MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

Stormwater Management

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Water Resources Division
MWA Conference 2023

Presentation Outline

- Understanding Water Quality Program Requirements
- Understanding Water Resources Programs
- Avoiding and Minimizing Impacts
- Stormwater Best Management Practices
- Information and Coordination Resources

Water Quality Programs

Part 31 Water Resources Protection

Prohibits a direct or indirect discharge into waters of the state that is or may become injurious to:

- Public health, safety, or welfare
- Domestic, commercial, industrial, agricultural, recreational, or other uses that are made or may be made of such waters
- Value or utility of riparian lands
- Livestock, wild animals, birds, fish, aquatic life, or plants or to their growth or propagation
- Value of fish and game

Part 4 Water Quality Standards

All surface waters of the state are designated and protected for the following uses:

- Navigation
- Industrial water supply
- Warmwater fishery
- Coldwater fishery (specific waterbodies)
- Other indigenous aquatic life and wildlife
- Partial body contact recreation
- Total body contact recreation (May through October)
- Fish consumption
- Public water supply (specific locations)

Surface Waters of the State

Part 4 Water Quality Standards

(u) "Surface waters of the state" means all of the following, but does not include drainage ways and ponds used solely for wastewater conveyance, treatment, or control:

(i) The Great Lakes and their connecting waters.

(ii) All inland lakes.

(iii) Rivers.

(iv) Streams.

(v) Impoundments.

(vi) Open drains.

(vii) Wetlands.

(viii) Other surface bodies of water within the confines of the state.

NPDES

National Pollutant Discharge Elimination System (NPDES)Permit Program

- EPA authorized Michigan to implement the NPDES permit program
- Goal: Protect water resources by addressing point source water pollution
- Permit requirements are written to control the discharge of pollutants into surface waters by imposing effluent limitations to protect water quality and the designated uses
- Effluent limitations can be numerical or narrative
- Stormwater is a wastewater covered under NPDES

NPDES Stormwater Programs

Site Level

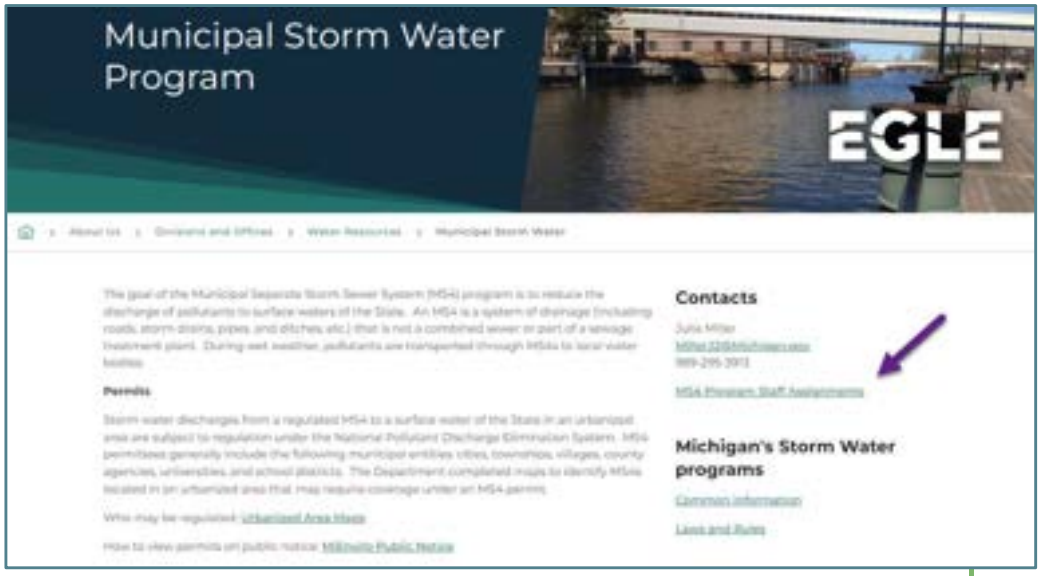
Construction Stormwater

Industrial Stormwater

System Level

Municipal Stormwater

Contact Information



Industrial Stormwater Program

Certain industrial activities are regulated and require NPDES permit coverage:

- Mining (Metals and Sand/Gravel)
- Landfills
- Scrap Recycling
- Airports
- Metals Manufacturing
- Transportation Equipment
- Land Transportation

Permit Requirements:

- Facility must develop a Storm Water Pollution Prevention Plan (SWPPP) that describes operational and structural controls implemented onsite
- Industrial stormwater certified operator is required to have supervision over SWPPP implementation

www.mi.gov/industrialstormwater

EGLE

Construction Stormwater Program

Soil Erosion and Sedimentation Control (SESC)

Part 91 provides for the control of soil erosion and protects adjacent properties and the waters of the state from sedimentation

- State level program
- Applies to disturbance of 1 acre or greater or within 500 ft of a surface water
- Limited to total suspended solids
- WRD authorizes municipalities to implement permitting at the local level

Michigan.gov/soilerosion

Construction Stormwater Program

Permit-by-Rule for construction activities

- NPDES program
- Coordinated with Part 91
- Applies to a disturbance of 1 or more acres
- Must have a point source discharge of storm water to surface waters
- Includes all pollutants on a construction site
- Requires SESC measures be inspected weekly and within 24 hours of a significant rain event by a certified storm water operator

