IMPLICATIONS OF PRECIPITATION CHANGES IN SOUTHEAST MICHIGAN AND OPTIONS FOR RESPONSE: A GUIDE FOR MUNICIPALITIES

Table of Contents

This fact sheet is part of a guide supporting decision makers and water resource managers as they adapt policies and practices in stormwater management in response to a changing climate.
hrwc.org/stormwater-and-climate

Issues in Stormwater Management: Detention and Conveyance

Across the region, patterns in precipitation have been changing. Historical records and projected trends indicate that these changes require modifications to the practice of stormwater management. Below is a summary of stormwater detention and conveyance considerations as rainfall volumes and patterns change.

Detention and Conveyance Standards

Stormwater rules established by municipalities in the State of Michigan rely on storm definitions from the 1992 document Rainfall Frequency Atlas of the Midwest (Bulletin 71). Detention and conveyance standards do not accommodate design storms as defined in NOAA's Atlas 14, released in 2013 which incorporates rainfall data through 2010. New storm definitions show increases in rainfall on an order of magnitude that will impact the function of detention and conveyance infrastructure. The 2-year 24-hour event used to design outlet restrictions for detention ponds increased from 2.26" to 2.35" inches (4%). Stormwater systems are typically designed to accommodate the 10-year 1-hour, 2-hour or 6-hour event which have increased by 16%, 14% and 11%, respectively. The result will be increased frequency and extent of flooding and surface ponding. This trend is expected to continue as we experience further climate change.

Actions

The following represents a list of options to mitigate impacts of increased precipitation associated with stormwater detention and conveyance systems:

1. **Adopt the 2013 NOAA Atlas 14 precipitation frequency estimates** – Local and County governments should adopt these current precipitation frequency estimates for stormwater management regulation and infrastructure design. Adopting the new NOAA precipitation frequency estimates will only bring us up to date with weather observations, it will not take into account the future changes.
2. **Periodically revisit rainfall data and design storm definitions** – While NOAA Atlas 14 is a significant improvement to precipitation frequency estimates, it is still a snapshot in time. Periodically updated estimates will improve the suitability of infrastructure and planning decisions based on the best available information and allow stormwater systems to evolve as the climate changes.
3. **Add a 15 to 20 % safety factor to stormwater management requirements** – In addition to adopting the 2013 NOAA Atlas 14 precipitation frequency estimates, counties and communities could add a 15 to 20 percent

safety factor to rain event sizes. This action would take into account the expected future increases in precipitation intensity, and ensure that new stormwater infrastructure is capable of handling future events.

4. **Treat stormwater onsite to the degree possible** – Requiring infiltration on new developments and redevelopments as well as providing incentives to retrofit existing development will reduce demands on the stormwater system.
5. **Implement LID practices at the site scale** – LID practices (including Green Infrastructure) encourage more infiltration, storage and treatment. Reductions in the volume of stormwater runoff can be achieved such that resulting run off volumes are more consist to those the system was designed to handle.
6. **Adapt planting plans over time** -- changes in precipitation and temperature will likely affect which species will succeed or become an invasive nuisance.
7. **Modify designs to prevent bypass during high volume rainfall events** -- for example, consider reallocating storage at bioretention facility rethinking vulnerable flow path elements. Add additional temporary storage.

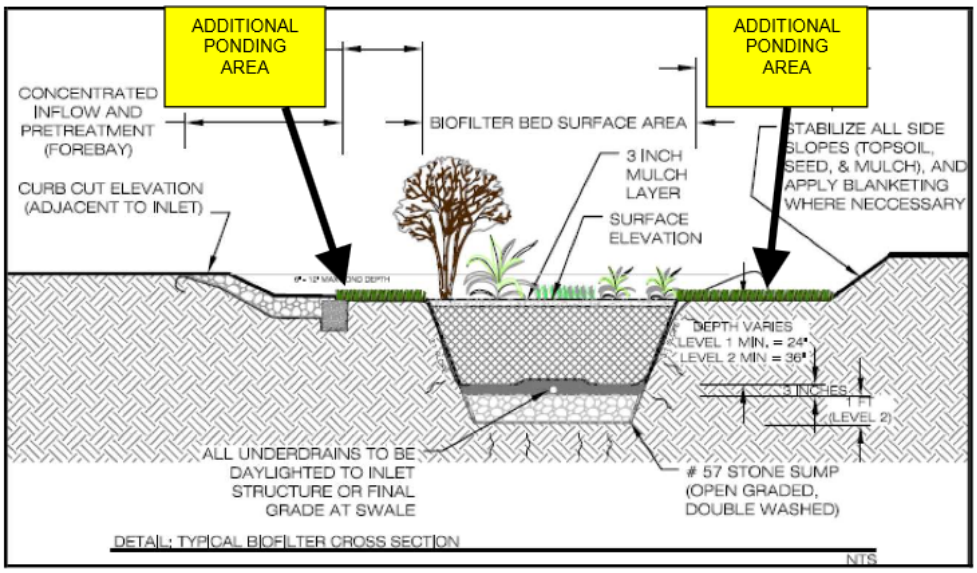
Dive Deeper
NOAA Atlas 14 data and analysis
hdsc.nws.noaa.gov/hdsc/pfds

The Tree resilience toolkit has information on suitable trees to southeast Michigan as climate changes www.hrwc.org/tree-toolkit

Adapting Stormwater Management for Climate Change in: Low Impact Development in Coastal South Carolina: A Planning and Design Guide
www.northinlet.sc.edu/LID/FinalDocument/loRes/Appendix%20G%20low%20res.pdf

Example

Changes in the volume and duration of a rainfall event can be managed in a bioretention facility by increasing the surface area allocated for above soil storage to create a holding zone to capture water when soil becomes temporarily saturated. Below is an example of a design that accomplishes this.



Adaptation of a bioretention facility
Additional surface ponding area has been incorporated while the surface area and volume of soil media remains the same.

Virginia Department of Conservation and Recreation. 2010a. Design specification no. 9: Bioretention. Version 1.8. April 13. Richmond, VA: Virginia Department of Conservation and Recreation.