Class 1:
New Stormwater Tools & the Design and Construction Process

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CITY OF TOPEKA UTILITIES

Stormwater Design Handbook Webinar Training Series

Introduction to the Ordinance & Handbook

https://www.topeka.org/utilities/stormwater-development-management/

Topic

What topic is the trainer discussing

Manual Section #

Where to find this topic in the Topeka Handbook

Topeka Stormwater BMP Design Handbook

Important Terms

Best Management Practice (BMP)

A structural facility used to manage stormwater runoff from a property **after construction**

NOT sediment & erosion control BMPs

Bioretention BMP on Jackson Street in Topeka

Extended Dry Detention BMP

Important Terms

Stormwater <u>Quality</u> BMP

A BMP that "treats" runoff to protect streams and properties from pollutants in stormwater

Bioretention BMP on private property in Topeka

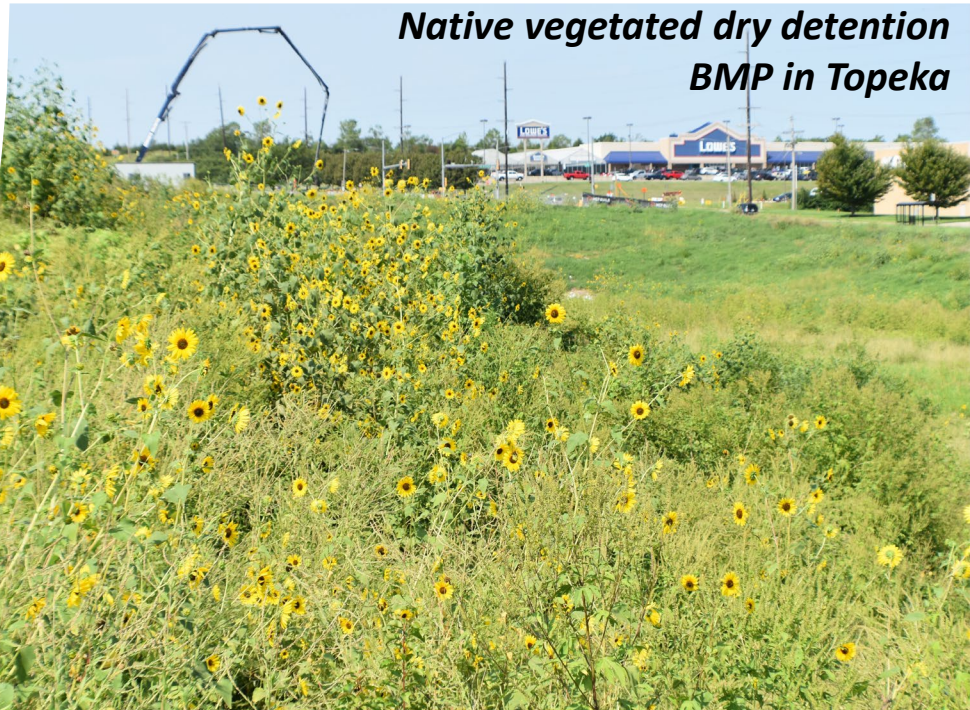
Bioretention BMP on Jackson Street in Topeka

Important Terms

Stormwater <u>Quantity</u> BMP

A BMP that manages runoff to protect onsite & downstream properties from flooding

Wet detention BMP in Topeka



Native vegetated dry detention BMP in Topeka

Goals for Topeka's code revisions

- Comply with Topeka's Municipal Stormwater Permit and EPA audit findings
  - Stormwater quality treatment
  - Municipal design plan review, construction, and maintenance processes
- "Modernize" and improve by aligning stormwater ***quality*** & ***quantity*** rules
- Use our improved understanding of Topeka streams for smarter regulation
- Use compliance & engineering methods that are locally relevant, effective, familiar, and flexible

Topeka's Stormwater "Tools"

Topeka Municipal Code	*Design Criteria & Drafting Standards*	*Stormwater BMP Design Handbook*
• **TMC Chapter 13.15** authorizes regulation of stormwater drainage, construction activities, and stream buffers. • **TMC Chapter 13.30** regulates stormwater and pollution during construction activities • **TMC Chapter 13.35** regulates the design and construction of post-construction stormwater quality and quantity BMPs • **TMC Chapter 13.40** regulates the inspection and maintenance of post-construction stormwater quality and quantity BMPs • **TMC Chapter 17.10** regulates stream buffer areas • **TMC Chapter 17.30** regulates land development in floodplains	• Drainage system design (inlets pipes, culverts, channels, etc.) • Refers to the *Stormwater BMP Design Handbook* for design of stormwater quantity BMPs (detention and retention facilities) • Refers to the *Stormwater BMP Design Handbook* for plan preparation and submittal requirements • Requirements and guidance for erosion prevention and sediment control practices	• **Supports the requirements of TMC Chapter 13.35** • Stormwater quality BMP design • Stormwater quantity BMP design (detention and retention facilities) • Stormwater management plan (i.e., drainage report) requirements • Stormwater BMP Record Drawing requirements ***Property Owner's Guide to Stormwater BMP Maintenance*** • Supports the requirements of TMC Chapter 13.40 • Requirements and guidance for stormwater quality and quantity BMP protection, inspection, and maintenance • Performance standards for stormwater quality and quantity BMP inspections • Stormwater quality and quantity BMP inspection checklists

Table 1-2 in Handbook, Chapter 1, Section 1.4

Design Rules Working Together

The "Stormwater DESIGN & CONSTRUCTION Ordinance" (TMC Chap. 13.35)

- **Clarified** rules for stormwater ***quality*** BMP design and construction
- **Added** rules for stormwater ***quantity*** BMP design and construction
- **Added** rules for **stormwater plan preparation and submittal**

For BMP design, the ordinance refers to:

Design Criteria & Drafting Standards

- Drainage system design (i.e., inlets, pipes, channels, culverts)
- ~~Detention/Retention basin design~~
- ~~Design plan preparation and submittal requirements~~
- Erosion and sediment control practices

Stormwater BMP Design Handbook

- Design standards for stormwater quality BMPs
- Design standards for detention & retention basins, now watershed-based
- Design plan preparation and submittal requirements

Stormwater Management Code Revisions

TMC Chapter 13.35

Establishes **core requirements** for stormwater BMP design & const.

CODE REVISIONS:

- Update and clarify stormwater ***quality and quantity*** requirements
- Insert stormwater design plan checklist
- Insert new construction termination rules
  - Stormwater BMP Record Drawing
  - Final Inspection

New to Topeka

DOES NOT INCLUDE:

- Calculation methods
- BMP design requirements
- Helpful checklists and support tools

In the new Stormwater Design Handbook

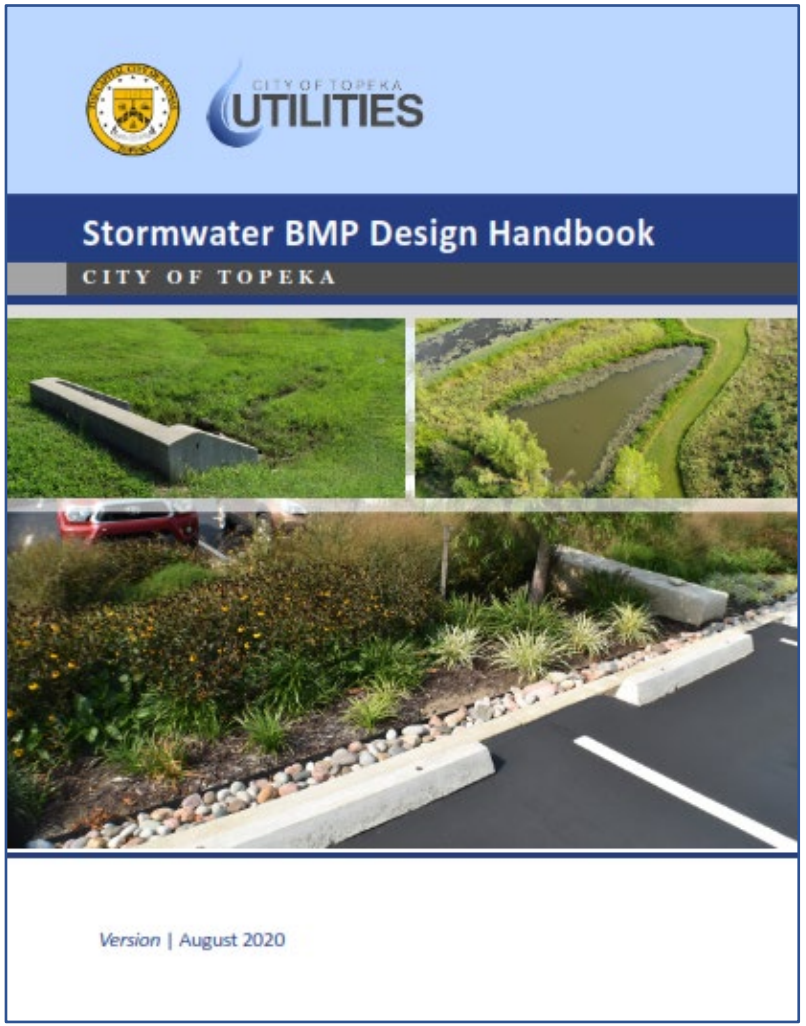
Stormwater BMP Design Handbook

Chapters

1. Introduction
2. Design Process & Plans
3. SW Quality Design
4. SW Quantity Design
5. LID Techniques

Appendices

A. Acronyms & Definitions
B. Required Forms
C. BMP Record Drawing checklist
D. BMP Certification Statement
E. BMP Design Procedure Forms



Handbook Contents

Chapter 1

Topeka Stormwater BMP Design Handbook

Chapter 1 - Introduction

- Negative impacts of runoff & benefits of management
- Handbook overview & relationship w/ City Code
- Handbook objectives & alignment w/ City Plans
- How to use the Handbook
- Companion resources
- City Utilities Contact Info

Table 1-3: Summary of Code Requirements and Supporting Information Provided in the Handbook

Provision Established in Topeka Municipal Code	*Supporting Policies and Guidance Provided in the Handbook*
TMC Chapter 13.35 - Stormwater Management	
• Code applicability and waivers	• Provides technical information for stormwater quantity performance criteria and justification to support waiver for criteria by the director
• Requirement to comply with stormwater quality performance criteria	• Provides ample guidance for implementation of LID techniques, especially those identified in the *MARC/APWA BMP Manual* • Refers to *MARC/APWA BMP Manual* for compliance calculations and stormwater quality BMP design specifications
• Requirement to comply with stormwater quantity performance criteria	• Provides policies and guidance for compliance and design of stormwater quantity (detention/retention) BMPs