Municipal Separate Storm Sewer System (MS4) Program

- NPDES Program
- **Goal:** Reduce the discharge of pollutants to surface waters in urban areas
- **MS4:** System of drainage (including roads, storm drains, pipes, and ditches, etc.) that is not a combined sewer or part of a sewage treatment plant and used solely for stormwater conveyance, treatment, or control.
- **Permittees:** Cities, townships, villages, county agencies, universities, and school districts
- **6 Minimum Control Measures:** Public Participation, Public Education, Illicit Discharge Elimination, Construction Stormwater Runoff, Post-Construction Stormwater Runoff Control, and Pollution Prevention/Good Housekeeping

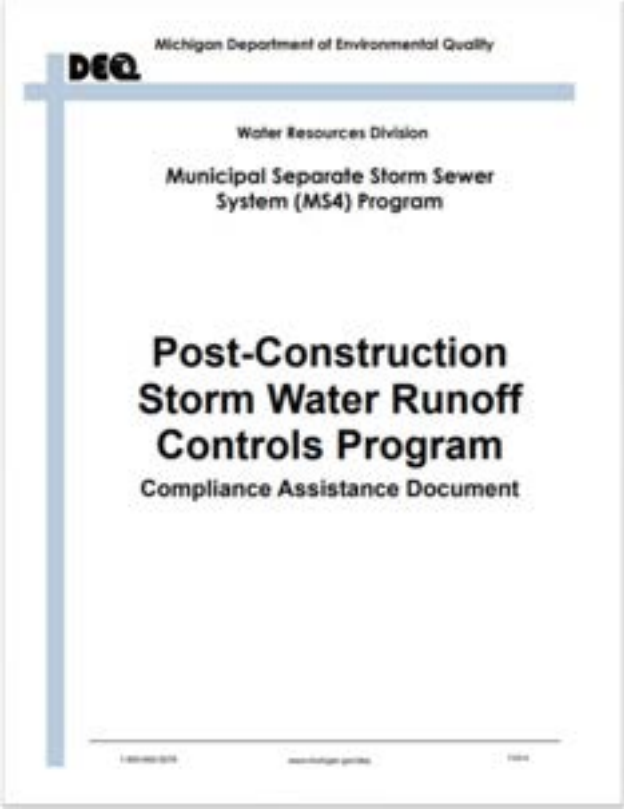
Michigan.gov/MS4

Michigan's MS4 Regulated Area

Quick Facts

Phase I	**Phase II**	**Regulated MS4 Area**
Ann Arbor Flint Grand Rapids Lansing Sterling Heights Warren	Currently over 300 MS4s; expecting more urbanized area based on 2020 Census	Serves a population of 6.5 million people or 66% of Michigan's population

MS4 Post-Construction Requirements



The MS4 program requires the implementation of Post-Construction Performance Standards to address stormwater runoff after construction.

- Applies to sites 1 acre or greater or less than 1 acre if part of a common plan of development/sale
- Municipalities implement as part of an ordinance, resolution, and/or coordination with the county drain commissioner's office
- A long-term operation and maintenance agreement is required to ensure BMPs are maintained in perpetuity

Contact Miekyn Cotton, MS4 Program Engineer, or Christe Alwin, Stormwater Permits Unit with questions

Water Quality Volume ‘First Flush’

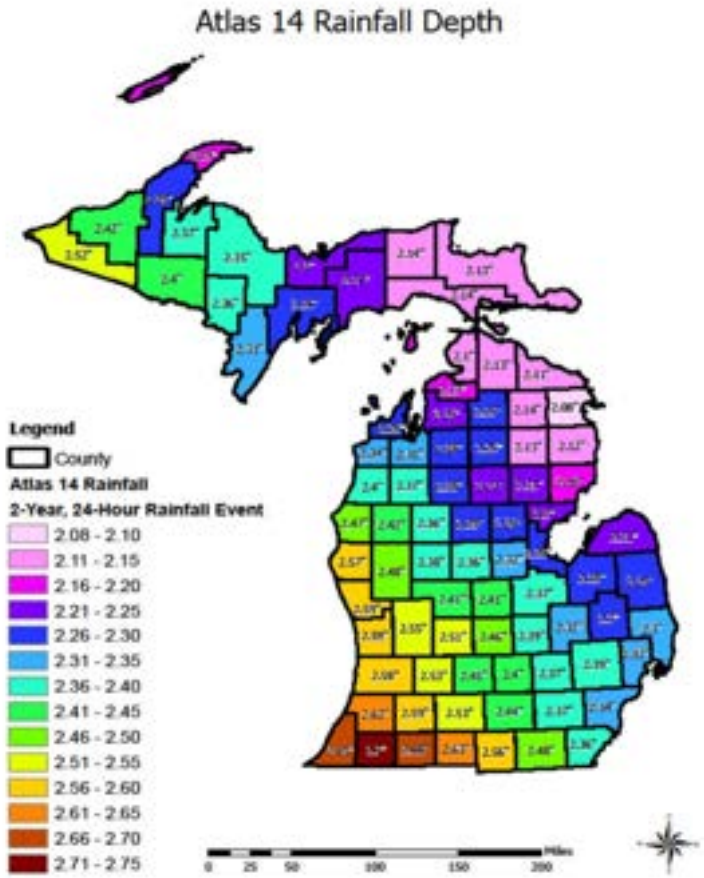
Requirement: Treat the first 1” of runoff from the entire project site

