

Section 1

Introduction

1.1 Background

Stormwater runoff is defined as excess water from any precipitation event not intercepted or retained by vegetation and that results in overland flow (Davis, 2005). Runoff, when managed by traditional systems, adversely impacts surface water quality in two ways: through the introduction of nonpoint source (NPS) pollutants and by altering the hydrologic cycle. Thus, sustainable stormwater management is crucial for the protection of public health and safety and for the maintenance of surface water quality and quantity.

The National Pollutant Discharge Elimination System (NPDES) permit program was developed by the Environmental Protection Agency (EPA) to address water quality issues imposed by urban stormwater runoff. The NPDES permit program requires municipalities and local entities to meet technology based effluent limitations and attain a 5-year renewable permit (EPA, 1999). Phase II of this program requires operators of municipal separate storm sewer systems (MS4) as defined by the EPA to pursue stormwater programs that protect water quality and reduce discharge of pollutants from new and re-developed areas (EPA, 2005).

The EPA designated the Kansas Department of Health and Environment (KDHE) to regulate the NPDES MS4 Stormwater Phase II program in Kansas. KDHE implemented a general permitting procedure to meet this requirement. The operator of a Phase II MS4 submitted a notice of intent in March 2003 that included a list of Post-Construction Best Management Practices (BMPs) specific to their community, and a measurable goal for each BMP to achieve over the 5-year permit term. The purpose of this manual is to assist Phase II cities in Kansas to meet the BMP implementation requirements defined in this permit.

1.2 Why a BMP Manual?

As part of complying with the NPDES general MS4 permit, a complete Stormwater Management Plan (SMP) is required. By implementing post construction BMPs in a stormwater management system, an agency can work to protect and improve water quality. The six minimum controls defined in this plan, and measures put in place to achieve each control, are described below.

- **Public Education and Outreach.** Installation of post construction BMPs provides opportunities for education using signs and brochures to communicate what a BMP is and how they function (Section 2.4). This manual provides guidance for construction and maintenance of lot level BMPs that can be implemented by an individual homeowner or business (Section 4.2).
- **Public Involvement and Participation.** BMPs provide volunteer opportunities for inspection and maintenance (Section 2.4 and Section 5.3).

- **Illicit Discharge Detection and Elimination.** Not applicable to this manual.
- **Construction Site Stormwater Runoff Control.** Not applicable to this manual. Please refer to local Construction Manual (if applicable).
- **Post-Construction Stormwater Management in New Development and Redevelopment Projects.** This manual focuses on providing structural BMP definition, design guidance, implementation guidelines, and inspection and maintenance practices, as well as non-structural BMP recommended guidelines. (Section 2, Section 3, Section 4, Section 5)
- **Pollution Prevention/Good Housekeeping for Municipal Operations.** BMP short and long-term inspection and maintenance requirements are defined in this manual (Section 5).

1.3 How to Use This Manual

This manual is intended to be used as a guide for the successful implementation of post construction stormwater BMPs. The design criteria, implementation guidelines, and inspection and maintenance recommendations outlined in this manual are intended to assist Kansas Stormwater Consortium Phase II cities in meeting requirements mandated in the 2004 NPDES permit for Post-Construction BMPs. This manual should serve as a guideline from which each agency can develop ordinances, design criteria, and construction standards and specifications for implementation of BMPs.

- **Section 2 – Implementation Guidelines.** Section 2 provides guidelines on how to implement BMPs into an agency’s stormwater infrastructure, from what BMP is appropriate for a specified type of development, what questions should be asked in relation to BMPs during the development process, and to how to combine BMPs together in a treatment train for increased water quality benefits. This section also contains information on how to use post construction BMPs for meeting public outreach goals.
- **Section 3 – Non-Structural BMPs.** Section 3 provides guidelines for non-structural BMPs, including stream buffer policy definition, preserving natural vegetation, and restoring natural vegetation. These BMPs are typically designated in an agency’s stormwater or watershed master plan, or defined during the planning stage of the development process. These BMPs can provide extraordinary benefits to stream health and stormwater runoff water quality with minimal long-term maintenance cost.
- **Section 4 – Structural BMPs.** Section 4 provides design guidance and examples for lot level BMPs, bioretention facility, vegetated swale, filter strip, infiltration trench, and extended dry and wet detention. Each section is intended to be independent; other sections may need to be referenced for additional calculation and/or