Handbook Contents

Chapter 2

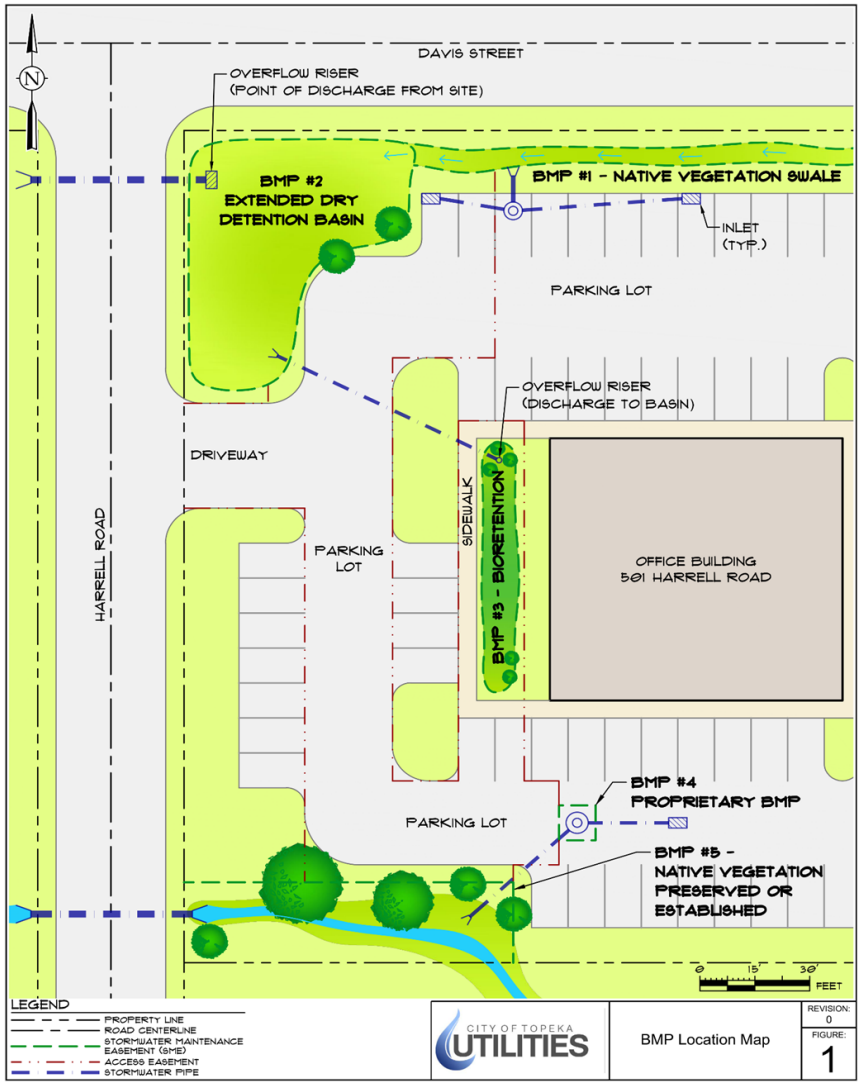
Topeka Stormwater BMP Design Handbook

Chapter 2 – Design Process & Plans

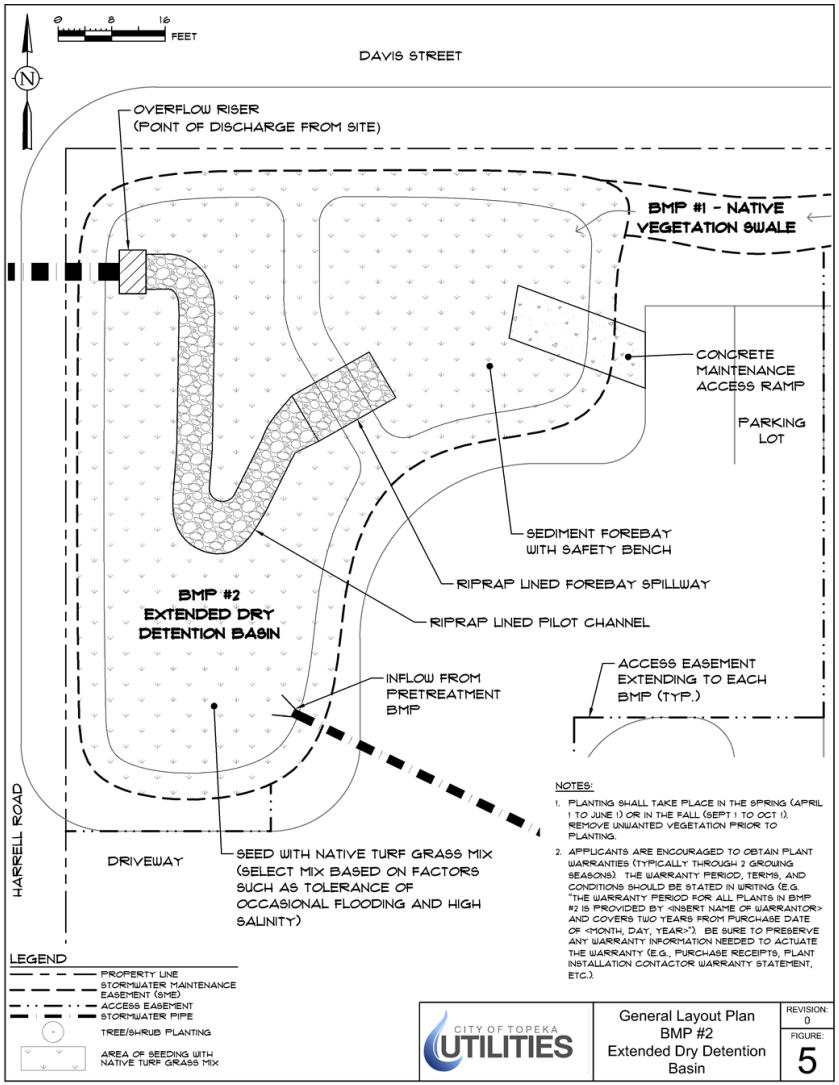
- Key stakeholders & concepts
  - Developers & Designers
  - City of Topeka
  - Future Property Owner
- Design Process Flowcharts
  - Pre-Design Planning (Hydrologic Characterization)
  - Design Standards Applicability
  - Design, Construction, & Construction Termination
  - Post-Construction Inspection & Maintenance
- Plan Requirements
  - Stormwater Management Plan (SWMP)
  - Stormwater BMP Record Drawing
- Stormwater BMP Record Drawing Inspection

Handbook Chapter 2

Example BMP Location Map



Example BMP Planting Plan



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Chapter 3

Topeka Stormwater BMP Design Handbook

Chapter 3 – Stormwater Quality Design

- Performance Standard and General Policies
  - Refers to MARC Manual
- Guidance on Green Infrastructure BMPs
- Policies for Infiltration (GI) BMPs
  - Feasibility criteria
  - Infiltration criteria
  - Underdrain criteria
  - Infiltration test requirements
- Policies for Vegetated BMPs
  - Native vs. Non-Native Species
  - Policies and Resources
- Policies for Manufactured Treatment Devices
- Guidance on BMP Selection, Location, & Protection
- Aligning Stormwater Quality & Quantity Designs
- Introduction to Green Street Design

Handbook Chapter 3

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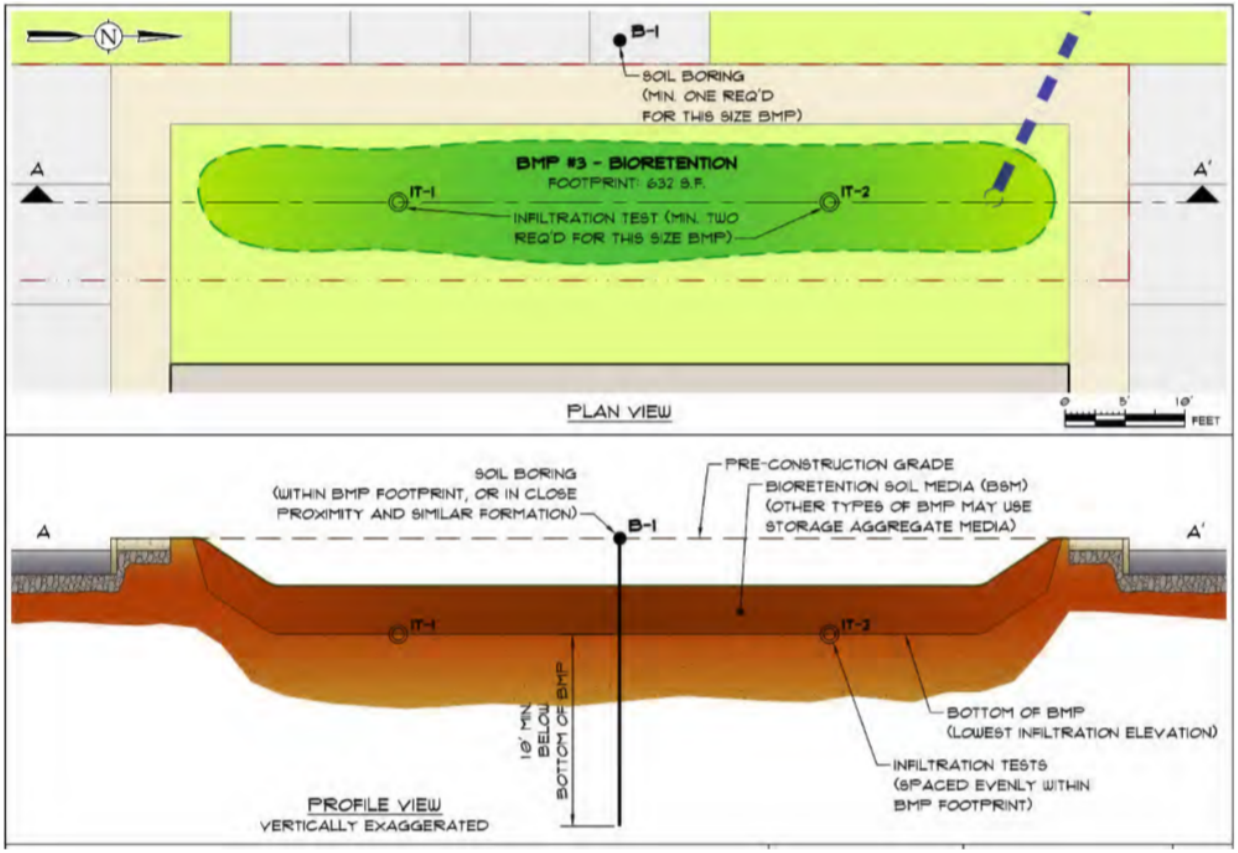
Table 3-1. Stormwater Quality BMP Value Ratings (adapted from *MARC/APWA BMP Manual*, 2012)

Cover Type or BMP	Median Expected Effluent EMC TSS (mg/L)*	Value Ratings				Overall Value Rating
		Water Quality Value	Volume Reduction	Temp. Reduction	Oils/ Floatables Reduction	
Native Vegetation Preserved/Established	N/A	5.25	2	1	1	**9.25**
Rain Garden	< 10	4	2	1	2	**9.0**
Infiltration Basin	< 10	4	2	1	2	**9.0**
Infiltration Trench	< 10	4	2	1	2	**9.0**
Bioretention	< 10	4	1.5	1	2	**8.5**
Pervious Concrete	10 - 20	3	1.5	1	2	**7.5**
Porous Asphalt	10 - 20	3	1.5	1	2	**7.5**
Modular Concrete Block	10 - 20	3	1.5	1	2	**7.5**
Extended Detention Wetland	< 10	4	2	0	1	**7.0**
Surface Sand Filter	< 10	4	0	0	2	**6.0**
Underground Sand Filter	< 10	4	0	0	2	**6.0**
Pocket Sand Filter	< 10	4	0	0	2	**6.0**
Perimeter Sand Filter	< 10	4	0	0	2	**6.0**
Extended Wet Detention Basin	10 - 20	3	2	-1	1	**5.0**
Vegetated Filter Strip	10 - 20	3	1	0	1	**5.0**
Extended Dry Det. Basin (Native Veg.)	20 - 50	3	1	0	0	**4.0**
Extended Dry Det. Basin (Non-Native Veg.)	20 - 50	2	0	0	0	**2.0**
Native Vegetation Swale	10 - 20	3	1	0	0	**4.0**
Non-Native Grass Vegetation Swale	10 - 20	1.5	0	0	0	**1.5**
Other Systems *(Manufactured Treatment Devices)*	10 - 100	1 – 3	0	0	2	**3.0 - 5.0**
- Proprietary Media Filtration Devices - Hydrodynamic Devices - Baffle Boxes - Catch Basin Inserts	Approved on a case-by-case basis. See Section 3.6 for design requirements.					
Green Roofs	No VR; Post-construction CN credit; See *MARC/APWA Manual*					
Cisterns	No VR; Post-construction CN credit; See Appendix F					

Handbook Chapter 3

Figure 3-2. Example of Appropriate Spacing and Depth for Soil Infiltration Tests



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Stormwater Quality BMP	*Value Rating*	*Land Use of Project or Areas Within a Project*								
					Roadways			Residential		
		Com-mercial	Indus-trial	Parking Lots	Shoulder & Medians	Travel-ways	Parks & Open Space	SFR Indiv. Lots	SFR Common Lots	Multi-Family Res.
Native Veg. Preserved/Estab.	9.25	●	◉	◉	●	✖	●	○	◉	◉
Rain Garden	9.0	◉	●	✖	○	✖	●	○	●	●
Infiltration Basin	9.0	●	●	○	●	✖	●	✖	●	●
Infiltration Trench	9.0	●	●	◉	●	✖	●	✖	●	●
Bioretention	8.5	●	●	●	●	✖	●	○	●	●
Pervious Concrete	7.5	●	◉	●	●	○	●	○	●	●
Porous Asphalt	7.5	●	◉	●	●	○	●	○	●	●
Mod. Concrete Block	7.5	●	◉	●	●	○	●	○	●	●
ED Wetland	7.0	●	●	○	○	✖	●	✖	◉	◉
Surface Sand Filter	6.0	●	●	○	●	✖	●	✖	●	●
Underground Sand Filter	6.0	●	●	●	●	✖	●	✖	●	●
Pocket Sand Filter	6.0	●	●	◉	●	✖	●	✖	●	●
Perimeter Sand Filter	6.0	●	●	●	●	✖	●	✖	●	●
Ext. Wet Detention	5.0	●	●	○	◉	✖	●	✖	●	●
Vegetated Filter Strip	5.0	●	●	◉	●	✖	●	●	●	●
Native Vegetation Swale	4.0	●	●	◉	●	✖	●	○	●	●
Vegetation Swale (Turf)	1.5	●	●	◉	●	✖	●	○	●	●
ED Detention Basin (Native Veg.)	4.0	●	●	○	◉	✖	●	✖	●	●
ED Detention Basin (Turf)	2.0	●	●	○	◉	✖	●	✖	●	●
Prop. Media Filter	*	◉	●	●	○	✖	○	✖	○	○
Hydrodynamic Device	*	◉	●	●	○	✖	○	✖	○	○
Baffle Boxes	*	◉	●	●	○	✖	○	✖	○	○
Catch Basin Inserts	*	◉	●	●	○	✖	○	✖	○	○
Green Roof	*	●	●	✖	✖	✖	●	✖	◉	◉
Cistern	*	◉	●	✖	✖	✖	●	✖	◉	◉

● = Usually very well suited for application on this land use. Check design specifications.
◉ = May be suitable for application on this land use, if project or hydrologic conditions allow. Check design specifications.
○ = Usually not for application on this land use but may be appropriate in limited situations. Check design specifications.
✖ = Not suitable for land use.
* = See Value Rating information on City website.