Implement: Stormwater best management practices designed to reduce total suspended solids loadings by 80% or achieve a discharge concentration not to exceed 80 mg/l

Typical Sediment Removal Rates of Stormwater Management Practices

Type	TSS Removal Rate (%)
Infiltration basin or trench*	89
Retention basin	89
Wet (wetland) swale	87**
Sand filter	86
Dry swale	81**
Vegetative filter strip	81
Wet extended detention pond	80
Multiple pond or pond/wetland complex	>80
Constructed stormwater wetland	>80
Bioretention	74
Grass swale	65**
Landscaped ED basin (no buffer)	50
Dry extended detention (ED) basin	49
Manufactured BMPs*** (swirl concentrators, filter systems)	43
Pervious pavement system	35
Catchbasin w/sump and hooded outlet	20
Conventional dry detention	18
Cistern	15

Channel Protection



Requirement: Post-construction runoff rate and volume of discharge not to exceed the pre-development rate and volume for all storms up to the 2-year, 24-hour storm at the project site or an equivalent alternative

Water Resources Programs
Part 303 – Regulatory Authority

- Use of a wetland is an activity that would significantly alter the biological, chemical, or hydrological characteristics of the wetland.
  - Most stormwater discharges are USES of the wetland
- The distance between the discharge and the wetland DOES NOT matter if the wetland is being used for stormwater storage or treatment.
- Mitigation may be required if the discharge will impact more than 1/3 acre (e.g. conversion of wetland types) but in general these types of impacts can be avoided through proper stormwater management and use of upland alternatives.

Water Resources Programs
Part 301 – Regulatory Authority

- Stormwater discharges can be regulated under several Part 301 provisions including:
  - Placement of structure or dredge/fill on bottomlands,
  - Enlarge an inland lake or stream,
  - Construct a waterway where the purpose is an ultimate connection with an inland lake or stream
  - Construct a waterway within 500 feet of an inland lake or stream
  - Or connect any waterway to an inland lake or stream for any purpose.
- Several permit project categories address stormwater management.

Other Statutes

- Part 315:
  - Depending on size, some detention ponds may fall under the authority of Part 315
  - Requires a permit for the construction of a structure that will be six feet or more in height AND will impound five surface acres or more at the design flood elevation.
  - Requires dams to have a specified spillway capacity, based on the hazard rating of the dam.
  - Contact your regional Dam Safety Engineer.

Stormwater Impacts

- Water Quantity Degradation from stormwater can occur by:
  - Changes stream flows and hydrographs and changes to channel width and depth
  - Changing wetland hydroperiods, conversation of wetland type (e.g. flooding), or downcutting channel(s) within wetlands
- Water Quality Degradation from stormwater can occur by:
  - Increased sediment loads
  - Increased pesticides, nutrients/fertilizers, non-soluble metals, and organic material

Avoiding and Minimizing Impacts

- Require stormwater management plans that:
  - Address water quality issues (e.g. remove pollutants)
  - Address water quantity issues (e.g. reduce peak flows and avoid conversion)
- Using natural wetlands for storage or treatment of stormwater should be avoided.
- Maintaining pre-development run-off amounts of clean water to natural wetlands is desired (i.e., don't starve the wetland of its water.)

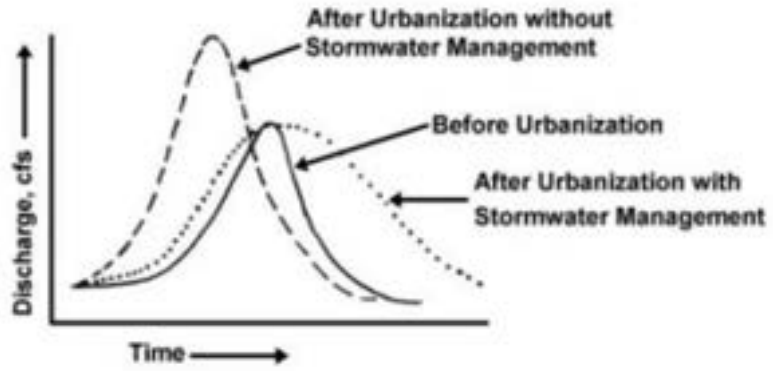


Figure 1.2 - Impact of Urbanization on Flood Peaks

Best Management Practices

- Includes structural or other methods that reduce degradation of surface waters, including wetlands:
  - Detention basins
  - Low Impact development
  - Infiltration practices
- Discuss with District Staff!
- Parts 301 and 303 require applicants to minimize environmental impacts to wetlands, lakes, and streams.

BMPs as Feasible and Prudent Alternatives

- Using Stormwater Best Management Practices, including Green Infrastructure, in addition to standard detention, can further avoid and minimize impacts to wetlands, lakes and streams.
- These BMPs often encourage working with the landscape by utilizing green spaces, paying attention to topography and natural waterways, reducing construction impacts, reducing sedimentation, etc.
- For larger developments or other sites that need stormwater management, permit applicants need to provide stormwater management plans for staff review.
- Comprehensive stormwater management is especially important in areas where there has been high historic loss of wetlands.

K(10

Detention Basins

- Wet detention basin (preferred)
- Dry detention basin
- Constructed wetlands
- Underground detention
- Bioretention
- Regional Detention

Detention basins **MUST** implement first flush and should have channel protection standards

Detention basin with a no mow buffer in West Bloomfield Township, MI
Source: Hubbell, Roth, & Clark

Underground system at Mid Towne Village, Grand Rapids, MI
Source: Driesenga & Associates, Inc.

