New Stormwater Management Requirements

Centre at Millennium Park
Johnson City
December 3, 2007

Purpose of this meeting

- Present the new stormwater requirements
  - Stormwater quality management ordinance
  - Draft water quality BMP manual
- Gather comments from the public on the approach

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We want citizen comments

- Ask questions and provide comments tonight
- Use comment cards
- City websites
  - ordinance and manual
  - this presentation
- Contact your local stormwater manager after the meeting (see handout)

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Meeting Agenda

1. Drivers for the new ordinance
2. Introduction to the new requirements
   - Background on approach
   - Highlights of the ordinance and manual
3. General timeline for new requirements
4. Questions/Answers

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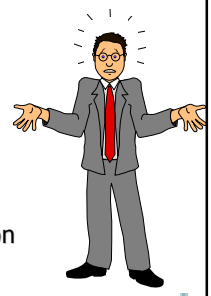
What are we talking about?

- New design requirements for stormwater control
  - Additional to current detention, drainage and floodplain requirements
- New developments and redevelopments only
- Bristol, Elizabethton & Johnson City



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Drivers for new stormwater requirements

SW regulation in the 1990's

- Drainage control
  - Peak discharge (detention ponds)
  - Pipes, ditches and channels
- Floodplain management
- Sinkhole regulation

Water Quantity Control

New Regulations

- MS4 Permit
  - **M**unicipal **S**eparate **S**torm **S**ewer **S**ystem
  - Part of the Clean Water Act NPDES program
  - Large cities permitted since early 90's
    - Nashville, Memphis, Knoxville, Chattanooga
  - Applicable to smaller cities/counties in urbanized areas
    - 85 cities & counties in Tennessee
    - Johnson City, Bristol, Kingsport, Elizabethton, Sullivan Co., Washington Co., Blountville, Bluff City, Jonesborough, etc…
  - Addresses stormwater quality control

MS4 Permit Control Measures

- Public Education & Outreach
- Public Participation
- Illicit Discharge Detection & Elimination
- Construction Site Runoff
- Post-Construction Water Quality
- Municipal Good-Housekeeping

- **Requires compliance activities in each area, targeting known pollutants**

MS4 Post-construction Requirements

Permitted jurisdictions must:

- Require water quality controls
  - Developments 1 acre or greater
  - Have structural and non-structural control strategies
  - Ensure long-term maintenance and operation of controls
- Require vegetated buffers

More Drivers

- Total Maximum Daily Load (TMDL)
  - Water quality control
    - Sediment/Habitat Alteration
    - Pathogens
- The list of impaired waters
- Heightened concerns about stormwater (flooding, erosion and water quality)

Impacts of These Drivers

- Necessary ordinance improvements
  - Erosion/sediment control
  - Pollutant discharges and dumping
  - Post-construction water quality control
  - Private stormwater facility maintenance

Tonight's focus

- Enforcement changes
  - Development plans submittal, review and enforcement
  - Construction site inspection and enforcement
  - Private facility maintenance enforcement

Post-construction stormwater approach

What is required in the new ordinance?

Georgia Stormwater Management Manual

- Developed by the Center for Watershed Protection
- Not reinventing the wheel
  - Georgia, Virginia, Vermont, Maryland, etc.
  - In Tennessee:
    - Knox Co, Maryville, Nashville, Franklin, etc.
- TDEC will likely REQUIRE this statewide within one to two years

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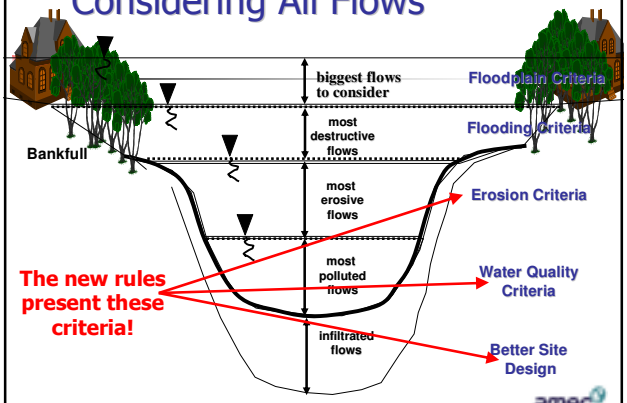
Considering All Flows