- maintenance information. The design summary table at the beginning of each structural BMP section provides condensed design guidance.
- **Section 5 – Operation and Maintenance.** Section 5 provides information on bringing BMPs into an agency’s maintenance schedule, including inspection and acceptance guidelines for BMPs associated with development practices. Inspection and scheduled maintenance checklists and forms are included for both vegetated and non-vegetated BMPs for designated time-frames.
- **Appendix A – Precipitation Information.** This section provides a map of varying precipitation zones in Kansas and the complete table of precipitation information for 14 cities in Kansas. The purpose of the map is to show how varied precipitation is across Kansas and the importance of precipitation as a factor in choosing appropriate BMPs. The table provides the water quality rainfall event, 14 day wet season rainfall event, and mean event rainfall for Phase II Kansas cities. This table is used for all hydrologic calculations.
- **Appendix B – Soils Information.** Appendix B provides soil texture and hydrologic class information. This data can be used to guide BMP and plant selection. Section 4 outlines appropriate soils for each BMP by hydrologic group. Appendix B.3 includes more detailed soil maps for each Kansas Phase II city.
- **Appendix C – Vegetation Information.** This section presents guidelines for the selection of native vegetation for BMPs. Appendix C.1 provides the general vegetation map for Kansas. Appendix C.2 can be used for more specific vegetation guidelines by ecoregion. Information from this section can be used to inform vegetation specialists with guidelines specific to the ecoregion in which the BMP will be installed.
- **Appendix D – Maintenance Tables.** Appendix D presents the maintenance tables described in Section 5. These tables should be used to guide the design and implementation of a maintenance schedule for each agency. This table can be copied and distributed as checklist form for BMP inspections.
- **Appendix E – Example Stream Buffer Ordinance**
- **Appendix F – Example BMP Brochure**
- **Appendix G – Detention Basin Outlet Structure Calculations and Example Design Worksheets**
- **Appendix H – BMP Application.** Appendix H presents graphs that use the impervious/pervious ratio and soil type as a guide to when BMPs should be applied to a site. A graph is presented for each Kansas Phase II city.
- **Appendix I – Post Construction Stormwater BMP Ordinance**

1.4 Definitions and Acronyms

- American Public Works Association (APWA)
- **Bioretention Soil Mixture (BSM):** A soil mix having defined chemical and physical properties to support a diverse microbial and plant community.
- California Stormwater Quality Association (CASQA)
- Clean Water Act (CWA)
- **Development:** The alteration of the natural landscape for human needs which results in increasing impervious area. This includes installation of utilities, infrastructure, and buildings.
- **Ecoregion:** A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables.
- Environmental Protection Agency (EPA)
- Extended Dry Detention Basin (EDDB)
- Extended Wet Detention Basin (EWDB)
- Federal Emergency Management Agency (FEMA)
- **First Flush:** The quantity of initial runoff from a storm or snowmelt event that commonly contains elevated pollutant concentrations. The first flush often contains a majority of pollutants in a drainage area.
- Hydrologic soil groups (HSG)
- Idaho Department of Environmental Quality (IDEQ)
- Kansas City Metropolitan Chapter of the APWA (KCMetro APWA)
- Kansas Department of Health and Environment (KDHE)
- **Karst:** A landscape characterized by the dissolution of a layer or layers of soluble bedrock, such as limestone.
- Manual of Uniform Traffic Control Devices (MUTCD)
- MidAmerica Regional Council (MARC)
- Municipal separate storm sewer system (MS4)

- **National Pollutant Discharge Elimination System (NPDES):** Defined in Section 402 of the Clean Water Act, this provides for the permit system that is key for enforcing the effluent limitations and water quality standards of the Act. The Phase II final Rule – published in the Federal Register on December 8, 1999 – requires NPDES permit coverage for stormwater discharges from certain regulated, small, municipal, separate storm sewer systems (MS4s) and from land areas greater than 1 acre disturbed by construction.
- **Native Vegetation:** Plant types historically located in this geographic area that are extremely well adapted to the climate and natural disturbances (e.g., fire, grazing, and/or flooding) of the region. Furthermore, these plant species have co-evolved with a suite of insects, microbes, and other wildlife. As a result, the grasses, wildflowers, sedges, forbs, shrubs, and trees of these plant communities are drought tolerant, disease and insect resistant, and hardy.
- Natural Resources Conservation Service (NRCS)
- **Non-point Source (NPS) pollutant:** Pollution that occurs over a diffuse area when rainfall, snowmelt, or irrigation runs over land or through the ground, picks up pollutants, and deposits them into rivers, lakes, and coastal waters or introduces them into ground water.
- **Post-Construction Best Management Practices (BMPs):** Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from non-point sources and minimizing runoff to waters of the United States after construction of an area is complete.
- **Pre-Development:** Conditions that existed prior to development (actual or proposed).
- **Redevelopment:** Development activities that occur on a site that is already developed. This includes remodeling that adds impervious area, tearing down/rebuilding structures, and expanding existing development, including constructing parking lots and non-habitable buildings.
- Stormwater Management Plan (SMP)
- **Time of Concentration (T_c):** The overland flow time to the most upstream inlet or other point of entry to an enclosed system or channel (T_i) plus the time for flow to travel in the enclosed system or channel to the point of consideration (T_T).
- **Total Maximum Daily Load (TMDL):** A regulatory limit on the amount of pollutants that can be released into a body of water without adversely affecting water quality.
- **Treatment train:** BMPs in series that work as a system to remove pollutants by providing treatment efficiencies necessary for managing stormwater runoff.

- Urban Drainage and Flood Control District (UDFCD) Denver, Colorado
- **Water Quality Rainfall Event:** The storm event that produces less than or equal a defined percent volume of all rainfall events on an annual basis.
- **Water Quality Volume (WQv):** The runoff generated by the water quality rainfall event.
- **Watershed:** All the land area that drains to a given point that may also be called a basin, catchment, or drainage area.

1.5 References

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EPA. 2005. *Stormwater Phase II Final Rule*. EPA 833-F011. Available at: www.epa.gov/NPDES/stormwater. Accessed 19 May 2008.

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