

# Post Construction Stormwater Draft Drainage Criteria Manual



Clean Water Program Task Force

June 11, 2013

# Design Standards & Drainage Criteria Manual

- ❖ Stormwater Drainage Design Standards:
  - ❖ Chapter 2.05 of the Design Standards
  - ❖ Minimum standards for the design and construction of BMP features as required by the Director of Public Works
- ❖ Drainage Criteria Manual (DCM):
  - ❖ Adopted by reference (by the Design Standards)
  - ❖ Specific guidance, criteria, and recommendations that discuss various considerations of BMP features, including construction, and maintenance
- ❖ Collectively, the Design Standards & DCM:
  - ❖ Establish technical specifications and engineering requirements
  - ❖ Aid in design, construction, & maintenance of the BMP features
  - ❖ Assist: engineers, water quality specialist, developers, planners, etc

# What are the Design Standards?

- ❖ Stormwater Drainage Design Standards:
  - ❖ Chapter 2.05 of the Design Standards
  - ❖ Minimum standards for the design and construction of BMP features as required by the Director
  - ❖ Purpose: “establish technical specifications, engineering requirements, and similar matters which property owners, subdividers, and permittees must meet when constructing or installing public & private improvements per LMC.”
  - ❖ Improvements must substantially conform to design standards
  - ❖ Deviation from the Design Standards may be requested, usually on a case by case basis, and must be requested and approved by Director
  - ❖ When in conflict with Lincoln Municipal Code, Code governs

# Design Standards:

- ❖ Revisions to the Design Standards (Chapter 2.05) include:
  - ❖ Additional Definition for Best Management Practice {Section 1}
  - ❖ Additional Policy of Stormwater Best Management Practices {Section 3}
  - ❖ Replacement of existing Stormwater Best Management Practices with a revised section {Section 10}
- ❖ Section 10: Stormwater Best Management Practices
  - ❖ 1: Overview
  - ❖ 2: Ownership & Maintenance of BMP's
  - ❖ 3: General Criteria
  - ❖ 4: Release Rate
  - ❖ 5: Storage
  - ❖ 6: Grading & Depth Requirements
  - ❖ 7: Outlet Works
  - ❖ 8. Location & Downstream Analysis
  - ❖ 9: Construction and Maintenance Considerations

# Design Standards: Examples

- ❖ Select Examples of Revisions to Section 10:
  - ❖ 10.2: Ownership & Maintenance of BMP's
    - ❖ “BMP facilities...are to be owned and maintained by the developer or a property-owners’ association...”
  - ❖ 10.4: Release Rate
    - ❖ “The Water Quality Control Volume is to be temporarily held and then released over a 24 to 40 hour period...”
  - ❖ 10.6: Grading & Depth Requirements
    - ❖ Side slopes no steeper than 4:1. Top width at least 14 feet. 2% bottom slope.
  - ❖ 10.8. Location & Downstream Analysis
    - ❖ “Structural BMP facilities shall be located and designed to not cause flooding and nuisance impacts to downstream properties...”

# What is the Drainage Criteria Manual?

- ❖ Drainage Criteria Manual (DCM)
  - ❖ Adopted by reference to and made part of the Design Standards
  - ❖ Purpose: Provides specific guidance for engineers, planners, landscape architects, developers, etc. in selecting, designing, maintaining, constructing, and installing BMPs
  - ❖ Also: Helps ensure the drainage facilities avoid disruption of community while improving the overall health and welfare of the region in an economic way
  - ❖ Represents an effective and practical resource with proven illustrative examples & equations used by engineering community

# DCM: Outline

- New Sections to DCM:
  - 8.1: Overview
  - 8.2: Drainage Criteria
  - 8.3: Structural BMP Descriptions
  - 8.4: BMP Maintenance
  - 8.5: Waivers & Credits

# DCM 8.1: Overview

- Purpose
- Clean Water Act Requirements
- Introduction
- Urban Stormwater Characteristics
- Structural and Nonstructural Best Management Practices
- General Planning and Design Guidelines
- Ownership and Maintenance of Best Management Practices
- References

