


PHRC Webinar Series
 Tuesday, April 8, 2014 1:00 pm

Stormwater 101

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Course Description

Recent regulatory and policy changes have now made stormwater management an issue for some single-family homebuilders. Regulatory and permit updates and increased public awareness of flooding and water quality are bringing the issues of stormwater management to others professions, such as municipal officials and code officials who may not be well versed in the topic. This session will teach builders, code and municipal officials, and other non-stormwater professionals on the basic issues of stormwater, the management of runoff, and the new rules that affect a larger percentage of the development community.



Learning Objectives

At the end of the this course, participants will be able to:

1. Understand how site conditions can contribute to an increase in stormwater runoff
2. Identify ways in which the generation of stormwater runoff can be minimized
3. Identify ways to treat stormwater runoff for volume, peak rate, and water quality
4. Identify how recent regulations including Pa Code Title 25, Ch 102 and Act 167 stormwater ordinances affect homebuilders and local government officials



Agenda

- **What is Stormwater (SW)?**
 - Pre- & post-development, SWM
- **Characteristics of SW**
- **Regulations**
 1. Historic background
 2. MS4
 3. PA Code Ch 102
 4. Act 167
- **Runoff Control and Design**



Common Acronyms


- **SWM** - Stormwater Management
- **BMP** – Best Management Practice
- **SCM** – Stormwater Control Measure
- **MS4** – Municipal Separate Storm Sewer System
- **PCSW** – Post construction stormwater management
- **O&M** – Operation and maintenance
- **E&S** – Erosion and Sediment Control
- **LID** – Low Impact Development
- **TMDL** – Total Maximum Daily Load

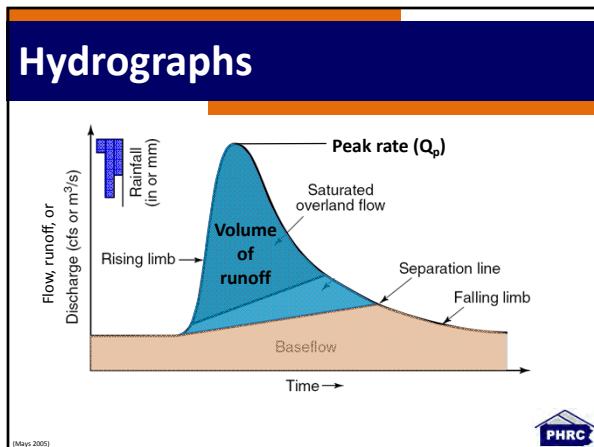


What is Stormwater?

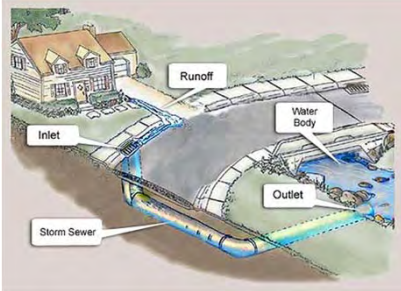
What is Stormwater?

- Water generated when **precipitation** from rain and snowmelt events **flows over land** or **impervious surfaces** & **does not percolate/infiltrate** into the ground





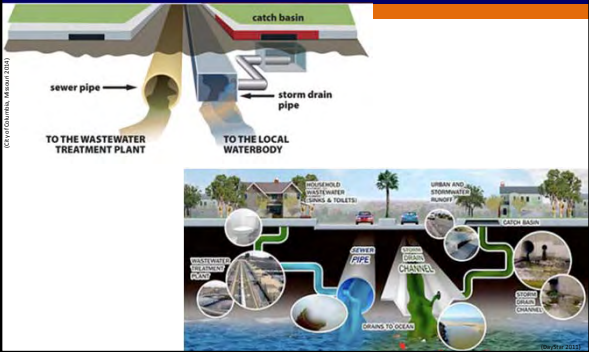
Where does Stormwater go?



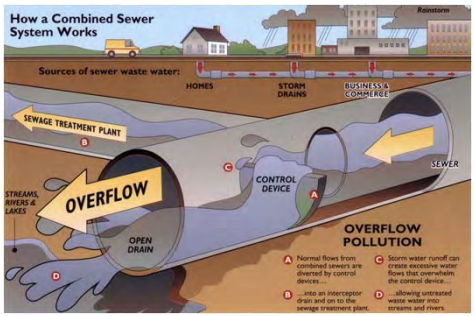
City of Columbia, Missouri 2014



Stormwater vs. Wastewater



Combined Sewer Overflow (CSO)