Handbook Chapter 3

CITY OF TOPEKA UTILITIES

Table 3-4. Stormwater Quality BMP Selection Based on Physical Constraints, Costs and Other Criteria *(for BMPs used for TMC 13.35 compliance. Table footnotes are on the next page.)*

BMP Type	Value Rating[1]	Stormwater Quantity Impact		Physical Constraints[2]					Cost Considerations			Other Policies of Note	
		Volume Reduction	Peak Flow Control	Max. Drainage Area	In Situ (Underlying) Soils Requirement	Engineered Media Required	Min Head (Elevation Difference)	Ground Level Encroachment (or Space Needed)	Construction Cost	Operation & Maintenance Cost	Triple Bottom Line Benefits	BMP Type *(Handbook sections with relevant policies shown in parenthesis)*	Landscape Credit Available for BMP[4]
Native Vegetation Preserved or Established	9.25	Yes	No	NA	no restriction	No	NA	High	Low	Med	High	• Green Infrastructure BMP • Vegetated BMP *(see Sections 2.6.3 & 3.4.3)*	20%
Rain Garden	9.0	Yes	Minimal	< 1 acre	A or B required	No	1-2ft	Low	Low	Med	High	• Green Infrastructure BMP • Infiltration BMP *(See Section 3.4.2)* • Vegetated BMP *(see Sections 2.6.3 & 3.4.3)*	20%
Infiltration Basin	9.0	Yes	Yes	< 5 acres	A or B required if not using an underdrain	Yes	2-10ft	Med	Med	High	Med	• Green Infrastructure BMP • Infiltration BMP *(See Section 3.4.2)*	10%
Infiltration Trench	9.0	Yes	Minimal	< 5 acres	A or B required if not using an underdrain	Yes	2-10ft	Med	Med	High	Med	• Green Infrastructure BMP • Infiltration BMP *(See Section 3.4.2)*	10%
Bioretention	8.5 Underdrain required	Yes	Yes	< 4 acres	No restriction, underdrain always required	Yes	3 ft	Med	Med	Med	High	• Green Infrastructure BMP • Infiltration BMP *(See Section 3.4.2)* • Vegetated BMP *(see Sections 2.6.3 & 3.4.3)*	20%
Pervious Concrete, Porous Asphalt, Mod. Concrete Block	7.5 Underdrain required	No	Yes	Impervious area draining to BMP ≤ 2/3 the total drainage area	No restriction, underdrain always required	Yes	2-10ft	NA	High	Varies	High	• Green Infrastructure BMP • Manufactured BMP[3]	10%
Extended Detention Wetland	7	No	Yes	2 to 1,000 acres	Do water budget analysis	No	6-10ft	High	Med	High	High	• Green Infrastructure BMP • Vegetated BMP *(see Sections 2.6.3 & 3.4.3)*	20%
Sand Filters: Surface, Underground, Pocket, & Perimeter	3-5	No	Yes	Varies (see design specifications)	No restriction	Yes	Varies	Med	Low	High	Low	• Conventional BMP	0%
Extended Wet Detention	5	No	Yes	2 to 1,000 acres	Do water budget analysis	No	6-10ft	High	Low	Med	Med	• Vegetated BMP *(see Sections 2.6.3 & 3.4.3)*	10%
Vegetated Filter Strip	5	Yes	No	As large as needed	No restriction	No	3ft	Med	Low	Low	Med	• Green Infrastructure BMP • Vegetated BMP *(see Sections 2.6.3 & 3.4.3)*	20%
Vegetation Swale	4 (native) 1.5 (turf)	Yes	No	< 5 acres	No restriction	No	3ft	Med	Low	Low	Med	• Green Infrastructure BMP • Vegetated BMP *(see Sections 2.6.3 & 3.4.3)*	20% (native plants) 0% (turf)
Extended Dry Detention	4	No	Yes	2 to 1,000 acres	Do water budget analysis	No	6-10ft	High	Low	Med	Low	• Vegetated BMP *(see Sections 2.6.3 & 3.4.3)*	10% (native plants) 0% (turf)
Proprietary Media Filtration Device	3-5	No	No	Manufacturer's specs	No restriction	Sometimes	Manufacturer's specs	Low	Low	High	Low	• Manufactured BMP[3]	0%
Hydrodynamic Device Baffle Boxes	3-5	No	No	Manufacturer's specs	No restriction	No	Manufacturer's specs	Low	Low	High	Low	• Manufactured BMP[3]	0%
Catch Basin Insert	3-5	No	No	Manufacturer's specs	No restriction	No	Manufacturer's specs	Low	Low	Med	Low	• Manufactured BMP[3]	0%
Green Roof	Roof area has CN=79	Yes	No	NA	NA	No	NA	NA	High	Med	High	• Green Infrastructure BMP • Vegetated BMP *(see Sections 2.6.3 & 3.4.3)* • Manufactured BMP[3]	10%
Cistern/Rainwater Harvesting	Volume credit[5]	Yes	No	NA	NA	No	NA	Low	Low	Med	Med	• Green Infrastructure BMP • Manufactured BMP[3]	10%

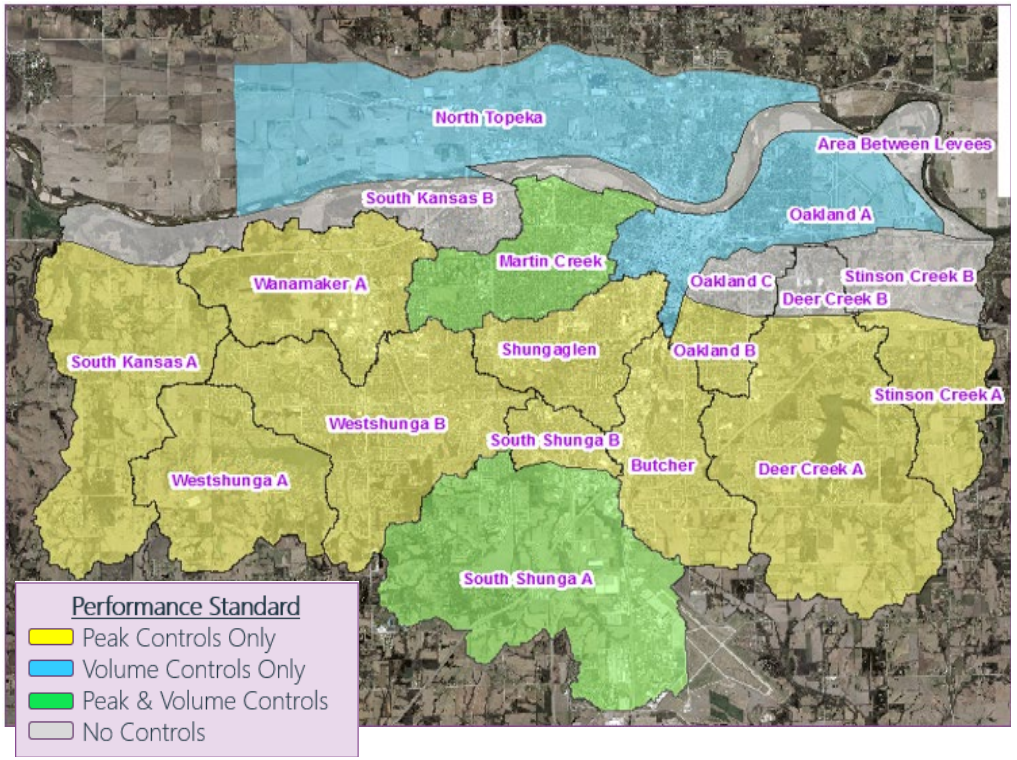
Handbook Contents

Chapter 4

Topeka Stormwater BMP Design Handbook

Chapter 4 – Stormwater Quantity Design

- Performance Standards (Watershed Based)
- Detention/Retention Design Specifications *(APWA-based)*
  - General policies
  - BMP specific policies
  - Computations requirements & methods



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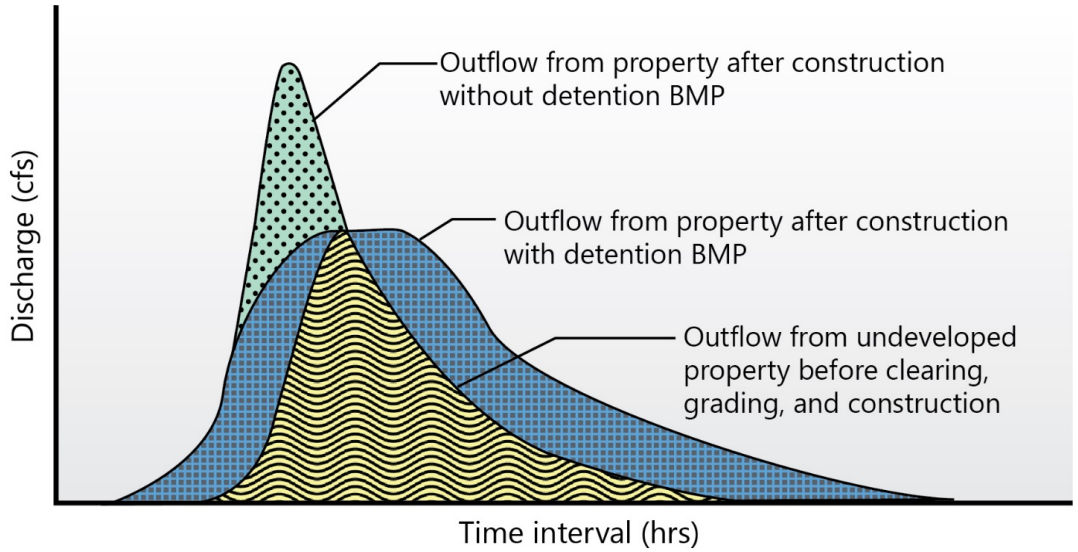


Left: Tall grass buffer help to create a "naturalized" stormwater pond that deters waterfowl residence. *Source: Lake County, IL*. **Right:** A "no mow" sign stands in a tall grass stormwater BMP buffer in Merrillville IN. *Source: Municipal Sewer & Water Magazine*.

Handbook Contents

Chapter 5

Topeka Stormwater BMP Design Handbook

Chapter 5 – Low Impact Development

- Background
- Incentives
- Planning & Design Process and Concepts
- Planning & Design Techniques

Table 5-1. LID Categories and Techniques

Early Coordination, Collaboration, and Communication	
❖ Work with a multi-disciplinary design team ❖ Pre-design hydrologic characterization	
Conservation of Natural Features & Resources	***"Build with the Land" Design Techniques***
❖ Preserve undisturbed natural areas ❖ Preserve/Restore stream buffers ❖ Avoid developing in floodplains ❖ Avoid developing on steep slopes ❖ Minimize siting on porous or erodible soils ❖ Soil management – preservation ❖ Soil management – restoration ❖ Restoration of native vegetation	❖ Redevelopment ❖ Fit the design to the terrain ❖ Reduce limits of clearing and grading ❖ Locate development in less sensitive areas ❖ Utilize open space development ❖ Consider creative development design

Handbook Contents

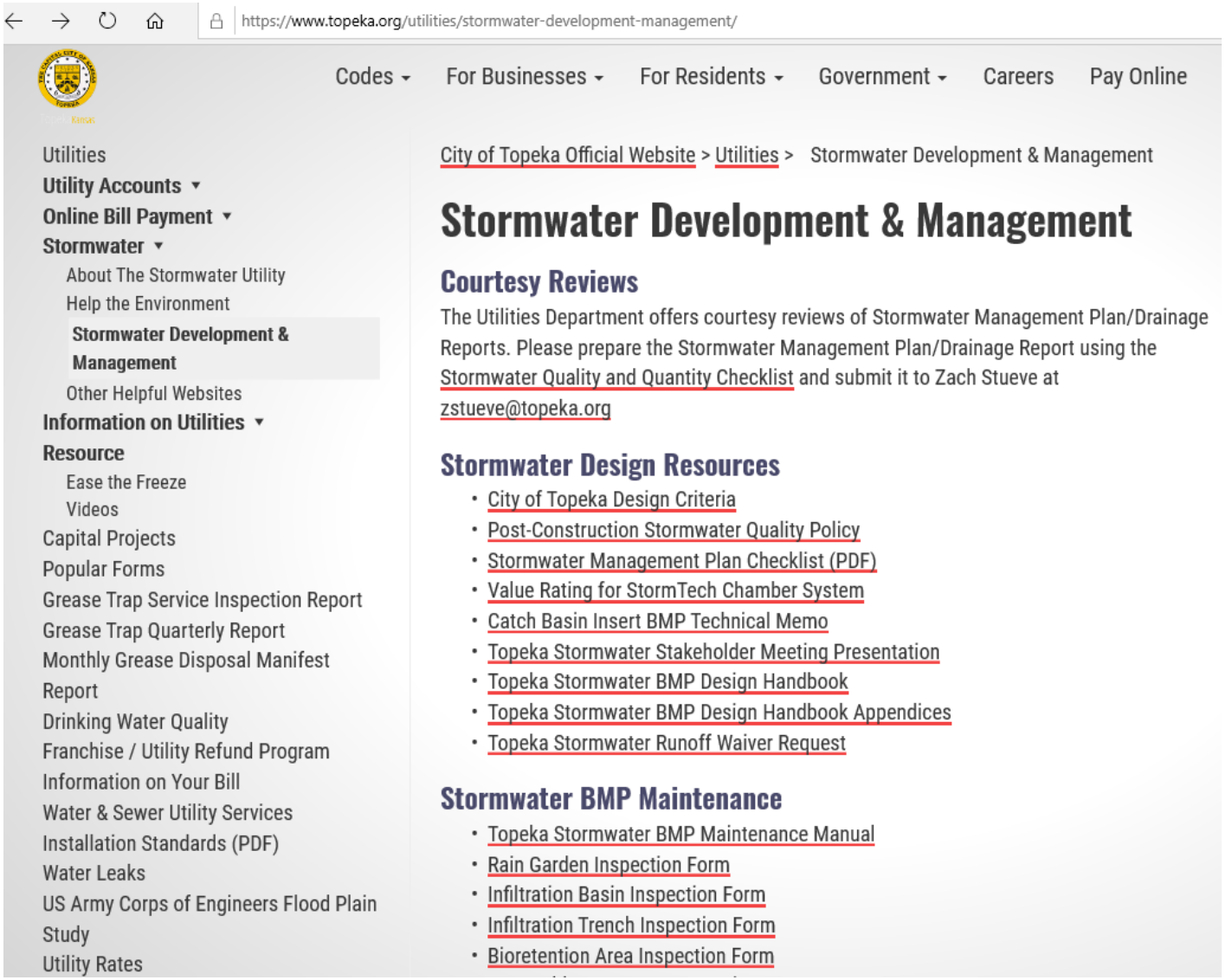
Appendices

Topeka Stormwater BMP Design Handbook

Appendices

A. Acronyms and Definitions
B. Stormwater BMP Record Drawing Checklist
C. LID Technique Form and GI-BMP Feasibility Form
D. Stormwater BMP Design Procedure Forms
E. Cistern BMP Design Specifications

Where to find the Handbook



BMP Maintenance Manual

1: Introduction and Stormwater BMPs 101
2: BMP Operational and Success Criteria
3: BMP Inspection
4: BMP Maintenance
5: Individual BMP Inspection Checklists
6: Helpful Resources

Target Audience: **Property Owners**

- ✓ Uncomplicated
- ✓ Visual
- ✓ Educational
- ✓ Themed

BMP Maintenance Manual

Property Owner's Guide to Stormwater BMP Maintenance

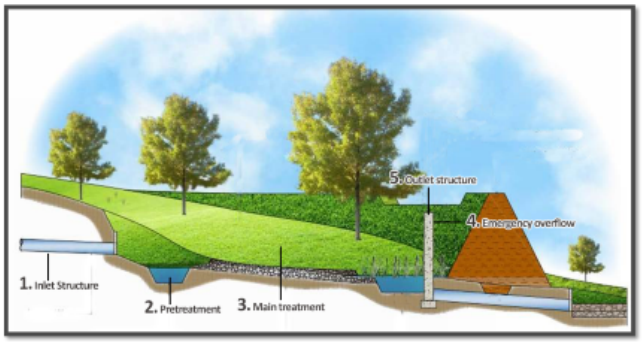
5.10 Extended Dry Detention Basics

Extended dry detention basins are Best Management Practices (BMPs) that collect and store stormwater. The basins remove pollution and control flooding. An extended dry detention basin will manage about 1-inch of stormwater and drain completely about 40 hours after a storm. Extended dry detention basins will be located in stormwater management easements (SMEs), and will be easy to find on your property's Stormwater BMP Record Drawing. basic parts (see the figure below):

Benefits of Extended Dry Detention:

- Easy and inexpensive to use
- Great at capturing pollutants
- Reduce erosion
- Can be used as an area for recreation or open space

1. **Inlet structures** let water flow into the BMP.
2. **Pretreatment** areas remove trash, debris, and dirt from stormwater flowing in. This helps to prevent clogging of the main treatment area.
3. The **main treatment** area is where stormwater is collected, so the water can be cleaned and drain at a controlled speed.
4. **Emergency overflows** let water escape and flow *around* the BMP during intense or long storms, without flooding the surrounding area.
5. The **outlet structure** lets the cleaner water exit the BMP.