# DCM 8.2: Design Criteria

- Water Quality Control Volume
  - Based on either 0.83 inch or 1.25 inch storm event, the area, and the impervious percentage of the development/ redevelopment area
  - Water Quality Control Volume (WQCV) is measured in acre-feet
  - $WQCV = P ( 0.05 + 0.009 I ) A$ 
    - P = Storm Event Rainfall (inches)
    - I = Impervious Area (%)
    - A = Area (acres)

# DCM 8.2: Design Criteria

- Release Rates/Storage
  - Water Quality Control Volume to be held and then released over a 24 hour to 40 hour period
  - Okay to have a Best Management Practice that combines water quality (i.e., BMP's) with flood control (i.e., Detention)
  - Best Management Practices that are designed for subsurface storage such as pervious pavements, bioretention, and rain gardens are to be designed to hold the Water Quality Control Volume for infiltration into ground

# DCM 8.2: Design Criteria

- Other requirements:
  - Grading and depth requirements
  - Outlet works
  - Location and downstream analysis

# DCM 8.2: Design Criteria

- Water Quality Control Volume Form
  - A form will be provided must be completed to verify the BMP's are able to detain the WQCV with the proper release rates.
  - Form provided in Drainage Criteria Manual Appendices

# DCM 8.3: Best Management Practices

- Provides details on common Best Management Practices that have been used in Lincoln
- Allows for use of other Best Management Practices not detailed in the Drainage Criteria Manual
- Best Management Types covered in this Drainage Criteria Manual include:
  - Bioretention (rain gardens, biocells, bioswales, etc)
  - Constructed Wetlands
  - Extended Detention Basins (used when combining water quality with flood control)
  - Green Roofs
  - Permeable Pavements
  - Retention Ponds
  - Underground Best Management Practices

# DCM 8.3: Best Management Practices

- Provides details on common Best Management Practices that have been used in Lincoln
- Allows for use of other Best Management Practices not detailed in the Drainage Criteria Manual
- Best Management Types covered in this Drainage Criteria Manual include:
  - **Bioretention (rain gardens, biocells, bioswales, etc)**
  - Constructed Wetlands
  - Extended Detention Basins (used when combining water quality with flood control)
  - Green Roofs
  - Permeable Pavements
  - Retention Ponds
  - Underground Best Management Practices

# DCM 8.3: Best Management Practices

Each BMP includes the following additional detailed information:

- Description
- Pollutant Removal Effectiveness
- Benefits/Limitations
- Site Selection
- Designing for Maintenance
- Design Procedure and Criteria
- Other Items as Applicable

# DCM 8.3: Best Management Practices

## Bio-Retention Example:

- Description
  - Pollutant Removal Effectiveness
  - Benefits/Limitations
  - Site Selection
  - Designing for Maintenance
  - Design Procedure and Criteria
  - Other Items as Applicable
- “A BMP that utilizes bioretention is an engineered, depressed landscape area designed to capture and filter or infiltrate the Water Quality Control Volume.”
  - Frequently referred to as: rain gardens, biocells, bioswales, etc.
  - Often requires consultation with a geotechnical engineer when proposed near a structure to evaluate soils, impacts, and minimum safe distances from structures.

# DCM 8.3: Best Management Practices

## Bio-Retention Example:

- Description
- Pollutant Removal Effectiveness
- Benefits/Limitations
- Site Selection
- Designing for Maintenance
- Design Procedure and Criteria
- Other Items as Applicable

- Sediment / Solids: Very Good
- Nutrients: Moderate
- Total Metals: Good
- Bacteria: Moderate

# DCM 8.3: Best Management Practices

## Bio-Retention Example:

- Description
- Pollutant Removal Effectiveness
- **Benefits/Limitations**
- Site Selection
- Designing for Maintenance
- Design Procedure and Criteria
- Other Items as Applicable