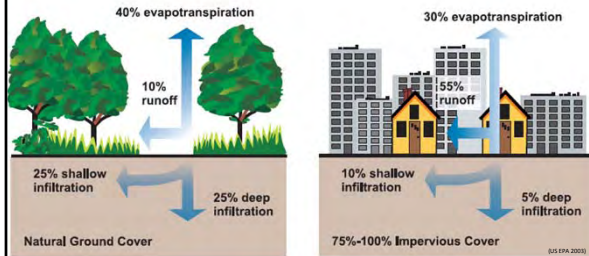


Moundsville WWP #43

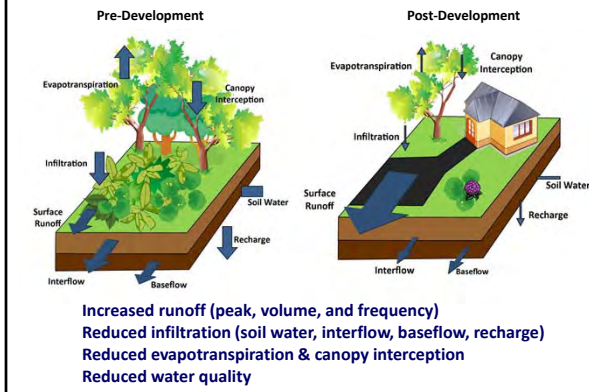


Stormwater Runoff

- Runoff is part of the natural hydrologic cycle, but development changes the natural response



Impacts of Development on Runoff Response



Stormwater Management Goals

Traditional goal: Reduce the post-development **peak flow rate** to the pre-development value

Use a stormwater management facilities to detain the water and release it slowly at the pre-development flow rate

Additional goal: Reduce the **volume** of runoff and better mimic the natural water budget

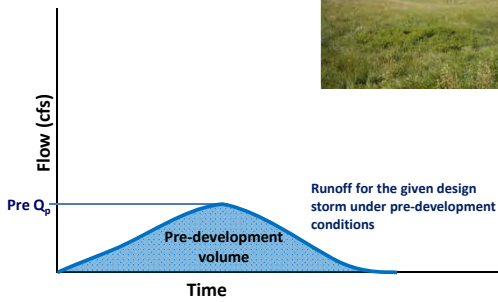


Historical Approach to SW Management

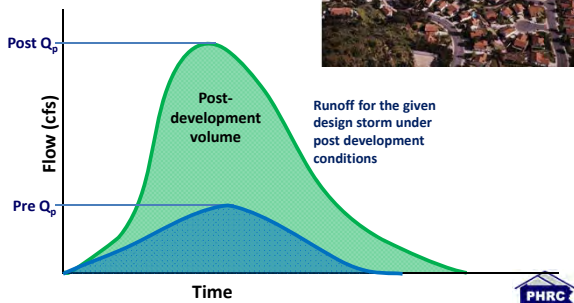
- Goal was to control flooding
- Peak runoff rate controlled with detention basins
- No volume control

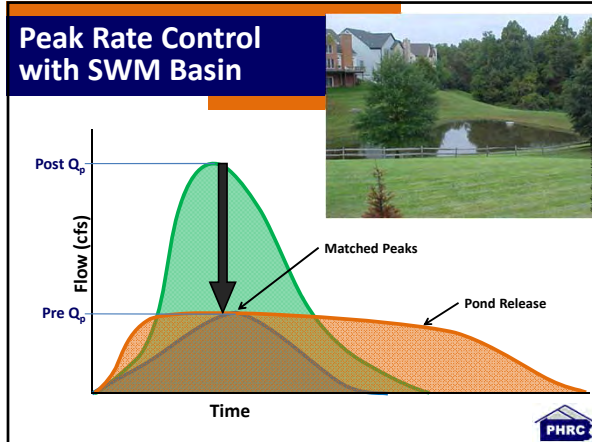


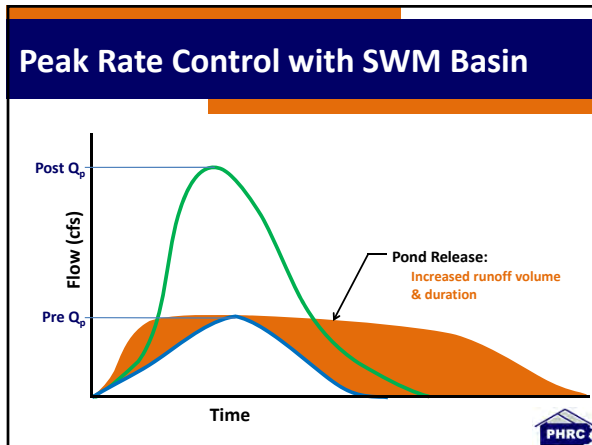
Pre-Development



Post-Development







Impact of Increased Volume & Duration

Increases downstream flooding

Changes stream physical characteristics (geomorphic impacts)

- Width
- Depth
- Slope
- Meander pattern


Which results in:

- Erosion & sedimentation
- Stream instability
- Degradation of habitat


Characteristics of Stormwater

What Defines Runoff Response?