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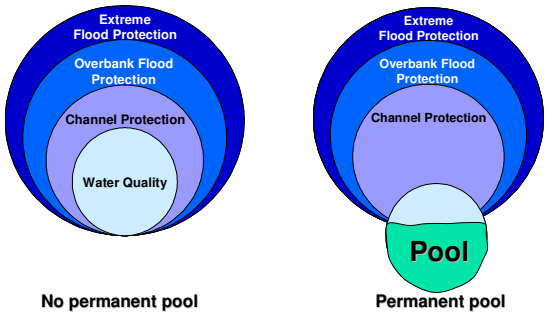
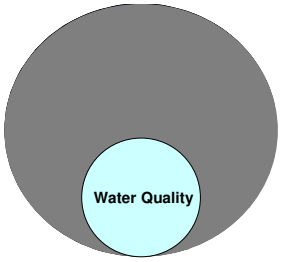
An integrated design approach



Water Quality Volume (WQv)



WQv Basics – The Rules

1. Calculate the WQv based on the total site imperviousness…
2. Reduce the WQv for doing certain non-structural 'green' things…
3. Treat the WQv to 80% TSS removal…
4. Use pre-specified structural controls to attain that standard…

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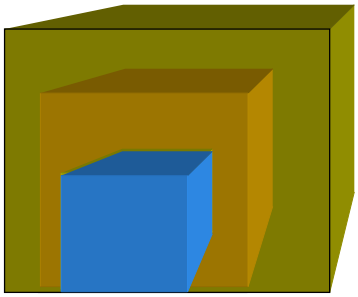
Water Quality Volume



1. Standard site design produces a WQ*v*
2. Reduce the WQ*v* with non-structural controls
3. Reduce the WQ*v* using pre-specified "WQv Reductions"
4. Treat the remaining WQ*v* volume with structural controls to meet the 80% TSS removal standard

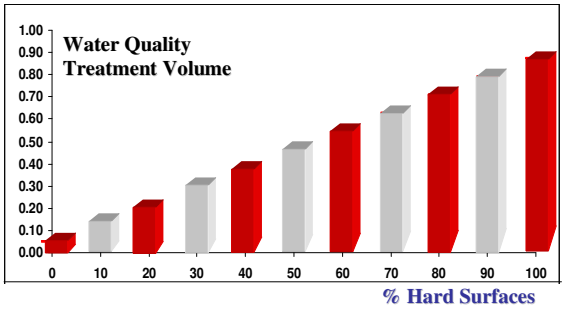
1. Calculating the WQv

A simple equation:

$$WQv = P*Rv*A/12 \quad \text{ac-ft}$$

Where: P = 85% rainfall depth (1.04 inches)
Rv = 0.0092*I + 0.015
I = impervious percent (e.g. 75%)
A = site area in acres

The more you pave, the more you treat!