25 acre constructed wetland development along M-53 in Romeo, MI
Source: Hubbell, Roth, & Clark

EGLE

Slide 22

AC(0 I added Regional Detention to the list since we promote this idea.

Not all detention basins can meet channel protection instead they are converted to extended detention with a slower release.
Alwin, Christe (EGLE), 2023-09-05T17:55:47.695

K(1 Is there a place you would want to further explain Regional Detention?
Kirkpatrick, Kathryn (EGLE), 2023-09-06T15:14:58.138

Why NOT Dry Detention Basins

- Drain dry basins allow for some detention (Quantity), but do not address water quality issues.
- Dry basins allow sediments/pollutants to re-suspend during future storms.
- Dry basins should be discouraged in most cases – alternatives include other structural BMPs or constructed wetlands
- Pretreatment of suspended solids is best to maintain capacity within the basin (e.g. forebay).

"first flush" after a rainfall event

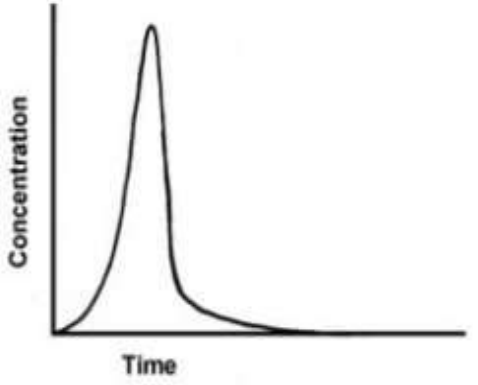


Figure 1.4 - Plot of Pollutant Concentration versus Time

BMP: Detention Basins

The primary purpose of detention basins is the attenuation of stormwater runoff peaks.

- Can be used in combination with other BMPs (e.g., distributed throughout the site).
- Regular maintenance of vegetation and sediment removal required.
- Natural high groundwater table required for wet ponds and constructed wetlands.
- Relatively impermeable soils or impermeable liner.
- Forebay for sediment collection and removal.
- Some ponds are designed to permanently hold smaller storms and discharge larger storms.
- Dewatering mechanism required for wet ponds and constructed wetlands.
- Stabilized emergency overflow and energy dissipation at all outlets.
  - Outlet structure configuration determines peak rate reduction effectiveness.

Detention Basin Location

- Should be located down gradient of disturbed or developed areas on the site.
  - Collect as much site runoff as possible from impervious surfaces (roads, parking, buildings, etc.)
- Should not be constructed on steep slopes or significantly alter or modify slopes to reduce steepness.
- Should not worsen the runoff potential of the existing site by removing trees.
- Should not be constructed within 10 feet of the property line or within 50 feet of a private well or septic system.
- Consider multiple BMPs distributed throughout the site if one detention basin cannot address all runoff.
- Should not be constructed in areas with high quality and/or well-draining soils
  - Applicant should instead consider installing BMPs capable of achieving stormwater infiltration and volume reduction.

EGLE

AC(2

Wet Detention Basins

AL1

- Design considerations in LID Manual (link)
  - Permanent, year-round control measures
  - Should be designed to mitigate runoff peak rates for 1 – 100 year rainfall events;
  - Max. water depth should not exceed 10 feet;
  - Should have 1+ sediment forebays or upstream pretreatment;
    - 24-hour detention time is required to achieve 60% TSS removal rate;
  - Minimum lenth-to-width ration of 2:1 is recommended to maximize sedimentation;
  - Sizing is generally 1-3% of drainage area.
    - Should be designed to treat water quality volume and mitigate peak rates for larger storm events.