- **Rainfall**
 - Timing
 - Volume
 - Data source NOAA Atlas 14
<http://hdsc.nws.noaa.gov/hdsc/pfds/>
- **Contributing area (drainage area, watershed)**
 - Size of drainage area
 - Volume
 - Surface characteristics
 - Timing
 - Volume
 - Quality



Precipitation



- **Design Storm or Events**
 - Generalized event based on statistics of historical events
 - Characteristics of event based on statistical analysis of past event



Design Events & Return Period

Return period – time interval for which an event will occur once on average

$$P = \frac{1}{T}$$

P = probability of occurrence for a given year
T = return period

Probability of occurrence is independent!

Probability of occurrence of a 100-year event:

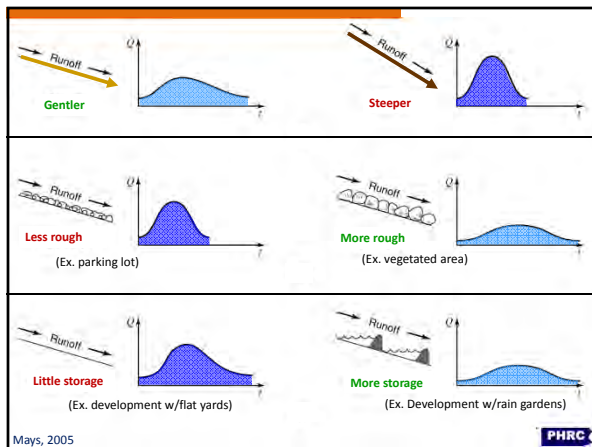
$$P = \frac{1}{T} = \frac{1}{100} = 1\%$$



Contributing Area

- **Drainage area or watershed**
 - Land area that contributes runoff to the point of interest (POI)
 - Outlined by highpoints or ridge
 - Use topo maps to determine the drainage boundary






Regulations:
1. Historical Background

Regulatory Background

1948 – Federal Water Pollution Control Act

1972 – Federal Clean Water Act, and 1977 amendments



1978 - PA Act 167 – PA Stormwater Management Act.

- Local municipalities developed stormwater ordinances
- Watershed based

Late 1980's Federal NPDES I

- Mandates E&S Controls
- Water quality for large municipal areas and industries.

1999 - Federal NPDES II

- Mandates peak, volume, and quality controls

Regulatory Background

2002 – Pennsylvania Implements NPDES II

- Establishes new policy
- Includes peak, volume, and quality controls
- Significant infiltration requirement

Mid to late 2000's – PA Act 167 – PA Stormwater Management Act

Changed from watershed-level to county-level program

New funding supply to develop plans

More municipalities adopted PA DEP Model Ordinance

2007 – Energy Independence and Security Act (EISA)

Federal projects with a footprint > 5,000 sq ft “shall use site planning, design, construction, & maintenance strategies ...to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow”

Retain the 95th percentile storm

Recent Updates

Nov 2010 – Revised Title 25, Chapter 102 Erosion and Sediment Control and Stormwater Management

NPDES permit requires E&S control during construction and post construction stormwater management (PCSM)

March 2013 – Revised MS4 Permit

Includes requirement for municipalities to develop and implement a TMDL plan if system discharges to a water body with a TMDL

2014? – EPA National Stormwater Rule

Much speculation that will require management a percentile storm (similar to EISA)

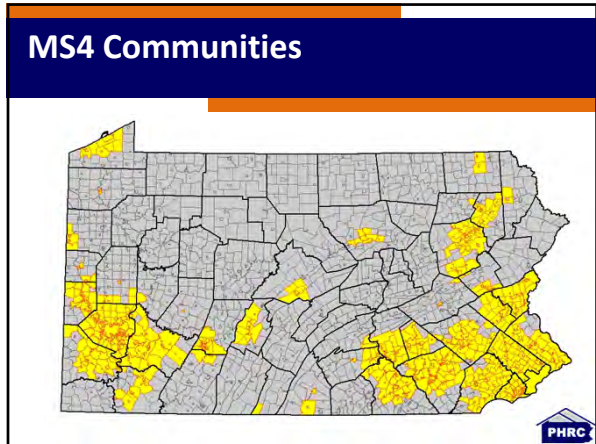
**Regulations:
2. MS4 Program**

What is an MS4?