2. Reducing the WQv

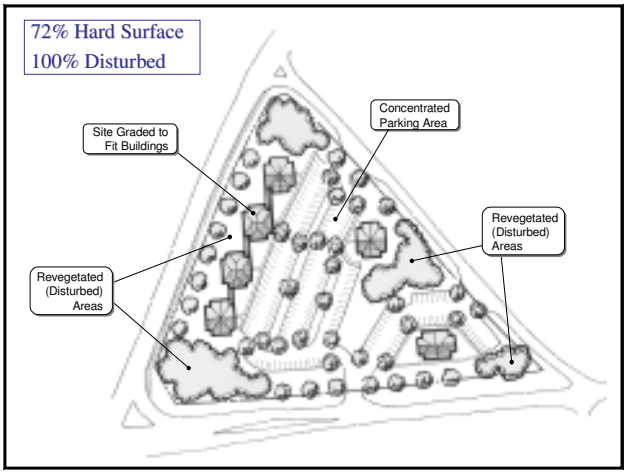
Use ***non-structural*** controls

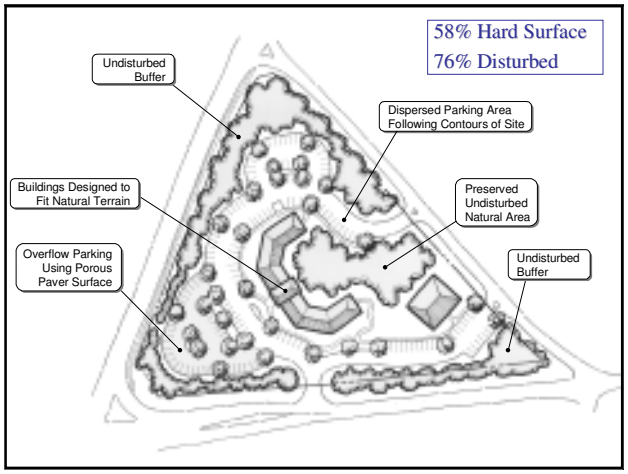
1. Simply reduce site imperviousness
   - Low impact site design approaches
   - Pervious pavements
2. Get "WQv Reductions"

Non-structural BMP examples

Same number of lots
less cost

Standard Site Design | Conservation Site Design





WQv Reductions

- Reduction 1: Natural Area Conservation
- Reduction 2: Managed Conservation Area
- Reduction 3: Stream and Vegetated Buffers
- Reduction 4: Vegetated Channels
- Reduction 5: Impervious Area Disconnection
- Reduction 6: Environmentally Sensitive Large Lot Neighborhood

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WQv Reductions work like this:

- Areas qualifying for reduction are subtracted from the "A" in the treatment volume equation.

$$WQv = P*Rv*A/12 \quad \text{ac-ft}$$

- And the reduction areas often count as controls in the TSS calculation
  - 100% TSS removal for Natural Conservation

Potential for Regulatory Conflict (examples)

- Subdivision regulations
  - Roadway widths
  - Cul-de-sac radius
  - Landscape islands
- Zoning regulations
  - Setbacks
  - Driveway requirements
  - Parking space requirements
- Drainage standards
  - Curb and gutter
  - Pipe

Source: Tonning

3. Treat WQv to the standard

WQ Goal:
80% TSS Removal

Total Suspended Solids

- TSS is a measure of "siltation"
- Siltation is a local and statewide pollutant of concern
- Probably handles other pollutants:
  - Adsorbed pollutants
  - Habitat alteration
  - In-stream alteration
- 80% removal is an attainable and reasonable expectation
  - Used across the eastern US
  - Significant WQ treatment
  - But not cost-prohibitive

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4. Using Structural BMPs

Table 3-1. TSS Removal % for Structural BMPs

Structural BMP	TSS Removal %
General Application BMPs	
Wet Basin	80
Wet Extended Detention	80
Micropool Extended Detention Basin	80
Multiple Basin System	80
Dry Extended Detention Basin	60
Conventional Dry Detention Basins	10
Shallow Wetland	80
Extended Detention Shallow Wetland	80
Basin/Wetland System	80
Pocket Wetland	80
Bioretention Area	85
Sand Filters (Surface and Perimeter)	80
Infiltration Trench	90
WQ Dry Swales	90
Wet Swales	75
Filter Strip	50
Grass Channel[1]	30
Gravity (oil-grit) Separator	30
Modular Porous Paver Systems[2]	*
Porous Pavement/Concrete[2]	*
Limited Application BMPs	
Organic Filter	80
Underground Sand Filter	80
Submerged Gravel Wetland	75
Alum Treatment System	90
Manufactured BMPs	10[3]
Underground Detention	10

Every control is assigned a known value for TSS based on field/research data

WQ BMP manual gives design information

So a site designer must go through these steps:

1. Measure the site's impervious area and calculate WQ*v* based on the site design.
2. Seek to reduce WQ*v* through the use of better site design and WQ*v* reductions.
3. Design BMPs that attain an 80% TSS removal for the site
   - One or more structural controls
   - Combine with TSS removals assigned to the WQv reductions