What are my responsibilities?

Ongoing protection, inspection, and maintenance is important to the function of your BMP. Here are a few things to keep in mind:

- BMPs found on your Stormwater BMP Record Drawing must be inspected and cared for by *you*, the property owner. The requirements for inspection and maintenance presented in this document are supported by the Topeka Municipal Code 13.35.
- You can choose to hire others (like a landscape company) to perform inspection and maintenance activities, but you are ultimately responsible for inspection and maintenance.
- The City of Topeka keeps track of your inspection and maintenance reports and may perform City-led inspections when they see fit. If you don't inspect and maintain your BMP, this violates the City's Stormwater Ordinance and can result in fines or penalties, and requirements to fix your BMP.

Your detention basin will last longer and you'll save money if you protect the plants and soil, keep your property clean, and do regular inspections and maintenance. The image below shows the four Success Factors needed to make sure you have an attractive, working detention basin. Remember that a **DOCUMENTED INSPECTION MUST BE DONE EVERY OTHER YEAR, NO LATER THAN 10/31**, using the Extended Dry Detention Basin Inspection Form included with this guidance sheet.

Do	Don't
✓ Mow grass 3-4 inches high and remove trash and debris regularly.	X Don't use too much salt and sand around the detention basin in the winter.
✓ Keep your property clean.	X Don't use too much fertilizer, herbicides, or pesticides. Contact a local nursery or landscape company if your plants aren't doing well.
✓ Do regular inspections and maintenance, often. Make repairs as soon as you notice problems.	X Don't let heavy equipment in the detention basin or use it as storage, even for landscape items (leaves, snow, soil mulch, etc.)
✓ To prevent damage, tell landscapers and contractors working on the property about the location and purpose of the BMP.	X Don't let pollutants (trash, pet waste, pesticides, oils, etc.) wash into the basin.

The Stormwater Design Process & Plan Review Checklist

Keys to a Successful Stormwater BMP

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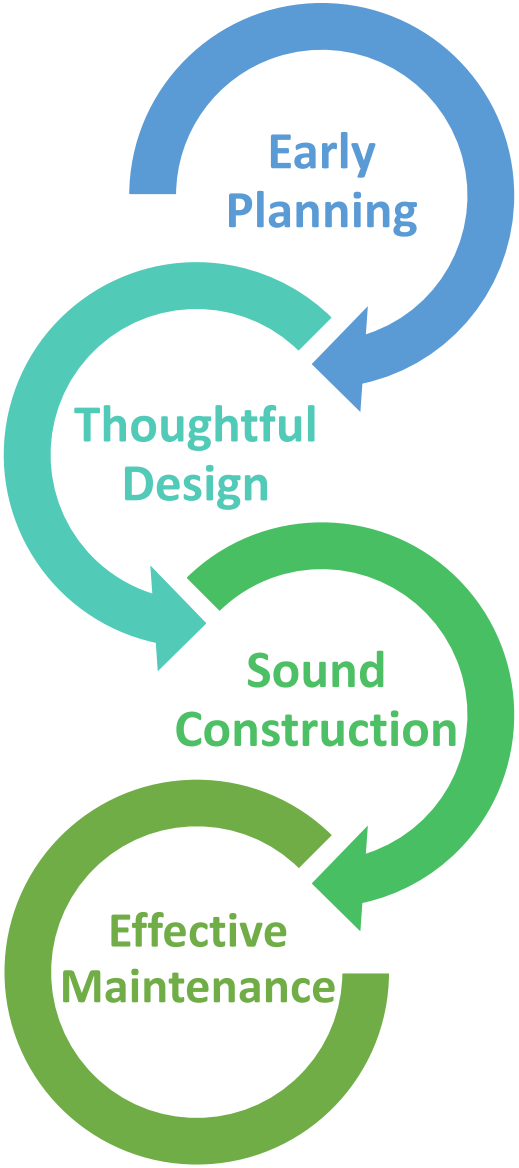


