Nonpoint Source Pollution Control in the USA: An Update

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Recent Advances
NPS Control in the USA

- NPS Legislation
- Clean Lakes, Wetlands
- BMP Implementation
- TMDL Programs, Watershed Approach, Low Impact Development

NPS Control Legislation

- **1991 - Phase I Stormwater Permit Program - Certain Industries, Large Municipalities (MS4's) and Construction Sites >5 acres**
- **1995 - Phase I Program Expanded to Include More Industries and Medium Municipalities**
- **2000 - Phase II Program Announced - Add Small Municipalities and Construction Sites between 1 to 5 acres**

NPS Control Legislation-More

- Phase II Implemented in Early 2003. Specific Compliance Dates are as Follows
- Oct.,2000- Menu of BMPs Issued by EPA
- Oct. 2001- EPA Issues Guidance on Setting Measurable Goals
- Dec.,2002- Phase II Permit Application
- Mar.,2003- Phase II Permit Required
- 2008 -Full Implementation of Stormwater Management Programs Required

NPS Control Legislation (3)

- **Section 319 of Clean Water Act (CWA) -- Provides funding for all states for NPS research and control. (e.g., in 1996, Virginia received about $2 million.**
- **Section 303 -- All states must submit a list of "impaired" waters for which TMDLs must be developed and BMPs planned. For example, Virginia must complete more than 80 TMDLs in the next 5 years.**

NPS Control Legislation (4)

- Many other laws and regulations have NPS related elements -- e.g., Coastal Zone Management Act; Clean Lakes Program, Wetland Protection Programs, and the Safe Drinking Water Act.
- Virginia has its stormwater management laws. Some counties such as Fairfax, even have stormwater utility tax, which is included in property taxes.

BMP Implementation

- First generation BMPs have been used since mid-1980s.
- Most often used urban BMP is dry detention ponds.
- Transportation agencies built the most number of BMPs.
- Buffer strips and constructed wetlands are recommended for NPS pollution from agricultural areas.

What Have We Learned?

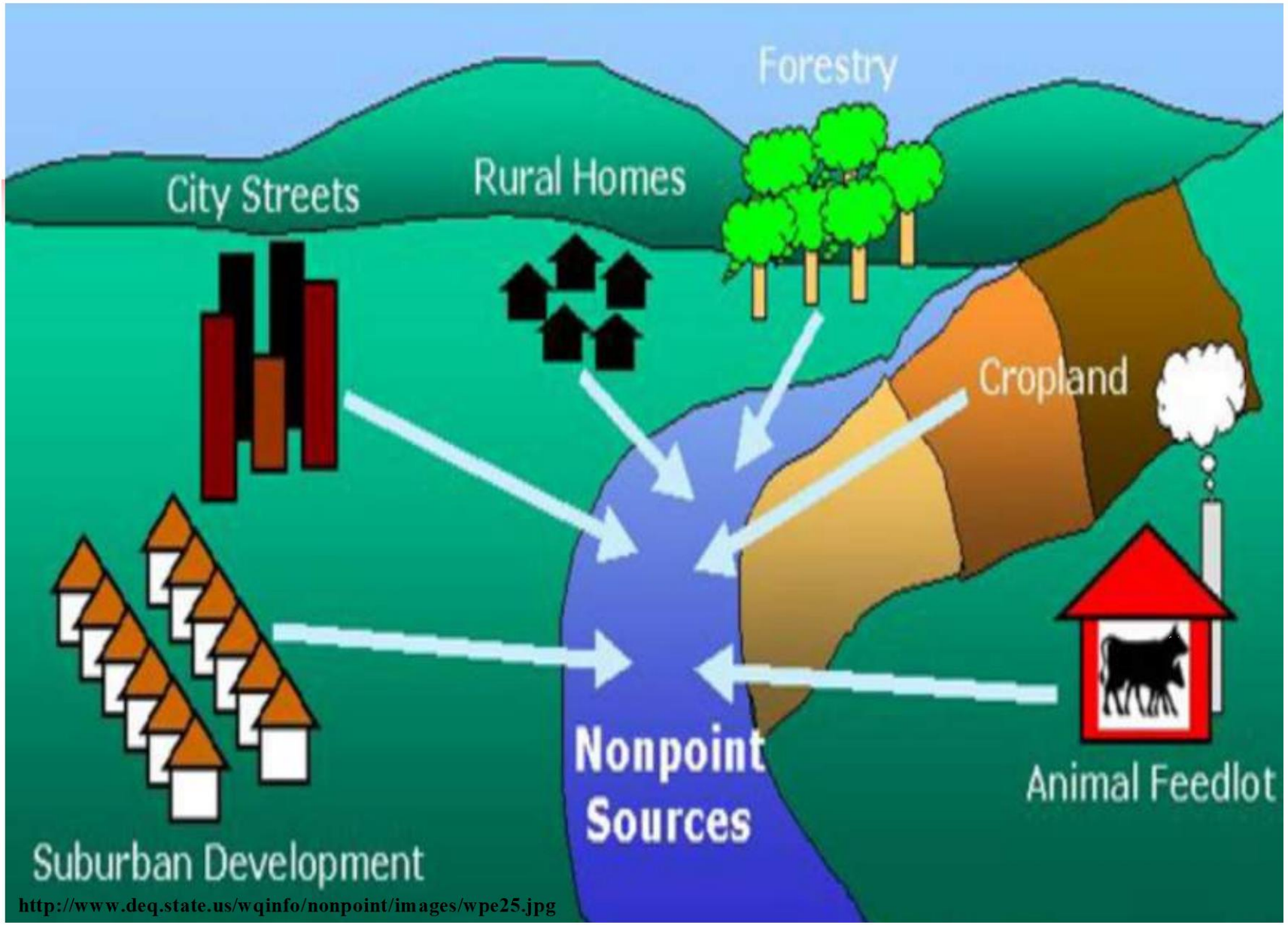
- Some BMPs just don’t work.
- Maintenance of a BMP is very important for its long-term performance.
- Vegetative BMPs don’t work right away.
- Materials accumulated in BMPs may be considered hazardous.
- Multiple-purpose BMPs may be the thing for the future.