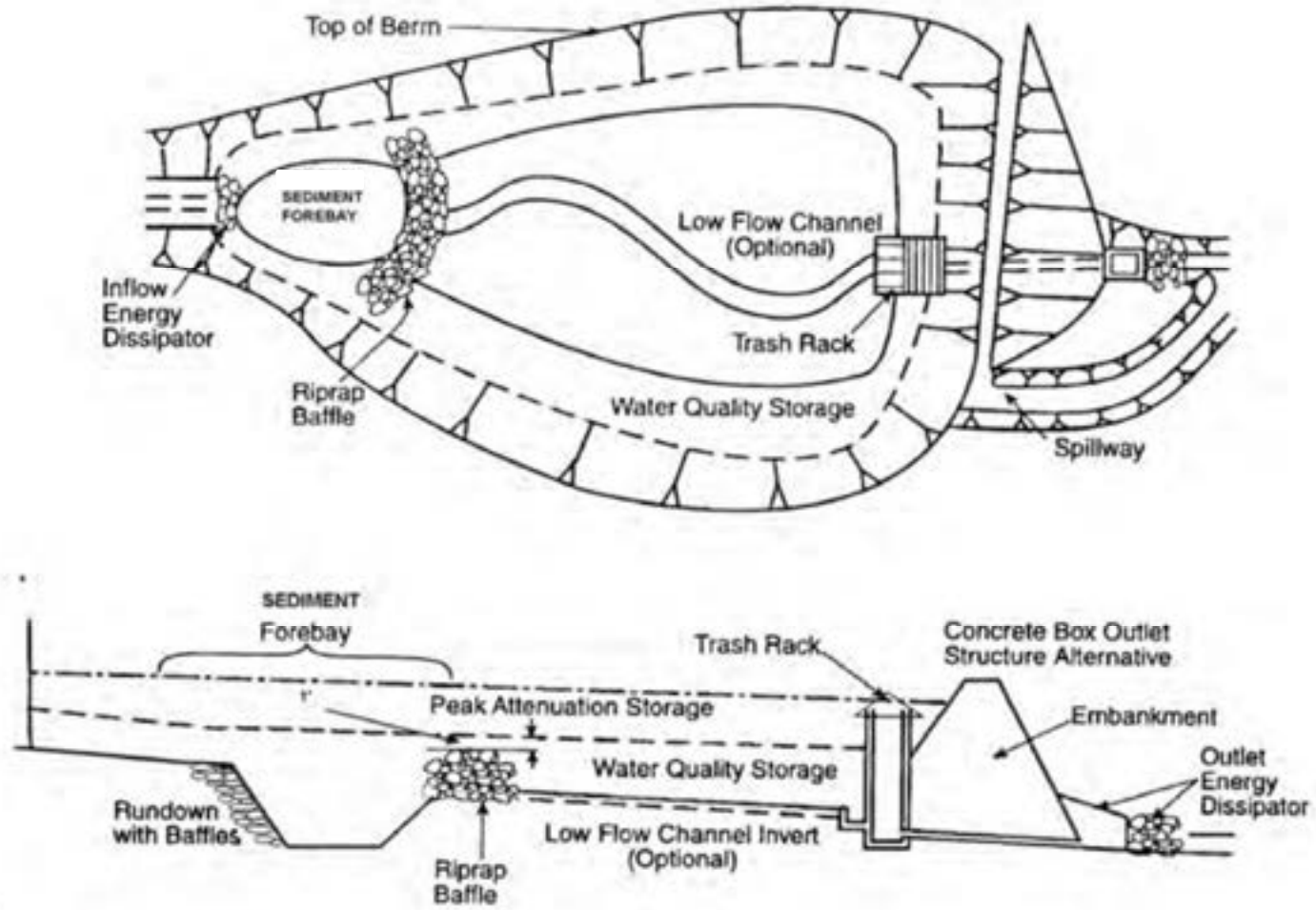
Slide 26

AL0 Called the NPS BMP manual now... 😊
Amy Lounds, 2023-05-20T22:54:13.764

AL1 Can you makes sure this is still correct according to the current manual?
Amy Lounds, 2023-05-20T22:54:51.610

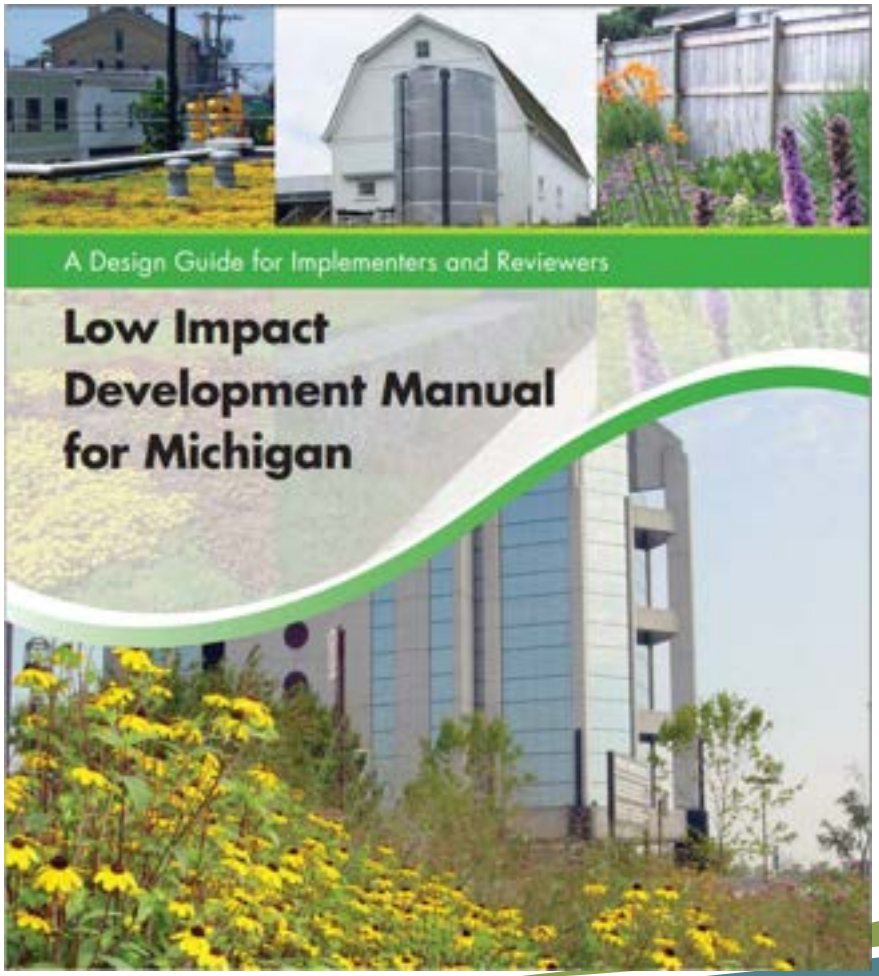
AC(2 This NPS BMP is from 1992. I would suggest replacing all this criteria with info from the LID manual.
Alwin, Christe (EGLE), 2023-09-05T18:00:31.163