Stage 1: Planning & Design

Stage 2: Grading & Construction

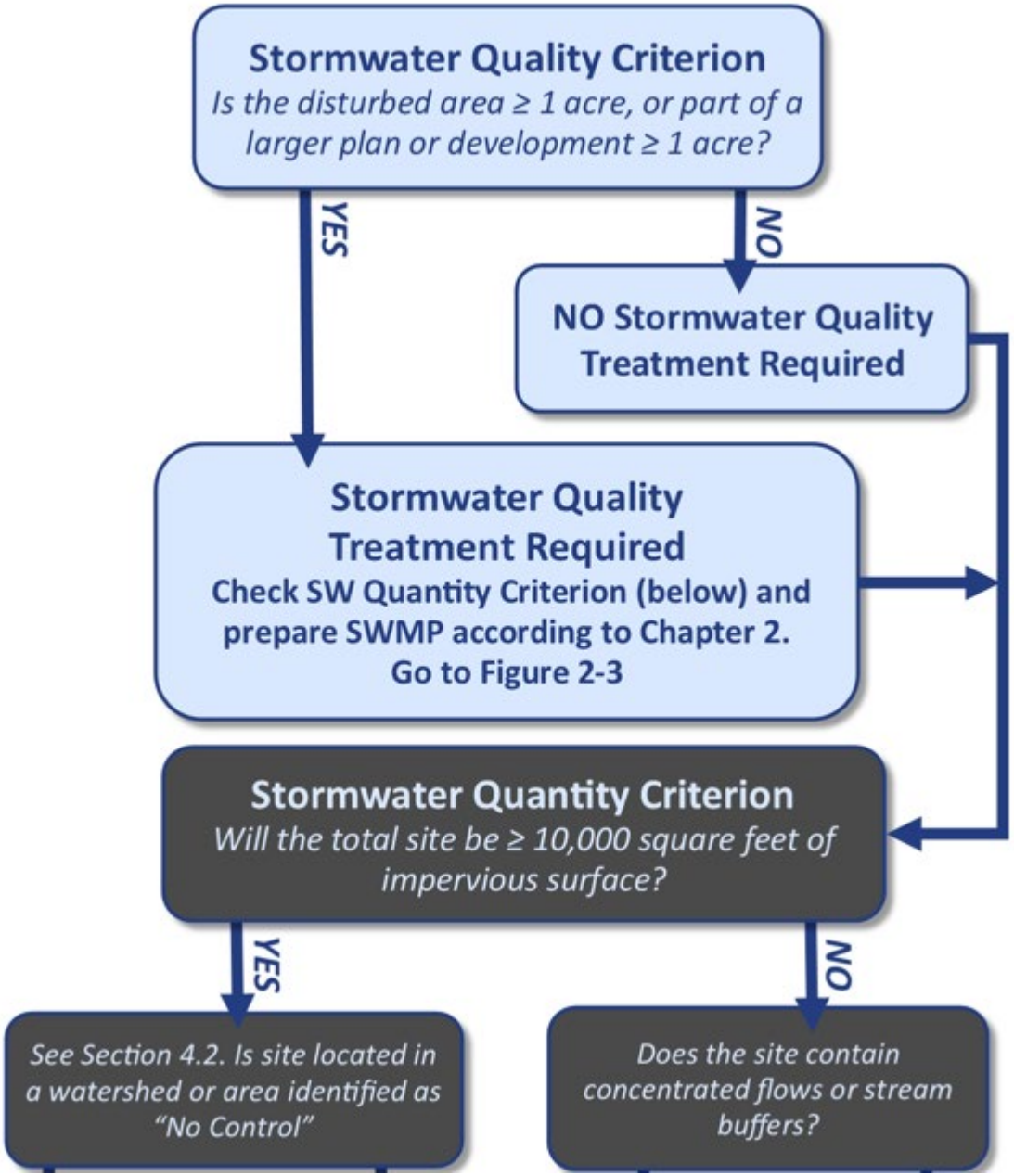
Stage 3: Long-Term Management

Performance Standard Applicability

Chapter 2

Section 2.3.2

Topeka Stormwater BMP Design Handbook

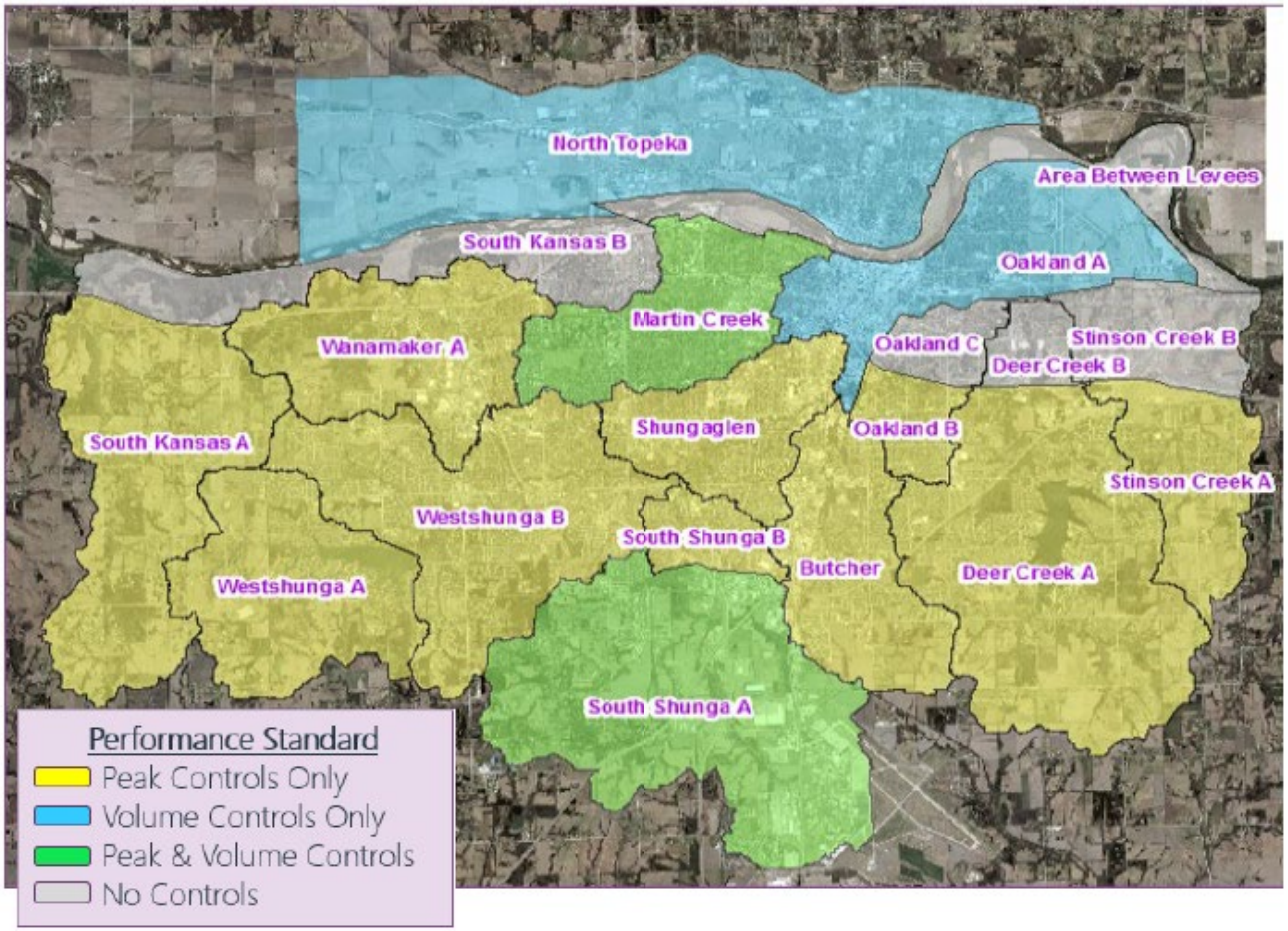


Performance Standard Applicability

Chapter 2

Section 2.3.2

Topeka Stormwater BMP Design Handbook

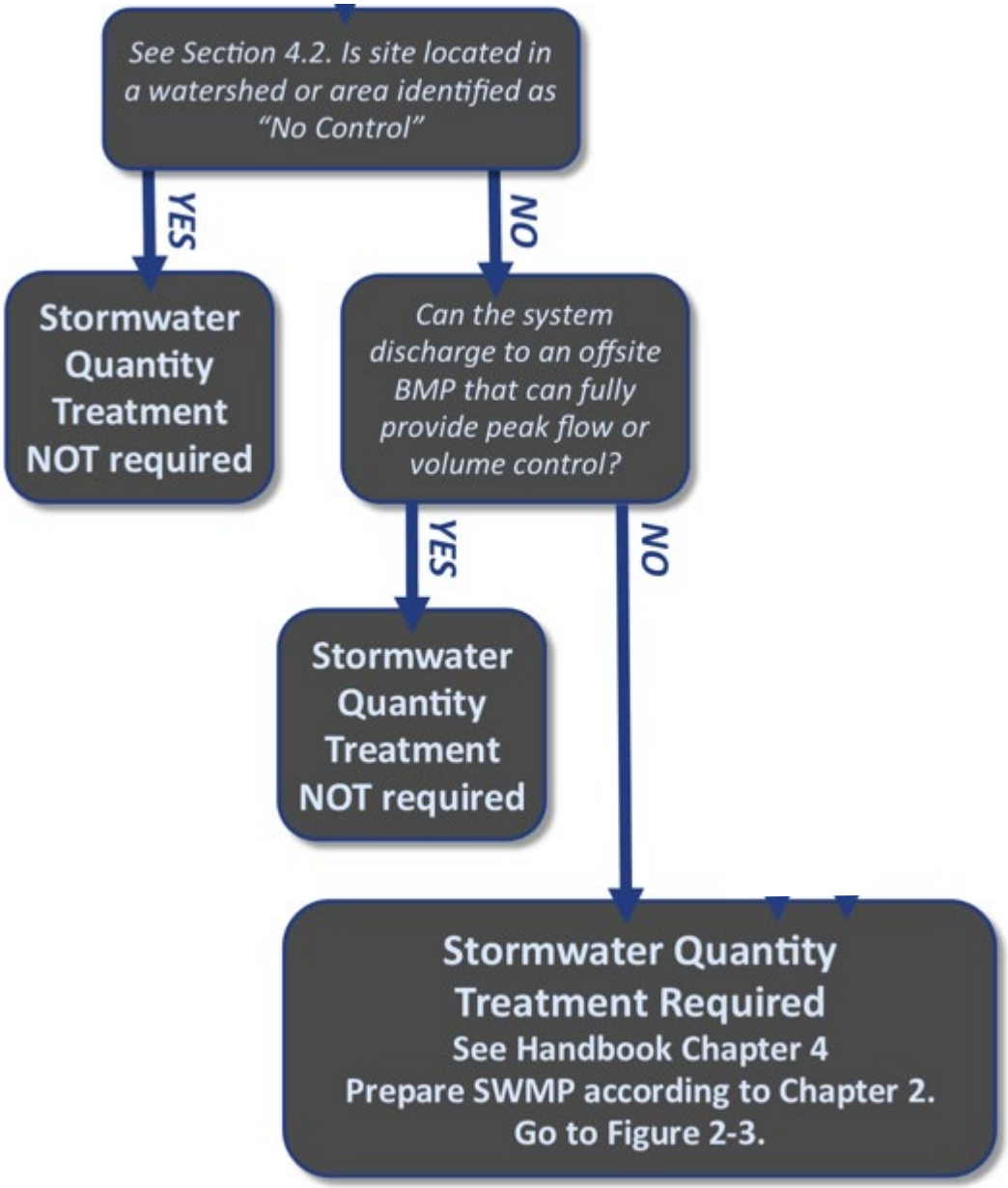


Performance Standard Applicability

Chapter 2

Section 2.3.2

Topeka Stormwater BMP Design Handbook

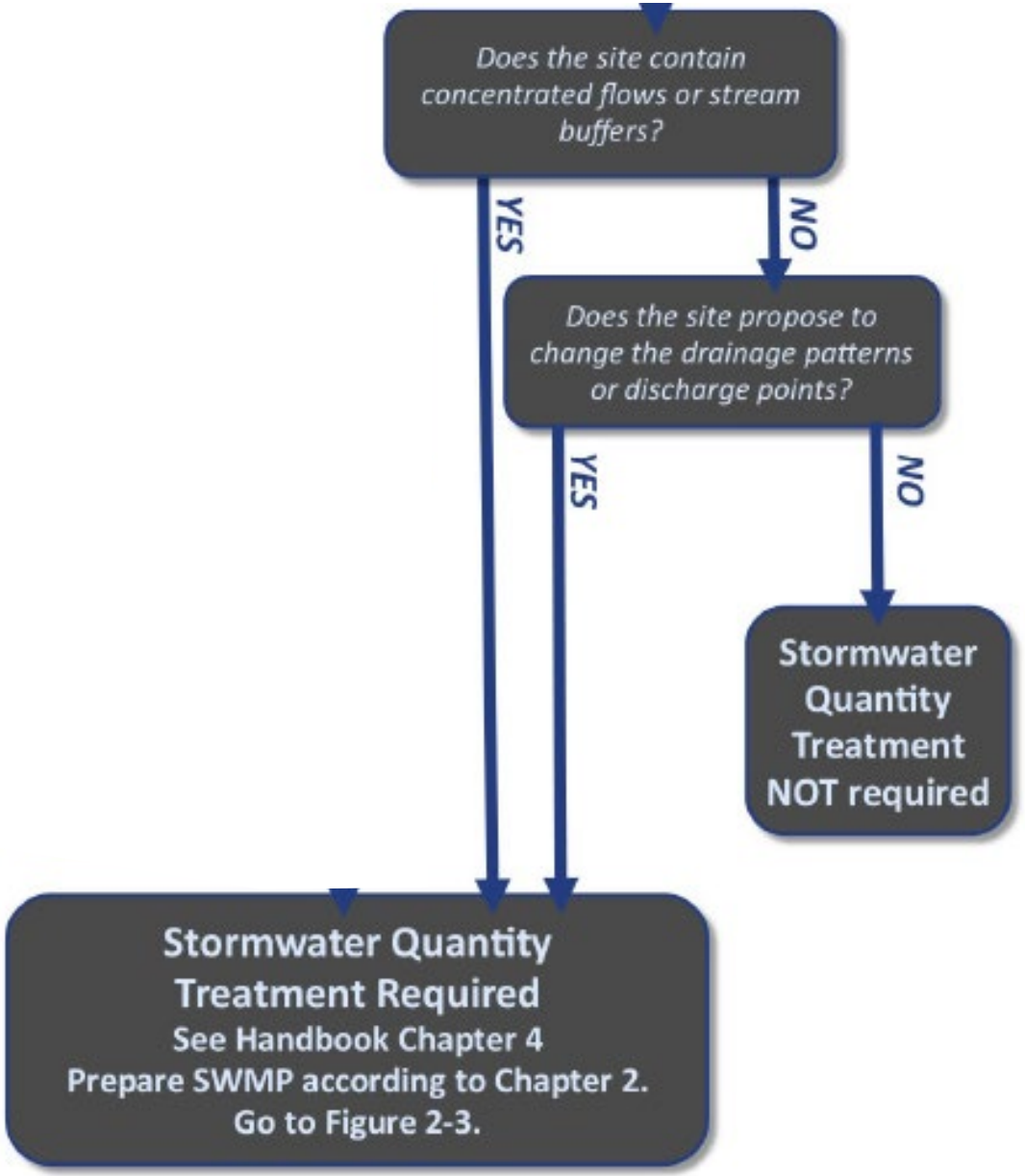


Performance Standard Applicability

Chapter 2

Section 2.3.2

Topeka Stormwater BMP Design Handbook



SWMP Requirements

- **SWMPs must:**
  - Be prepared per the Handbook and the Topeka Design Criteria
  - Comply with all local, state and federal permit requirements, plans and programs
  - Use Topeka Stormwater Management Plan Checklist
  - Be signed and sealed by a Professional Engineer

- **We recommend:**
  - Consult a registered Landscape Architect, horticulturalist, or plant ecologist for BMP Planting Plan design

Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

Existing Conditions Information

- **Narratives:**
  - Land use, topography, and hydrologic characteristics
- **List:** each impervious area added since 2011
- **Map:**
  - Drainage features
  - Interior drainage area boundaries
  - Surface flow paths
  - Discharge points/outfalls
  - Floodplains, levees, and critical areas
  - Easements
  - Pervious and impervious areas
- **Identify and calculate:**
  - Peak flows at each discharge point (for all required storm events)

Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

Proposed Conditions Information

- **Narratives:**
  - Land use of disturbed areas
  - Topographic and hydrologic characteristics
  - Describe impervious areas to be added or replaced
  - Identification of any land use “hot spots”
- **Site Plans and Grading Plans must include:**
  - Minimum 2-foot contours of proposed grading
  - Easements:
    - Stormwater Management
    - Access
    - All others
  - Location and boundaries of LID Areas
  - Profiles for all pipeline crossings

Key Elements of a SWMP

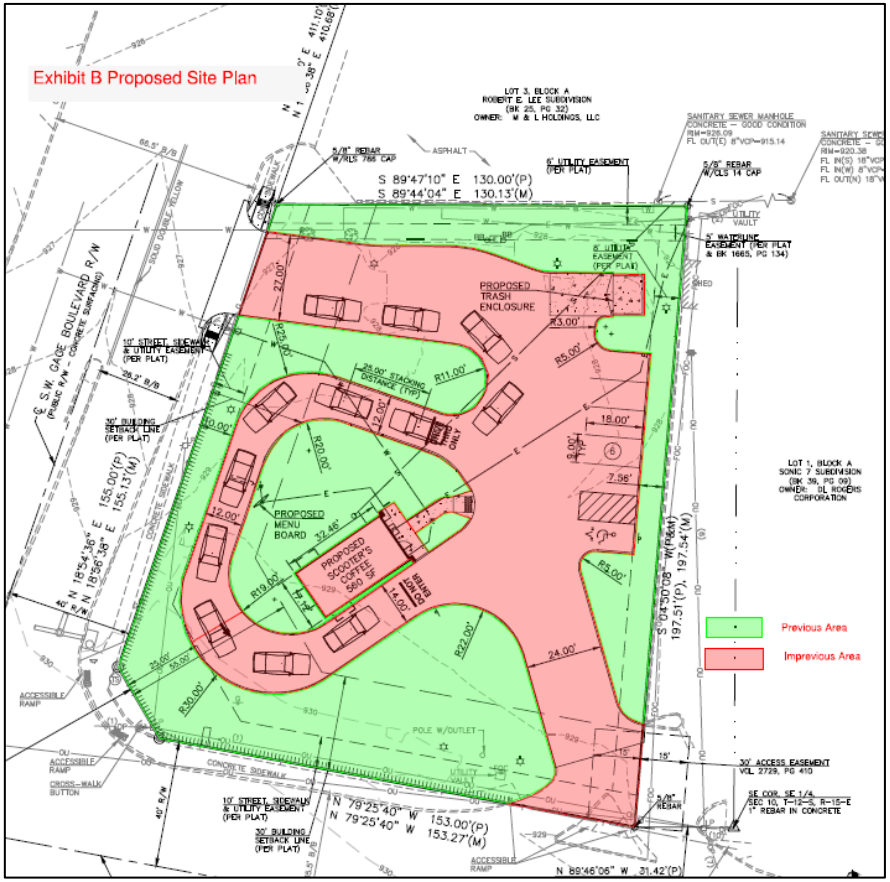
Topeka Stormwater Management Plan Checklist

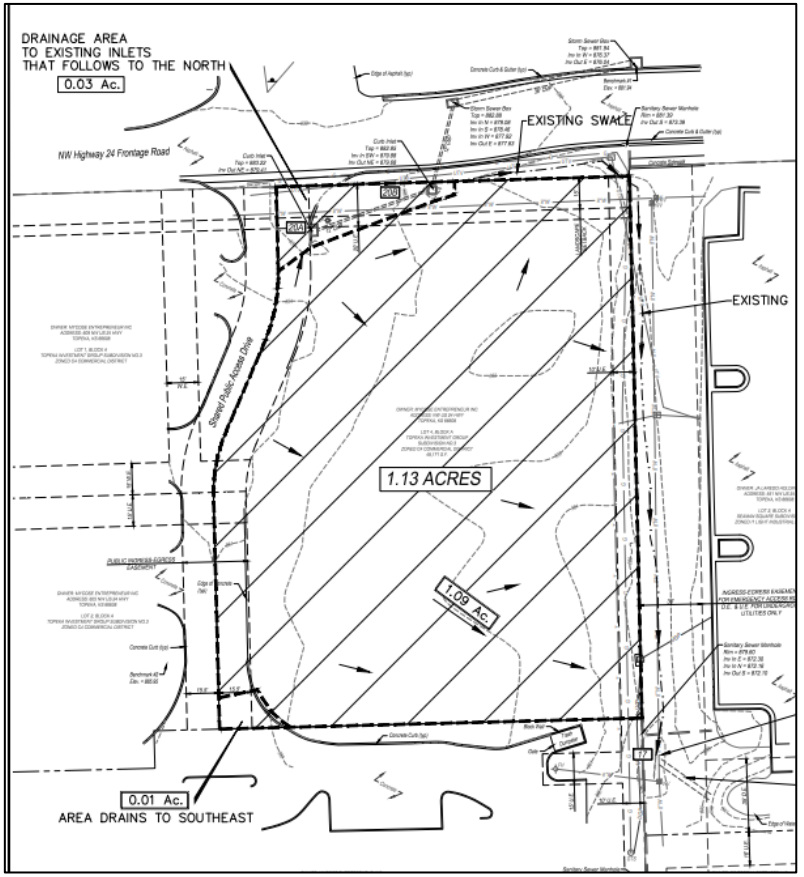
Proposed Conditions Information

- **Map the proposed:**
  - Drainage features
  - Interior drainage area boundaries
  - Surface flow paths
  - Discharge points/outfalls
  - Floodplains, levees, and critical areas
  - Easements
  - Pervious and impervious areas
- **Identify and calculate:**
  - Peak flows intercepted by stormwater BMPs
  - Proposed conditions peak flows at each discharge point (for all required storm events)
  - Peak flows leaving site from each driveway

Effective Mapping

- **Clearly** labeled
- Arrows showing flow paths
- Colors or shading help distinguish drainage areas, impervious vs. pervious areas, etc.





Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

On-Site Conveyance System Information

- **Map:** All components of stormwater conveyance system:
  - Swales, ditches, and channels
  - Gutters, inlets, and drains
  - Catch basins
  - Pipes and culverts
  - Headwalls, wing walls, and end walls
  - Aprons and armoring
- **Calculations:** Storm conveyance system design

The on-site stormwater system must be designed for the **10-year storm** with provisions for safe overflow of the **100-year storm**.

Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

Overland Flow Path Information

- **Map:**
  - Overland flow pathways for flows above the required design storms
- **Calculations must show:**
  - Proposed design manages overflows in a manner that does not cause or increase negative impacts to other properties or infrastructure

Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

Stormwater Quantity Summary

- **Describe** the approach to be used to meet the stormwater quantity requirements
- **Summarize** the difference in pre-developed and post-developed peak flow rates
- **Identify** upstream and downstream impacts

Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

Stormwater Quality Information

- **Describe** how the design meets stormwater quality requirements

  Use the MARC Manual of Best Management Practices for Stormwater Quality

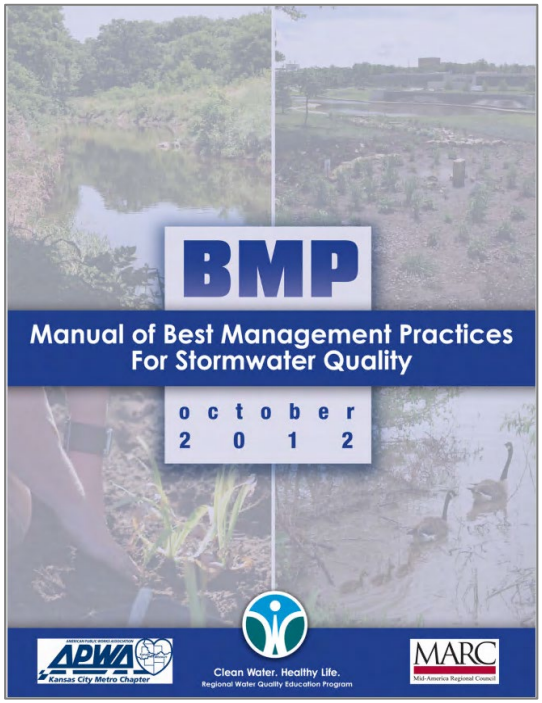


Table 4.4
Best Management Practice Value Ratings

Cover Type or BMP	Median Expected Effluent EMC TSS (mg/L)	Value Ratings: Water Quality Value	Volume Reduction	Temperature Reduction	Oils/ Floatables Reduction	Overall Value Rating
Vegetation	N/A	5.25	2	1	1	9.25
Native Vegetation preserved or established						
Rain Garden	< 10	4	2	1	2	9.0
A small residential depression planted with native vegetation designed to capture and infiltrate runoff						
Infiltration Practices	< 10	4	2	1	2	9.0
Infiltration Basin						
Infiltration Trenches						
Bioretention	< 10	4	1.5	1	2	8.5
Small engineered and landscaped basins designed to filter runoff before release						
Pervious or Porous Pavement	10-20	3	1.5	1	2	7.5
Pervious Concrete						
Porous Asphalt						
Modular Concrete Block						
Extended Detention Wetland	< 10	4	2	0	1	7.0
A land area that is permanently wet with hydric soils sized to detain the WQv for a minimum of 40 hours.						
Media Filtration Practices	< 10	4	0	0	2	6.0
Surface Sand Filter						
Underground Sand Filter						
Pocket Sand Filter						
Perimeter Sand Filter						
Extended Wet Detention	10 - 20	3	2	-1	1	5.0
A basin intended to have a permanent pool and sized to detain the WQv for a minimum of 40 hours						
Vegetated Filter Strip	10 - 20	3	1	0	1	5.0
Buffer strip with native vegetation treating sheet flow						
Native Vegetation Swale	10 - 20	3	1	0	0	4.0
Native grasses and forbes planted in a swale to reduce velocity of runoff and promote infiltration						
Extended Dry Detention Basin	20 - 50	2	1	0	1	4.0
A basin lined with native plant species designed to detain the WQv for a minimum of 40 hours with no permanent impoundment of water						
Other Systems	10 - 100 [h]	1-3 [i]	0	0	2	3.0-5.0 [g]
Proprietary Media Filtration Devices						
Hydrodynamic Devices						
Baffle Boxes						
Catch Basin Inserts						
Signage	N/A	N/A	N/A	N/A	N/A	BMP VR + 0.25 [e]
Green Roofs – No VR, Credit for Post Concrstrcution CN Reduction, See Design Section						CN Credit See Design
Notes:						

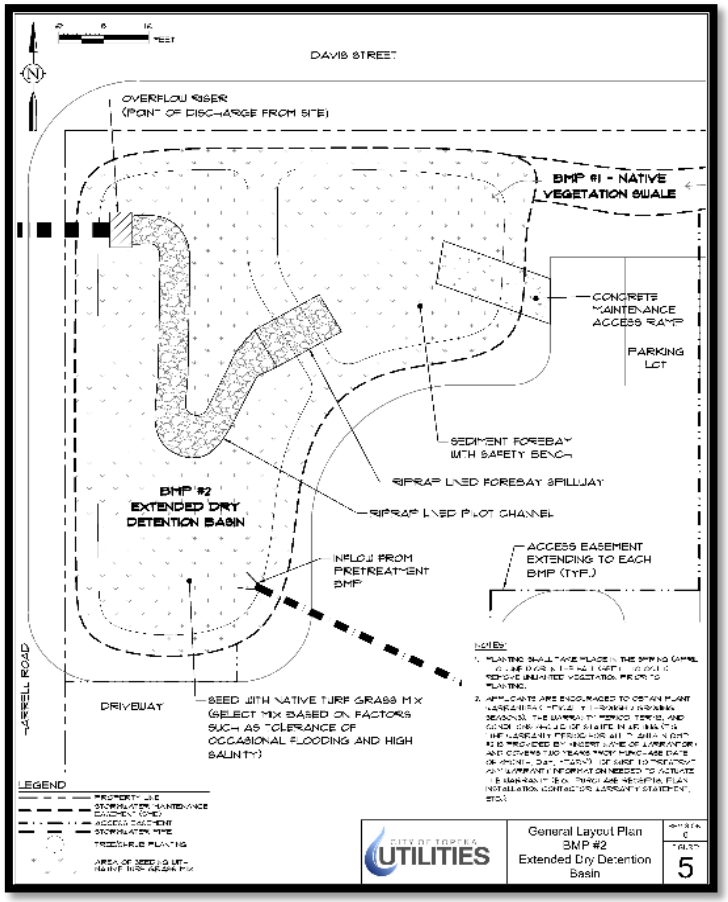
Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

Stormwater Quality Information

- **Map:**
  - Stormwater quality BMP locations/boundaries
  - BMP drainage areas
  - BMP plan and profile views
  - BMP Planting Plan (each vegetated BMP)
- **Provide:**
  - Level of Service/Value Rating Worksheets (MARC Manual)
  - Mitigation Plan Worksheets (MARC Manual)
  - Infiltration Design Information
  - Water Quality Volume Calculations
  - BMP Design Procedure Forms
  - Documentation that the BMP meets the design requirements defined in the MARC Manual.

Stormwater Quality Information



Example BMP Planting Plans

Example Mitigation Plan Worksheet

WORKSHEET 2: DEVELOP MITIGATION PACKAGE(S) THAT MEET THE REQUIRED LS

Project: ***BMP Manual Example No. 1*** By: SAS Date: 11/20/07
Location: Bur Oak, Missouri Checked: Date:
Sheet 2 of 2

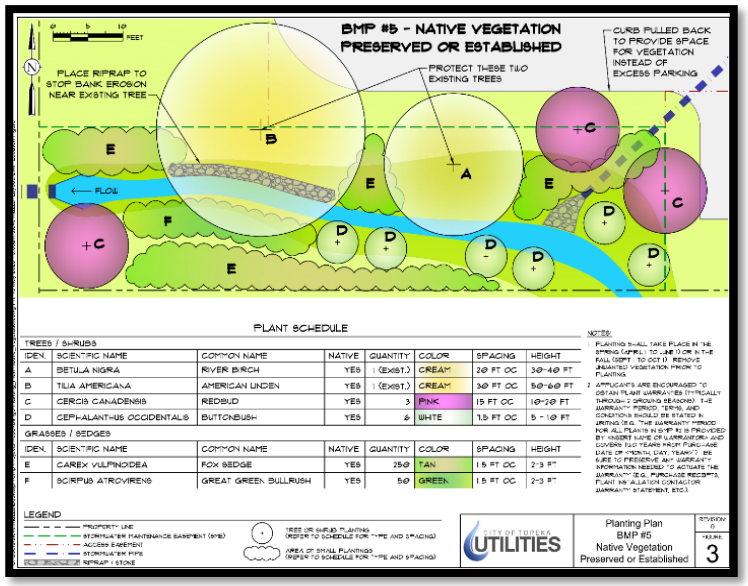
1. **Required LS (from Table 1 or 1A or Worksheet 1 or 1A, as appropriate):** 5

   Note: Various BMPs may alter CN of proposed development, and LS; recalculate both if applicable.

2. **Proposed BMP Option Package No. 3**

Cover/BMP Description	Treatment Area	VR from Table 5 or 6[1]	Product of VR x Area	
Preserved native vegetation	14.00	9.25	129.50	
Streets	19.51	0.00	0.00	
Houses/driveways	15.50	0.00	0.00	
Native grass lawn*	46.49	9.25	430.06	*[Note: Maintain native lawns through covenants?]*
Total*:	95.50	**Total:**	559.56	
		Weighted VR:	5.86	= total product/total area

1 VR calculated for final BMP only in Treatment Train.
2 Total treatment area cannot exceed 100 percent of the actual site area.



Requests for Waiver from Post-Construction Water Quality Requirements

Submit to the Utilities Director

Include:

a) Description of proposed project
b) Explanation of existing conditions
c) Existing condition land cover – label impervious and pervious
d) Proposed land cover & site plan – label impervious and pervious
e) Pre- and Post-condition runoff calcs for 10- and 100-year events
f) Verification that existing drainage patterns WILL NOT change
g) Verification of 10-year discharge from driveways

Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

Easement Information

- **Identify:**
  - Existing Drainage or Stormwater Management Easements
  - Will they remain or be vacated?
- **Describe:**
  - Proposed easements
  - Potential easement conflicts

Easement language is in the Subdivision Checklist

Forms for Easements Granted by Instrument are here:
https://www.topeka.org/engineering/easement-forms/

Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

Stream Buffer Information

- **Identify and label:**
  - All streams on the site or adjacent to the site that require a stream buffer easement
  - All stream buffer easement extents (inner and outer limits)

- Submit waiver requests **for development within a stream buffer** to the Utilities Director.

Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

Floodplain Information

- **Identify and label:**
  - FEMA Special Flood Hazard Areas
  - Channelized drainage areas
  - Designated floodplains on a City of Topeka work map, such as the levee ponding areas
  - Drainage Easement Extents
- **Drainage Easements** shall cover the **entire** 100-year WSEL extent

Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

BMP Inspection & Maintenance Plan

- **Map:**
  - Property boundary
  - Building and pavement footprints
  - General description of pervious land cover areas
    - *Woods, turf, landscaped bed, etc.*
- Copy of BMP-specific inspection & maintenance guidance from Topeka BMP Maintenance Manual
- Explanation of Maintenance Verification for existing BMPs that will remain
- Acknowledgement of BMP Responsibility (signed)
- For proprietary BMPs
  - Vendor name & contact info
  - Manufacturer name & contact info
  - BMP make, model, & date of manufacture
  - Manufacturer's maintenance guidance
  - List of parts that must be removed/replaced for normal operation

"Topeka BMP Maintenance Manual"

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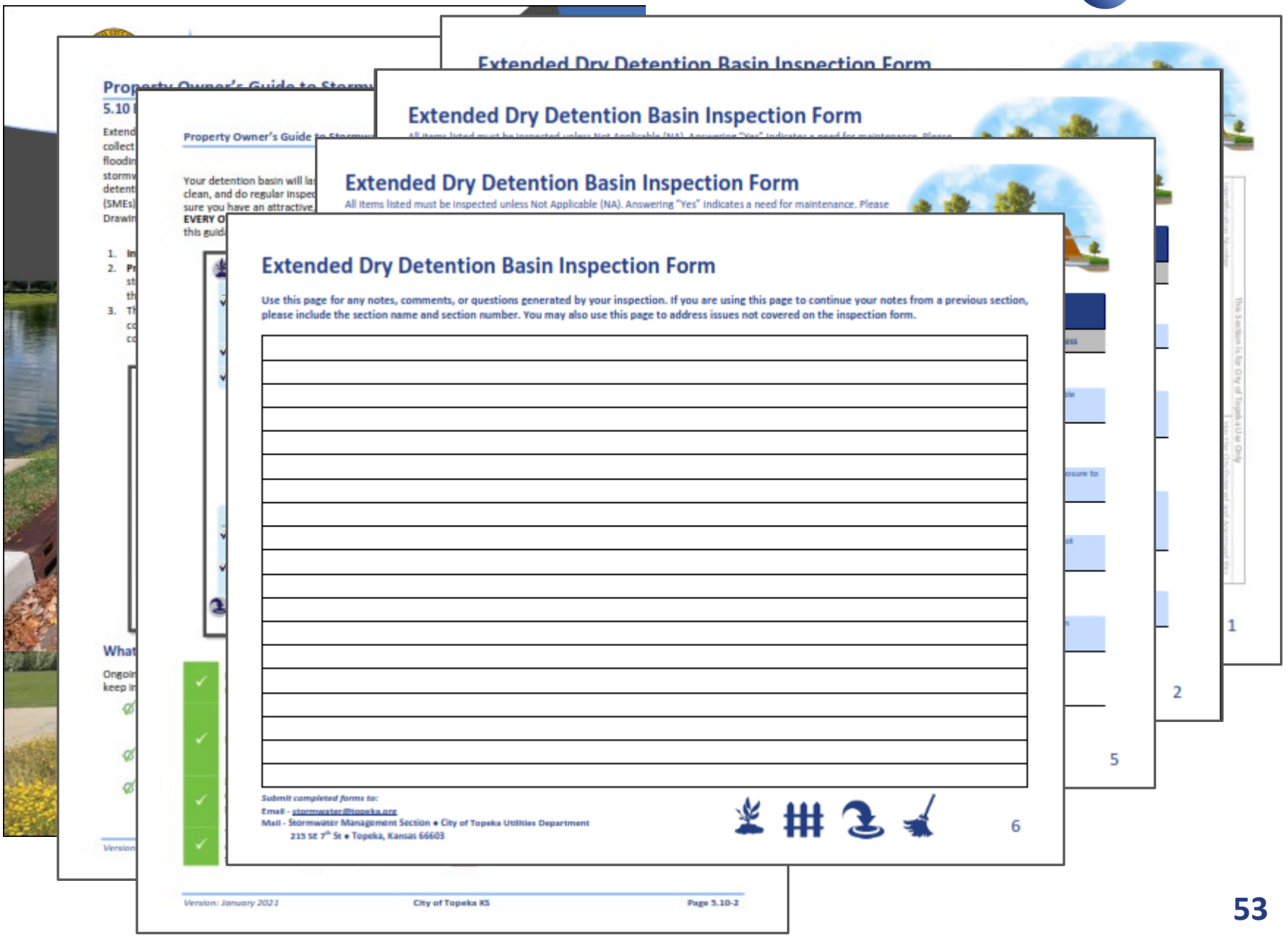