What Do We Really Need To Know ?

- Quantitative relationship relating BMP implementation to real water quality improvement. Optimal BMP placement at the watershed scale.
- How to maintain a BMP.
- Who pays and how?
- Water-quality based BMP design
- Design guidelines for certain BMPs. For example, should a BMP designed for a 2-year storm, or a 6-month storm?
- Cost-effectiveness of a BMP.

Second-generation BMPs

- **Space-limited, or ultra-urban BMPs (for BMP area less than 0.5 acre, or over 50% imperviousness in the watershed).**
- **Manufactured BMPs such as Stormceptor; Vortechs Unit, StormTreat; Multi-chamber Treatment Train (MCTT), etc.**
- **BMPs integrated into the landscape, e.g., the Bioretention Area or Rain Garden.**
- **Design, Maintenance and Performance information lacking.**



http://www.deq.state.us/wqinfo/nonpoint/images/wpe25.jpg

Nutrient Management in Agriculture Areas

- Reduction of N and P applications
- Treatment Processes
- Land Application
- Agricultural BMPs – Vegetative Buffers, Treatment Wetland, Detention and Retention, Phytoremediation
- Proprietary Technologies

Treatment Chambers or Manufactured BMPs

- Mostly proprietary
- Laboratory-Tested, but very few field data
- Especially suitable for space-limited situations
- Long-term cost-effectiveness needs to be established

