ENVIRONMENT, HEALTH & SAFETY
UNIVERSITY OF MICHIGAN

Storm Water Management at the University of Michigan

Standard Operating Procedure

Date: 05/24/23
Revision #: 04

The green roof installed on top of the Mott Children's & Von Voigtlander Women's Hospital.

The constructed wetland basin included as part of the Art & Architecture storm water management system.

Vegetated swale with built in check-dam structures located at the University of Michigan Arboretum.

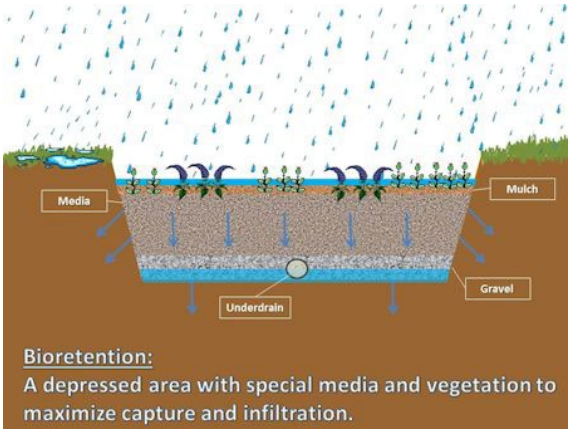
Table of Contents

Structural Controls

Structural controls use infrastructure to control and manage storm water runoff. The University of Michigan uses the following structural controls around campus:

Bioretention (rain gardens, planter boxes, sand filters)

Dana Building and Ross School of Business



Bioretention systems are depressed areas that capture and treat runoff. Most often bioretention includes:

- Space between the underdrain and the bottom of the bioretention basin to promote further storage and infiltration.
- A gravel layer surrounding an underdrain
- A sandy media mix layer atop the gravel to encourage infiltration
- A mulch layer to keep in moisture and to prevent internal erosion.
- Vegetation to further increase infiltration and pollutant removal

Constructed Wetlands

Art and Architecture Building (Southernmost portion of basin system is a constructed wetland)

Constructed storm water wetlands are designed using different water depth zones to support different wetland vegetation species. The vegetation helps capture and treat storm water runoff.

Underground Detention

Mott's Children Hospital, Von Voigtlander Women's Hospital, Athletics Operations Center, Weill Hall parking lot, SC-36 parking lot

Underground detention systems are designed to capture and control storm water runoff by slowly releasing the water overtime.

These systems help to remove nutrients, sediment, and debris from storm water runoff.

Underground Retention

Under Palmer Field, Moore School of Music, Softball and baseball fields, North Ingalls Mall, Munger Graduate Residences, Art Museum

Underground retention systems are manufactured units designed to capture and infiltrate storm water runoff into the ground. Captured water infiltrates into existing soils.

Underground retention systems remove nutrients, sediment, and help to reduce storm water runoff volume and rate into surface waters.

Dry/Wet Detention and Retention Basins

The University Golf Course (detention basin) and the North Campus Grounds (retention basin) are two examples of the more than 40 storm water management basins found on the Ann Arbor Campus.

- Dry detention basins: Remain predominantly dry between storm events. Storm water runoff is captured during a storm event and is slowly released from the basin to make room for the next storm event.
- Wet detention basin: Functions the same way as a dry detention basin. However, a wet detention basin maintains a static level of water between storm events.
- Retention basin: Enables captured storm water to infiltrate into the ground.

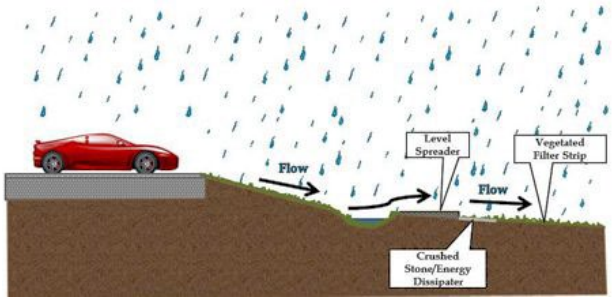
Hydrodynamic Separators/Swirl Concentrator

Multiple across campus, but go unnoticed as they are underground

Hydrodynamic separators and Swirl Concentrators help to remove sediment, debris, and oil from storm water. They are usually used where space is limited or upstream of a larger BMP to reduce the amount of sediment deposited at a downstream BMP.

