3-Tiered Approach to Sizing BMPs

Achieving water quality improvements, natural resource enhancements and flood control in urban areas requires a thoughtful balance between controlling sources and treating pollution already mobilized by runoff. Construction of structural BMPs such as rain gardens and vegetated swales helps catch and treat stormwater.

1 Stormwater Treatment

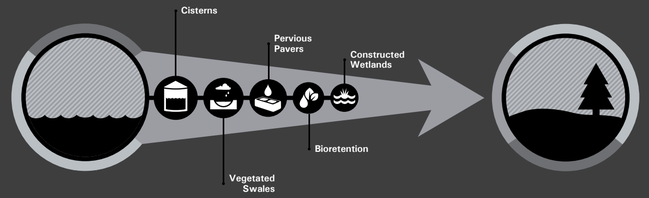
Improving stormwater quality with structural controls requires that runoff be routed through BMPs. Sizing BMPs to effectively capture runoff will reduce pollutants through filtration, uptake and settling processes. An initial BMP-sizing goal is to capture or treat 80 percent of post-construction runoff.

2 Volume Reduction

For sites not constrained by existing infrastructure or environmental conditions, a 10 percent reduction in runoff volume serves as a guideline for new and redevelopment projects.

3 Rate Control

Natural resource agencies are concerned that the frequency of high flow rates in Hinkson Creek are increasing. Preliminary watershed flow-rate reductions could prevent deterioration of aquatic habitat and reduce flooding risks.



Mizzou BMP Model

The University of Missouri uses a variety of Best Management Practices to control stormwater runoff throughout the campus. Cisterns, swales, pervious pavers, and bioretention all help to turn affected areas into enviromentally sustainable spaces.

East Campus Stormwater Modeling Case Study

MU engineers are using sophisticated computer models to guide stormwater planning for new and redevelopment projects. A 150 acre watershed located in east campus was selected as a case study area. The goal of the case study was to assess stormwater improvements possible through installation of Best Management Practices (BMPs).

BMP Planning Options

University engineers modeled three typical situations on campus according to the footprint available for BMP construction. These results are supporting ongoing watershed-based planning and goal setting efforts.

1 Constrained Situations

Areas that are highly developed have fewer opportunities for BMPs than open areas. A limited footprint of distributed BMPs for stormwater control is achievable in constrained settings.

2 Moderate Scenarios

Watersheds having moderate open-space but without regional control opportunities. Significant improvements can be achieved with investments in widespread installation of site level BMPs.

3 Optimized Situations

The addition of a centralized detention basin (regional control) along with distributed BMPs increase watershed-level stormwater control.

MU Researchers Study Stormwater Controls at Hinkson Bottoms

University of Missouri faculty and students planted 777 willow trees on March 22, 2012, at Hinkson Bottoms, an effort that is part of an ongoing collaboration between the College of Agriculture, Food and Natural Resources, College of Engineering and Campus Facilities to study stormwater and floodplain management.

During the two-year project, Jason Hubbart, an assistant professor of forest hydrology and water quality in CAFNR, will study how the trees help the soil absorb more water and then disperse it into the atmosphere by transpiration before it reaches the waterway. Hubbart believes the restoration of urban floodplain forests like the one at Hinkson Creek may help mitigate stormwater runoff.

“Tree root systems increase soil pore spaces. The soil can then retain more water, turning the floodplain into a massive sponge,” Hubbart said.

Willow trees are particularly beneficial to stormwater management, according to Hubbart. While bottomland hardwoods such as maples and sycamores transpire, or release, an average of four to five millimeters of water per day, willows transpire six to eight millimeters in one day during summer months. After one year, the trees can be sustainably harvested and used for biomass at the MU Power Plant or elsewhere.

Results from the study, which is being funded in part by the Environmental Protection Agency and MU Extension, could also be used to develop a national model for urbanizing areas that are prone to flooding and pollution from water runoff.

“This is an opportunity for the university to play a significant role in floodplain management and carbon neutrality by virtue of growing a biomass crop,” Hubbart said.

Hubbart will oversee monitoring of the Hinkson Bottoms site in collaboration with Enos Inniss, assistant professor of environmental engineering, by installing a meteorological station and positioning sensors in the soil.

Campus Facilities maintains Hinkson Bottoms and is working with the College of Engineering and CAFNR on another stormwater project to test the efficacy of best management practices on campus, near the Animal Resource Center.

ENVIRONMENTAL STATEMENT

The University of Missouri saved these valuable resources by using 80% recycled paper containing 60% post-consumer waste, processed chlorine free and manufactured with electricity that is offset with Green-e certified renewable energy.

TREES	WATER	ENERGY	SOLID WASTE	GREENHOUSE GASES
1 fully grown	570 gallons	0.5 million BTU	38 pounds	105 pounds of CO_2

Calculations based on research by Environmental Defense and other members of the Paper Task Force

University of Missouri
180 General Services Building
Columbia, MO 65211
t: 573.882.3091
http://www.cf.missouri.edu/masterplan/stormwater

Willow trees planted at Hinkson Bottoms can be used for biomass and help control stormwater runoff.