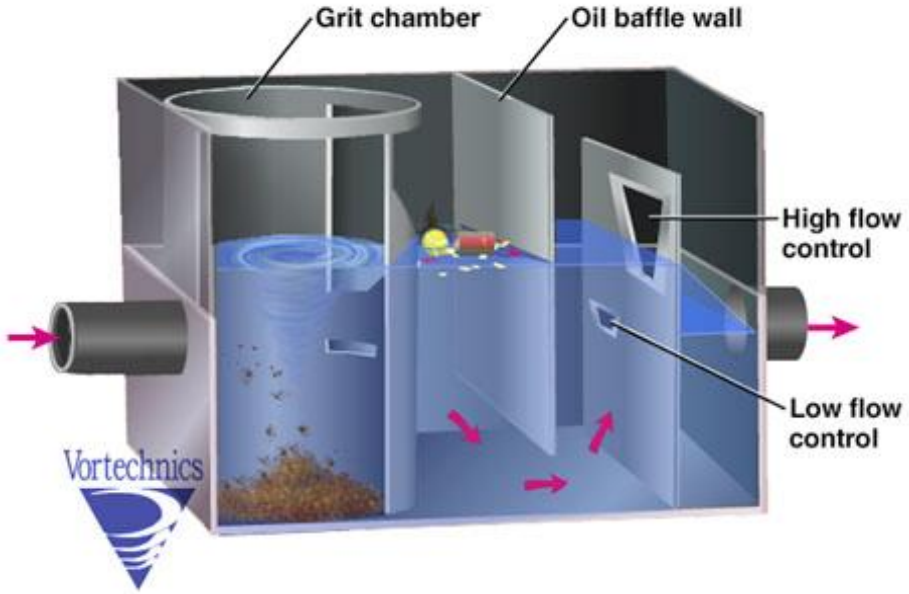
VORTECHS

Site location: UVA Facility Management Parking Lot.

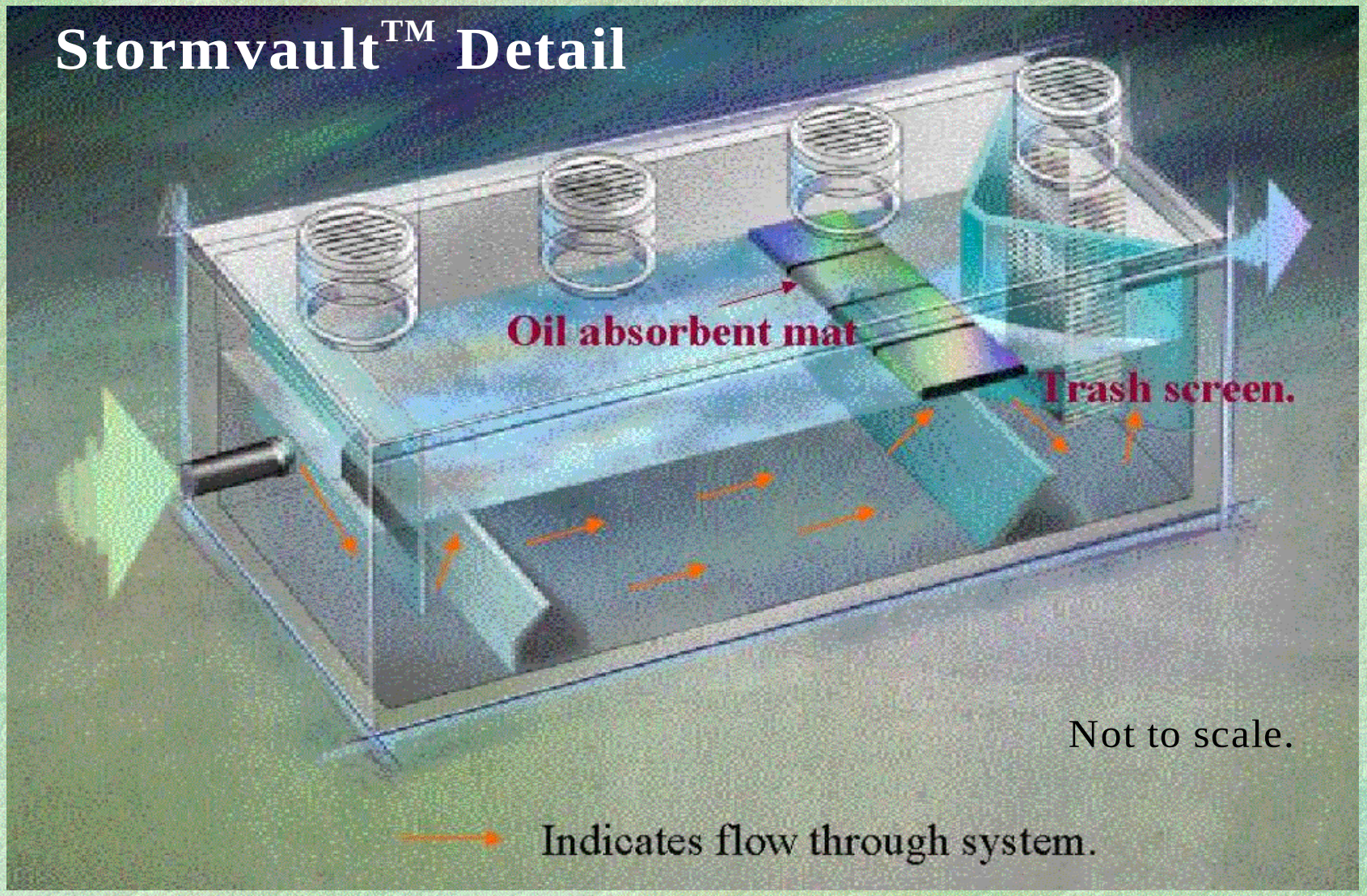
Drainage Area: Receives drainage from a 0.60 acre impervious parking lot.