- +Uses multiple treatment processes to remove pollutants such as: sedimentation, filtering, adsorption, evapotranspiration, and biological uptake
- +Stormwater treatment is provided within portions of a site that are already reserved for landscaping
- +Potential for reduction of irrigation requirements by taking advantage of site runoff
- -Additional design if near structures or expansive soils
- -Sediment loads can clog

# DCM 8.3: Best Management Practices

## Bio-Retention Example:

- Description
  - Pollutant Removal Effectiveness
  - Benefits/Limitations
  - **Site Selection**
  - Designing for Maintenance
  - Design Procedure and Criteria
  - Other Items as Applicable
- Can do in landscaping areas
  - Can be used in conjunction with detention cell retrofit
  - Can be done at one site (if small) or with multiple installations at larger sites
  - Not where there is baseflow
  - Can be installed in parking lot islands, street medians, etc.
  - Watershed Considerations: slope, soils, vegetation, land use, etc.
  - Special considerations next to structures or if subsoil is saturated or relatively impervious (i.e., clay)

# DCM 8.3: Best Management Practices

## Bio-Retention Example:

- Description
  - Pollutant Removal Effectiveness
  - Benefits/Limitations
  - Site Selection
  - **Designing for Maintenance**
  - Design Procedure and Criteria
  - Other Items as Applicable
- Does not recommend a filter sock on underdrain
  - Full vegetation is best cover for bioretention
  - Considerations to growing medium & maintenance for each (such as mowing)
  - Considerations for shallow bio-retention area to avoid excessive & erosive slopes.
  - Irrigation system considerations
  - Also refers to Section 8.4: which discusses recommended maintenance practices for all BMPs.

# DCM 8.3: Best Management Practices

## Bio-Retention Example:

- Description
  - Pollutant Removal Effectiveness
  - Benefits/Limitations
  - Site Selection
  - Designing for Maintenance
  - **Design Procedure and Criteria**
  - Other Items as Applicable
- Follow Steps (& consider the recommendations provided for each):
    - 1. Find required WQC Volume
    - 2. Layout Basin Geometry
    - 3. Pick Growing Medium
    - 4. Layout & Design Underdrain System
    - 5. Consider & Design Impermeable Geomembrane Liner and/or Geotextile Separator Fabric
    - 6. Design Inlet & Outlet Control
    - 7. Consider & Pick Vegetation

# DCM 8.3: Best Management Practices

## Bio-Retention Example:

- Description
  - Pollutant Removal Effectiveness
  - Benefits/Limitations
  - Site Selection
  - Designing for Maintenance
  - Design Procedure and Criteria
  - **Other Items as Applicable**
- Bio-Retention Sub-Section includes the following additional items:
    - Important Design Considerations (i.e., dist. From buildings, slope, etc)
    - Design Aesthetics
    - Construction Considerations (i.e., protect area from excessive sediment during and after construction, to avoid clogging & failure)

# DCM 8.4: BMP Maintenance

## ■ Maintenance:

- Maintenance includes regularly scheduled activities, as well as non-routine repairs that may be required after large storms, or as a result of other unforeseen problems
- A key consideration to BMP design is maintenance
- Entity owning the BMP responsible for Maintenance
- City responsible for ensuring maintenance occurs
- For public facilities, key issue is ensuring adequate staff and budget are provided to department responsible for maintenance.

# DCM 8.4: BMP Maintenance

- Maintenance Responsibility
  - “Identifying who is responsible for maintenance of BMP’s and ensuring that an adequate budget is allocated for maintenance is critical to the long-term success of BMP’s.
  - Can be assigned different ways:
    - Publicly owned BMP’s that are responsibility of the City
    - Privately owned BMP’s that are responsibility of the property owner
    - Privately owned BMP’s may be maintained by City by written agreement & reimbursement of fees

# DCM 8.4: BMP Maintenance

## ■ Maintenance Plan

- “A maintenance plan can be prepared as stand-alone documents, or made part of a construction set.”
- To be prepared & submitted as part of the development review/approval process, and provided to owner upon sale
- Key components needed in a Maintenance Plan:
  - Simple drawing of Development/Redevelopment site to include location
  - Maintenance requirements
  - Inspection Form
  - Contact Information
  - Agreements
  - Other Appropriate Items