Links

STORMWATER MANAGEMENT

1. MU Environmental Health & Safety
   ehs.missouri.edu/env/stormwater
2. City of Columbia
   gocolumbiamo.com/publicworks/stormwater
3. Boone County
   showmeboone.com/stormwater
4. Missouri Department of Natural Resources
   dnr.mo.gov/env/wpp/stormwater
5. U.S. Environmental Protection Agency
   epa.gov/greeningepa/stormwater
6. Stormwater BMP Performance Database
   bmpdatabase.org

CAMPUS PLANNING & MANAGEMENT

7. MU Campus Master Plan
   cf.missouri.edu/masterplan/stormwater
8. MU Sustainability Office
   sustainability.missouri.edu
9. MU Campus Facilities-Landscape Services
   cf.missouri.edu/ls

EDUCATION AND OUTREACH

10. MU School of Natural Resources
    snr.missouri.edu
11. MU Department of Civil and Environmental Engineering
    engineering.missouri.edu/civil
12. U.S. Green Building Council & LEED
    usgbc.org
13. Low Impact Development
    lowimpactdevelopment.org

Stormwater Master Plan

UNIVERSITY OF MISSOURI
FEBRUARY 2013 DRAFT

2013

Protecting Our Waters

MU is embracing an Integrated Stormwater Management approach to protecting our waters through sustainable controls, green infrastructure – as a designated botanic garden – and resource stewardship.

Stormwater runoff occurs when rain or snowmelt is not absorbed into soil but runs over the ground. Chemicals, nutrients and sediment can be carried by runoff from parking lots, lawns and fields into nearby streams and lakes. Pollutants mobilized by stormwater and excessive stress caused by floods can threaten the waters in which we fish and swim.

This Stormwater Master Plan affirms MU’s ongoing commitment to environmental quality. As an adaptive document, this plan will be periodically revised to incorporate the latest advancements in stormwater research, information from ongoing, local waterway studies, and new treatment technologies.

GOAL

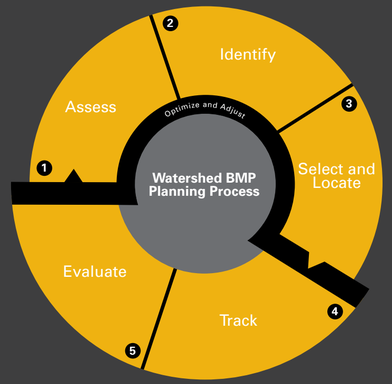
The University of Missouri Stormwater Master Plan provides an adaptable framework that enables the campus community to improve stormwater quality, maintain regulatory compliance and sustain water resource stewardship. This overall goal is energized by Mizzou’s leading research and innovation engine, a key asset in developing solutions to evolving stormwater challenges.

OBJECTIVES

- Identify an optimal set of site-level stormwater controls and guidelines for new and redevelopment projects.
- Pursue a watershed-scale management approach to effectively place stormwater controls, assess contributions and evaluate improvements.
- Provide an adaptable framework that enables MU to address evolving regulations and the needs of local waterways.
- Sustain innovation by integrating Mizzou’s education, research and outreach programs into the stormwater planning process.

What is a watershed?

A watershed is the area of land that is drained by a common river, stream or flow path. Small watersheds feed larger ones where two or more streams come together. Locally, the Grindstone Creek watershed feeds Hinkson Creek, eventually reaching Perche Creek, which drains into the Missouri River. An approach that recognizes the importance of managing stormwater according to watershed boundaries is termed the watershed-based best management practices (BMP) planning process.



Watershed Cycle

1. Assess runoff area characteristics.
2. Identify BMP opportunities and watershed priorities.
3. Iteratively select, size and locate BMPs to achieve priorities.
4. Assess subwatershed contributions and track progress.
5. Evaluate improvements and implement adaptive revisions.

BMP Research Grant

MU received a Missouri Department of Natural Resources grant to study the effectiveness of BMPs on preventing water pollution in the Hinkson Creek. The $253,800 award, along with MU matching funds of $169,267, will allow collaborators (the College of Engineering, CAFNR, University Extension and Campus Facilities) to monitor BMPs and educate engineers and students on the best design and maintenance of BMPs. The project is expected to be finished in March 2014.

Mizzou BMPs

Bioretention at Rollins Group.
It pools excess water so that it can infiltrate the area or evaporate, reducing runoff.

A swale located at the corner of College and Stadium.
It manages stormwater runoff from the nearby parking lot.

Pervious pavers outside the MU Sustainability Office.
They filter pollutants and reduce stormwater runoff.

Underground cistern below Tucker Hall.
It is used to irrigate greenhouse plants.

Stormwater Baseline Map
Main Campus

Map Legend

Potential Stormwater Improvement Areas

- Planter Box
- Cistern
- Vegetated Swale
- Bioretention
- Bioretention or Vegetated Swale
- Pervious Pavers
- Constructed Wetland
- Research
- Multiple Opportunity Area
- Existing BMP

Base Map Legend

- Subwatershed Boundaries
- MU Campus Boundary
- MU Buildings
- Roads/Sidewalks
- Master Plan Build-Out
- MU Storm Sewer
- Streams
- 100 Year Flood Zone

UNIVERSITY AVENUE
COLLEGE AVENUE
ROLLINS STREET
PROVIDENCE ROAD
TIGER AVENUE
HOSPITAL DRIVE
STADIUM BOULEVARD
HINKSON BOTTOMS

0 0.25 0.5 0.75 1 Miles

Regional Context

Total area acrage versus existing impervious area (shown in percentage of total acreage)