BMP Specifications

- 4.5cfs peak design flowrate.
- 3000gal storage capacity.
- Flow through device designed to treat the first flush.
- 80% design TSS RE.



Stormvault™ Detail



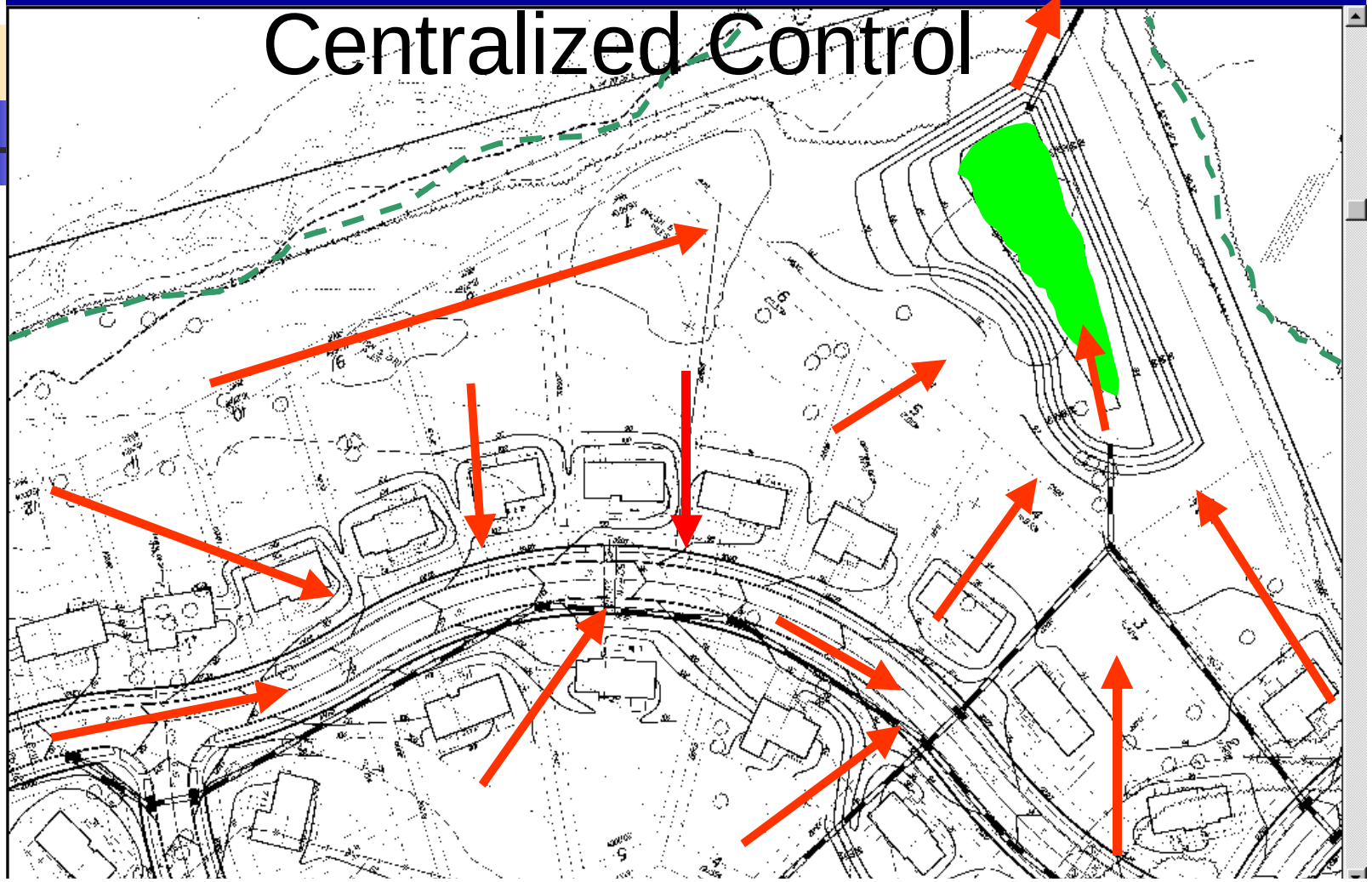
Most Recent Development

- More implementation of underground structural BMPs in ultra-urban situations – e.g., Walt-Mart, CALTRANS.
- Tools for watershed implementation of BMPs – e.g., Tetratech BMP Toolbox.
- Widespread recognition of the potential for LID practice applications – e.g., national LID conference, local requirements for LID applications