# DCM 8.4: BMP Maintenance

- Maintenance form provided for each of Lincoln's common Best Management Practices
- Maintenance information includes a typical inspection form for each type of Best management Practice
- Additional Maintenance Considerations for each.
  - The **Bio-Retention Example** has the following Maintenance Considerations:
    - Inspection
    - Debris & Litter Removal
    - Mowing & Plant Care
    - Irrigation Scheduling & Maintenance
    - Replacement of Wood Mulch
    - Sediment Removal & Growing Media Replacement

# DCM 8.5: Waivers & Credits

- 1. Watershed Based Criteria
  - Credits must be used (and BMP's located) within the same watershed that the Credit was taken from.
- 2. Waivers
  - May be granted based on Director's discretion
  - Generally waivers may be allowed in the following circumstances:
    - Emergency work or repairs necessary to health, safety and the general welfare of public
    - Retro-fitted BMP's on previously developed property that provide equivalent benefit
    - Previously constructed private or public BMP's that were constructed above the standards
    - Where project cost of implementing the proposed standards is so disproportionate, that completing the project would not be practical.

# DCM 8.5: Waivers & Credits

## ■ 3. Credit Policy

- Based on a volume (acre-feet) of stormwater being treated above that required (1.25” for development / 0.83” for re-developments), up to an amount of 1.65”
  - The volume of credit is the extra volume obtained by treating over the required amount
- Additional Incentive: Credits could also be earned by treatment of stormwater through alternative BMP’s that use subsurface storage (i.e. porous pavements, bio-retention) combined with infiltration practices that do not drain to the Storm Sewer System.
  - These credits based on a volume of 0.01 Ac-Ft per acre treated.
- Other Possibilities: Credits for Minimum Flood Corridor Buffers if shown to filter and treat a specified volume of stormwater runoff

# DCM 8.5: Waivers & Credits

- 3. Credit Policy – Example:
  - 20-acre residential development (with 30% impervious area), required to treat 1.25” (which equates to 0.67 Ac-Ft)
    - If one oversized to treat 1.65 Inches, or 0.88 Ac-Ft...
    - The difference between required and actual is 0.21 Ac-Ft. This “credit” can be used elsewhere in watershed.

# Best Management Types (8.3)

- Bioretention
- Constructed Wetland Pond
- Extended Detention Basin
- Green Roof
- Permeable Pavement
- Retention Pond
- Underground Best Management Practices

## BIORETENTION (Rain Gardens)

Rain Gardens in Lincoln



Public Works 901 Building



Residential Location



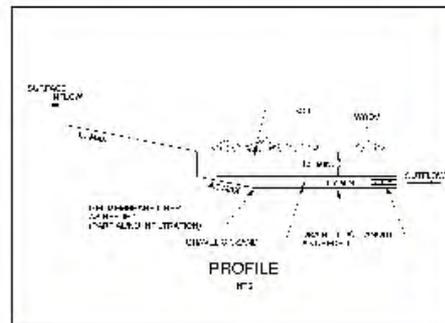
Prescott School

### Description:

Bioretention is an engineered, depressed landscaped area that is designed to capture and filter out and/or infiltrate stormwater. Bioretention Best Management Practices (BMPs) may also be called rain gardens, biocells, planter boxes or bioswales. Bioretention uses deep rooting perennial vegetation native to this area and sometimes engineered soils to create a natural filtration system for treating and removing many pollutants found in stormwater. Bioretention BMPs function best when the soils are suitable for infiltrating ground water. Bioretention BMPs need to be placed away from building foundations where basements are utilized. A liner may be added to the bottom of the BMP to address unwanted water near foundation or in areas that don't infiltrate well.

### Benefits:

- Utilizes multiple natural processes to remove pollutants
- Provides aesthetic amenities
- Reduces land that requires irrigation
- Reduces mosquito populations



Pioneers Park Nature Center

### More information:

Links:

<http://lincoln.ne.gov/city/works/watshed/educate/bmoguide/pdf/3.2.pdf>