Figure 7.21
Extended detention basin



Source: New Jersey BMP Manual

SEMCOG
Low Impact
Development
Manual



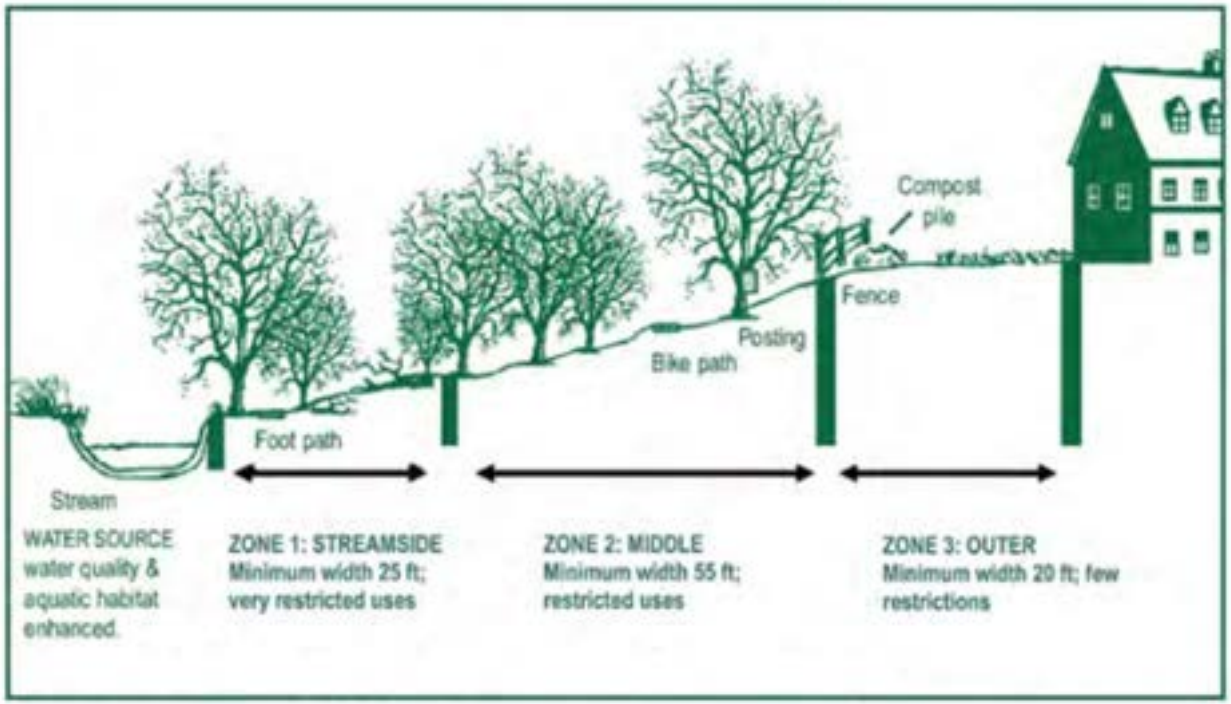
Low Impact Development

- LID aims to replicate the natural water cycle by:
  - Maintaining natural areas to manage stormwater close to its source,
  - Minimizing total runoff volume,
  - Controlling peak rate of runoff,
  - Maximizing infiltration and groundwater recharge,
  - Maintaining stream baseflow,
  - Maximizing evapotranspiration, and
  - Protecting water quality.

Green Infrastructure

- BMPs used to manage stormwater runoff and meet the goals of LID
- GI should be evaluated for placement around the site to maximize infiltration
- Challenges:
  - Clay/tight soils
  - High groundwater table
  - Contaminated groundwater/soils

BMP: Riparian Buffers

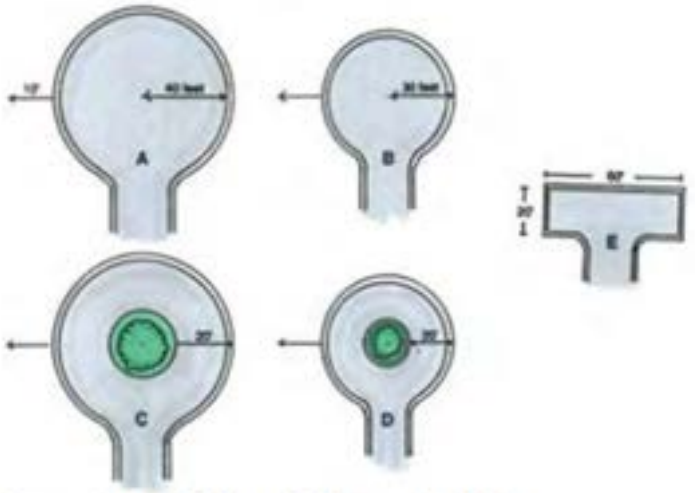


Buffer width recommendations

Source: Schueler, Watershed Protection Techniques, 1994 (Graphic courtesy of the Center for Watershed Protection)

BMP: Impervious Surface Reduction

- Alternative roadway layouts, restricting on-street parking, minimizing cul-de-sac radii
- Smaller/slanted parking stalls/compact parking spaces
- Narrowed traffic lanes
- Overflow parking areas constructed of pervious paving materials
- Reduce front yard setbacks to allow for shorter driveways
- Alternative materials for patios, sidewalks, driveways (ex: permeable pavers).



