BMP Evaluation and Design Improvement

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Outline

- Adaptive management in design
- Stormwater quality and BMP effectiveness
- Monitoring to support design
- Modeling to support design
  - Computational model
  - Physical model
- Balancing competing interests in BMP evaluations
Adaptive Management in Design

1. Problem Definition
2. Site Characterization
   - Identify Constraints
3. Identify Applicable Fundamental Treatment Unit Processes
4. Select Treatment System Components
5. Assess/Refine Treatment System Components
6. Size and Develop Conceptual Design of Treatment Systems
7. Final Design, Construct System
8. Operate and Maintain System
9. Adaptive Management
   - Monitor Systems
   - Evaluate Performance, Effectiveness
   - Refine Designs
   - Retire/Replace
10. Final Design, Construct System

Adaptive Management in Design
Stormwater Quality is highly variable:
- Spatial
- Temporal

Function of:
- Land use/imperviousness
- Slope, vegetation
- Soils

### BMP Efficiency Varies

- RRM, literature review, expert panel assessment
  - Level 1 - median removal efficiency
  - Level 2 - 3rd quartile (75%) removal efficiency

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BMP Monitoring and Assessment

- Hydraulic Monitoring (mass-in, mass-out)
- Paired watershed monitoring
  - Spatial
  - Temporal
- Models
  - Computational
  - Physical
Computational Modeling for BMP Design
City of Fairfax, Virginia

Watershed: 139 acres (56.2 ha)

Impervious surface: 40%

Ashby Pond Characteristics

- V = 111,156 ft$^3$ (188,179.2 m$^3$)
- A = 61,239 ft$^2$ (2,914 m$^2$)
- Age: about 25 years
Model/Design Objective: Storage (2-yr)
Physical Models/Mesocosms

- Applied in bioretention, floating wetlands
- Advantage: replication, controlled conditions
Balancing Competing Interests

- Balancing:
  - Science
  - Water quality/regulation
  - ROI

- Risk has to be managed, cannot be avoided