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WQv Approach Advantages

- ✓ Not re-inventing the wheel
- ✓ Approach is in-line with TDEC's "thinking"
- ✓ Everyone is held to the same standard
- ✓ Provides **flexibility** for site designers
  - ✓ Menu of structural BMPs
  - ✓ Flexibility in site design approach – but must meet 80% TSS removal standard
- ✓ Includes and promotes "green" options:
  - Reduced imperviousness = reduced runoff
  - Natural area & buffer conservation

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Intro to Structural BMPs

Curt Jawdy, PE
AMEC Earth & Environmental, Inc.

If only…

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Typical Detention Basin

More depth = less area

Sedimentation

Water Quality Ponds

Advantages

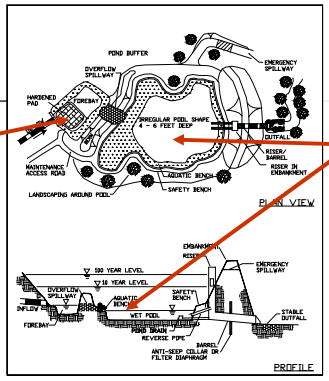
- 80% TSS removal
- Community acceptance
- Wildlife habitat
- Can be designed for quality and quantity

Disadvantages

- Warm water discharge
- Dam height restrictions

Sediment Forebay

Permanent Pool



Mosquito Control

- Maintenance is key…
- Design features
  - Drain within 72 hours
  - Drawdown gate
  - Predator habitat
  - Mosquito fish
  - Aeration

Stormwater Wetlands

Advantages

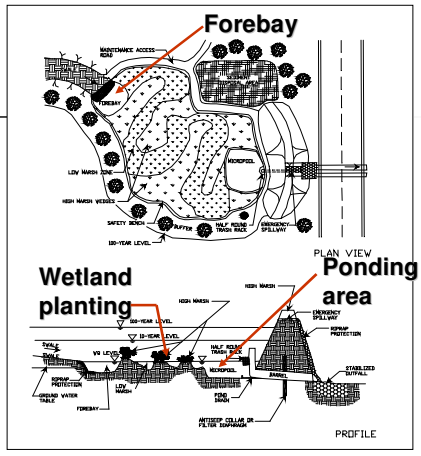
- 80% TSS removal
- Habitat for wildlife
- Water quality and quantity

Disadvantages

- Large amount of land needed
- Nuisance if not designed/installed properly
- Sedimentation failure
- Warm water discharge
- Constant source of water needed