Source: Center for Watershed Protection, 1998.

BMP: Bioretention

- Shallow surface depressions planted with native vegetation to capture and treat stormwater runoff from rooftops, streets, and parking lots.
- Benefits include:
  - Volume control and groundwater recharge,
  - Moderate peak rate control, suspended solids filtration
  - Versatile with broad applicability, can be placed throughout a site
  - Enhance site aesthetics, habitat
  - Potential air quality and climate benefits

Schematic of a small residential rain garden

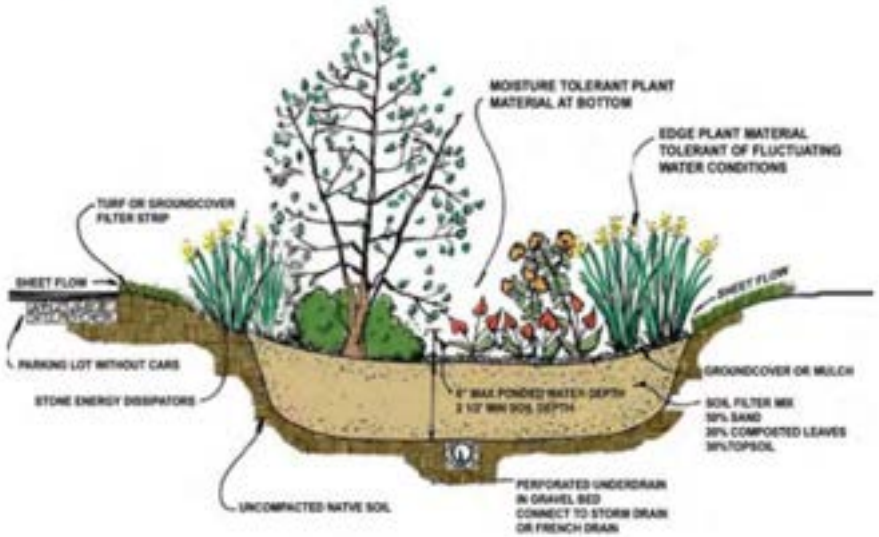
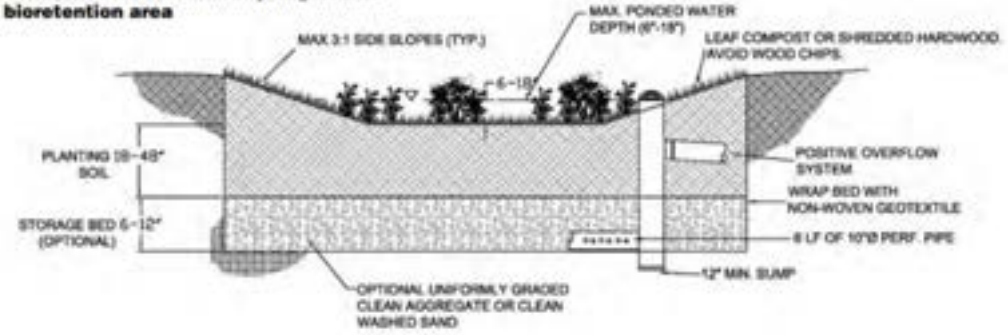


Figure 7.6
Schematic of a technically engineered bioretention area

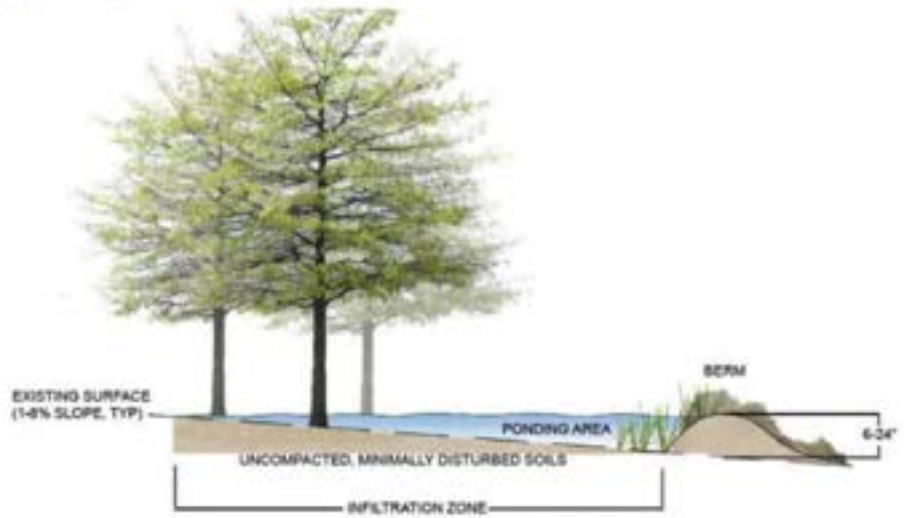


Source: Prince George's County Bioretention Manual with modifications by Cahill Associates, 2004