• **An MS4 is a conveyance system of conveyances that is:**

- Owned by a state, city, town, village, or other public entity that discharges to waters of the U.S.
- Designed or used to collect or convey stormwater (including storm drains, pipes, ditches, etc.)
- Not a combined sewer
- Not part of a Publicly Owned Treatment Works (sewage treatment plant)






- ### MS4 Permits: 6 Minimum Control Measures (MCMs)
- Each MS4 must implement a Stormwater Management Program that contains BMPs to satisfy each one of the MCMs:
 - Public Education and Outreach
 - Public Participation/Involvement
 - Illicit Discharge Detection and Elimination
 - Construction Site Runoff Control
 - Post-Construction Runoff Control
 - Pollution Prevention/Good Housekeeping


Regulations: 3. PA Code Chapter 102

Erosion & Sediment Control AND Stormwater Management

E&S Control Requirements

- **Based on area of earth disturbance**
 - < 5,000 ft²
 - BMPs must be installed to minimize E&S
 - > 5,000 ft²
 - A written E&S plan is required and BMPs installed
- Written plan is also needed when there is a potential discharge to special protection waters or required by other regulations (Ch 105)



102.4 (b) 

When a Permit is Required


- **Area of earth disturbance >= 1 acre**
- **Earth disturbance**
 - Clearing, grading, excavating, stockpiling
 - Includes smaller sites that are part of a larger common plan of development or sale



102.5 (a) 

When a Permit is Required

- **Demolition**
 - If demolition is limited to building framing and the use of equipment will not cause earth disturbance, no permits needed
 - If demolition involves removing foundation or other activity that will disturb earth and area of disturbance > 1 acre permit is required



Permit Requirements

- **If earth disturbance activities \geq 1 acre:**
 - Need an individual NPDES permit or coverage under a general NPDES permit for **Stormwater Discharges Associated with Construction Activities**
 - A post-construction stormwater management (PCSM) plan must be developed and implemented

102.5 (f)



Special Protection Waters

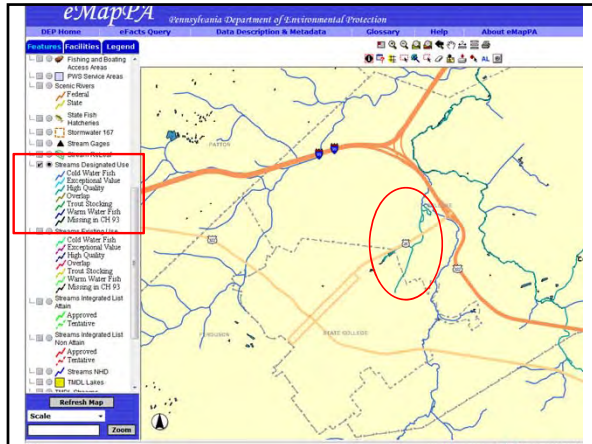
- **HQ = High Quality**
- **EQ = Exception Value**
- **Property does not have to abut the water**
 - Does rain that falls on the property drain to a special protection water?
- **For HQ & EV waters**
 - Evaluate and include nondischarge alternatives in E&S Plan
 - If nondischarge alternative not feasible, the E&S Plan must include ABACT (Antidegradation Best Available Combination of Technology)
 - Nondischarge and ABACT design standards are listed in the *Erosion and Sediment Pollution Control Program Manual* (363-2134-008)



Stormwater & Special Protection Waters

- **How do I determine if a water is High Quality and Exceptional Value?**
 - Chapter 93
<http://www.pacode.com/secure/data/025/chapter93/chap93toc.html>
 - eMapPa
<http://www.emappa.dep.state.pa.us/emappa/viewer.htm>





Coordination with Local Government

- Municipality or county must notify the conservation district or DEP within 5 days of receiving an application for a project that involves earth disturbance of 1 acre or more
- Municipality or county may not issue a building or other permit or approval until the DEP or conservation district has issued or approved the NPDES permit

102.42 and 102.43

Regulations:

4. Act 167

Act 167

- Program for counties to develop comprehensive watershed-based stormwater management plans
- Plans are implemented through local municipal ordinances
- Within 6 months of DEP's approval of Plan, all municipalities must adopt ordinance
- Act 167 plan can be used to meet some MS4 regulations



Runoff Controls and Design

What are we Controlling?

