

## Stormwater Management - Design, Inspection and Operation/Maintenance of Stormwater Control Facilities Training program

### Course Description

The success of a long-term cost effective operation of a stormwater management facility depends on the 1) appropriate design, 2) an efficient inspection program undertaken during the construction phase and 3) the adoption of well organized operation and maintenance practices. This workshop describes all the above aspects of stormwater management, by assisting the designer to produce a cost effective design, with low maintenance cost and long-term trouble free operation. Similarly, the workshop will assist those involved in the operation and maintenance program to understand the design principles, the required performance of the facility and to ensure that the BMP facilities are operating at their maximum efficiency over its useful life.

First the “big picture”, is presented, why we need to control urban runoff and to protect our water courses. The next group of topics describe the early considerations a designer must address, such as the selection of water quantity, quality, and erosion control criteria. A detailed review of alternative Best Management Practices follows, presenting the latest North American and European practices developed over the past several decades, some more successful than others, including the more recently introduced Low Impact Development. It will review most of these practices and will provide a clear guidance on the selection of the most appropriate alternative. Special cases will be described, such as the selection of BMPs for redevelopments, retrofits and infilling. The course will provide an overview of the various computer programs available to assist in the design of BMPs, with emphasis on the programs most frequently used BMPs. The final part of the course will be a Workshop, where an actual Stormwater Management Design for an infill development will be demonstrated.

### By participating in this workshop

You will receive an overview on the practical application of sound design of stormwater management techniques, and the equally important operation and maintenance tasks. Case studies will be presented to demonstrate in very practical terms the pro's and con's of alternative strategies, the pitfalls that can be avoided, and the design features that characterize successful systems. You leave with the confidence that you not only understand the concepts but also can apply the knowledge to your projects.

## After participating in this course, you will be able to:

- select the most suitable design approach, including the best computer software for your project out of the available design approaches and practices that you study in this course
- examine design applications in new developments and retrofitting into existing urban areas
- apply new innovative emerging techniques for stormwater quantity, quality and erosion control
- solve stormwater problems being exposed to them in the course under specialist guidance
- adjust to your changing role and responsibility
- employ cost effective operation and maintenance methods
- use the best practices gleaned from the experience of national and international experts in municipal infrastructure
- develop and implement a successful and affordable stormwater management program that meets the regulations and requirements for controlling quantity, quality and erosion

## Objective

to provide participants with a working knowledge of current methods for designing effective drainage systems that minimize their construction and maintenance costs.

## Who Should Attend?

Municipal engineers, designers, operation and maintenance staff, developers, planners, consultants, engineers, and other technical personnel responsible for drainage and storm water management facilities? This course is particularly suited to those who want a comprehensive review of both the design and implementation methods.

## Course Outline

Welcome, Introduction, Workshop Preview, Learning Outcomes and the Assessment Method

Overview –The Big Picture

### 1. Why Do We Need Storm Water Management?

- Effect of urbanization on: surface runoff, peak flow, volume and timing, surface water quality, groundwater quantity and quality, natural habitat, stream corridors
- Changes in hydrological cycle-why we cannot match pre-development conditions once we urbanize

- Degradation of receiving watercourses, erosion and sedimentation
- Changes in stream temperatures-effect on cold water streams
- Current issues in controlling storm water quantity and quality-the lack of finding perfect solutions

## **2. Protection of Receiving Watercourses**

- Flood hazards-risk assessment and need for public education
- Flood plain delineation, choice of flood plain criteria and the problems of public acceptance
- Aquatic habitat protection
- Erosion, meandering, and the new concept of Valley Control
- Introduction to Morphology-is it a science or art?

## **3. Selection of Best Management Practices Design Criteria**

- Post and pre-development criteria
- Water quality, fish and body contact recreation criteria
- Erosion control criteria
- Major-minor system
- Water balance, recharge criteria-why it is impossible to meet some of the criteria
- Water temperature criteria -why it is impossible to meet frequently the criteria
- Effect of climate change-how to make allowance for it when we know so little?

## **4. Review of Numerous Alternative Stormwater Water Management BMPs-and Why None Are Perfect**

- Source control: roof and foundation drains, permeable pavers, etc.)
- Conveyance controls, (Swales, pervious pipes, etc.)
- End-of- pipe controls, (wet and dry ponds, underground tanks, wetlands, filters, infiltration facilities, separators, etc.)
- Good Housekeeping and municipal practices, (Land use restriction, litter control, recycling, waste control, street sweeping, road salt management, public education, etc.
- Recommended BMP Manuals

## **5. Recent Developments in the Design of BMP for Low Impact Developments-How Effective Are They?**

- Low Impact Developments
- Innovative Landscape design: rain garden, bio-retention, permeable paving and green roofs

- Review of emerging technologies, new commercial products to control water quality-and the search for the whole truth

#### **6. How to Select BMPs for Different Site Conditions**

- Treatment trains
- Selection process, use of selection matrix
- Short and long-term costs

#### **7. Special Cases: Redevelopment, Retrofits, and Infilling**

- Stormwater management criteria
- Applicable practices
- Approach to retrofits

#### **8. Design of the More Frequently Used Best Management Practices**

- Outline of Wet pond design
- Outline of Grassed swale design

#### **9. Operation and Maintenance of BMPs-a Municipality's Long Term Liability**

- Municipal input during reviews of pond, wetland, swale, infiltration, porous pavement designs
- Erosion and sediment control at construction sites and inspection during construction
- Operation and maintenance tasks for source, conveyance and end-of- pipe facilities
- Preparation of municipal operation and maintenance plan
- Resources: budgeting, manpower, equipment, scheduling

#### **10. Monitoring**

- Programs for monitoring flows, water quality, aquatic habitat,
- Base line monitoring
- Performance monitor
- New trend in effectiveness monitoring-how to do it and the difficulty of scoping it
- Parameters to be monitored, sampling, equipment
- Safety, and public perception-lessons learned from court cases
- Preparation of a four phase monitoring program

### **11. Introduction to Frequently Used Softwares and the Haestad softwares (included in the course) contained in the Hydraulic Engineering Handbook**

- Overview of hydrology models-HYMO based, SWMM based, etc
- Overview of hydraulic models: HEC-RAS, MOBED
- Overview of the Haestad drainage models-StormCad, FlowMaster, CulvertMaster, and PondPack

### **12. Workshop – BMP Design Example**

A step by step design example for an infill development, demonstrating a case of extremely severe control criteria dictated by the agency and the selection of peak flow and water balance BMP design criteria and controls