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Volume III

Chapter 1: Introduction
Chapter 2: Hydrologic Analysis
Chapter 3: Flow Control Design
   3.1 – Roof Downspout Controls
   3.2 – Detention Facilities
   3.3 – Infiltration Facilities

Appendices III-A thru III-D
Volume III: Updating Infiltration Guidance

Section 3.3
Infiltration facilities for Flow Control & Treatment

New Section 3.4
Site Procedures for Bioretention & Permeable Pavement
Section 3.3.4: Simplified Approach to Infiltration Design

- Applies to sites < 1 acre
- No groundwater mounding analysis
- Steps remain same, but references updated guidance
- New step to conduct performance testing
Section 3.3.5: Site Characterization Criteria

Subsurface characterization

- Minimum test hole depth
- Groundwater monitoring wells
  - One wet season, unless historical data
  - 3 wells for flow direction & gradient, unless …
- If Grain Size Analysis Method
  - 1 analysis per soil layer in each test hole to 2.5x max water depth, but not < 6 feet

Infiltration rate determination

- References updated section 3.3.6
Section 3.3.6: Design Saturated Hydraulic Conductivity

Large-scale Pilot Infiltration Test
- Drainage areas $\geq$ 1 acre
- Field procedures

Small-scale Pilot Infiltration Test
- Drainage area < 1 acre
- Bioretention or Permeable Pavement
- Soils with high infiltration rate
- Field procedures
Section 3.3.6 (con’t)

Soil Grain Size Analysis Method
(only unconsolidated soils)

• For each soil layer up to 2.5x water depth, but not < 6 ft
• D10, D60, D90, Fines
• Equation to estimate Ksat for each layer
• Equation to estimate effective average Ksat
Section 3.3.6 (con’t)

Options removed

- USDA Soil texture-based estimates
- Estimates based on D10 size
Section 3.3.6 (con’t)

Correction factors to PIT Results

Converts field results to a long-term estimate

• CFv - Site variability & # of tests: 0.33 to 0.6
• CFt - Test Method: 0.33 or 0.5
• CFm - Influent Control: 0.9
• CF_T = CFv x CFt x CFm: 0.1 to 0.27

Correction factors for Grain Size Method

• CF_T = CFv x CFm: 0.3 to 0.54
Section 3.3.7: Site Suitability Criteria

SSC-4: Max infiltration rates for treatment
- Short-term rate increased from 2.4 in/hr to 12 in/hr
- Long-term rate increased from 2 in/hr to 3 in/hr

SSC-6: Soil Physical & Chemical Suitability
- Organic content changed from unspecified to a minimum of 0.5 %
Section 3.3.8: Detailed Approach to Infiltration Design

Steps 1 – 5: same as Simplified Approach

Steps 6 – 9: unchanged or clarified

New Step 10: Groundwater Mounding Analysis

- Drainage area > 1 acre
- MODRET or equivalent
- Testing & Monitoring

Input requested on drainage area cutoff & site conditions justifying exemption
Simulation of Groundwater Mounding Beneath Hypothetical Stormwater Infiltration Basins

- Potentially affected nearby structure
- Impervious surfaces
- Stormwater infiltration basin
- Depth of basin
- Unsaturated zone
- Ground water mound beneath stormwater infiltration basin during storm event
- Maximum height of groundwater mound
- Seasonal high water table
- Maximum extent of 0.25-foot increase in water level
- Saturated zone
- Thickness of aquifer (prior to stormwater infiltration)
- Bottom of aquifer
Section 3.3.8: Detailed Approach to Infiltration Design

Steps 1 – 5: same as Simplified Approach

Steps 6 – 9: unchanged or clarified

New Step 10: Groundwater Mounding Analysis

- Drainage area > 1 acre
- MODRET or equivalent
- Testing & Monitoring

Input requested on drainage area cutoff & site conditions justifying exemption
New Section 3.4: Site Procedures for Bioretention

Small Commercial: one small-scale PIT

Residential: small-scale PIT at each potential site
  - Per 50 feet for long, narrow layout; e.g. road ROW
  - Groundwater thru wet season

WWHM guidance: needs changing due to bottom area & slide slope ratio

Should underlying soils have a correction factor?
New Section 3.4: Site Procedures for PP

Sites where only MR 1 – 5 apply:
• Groundwater observations; no infiltration tests

Commercial sites where MR 1 – 9 apply:
• Small-scale PIT per 2500 sq. ft.; at least 1 per site

Residential sites where MR 1 – 9 apply:
• Small-scale PIT per 150 ft of road & every lot
• Criteria for reduction of test frequency
• Groundwater thru wet season

WWHM modeling guidance
New Section 3.4: Site Procedures for Bioretention & PP

- Tracking of lot obligations
  - Plat/short plat approvals
  - Deed requirements

Note to Reviewers
- Comments requested regarding guidance for assessment of interflow and localized flooding issues
Draft includes only a partial update of this section

Update Critical Design Criteria and Flow Modeling Guidance
Western Washington Hydrology Model

Major Updates include:

- Compatibility with Windows 7
- LID modeling and Compliance with LID Standard
- Wetland Flow Matching Criteria
WWHM: Updates

Compatibility with Windows 7

Newer PCs Use Windows 7

Existing WWHM 3 is Incompatible with Windows 7
LID Performance Standard
(Min Req. #5)

Match flow durations:
8% - 50% of 2-yr pre-development

WWHM Calculates and Compares
Pre- and Post-development flow durations
WWHM: Updates

LID Modeling Elements/Icons for:

- Permeable Pavement
- Vegetated Roof
- Bioretention
- Embankments/Slopes
WWHM: Updates

For Permeable Pavement Users Specify:

- Pavement Thickness & Porosity
- Aggregate Base Thickness & Porosity
- Max Ponding Depth
- Native Soil Infiltration
For Vegetated Roof Users Specify:

- Media Thickness
- Vegetation Type
- Length of Drainage
- Model Assigns Runoff Parameter Values
WWHM: Updates

Bioretention Model:

- Uses Darcy’s and Van Genuchten’s equations
- Simulates Wetting/Drying & Computes $K$
- Defaults to Bioretention Soil Type
  - Assigns Pre-determined Parameter Values
- Users Specify Soil Depth
WWHM: Updates

Embankments/Slopes Module:

- Used for Compost-Amended Vegetative Filter Strip (CAVFS) on Sloped Surfaces
- Uses Bioretention Algorithm
- Default Soil Type
- Users Specify Embankment Slope and Soil Depth
Minimum Requirement #8 Specifies:

- Daily Discharge Deviation \( \pm 20\% \)
- Monthly Discharge Deviation \( \pm 15\% \)
Questions?