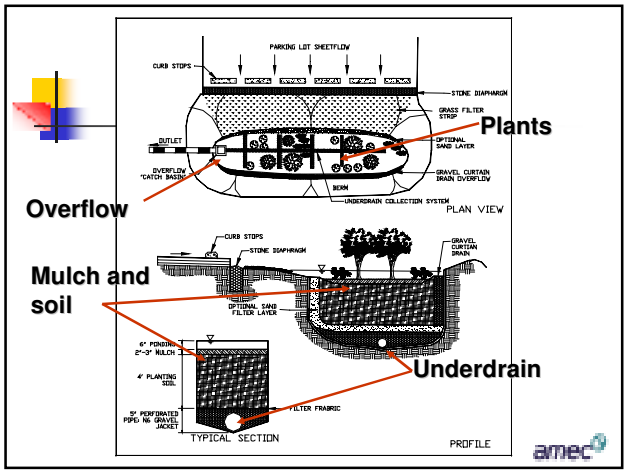
Critical Issues

- Water balance
- Vegetation



Bioretention

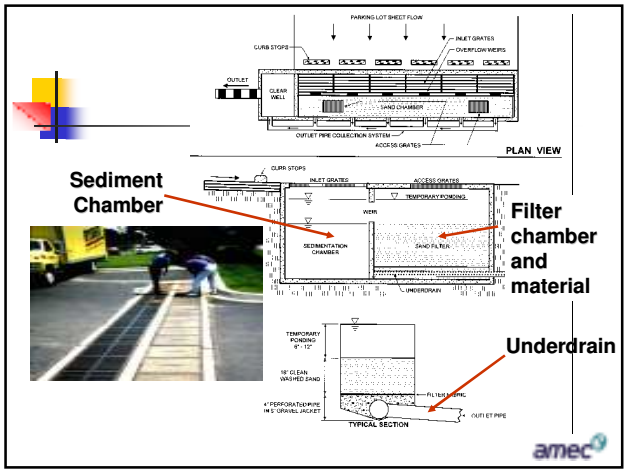
- Advantages
  - 85% TSS removal
  - Easily incorporated into new development
  - High acceptance
  - Good for paved areas
  - Low maintenance
- Disadvantages
  - Clogs easily
  - Detailed planting plan required
  - Not appropriate for steep slopes
  - Expensive



Sand Filters

Advantages
- 80% TSS removal
- Good for redevelopment
- Good for paved areas
- Good for a-typical pollutants
- Good for commercial / industrial sites

Disadvantages
- High maintenance
- Clogs easily
- Expensive
- Possible odor problems
- Cannot provide water quantity control
- Not appropriate for landscaped areas

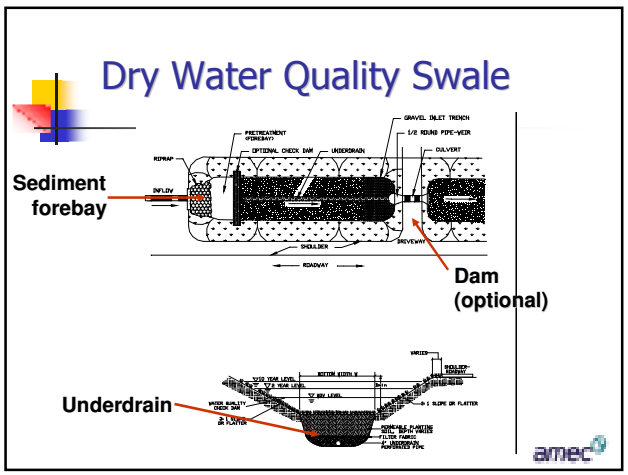


Water Quality Swales

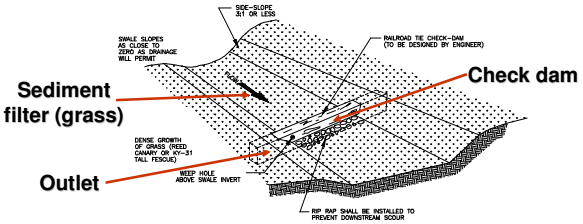
Advantages
- 75%-90% TSS removal
- Low cost
- Low land requirement
- Low maintenance

Disadvantages
- Wet swales can cause nuisance issues
- Can only be used on mild slopes
- Re-suspend sediments

Dry Water Quality Swale

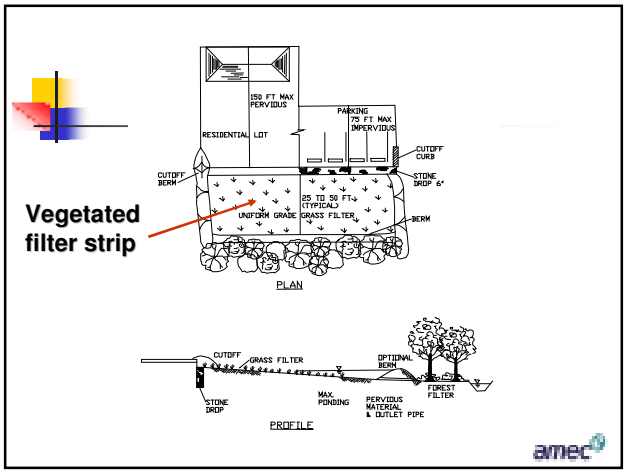


Wet Water Quality Swale



Vegetated Filter Strips

- Advantages
  - High acceptance
  - Wildlife habitat
  - Easy maintenance
  - Can be combined with other BMPs for pre-treatment
- Disadvantages
  - 50% TSS removal
  - Cannot be designed for water quantity control
  - Must maintain sheet flow across entire length of filter