1. Peak rate
2. Volume
3. Water quality



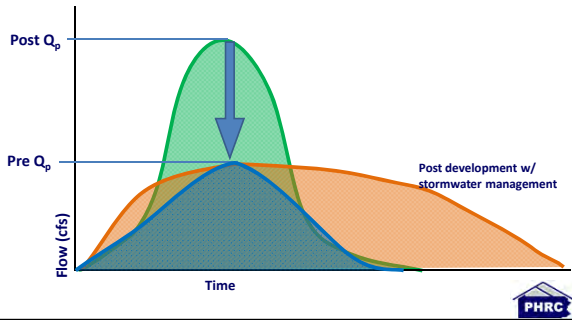
Stormwater Design Standards

1. Peak Rate Control

- Reduce post-development peak rate to pre-development peak rate for following design events:
 - 2-year
 - 10-year
 - 50-year
 - 100-year
- or requirement of approved Act 167 plan

102.8 (g) PHRC

1. Peak Rate Control



Stormwater Design Standards

2. Volume Control

- Difference between the post-development and pre-development volumes for the 2-year event
- Or requirement of approved Act 167 plan

102.8 (g)

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2. Volume Control Standards

- Do not increase the post-development total runoff volume for all storms equal to or less than the 2-year/24-hour event
 - or requirement of approved Act 167 plan



Stormwater Design Standards

3. Water Quality

- Difference between the post-development and pre-development volumes for the 2-year event

102.8 (g)



3. Water Quality Standard

- Post-development 2-year, 24-hour event
 - 85% reduction in post-development total suspended solids (TSS)
 - 85% reduction in post-development total phosphorus
 - 50% reduction in post-development total nitrogen



Summary of Control Regulations

1. Increased peak rate

- Reduce post-development peak rate to pre-development value for 2-, 10-, 50-, and 100-year events

2. Increased volume

- No net change for 2-year, 24-hour event

3. Water quality

- 85% TSS
- 85% P
- 50% N



General Approach to Minimize SW

1. Preserve and protect environmentally sensitive site features

2. Reduce/minimize impervious areas

3. Minimize disturbed areas

4. Disconnect unavoidable impervious areas where possible



Low Impact Development (LID)

- Approach to land development that works with nature to manage stormwater as close to its source as possible
- Preserves and recreates natural landscape features
- Minimizes effective imperviousness to create functional and appealing site drainage that treats stormwater as a resource rather than a waste product



Green Infrastructure (GI)

- Infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrology
- Practices include rain gardens, porous pavements, green roofs, infiltration planters, trees and tree boxes, and rainwater harvesting for non-potable uses such as toilet flushing and landscape irrigation



Minimize Generation of SW

- Preserve and protect environmentally sensitive site features
 - Identify and protect stormwater critical land areas and other environmentally sensitive areas
 - Preserve or re-create natural enclosed depressions
 - Preserve and/or replace topsoil




Minimize Generation of SW

- Reduce/minimize impervious areas
 - Road and Sidewalk Width



Minimize Generation of SW

- **Reduce/minimize impervious areas**
 - Use of pervious materials



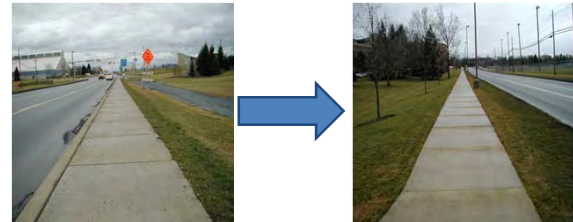
Minimize Generation of SW

- **Disconnect unavoidable impervious areas where possible**
 - Minimize use of curbs; replace with roadside swales where possible




Minimize Generation of SW

- **Disconnect impervious areas**
 - Disconnect and/or direct sidewalk runoff away from street.



Minimize Generation of SW


- **Disconnect impervious areas**
 - Disconnect curbed parking areas and direct to filter strip or other infiltration BMP



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Major Design Considerations


- **Soil infiltration capacity**
 - Limiting factors such as fragipans, shallow depth to bedrock or water table, karst topography
- **Location of cut and fill material**
- **Minimizing compaction of soil**
 - Can't compact in areas used for infiltration




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Design Approach

- **Use a "Treatment Train"**



Spread runoff out
Use multiple practices spread across the site
Recharge/infiltration & water quality at source
Peak control at site outlet



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Wrap-up

- **Issues of stormwater**
- **Regulatory Requirements**
 - MS4, PA Code Ch 102, Act 167
- **Management**
 - What’s the size of the problem
 - Retrofit BMPs
 - Small depressions & vegetation
- **SW versus Flood Control**
 - What happens when we get 10 inches of rain in a day?



References

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Questions & Evaluations

Next webinar:
Tuesday, May 13 at 1:00pm
Aging in Place