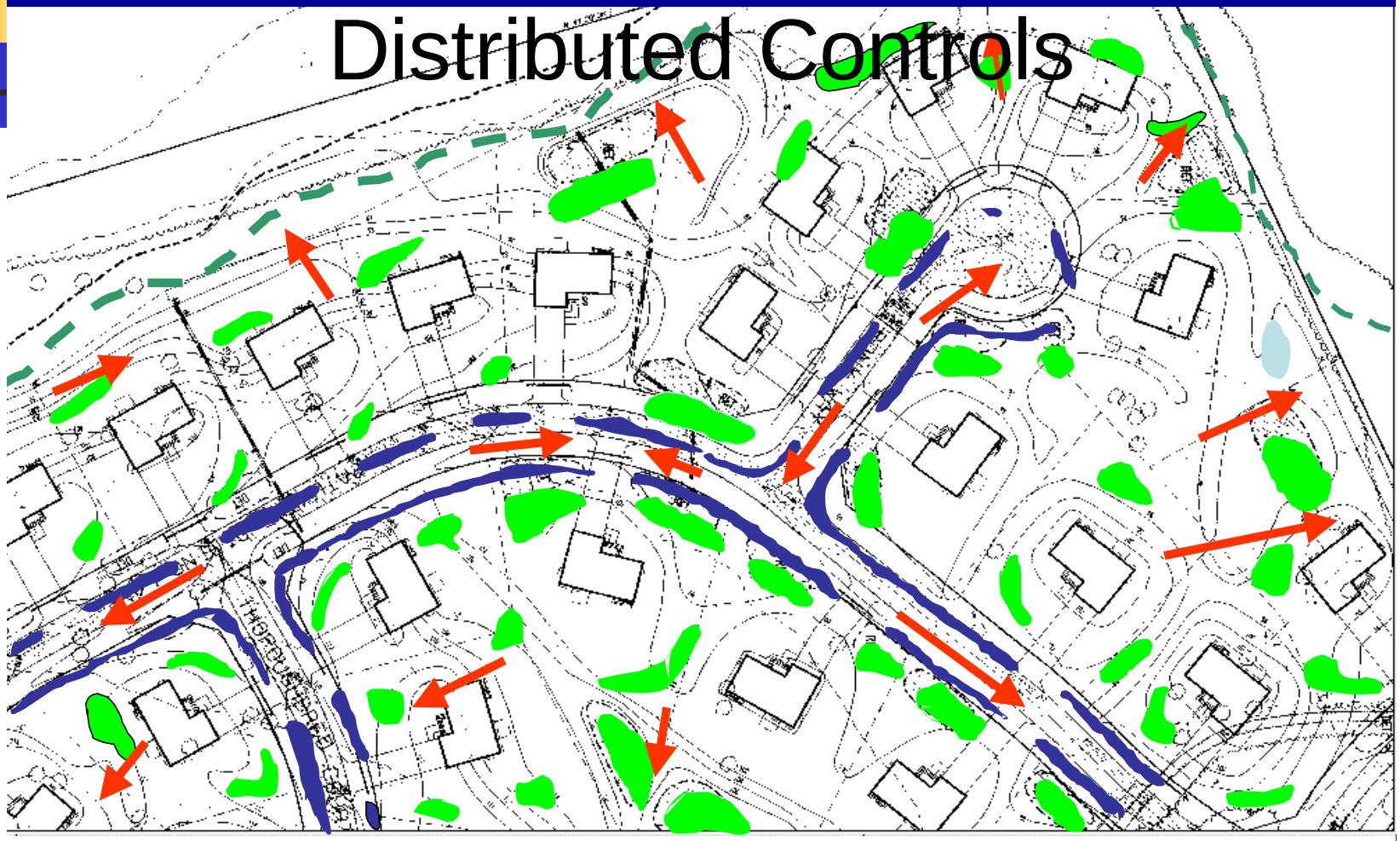
LID Design Principles

- "Mimic" Natural Hydrology
- Control micro storms while maintaining traditional drainage and flood control functions
- Distribute storage and conveyance in the watershed in an optimal way
- Use local plants in "green" BMPs and integrate controls into the landscape