Porous Concrete

- Porous pavement that allows for the rapid infiltration of water and overlays a stone aggregate reservoir


Porous Concrete - Design Criteria & Specifications

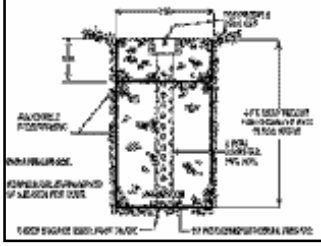
- Used for low traffic areas.
- Subsoils infiltration rate > 0.5 in/hr
- Use adjacent to stabilized areas to prevent clogging
- Use on slopes < 5%
- Do not use around hotspots

Modular Porous Paver Systems

- Porous pavement surface composed of structural units with void areas that allow for the infiltration of runoff


Infiltration Trenches

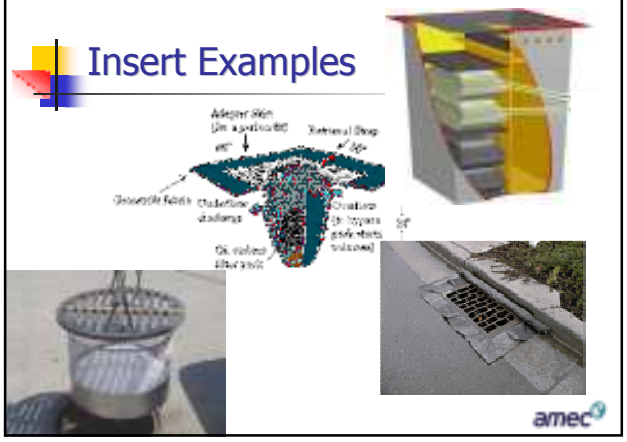
- Advantages
  - 90% TSS removal
  - Groundwater recharge
  - Good for sandy soils
- Disadvantages
  - Groundwater contamination potential
  - Clogs easily
  - Karst soils pose bypassing potential
  - Geotechnical testing required


Catch Basin Inserts

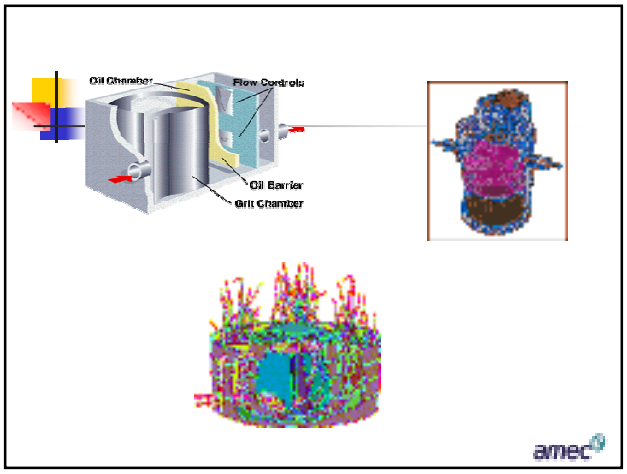
- Advantages
  - Pollutant specific
  - Good for paved areas
  - Good for retrofitting
- Disadvantages
  - High maintenance
  - Clogs easily
  - Small drainage area
  - High cost
  - Differing pollutant removal rates

Insert Examples



Other Proprietary BMPs

- Advantages
  - Many types
  - Many different pollutant rates
  - Good for retrofitting
  - Good for highly paved areas
- Disadvantages
  - High cost
  - Little in-the-field research
  - High maintenance cost



Expense of Proprietary Solutions

Proprietary Systems Usage Criteria

- Independent third-party verification of performance
- Proven record of longevity in the field
- Proven ability to function in Tri-Cities conditions

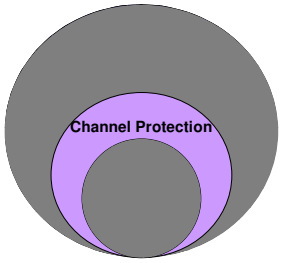
Long-term maintenance

- Required to ensure BMPs are functioning as intended
  - Structural BMPs - 80% TSS removal
  - Buffer areas – canopy and streambank stabilization
- The property owner must inspect and maintain
  - City will inspect periodically