Key Elements of a SWMP

Topeka Stormwater Management Plan Checklist

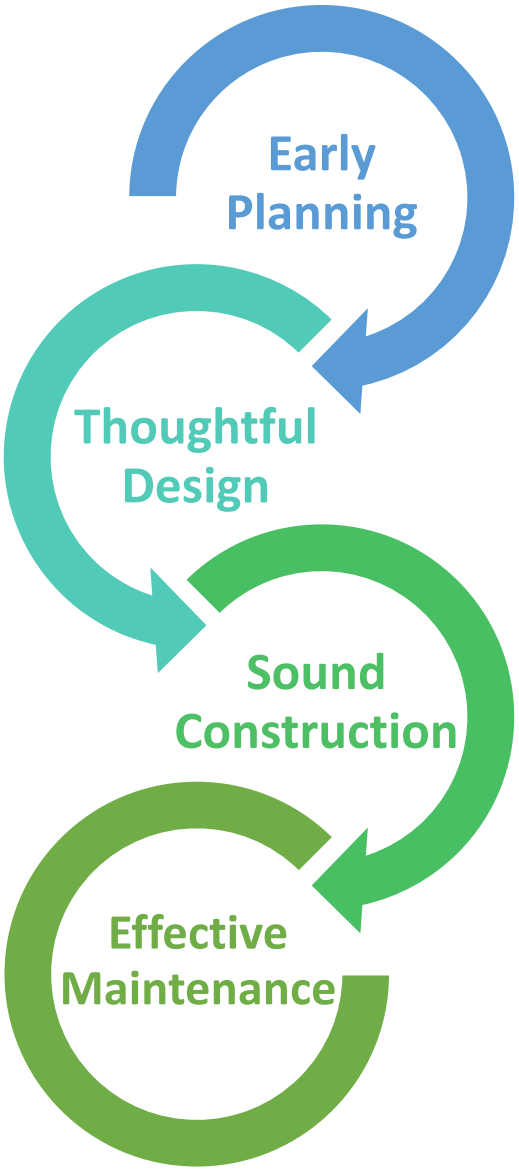
Other Notable Items

- **Levee Review required** when any portion of project lies within 500 ft from centerline of levee ("levee critical zone")
- **KDOT approval required** for changes to drainage entering KDOT right-of-way
- **Drainage agreement <u>between property owners</u> required** for point source discharges onto a neighboring property
- **Public Improvement Project required** for alterations or installation of a public drainage structure in the public right-of-way or public easement

The Construction Termination Process

https://www.topeka.org/utilities/stormwater-development-management/

Life Stages of Stormwater BMPs



Stage 1: Planning & Design

Stage 2: Grading & Construction

Stage 3: Long-Term Management

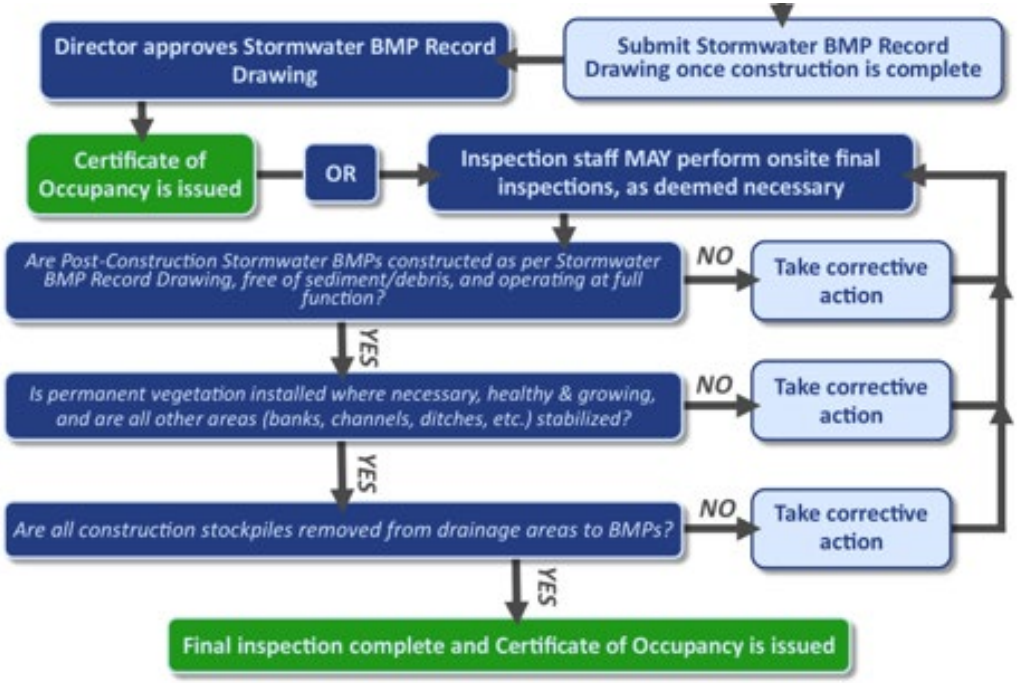
Importance of Const. Termination

- "Officially" transitions BMPs from const. to maint. stage
  - TMC Chapter 13.35 "ends" and Chapter 14.40 "begins"
- Establishes a record of each BMP at end of construction
- Assures correct BMP construction and proper function to Developer, City, & Future Property Owner
- Evaluates:
  - Construction compliance with approved SWMP
  - "Proper" BMP construction
  - BMP locations and types
  - BMP function at construction termination
    - Functional and undamaged
    - Clean *(no construction sediment or debris, well-maintained)*
    - Protected *(no open, dirty, or unstable areas in drainage area)*
    - Plant coverage and health *(vegetated BMPs only)*

Construction Termination Process

Chapter 2

Topeka Stormwater BMP Design Handbook



1. Submit Stormwater BMP Record Drawing **for approval**
2. "Final" Inspection *(maybe)*

Stormwater BMP Record Drawing

Chapter 2, Section 2.5

Topeka Stormwater BMP Design Handbook

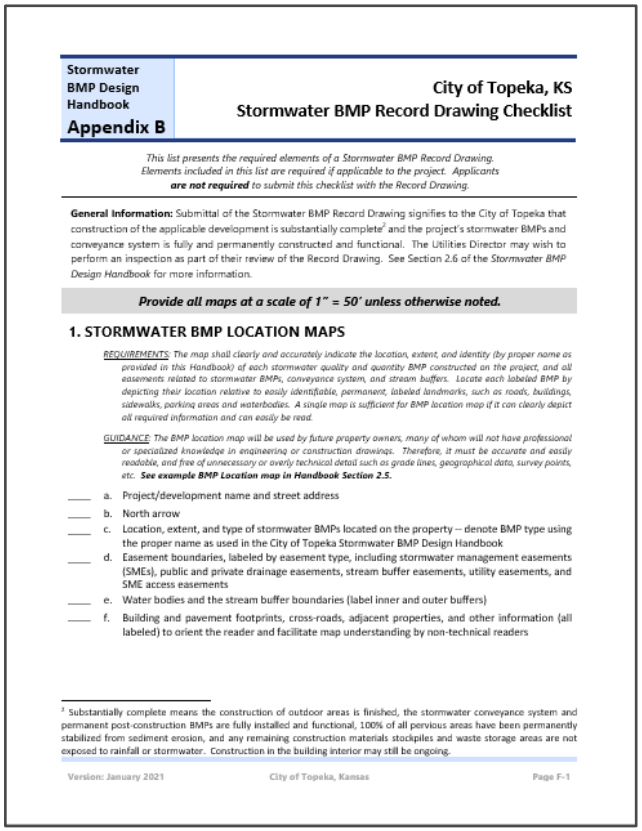
- Major Elements
  - Stormwater BMP Location Map
  - Stormwater BMP Certification Statement
  - As-Built Plans
  - BMP Planting Plans

Stormwater BMP Record Drawing Checklist

Appendix B

Topeka Stormwater BMP Design Handbook

- Full list of record drawing requirements



Stormwater BMP Design Handbook
Appendix B

City of Topeka, KS
Stormwater BMP Record Drawing Checklist

*This list presents the required elements of a Stormwater BMP Record Drawing. Elements included in this list are required if applicable to the project. Applicants **are not required** to submit this checklist with the Record Drawing.*

General Information: Submittal of the Stormwater BMP Record Drawing signifies to the City of Topeka that construction of the applicable development is substantially complete[1] and the project's stormwater BMPs and conveyance system is fully and permanently constructed and functional. The Utilities Director may wish to perform an inspection as part of their review of the Record Drawing. See Section 2.6 of the *Stormwater BMP Design Handbook* for more information.

Provide all maps at a scale of 1" = 50' unless otherwise noted.

1. STORMWATER BMP LOCATION MAPS

REQUIREMENTS: The map shall clearly and accurately indicate the location, extent, and identity (by proper name as provided in this Handbook) of each stormwater quality and quantity BMP constructed on the project, and all easements related to stormwater BMPs, conveyance system, and stream buffers. Locate each labeled BMP by depicting their location relative to easily identifiable, permanent, labeled landmarks, such as roads, buildings, sidewalks, parking areas and waterbodies. A single map is sufficient for BMP location map if it can clearly depict all required information and can easily be read.

GUIDANCE: The BMP location map will be used by future property owners, many of whom will not have professional or specialized knowledge in engineering or construction drawings. Therefore, it must be accurate and easily readable, and free of unnecessary or overly technical detail such as grade lines, geographical data, survey points, etc. ***See example BMP Location map in Handbook Section 2.5.***

____ a. Project/development name and street address
____ b. North arrow
____ c. Location, extent, and type of stormwater BMPs located on the property – denote BMP type using the proper name as used in the City of Topeka Stormwater BMP Design Handbook
____ d. Easement boundaries, labeled by easement type, including stormwater management easements (SMEs), public and private drainage easements, stream buffer easements, utility easements, and SME access easements
____ e. Water bodies and the stream buffer boundaries (label inner and outer buffers)
____ f. Building and pavement footprints, cross-roads, adjacent properties, and other information (all labeled) to orient the reader and facilitate map understanding by non-technical readers

[1] Substantially complete means the construction of outdoor areas is finished, the stormwater conveyance system and permanent post-construction BMPs are fully installed and functional, 100% of all pervious areas have been permanently stabilized from sediment erosion, and any remaining construction materials stockpiles and waste storage areas are not exposed to rainfall or stormwater. Construction in the building interior may still be ongoing.

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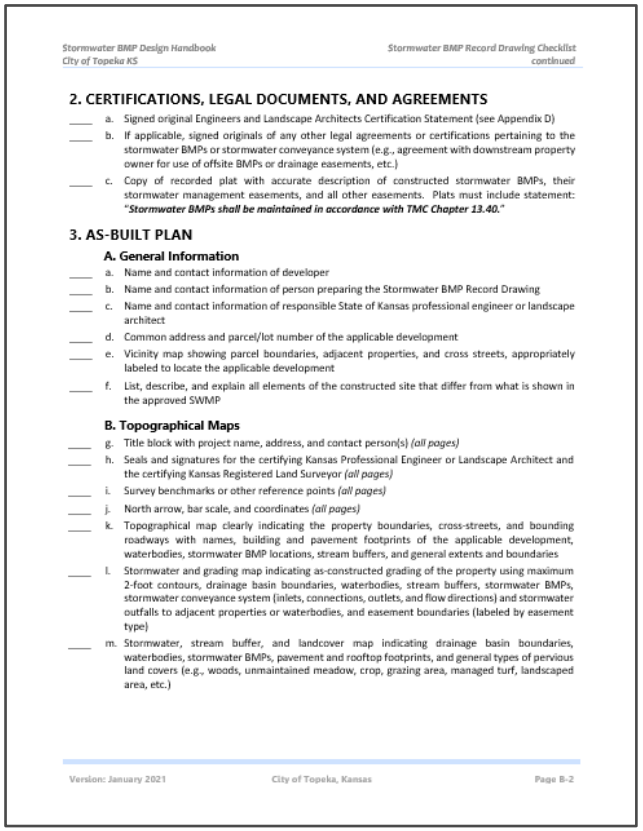

Stormwater BMP Design Handbook
City of Topeka KS
Stormwater BMP Record Drawing Checklist
continued

2. CERTIFICATIONS, LEGAL DOCUMENTS, AND AGREEMENTS

____ a. Signed original Engineers and Landscape Architects Certification Statement (see Appendix D)
____ b. If applicable, signed originals of any other legal agreements or certifications pertaining to the stormwater BMPs or stormwater conveyance system (e.g., agreement with downstream property owner for use of offsite BMPs or drainage easements, etc.)
____ c. Copy of recorded plat with accurate description of constructed stormwater BMPs, their stormwater management easements, and all other easements. Plats must include statement: "***Stormwater BMPs shall be maintained in accordance with TMC Chapter 13.40.***"

3. AS-BUILT PLAN

A. General Information

____ a. Name and contact information of developer
____ b. Name and contact information of person preparing the Stormwater BMP Record Drawing
____ c. Name and contact information of responsible State of Kansas professional engineer or landscape architect
____ d. Common address and parcel/lot number of the applicable development
____ e. Vicinity map showing parcel boundaries, adjacent properties, and cross streets, appropriately labeled to locate the applicable development
____ f. List, describe, and explain all elements of the constructed site that differ from what is shown in the approved SWMP

B. Topographical Maps

____ g. Title block with project name, address, and contact person(s) *(all pages)*
____ h. Seals and signatures for the certifying Kansas Professional Engineer or Landscape Architect and the certifying Kansas Registered Land Surveyor *(all pages)*
____ i. Survey benchmarks or other reference points *(all pages)*
____ j. North arrow, bar scale, and coordinates *(all pages)*
____ k. Topographical map clearly indicating the property boundaries, cross-streets, and bounding roadways with names, building and pavement footprints of the applicable development, waterbodies, stormwater BMP locations, stream buffers, and general extents and boundaries
____ l. Stormwater and grading map indicating as-constructed grading of the property using maximum 2-foot contours, drainage basin boundaries, waterbodies, stream buffers, stormwater BMPs, stormwater conveyance system (inlets, connections, outlets, and flow directions) and stormwater outfalls to adjacent properties or waterbodies, and easement boundaries (labeled by easement type)
____ m. Stormwater, stream buffer, and landcover map indicating drainage basin boundaries, waterbodies, stormwater BMPs, pavement and rooftop footprints, and general types of pervious land covers (e.g., woods, unmaintained meadow, crop, grazing area, managed turf, landscaped area, etc.)

