2**

Day 3: 05 March 2010

8:00-9:30 **Pumping Tests in Leaky Confined Aquifers**
- Conceptual Models
- Mathematical Models
- Hantush-Jacob (1955)
- Hantush (1960)
- Neuman-Witherspoon (1969)
- Moench (1985)
- Case Histories

9:30-9:45 Morning Break
9:45-11:15 **Pumping Tests in Unconfined Aquifers**
- Conceptual Models
- Mathematical Models
- Neuman (1974)
- Tartakovsky-Neuman (2007)
- Case Histories (Instantaneous and Noninstantaneous Drainage)

11:15-12N **Making Confident Boring Log Correlations**
- Sediment Descriptions and Correlations

12N-1:00 Lunch
1:00-2:00 **Pumping Tests in Fractured Aquifers**
- Conceptual Models
- Methods for Pumping Test Analysis
- Case History

2:00-2:15 Afternoon Break
2:00-3:30 **Pumping Tests: Additional Issues**
- High-K Media
- Stream-Aquifer Systems
- Characterising Aquifer Heterogeneity

3:30-4:30 **Analysis Demonstrations and Exercises**
4:30-5:00 **Q & A Session / Discussion**
5:00 **Adjourn Course**

Education Level

Intermediate to advanced. This course begins with a brief overview of hydrogeologic principles for aquifer testing and continues at an advanced level throughout the course to match the range of real project conditions.

Fees (inclusive of GST)

Earlybird* ACLCA members — ***AUS $ 1,300***
ACLCA members — ***AUS $ 1,500***

Earlybird* non-ACLCA-members — ***AUS $ 1,600***
Non-member— ***AUS $ 1,800***

** Earlybird registrations must be received before 22 January 2010*

The course fee includes 24 contact hours of instruction, course notebook, *Field Guide for Slug Testing and Data Analysis*, *Field Guide for Soil and Stratigraphic Analysis*, certificate, full catering during the course (morning and afternoon teas and lunch).

Register at: www.aclca.org.au

Course Location

Karstens at CQ, Conference & Training Centre
123 Queen Street,
Melbourne, Victoria
www.karstensatcq.com.au

Accommodations

Citiclub Hotel
113 Queen Street
Melbourne, Victoria
Phone: 03-9602 1800
www.cqmelbourne.com.au

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