Long-term maintenance

- Maintenance guidance in WQ BMP Manual
- Ensured via executed "Covenants for Maintenance of BMPs"
  - Does not apply to existing facilities
  - Executed at site planning stage
  - Registered with the deed
  - Changes hands with property ownership

Channel Protection



Increased Duration and Frequency of Channel Forming Flows

- Approximately ½ bankfull to bankfull flow
- Approximately 1-year to 2-year small flood events

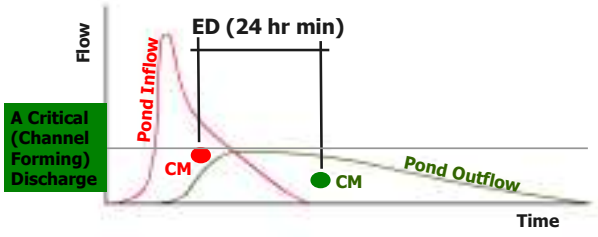
Channel erosion protection

- UT study indicates significant sediment load from stream erosion
- Useful for NPDES & TMDL compliance
- Goals
  - protect stream banks
  - reduce sediment loads

Channel Protection Volume (CPv)

1. Capture the volume of runoff from the 1-year, 24-hour storm (CPv)
2. Discharge the CPv over no less than 24 hours period.

CPv Result

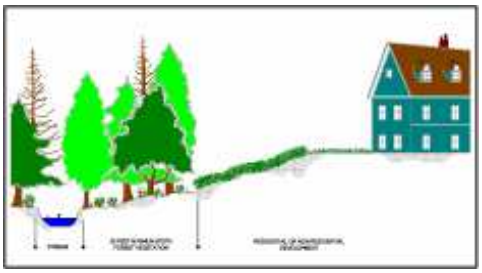


Vegetated Buffers

Buffers are good for water quality…

Purpose of buffer requirements

- Provide stream canopy
  - Shade for stream habitat
  - Cool runoff/streams
- Anchor streambanks
  - Vegetation for habitat
  - Prevents eroding banks



Vegetated Buffer Requirements:

- 25 ft width
- Streams: trees, shrubs, grasses
- Wetlands, ponds, lakes: dense grass
- Vegetation maintenance is allowed
- Use is restricted
- No impervious surfaces
  - Paths, trails allowed in some cases
- Must be established and maintained in perpetuity

Community Benefits

Source: Hirshman

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Summary of New Requirements

- All <u>new</u> developments/redevelopments greater than 1 acre must:
  - Treat the WQv to 80% TSS removal
  - Protect channels through extended detention
  - Establish, protect, maintain the 25 ft vegetated buffer
  - Execute covenants for perpetual maintenance
  - Inspections and maintenance
    - Property owner responsibility
    - Local jurisdiction will inspect and enforce

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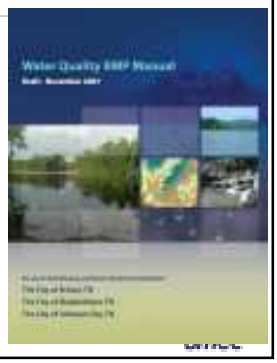
Framework of New Requirements

- Stormwater quality ordinance
  - Sets basic requirements
  - Refers to WQ BMP Manual
  - Sets the stage for enforcement
- WQ BMP Manual
  - Establishes WQ standards
  - Provides
    - BMP design criteria
    - BMP maintenance info
    - plan submittal process info
- Ordinance and manual are on-line at city websites



Timeline for new requirements

- **Jan 2, 2007 – Public comments due**
- **Jan 08 – WQ BMP Manual completed**
- **Jan/Feb/Mar 08 – Adopt Ordinances**
- **Feb/Mar/Apr 08 – Technical workshops for developers and engineers**

Local contacts & websites

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Comments due by January 2, 2008.