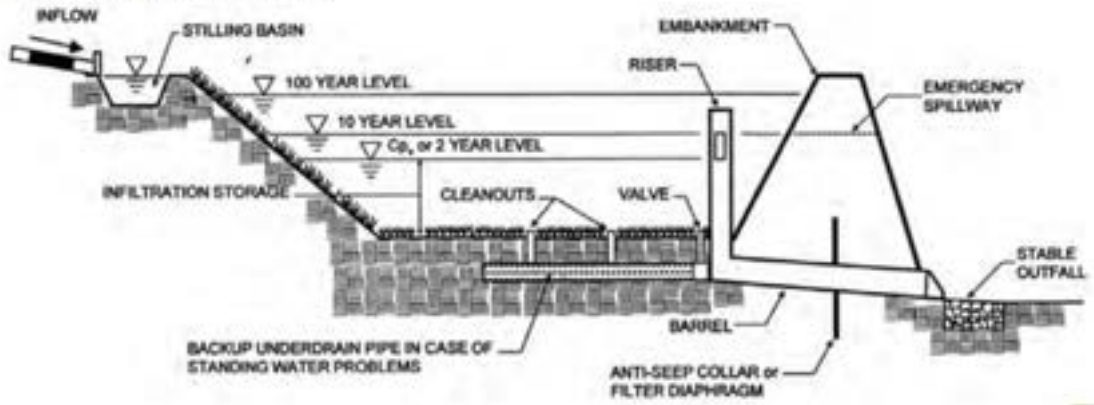
BMP: Infiltration

- **Dry wells (seepage pits, French drains or Dutch drains)**
  - Subsurface storage facility (structural chambers or excavated pits, backfilled with a coarse stone aggregate)
  - Temporarily store and infiltrate stormwater runoff from rooftop structures. Typically for smaller drainage areas, < 1 acre in size.
- **Infiltration basins**
  - Shallow surface impoundments that store, capture, and infiltrate runoff over a period of several days on a level and uncompacted surface.
  - Typically for drainage areas of 5 - 50 acres with land slopes < 20%
- **Infiltration berms**
  - Berms may serve various stormwater drainage functions: creating a barrier to flow, retaining flow for volume control, and directing flows.
- **Infiltration trenches**
  - Typically composed of a stone trench wrapped with geotextile which is designed for both stormwater infiltration and conveyance in drainage areas <5 acres.
- **Subsurface infiltration beds**
  - Rock storage bed below other surfaces such as parking lots, lawns, and playfields for temp. storage and infiltration of stormwater runoff with a max drainage area of 10 acres.
- **Bioretention**

Typical components of a berm

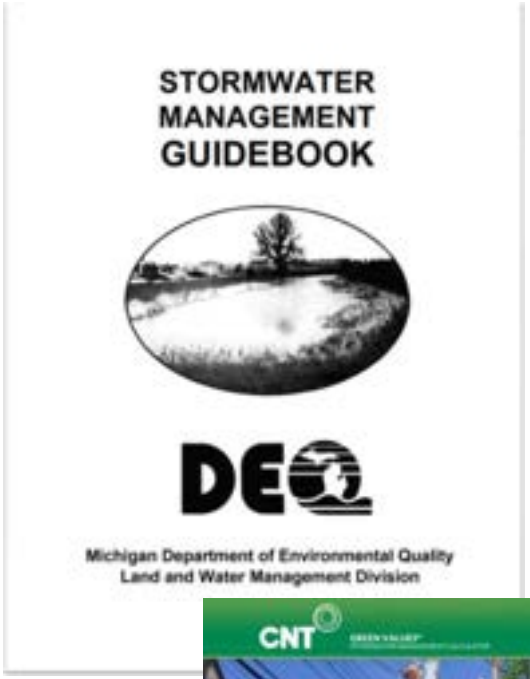


Schematic of infiltration basin

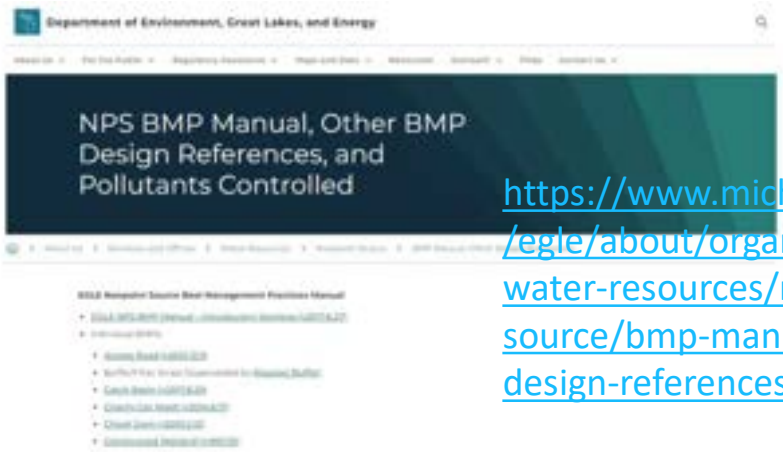


AL0

Other Resources



[Stormwater Management Guidebook]



https://www.michigan.gov/egle/about/organization/water-resources/nonpoint-source/bmp-manual-and-design-references

http://greenvalues.cnt.org/

MS4 Program Stormwater Guidance Document

EGLE

Slide 37

AL0 How about list the MS4 doc, LID manual, the NPS manual, the green values, etc. all on one slide right before questions?

Amy Lounds, 2023-05-20T22:53:26.626

In Conclusion

- Impacts to wetlands, lakes and streams from stormwater management should be avoided and minimized.
- Permits are often needed for stormwater management (e.g., discharges to wetlands)
- Coordinate with WRD District staff

Questions?