

# ***Upgrading Treatment Plants and Pumping Stations***

## **Purpose and Background**

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This seminar presents the basics of pressure pipe and open channel flow hydraulics as applied in the design and operation of water and wastewater treatment plants. Calculators will be used in design examples.

Topics covered include: basics of pipe and open channel flow, hydraulic head losses, pipe and channel layout and design, flowmeter selection, flow control and flow distribution, design of hydraulic elements, and design of water and wastewater treatment plant unit processes. Topics not included are pumps and pump station design (offered separately by ASCE).

This seminar will provide engineers with the hydraulic engineering design tools needed to successfully layout and design the flow elements of both water and wastewater treatment plants. Numerous design examples are incorporated in the seminar material – both theoretical examples and practical design solutions from existing treatment plants.

## **Seminar Instructor**

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**David J. Hanna, P.E., M.ASCE**, is a graduate of Rensselaer Polytechnic Institute with an M.S. in Environmental Engineering, and a B.S. in Marine Engineering/Mechanical from the United States Merchant Marine Academy. Mr. Hanna is a Professor at Ferris State University with faculty responsibilities in the construction management and surveying engineering programs. He worked for several consulting engineering and construction management firms for eighteen years before joining the faculty at Ferris State University in 1991.

Mr. Hanna is a professional engineer in Ohio. He has designed numerous pumping stations and pumping systems associated with water and wastewater projects. Sizes of the facilities range from 80 gallons per minute to 30 million gallons per day. His experience includes design, construction administration, construction installation and quality control, and startup of new facilities as well as evaluation and troubleshooting of existing pumping and treatment facilities.

Mr. Hanna has served as an instructor on hydraulics, pumping systems and treatment processes to the New York State Department of Environmental Conservation and the New York State Department of Health with operator training and certifications programs. He is a member of ASCE and has been an instructor with the ASCE Continuing Education Division since 1999.

- To register your group, contact John Wyrick ([JWyrick@asce.org](mailto:JWyrick@asce.org)) or Stephanie Tomlinson ([STomlinson@asce.org](mailto:STomlinson@asce.org))

## Summary Outline

### Hydraulic Design Criteria

- Importance of hydraulic design
- Plant layout
- Process diagrams
- Hydraulic grade lines
- Plant piping
- Yard piping

### Plant Hydraulic Design

- Design philosophy
- Hydraulic design
- Basis of design
- Plant siting
- Plant layout
- Flow diagrams
- Hydraulic profiles

### Open Channel Hydraulics

- Types of open channel flows
- Geometry factors
- Energy factors
- Specific energy
- Froude and Reynolds numbers
- Critical flow
- Uniform flow
- Non-Uniform flow
- Rapidly varying flow
- Hydraulic jumps

### Closed Conduit Flow

- Hydraulic principles
- Friction head loss
- Bernoulli and general energy equations
- Laminar and turbulent flow
- Pipe friction losses
- Minor losses
- Series piping headlosses
- Parallel piping headlosses

### Flow Control and Distribution

- Gates
- Valves
- Weirs
- Distribution boxes

- Hydraulic control points
- Parshall flumes
- Manifolds

### Weirs

- Fundamental hydraulics
- Sharp crested weirs
- Broad crested weirs
- Triangular section weirs
- Trapezoidal section weirs
- Selection and use of weirs

### Orifices, Gates and Tubes

- Orifices
- Discharge of falling head
- Gates
- Tubes
- Nozzles

### Flow Measurement

- Hydraulic principles
- Basics of flow measurement
- Accuracy of flow measurement
- Selection of primary elements
- Selection of secondary elements
- Application of flumes
- Field measurements

### Wastewater Treatment Plant Process Hydraulics

- Screening
- Grit removal
- Sedimentation
- Aeration
- Contact tanks
- Cascade aerators
- Outfalls

### Water Treatment Plant Process Hydraulics

- Mixing
- Flocculation
- Sedimentation
- Filtration

### Wastewater Treatment Plant Design Example

### Water Treatment Plant Design Example

### References and texts

## Seminar Benefits

- Know the fundamental principles of pressure pipe and open channel flow hydraulics
- Learn how to calculate head losses in pipes and open channels
- Learn how to integrate hydraulic design of treatment plants into overall plant layout and design
- Learn the hydraulic design basics of common unit processes of water and wastewater treatment
- Learn how to develop and plot a plant hydraulic grade line
- Learn how to select and use hydraulic control points in plant design
- Learn how to marry theoretical hydraulics with practical plant layout and operations

## Who Should Attend?

- Civil, Design, Mechanical and Electrical Engineers
- Consulting Engineers
- Project Managers
- Specification Writers
- Construction and Mechanical Contractors
- Plant Superintendents and Operators
- Approval Agency Plan Reviewers

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