Level Spreader-Vegetated Filter Strips

Mobility Transfer Center – Baxter Rd.



Most often level spreaders are long, thin, evenly laid strips of concrete that receive storm water flow and evenly distribute it to a downstream vegetated area.

Level spreaders must be flat to be effective; otherwise storm water flow will accumulate in one area and cause erosion. When properly installed, level spreaders evenly disperse flow and greatly improve infiltration.

Green Roofs

Ross School of Business, Kresge Business Library, Mott's Children's Hospital, School of Nursing, and Von Voigtlander Women's Hospital

Green roofs incorporate vegetation and special media (natural and synthetic materials that promote growth, infiltration, and absorption) to maximize infiltration and evapotranspiration on rooftops. Most often, a green roof consists of:

- An impermeable layer over a rooftop (to prevent leaks and structural damage)
- A drainage layer
- A growing media layer
- A vegetation layer

Common Green Roofs

- Intensive: Contain deep growing media depths, large plant types (sometimes trees) and may even support walking or sitting areas for people.
- Extensive: Contain smaller growth media depths, smaller plant species and are generally not built for people to walk on.

Grassed Swales/Vegetated Swales

University of Michigan Arboretum

Grassed or vegetated swales are ditches or complex vegetated systems that promote infiltration while conveying storm water runoff.

Porous Pavement

NC-78 and W-16 parking lots, porous pavers around Crisler, Munger, School of Nursing, various locations where concrete around bike racks is porous

Porous Pavement

Permeable Pavers

Porous pavement consists either of specialty concrete or asphalt that allows water to flow through it or interlocking paver brick/blocks that have gaps between the paver units.

Water flows downward through these systems into a prepared bed for infiltration into the native soils.

Flood Control Project

Considering the complexity of U-M's campus, the damage to facilities and equipment caused by flooding can lead to substantial problems. To combat the issue, U-M decided to address current conditions and to evaluate future construction. U-M continues to:

- Evaluate the storm water system using hydraulic models
- Determine the effectiveness of potential solutions for handling flood issues
- Develop short-term and long-term solutions to flooding

SOLUTION	PURPOSE	STRUCTURES USED
Short-term solutions	Protect buildings from flooding under the existing storm water system	• Pumps • Backflow prevention valves • Waterproofing low entrances

Long-term solutions	Provide flood protection from a 100-year storm event	• New storm water detention and retention facilities
		  ○ Life Science Initiative Building and the Palmer Drive Commons (holds one million gallons of storm water)
		  ○ North Campus
		• Lager sewers
		• More catch basins
		• Relief sewers

The following pictures were taken during the construction of a wet detention pond located on the University of Michigan North Campus:

Non-Structural Controls

Non-structural controls use best management practices to minimize the effects of storm water runoff such as:

- Reducing runoff and pollutants at their source:
  - Preserve wetlands, vegetation, and other existing features that naturally manage storm water
  - Direct storm water to open grassy areas
  - Control soil erosion
- Minimizing impervious surfaces
- Building up instead of out
- Redeveloping (infilling) vacant buildings and lots
- Following best management practices regarding
  - Landscaping
  - Household hazardous materials
  - Recycling
  - Car maintenance

Storm Drain Markers

Starting in 1995, EHS and student volunteers began labeling storm drain inlets with the message, “Dump No Waste – Keep Our Michigan Waters Blue” and “Keep Our Michigan Waters Blue: Dump No Waste – Flows to River.”

Other efforts to prevent pollutants from being dumped into storm drains include:

- An educational video and EHS webpages developed to help the U-M community understand storm water pollution prevention issues.
- Installing new storm water inlets on campus with the message "Dump No Waste – Drains to Waterways" engraved on them.

Winter Maintenance Collaboration

Several U-M Facilities and Operations departments collaborate when determining best locations for snow storage to ensure the protection of storm water best management practices on campus and avoid active areas such as construction sites.

All groups responsible for snow and ice removal also keep environmental concerns in mind when selecting deicer products, calibrating equipment for proper application, and being proactive when anticipating winter weather.