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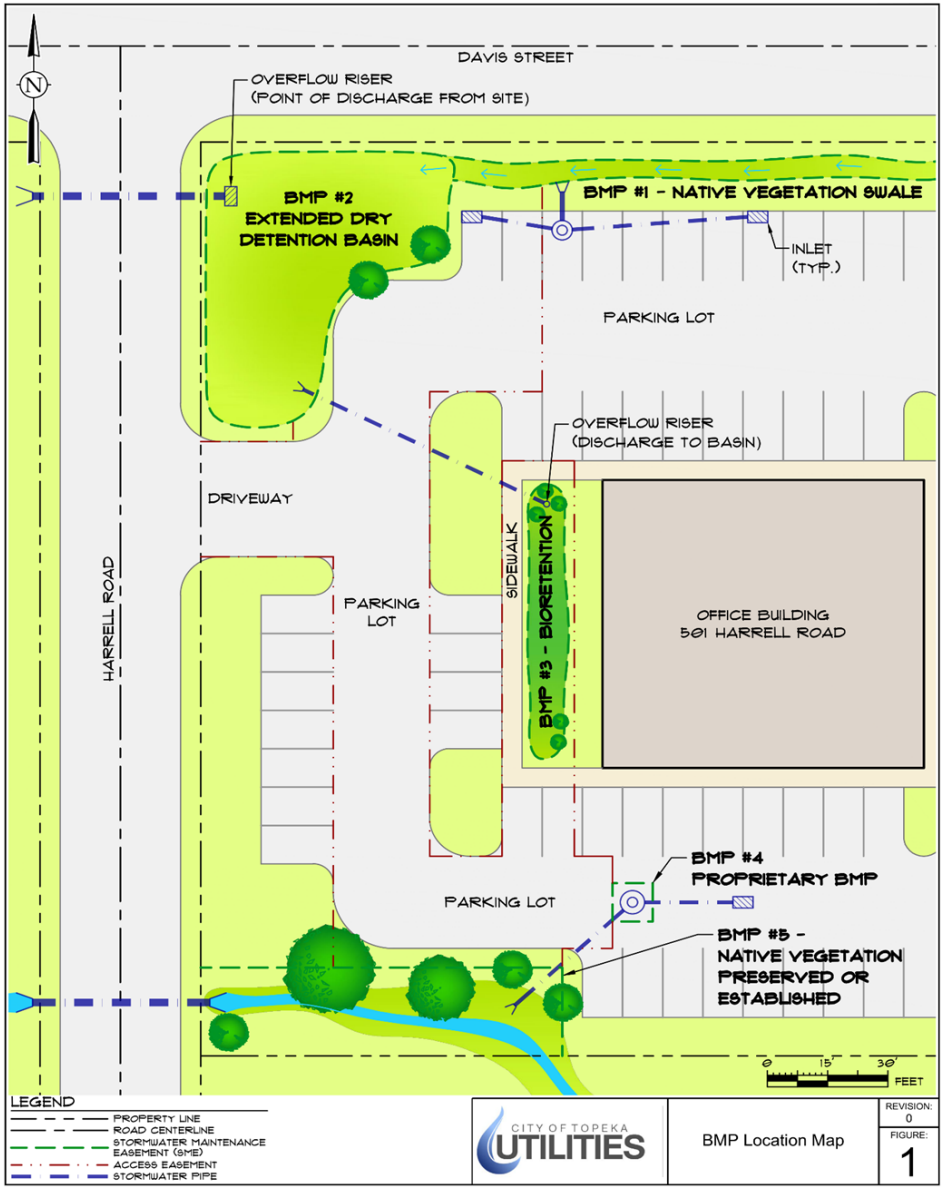
BMP Location Map

- Prepared for the **Owner** and **Maintainer**
- Non-technical
- Easy to understand
- Labeled



As-Built Plan

Chapter 2 & Appendix B

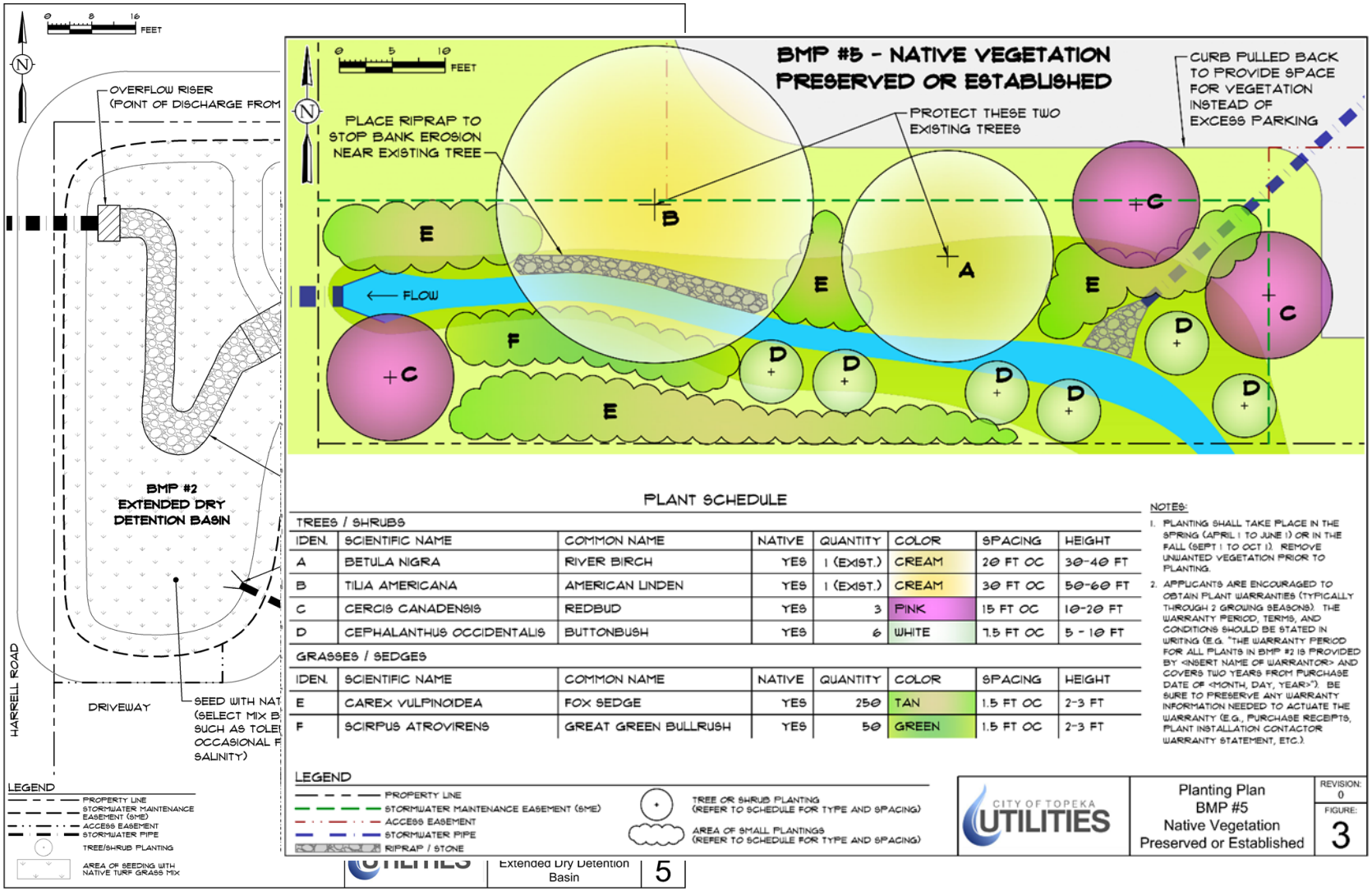
Topeka Stormwater BMP Design Handbook

- Major Requirements
  - General Info *(developer, designer, location, etc)*
  - Topo & Hydrology Maps
  - Detailed Stormwater BMP Information
  - BMP Planting Plans
  - Hotspot Maps/Info
  - Conveyance System Maps/Info

As-Built Plan

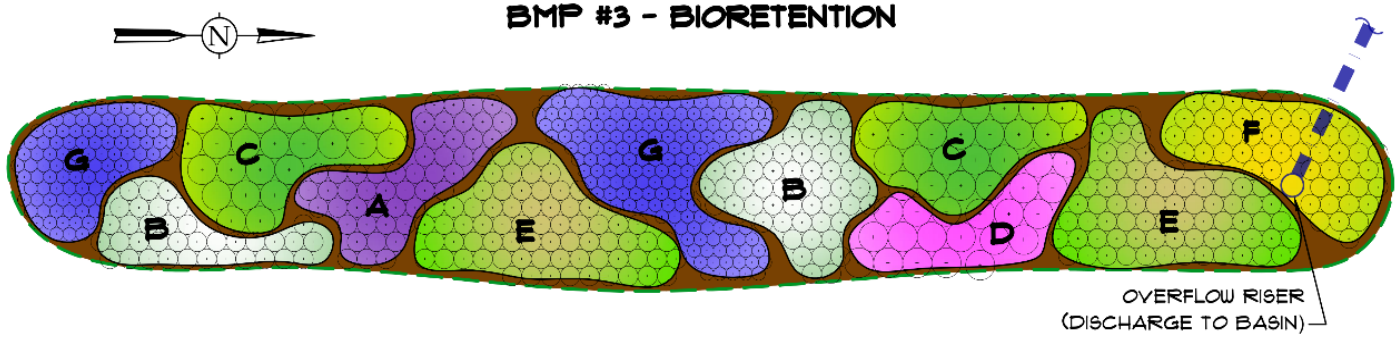
- **BMP Info for <u>each BMP</u>**
  - Plan view of each BMP w/ all components labeled
  - Drainage area
  - Cross-section view
  - Type, condition, dimensions, depth, materials, etc.
  - Design calculations
  - Additional detail for proprietary BMPs
- **Planting Plan for <u>each vegetated BMP</u>**
  - Labeled map with plan legend of BMP **<u>as-planted</u>**
  - For each plant species
    - Type (genus/species)
    - Location, spacing, expected spread
    - Installation schedule/reqmts
    - Growing conditions
    - Care requirements
    - Warranty info

BMP Planting Plans



BMP Planting Plans

BMP #3 - BIORETENTION



PLANT SCHEDULE

IDEN.	SCIENTIFIC NAME	COMMON NAME	NATIVE	QUANTITY	COLOR	SPACING	HEIGHT
A	BAPTISIA AUSTRALIS	BLUE FALSE INDIGO	YES	50	PURPLE	12" OC	2-4 FT
B	PENSTEMON DIGITALIS	FOXGLOVE BEARDTONGUE	YES	90	WHITE	12" OC	2-3 FT
C	SPOROBOLUS HETEROLEPSIS	PRAIRIE DROPSEED	YES	43	GREEN	18" OC	1-3 FT
D	ASCLEPIAS INCARNATA	SWAMP MILKWEED	YES	20	PINK/PURPLE	18" OC	3-5 FT
E	CAREX VULPINOIDEA	FOX SEDGE	YES	142	TAN	12" OC	2-3 FT
F	RUDBECKIA FULGIDA SPECIOSA	SHOWY BLACK-EYED SUSAN	YES	54	YELLOW	12" OC	2-3 FT
G	GENTIANA ANDREWSII	BOTTLE GENTIAN	YES	262	BLUE	8" OC	1-2 FT

NOTES:

1. PLANTING SHALL TAKE PLACE IN THE SPRING (APRIL 1 TO JUNE 1) OR IN THE FALL (SEPT 1 TO OCT 1). REMOVE UNWANTED VEGETATION PRIOR TO PLANTING.
2. APPLICANTS ARE ENCOURAGED TO OBTAIN PLANT WARRANTIES (TYPICALLY THROUGH 2 GROWING SEASONS). THE WARRANTY PERIOD, TERMS, AND CONDITIONS SHOULD BE STATED IN WRITING (E.G. "THE WARRANTY PERIOD FOR ALL PLANTS IN BMP #2 IS PROVIDED BY <INSERT NAME OF WARRANTOR> AND COVERS TWO YEARS FROM PURCHASE DATE OF <MONTH, DAY, YEAR>"). BE SURE TO PRESERVE ANY WARRANTY INFORMATION NEEDED TO ACTUATE THE WARRANTY (E.G., PURCHASE RECEIPTS, PLANT INSTALLATION CONTACTOR WARRANTY STATEMENT, ETC.).

LEGEND

- STORMWATER MAINTENANCE EASEMENT (SME)
- STORMWATER PIPE
- PLANTS (REFER TO SCHEDULE FOR TYPE AND SPACING)

CITY OF TOPEKA UTILITIES

Planting Plan
BMP #3
Bioretention

REVISION: 0

FIGURE: 2