

Construction Dewatering and Groundwater Control - Design and Application

Purpose and Background

Groundwater control is a significant issue with all underground construction. Water affects the design of the structure, the construction procedures, and overall project costs. Groundwater is the single most significant source of delays, claims, and litigation in the underground construction industry. Determining the most effective solution to a groundwater issue will be enhanced if engineers and contractors are up to date in their understanding of groundwater phenomena, the methods of identifying and analyzing site-specific situations, and the tools available to control those situations.

This seminar will present the variety of dewatering and groundwater control methods available, including recent developments. Both theory and practice will be discussed, the latter based on actual case histories presented.

Groundwater, and how best to address its potential impact on underground construction, is not generally well understood outside of a limited specialty arena. Through this seminar, industry professionals will gain a greater knowledge and practical understanding of this important topic and how to apply that knowledge to minimize risk and to benefit the design and construction of future underground projects.

Topics covered will include the conditions where different dewatering methods are effective; site subsurface investigation appropriate for dewatering projects, including pumping tests; analysis and design of dewatering systems using analytical methods; installation and operation considerations; grouting and other passive cut-off methods; side effects from dewatering; and practical applications of dewatering for construction and remediation of contaminated sites.

Seminar Instructors

Paul C. Schmall, Ph.D., P.E., D.GE, F.ASCE, is Vice President Engineering for Moretrench, which is an industry leader in construction dewatering. He is recognized as an expert in the construction dewatering field and is a co-author of *Construction Dewatering and Groundwater Control: New Methods and Applications*, 3rd Edition, published in 2007. This publication has been acknowledged as the most comprehensive single text available on the subject. Mr. Schmall has more than 25 years of practical experience in the design, installation and maintenance of all types of dewatering and groundwater control systems. He has designed, performed and analyzed numerous full scale pumping tests for owners during the design stages of large civil projects as well as on Moretrench-contracted dewatering projects. He has also performed extensive dewatering in regions of the country known for groundwater bacteria and their effects on dewatering systems, and is skilled in treatment of dewatering systems for such conditions.

Gregory M. Landry, P.E., M.ASCE, is Moretrench's Chief Engineer for Groundwater Control Services. He has extensive experience speaking about groundwater control in both academic and industry settings. Mr. Landry has over 10 years of hands on experience in the design, analysis and implementation of construction dewatering and groundwater remediation systems throughout North America; particularly in regions with difficult and variable soil conditions. Mr. Landry serves on related industry committees and is a past co-instructor of this course (with Paul Schmall).

- For group training, contact John Wyrick (JWyrick@asce.org) or Stephanie Tomlinson (STomlinson@asce.org)

Summary Outline

Choosing the Appropriate Groundwater Control Method

- Sumps and open pumping versus predrainage methods
- Cutoff or exclusion methods
- Methods in combination

Site Investigation for Construction Below the Water Table

- Borings and borehole tests - the dos and don'ts
- Interface and variable geologic conditions
- Piezometers - are your water levels reliable and what do they mean to dewatering?
- Laboratory analysis of soil samples - effective use and pitfalls to the unwary
- In-situ and geophysical methods
- Pumping tests - from the routine to the complex
- Groundwater testing for corrosion/incrustation/contamination

Dewatering Analysis

- Understanding aquifer types and their implications to dewatering
- Evaluating hydraulic conductivity - methods and selection from the data scatter
- Evaluation of pumping tests
- The ideal aquifer
- Equilibrium equations and the adjustments necessary to make them effective in dewatering design
- Why steady state works in dewatering
- Partial penetration
- Storage depletion
- Flow nets - when and how to use in dewatering
- Groundwater models - applications and limitations

Groundwater Models

- 2-D versus 3-D models
- The conceptual model
- Verification of model results
- Model calibration
- Transient analyses
- Applications of modeling in the real world

Tools of Dewatering

- Wells
- Wellpoints
- Ejectors
- Installation and operation considerations
- Integrating cutoff methods with dewatering
- Dewatering at contaminated sites
- Non-technical issues - permits/unions

Avoiding the Potential Side Effects of Dewatering

- Damage from improper dewatering
- Ground settlement due to dewatering
- Timber piles
- Effects on nearby water supplies
- Contaminant migration

Groundwater Cutoff Methods

- Vertical walls
- Grouting
- Ground freezing
- Artificial recharge
- Tunneling shields

Effective Specifications & Avoiding Disputes

- Performance based specifications
- Detailed specifications
- Specified minimum systems
- Dewatering submittals
- Geotechnical data reports
- Geotechnical baseline reports

Seminar Benefits

- How to choose the appropriate groundwater control method
- How to plan and perform an effective geotechnical investigation for dewatering projects
- How to plan, perform and evaluate pumping tests
- How to use analytical methods in the practical design of dewatering systems
- How to use groundwater computer models in the evaluation of complex groundwater conditions
- How to install, operate and maintain deep well, well point and ejector systems
- How/when to consider structural groundwater cutoff and exclusion methods
- How/when to consider alternative methods of groundwater cutoff and exclusion, such as grouting
- How to effectively integrate groundwater cutoff methods with dewatering
- How to recognize and mitigate the potential side effects of dewatering
- How to plan and utilize dewatering methods with the remediation of contaminated sites
- How to evaluate the impact of dewatering on a project cost, schedule, disputes and side effects
- Tips on how to prepare effective specifications and contract documents, including concepts related to geotechnical baseline reports

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