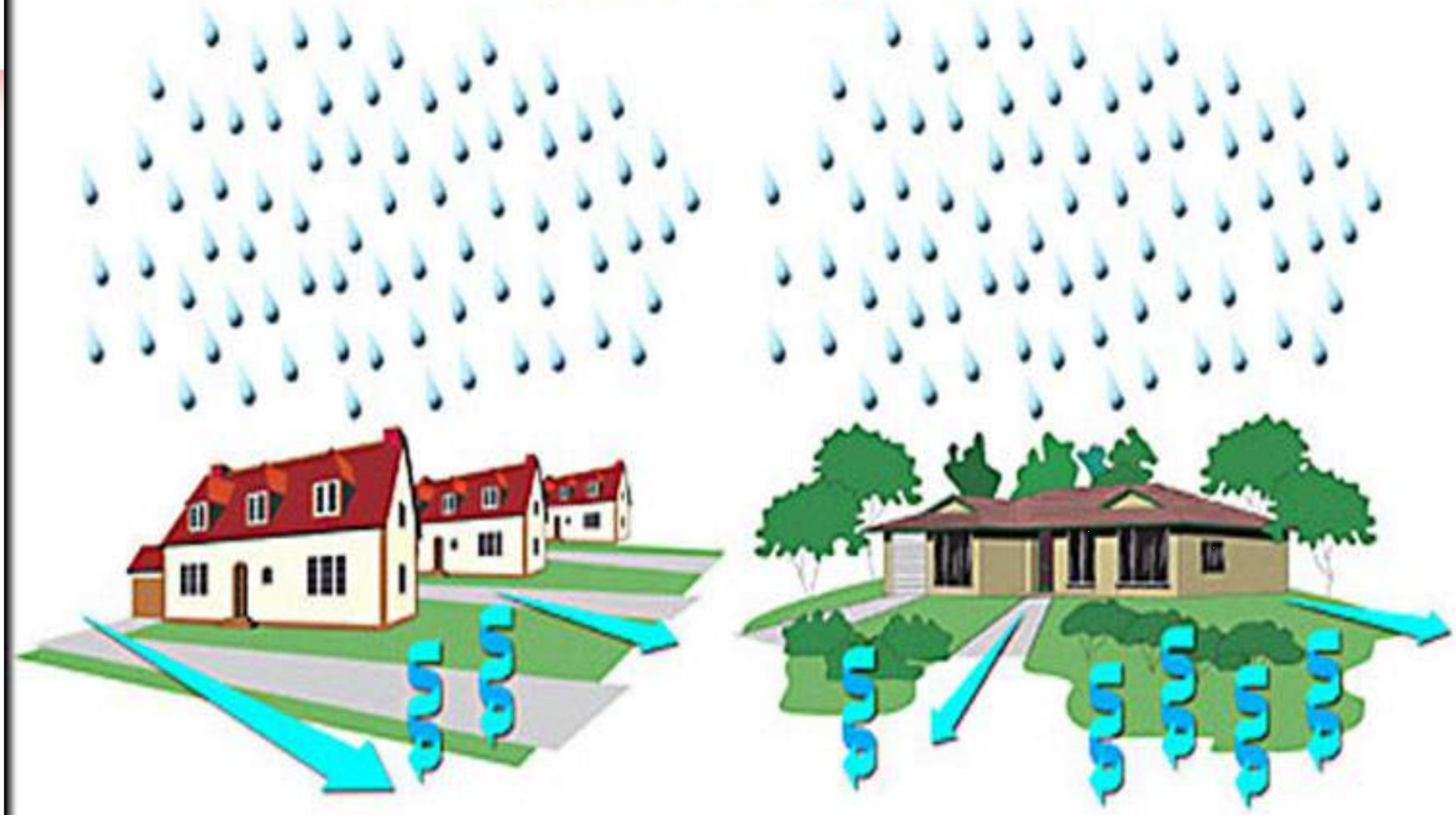
Centralized Control



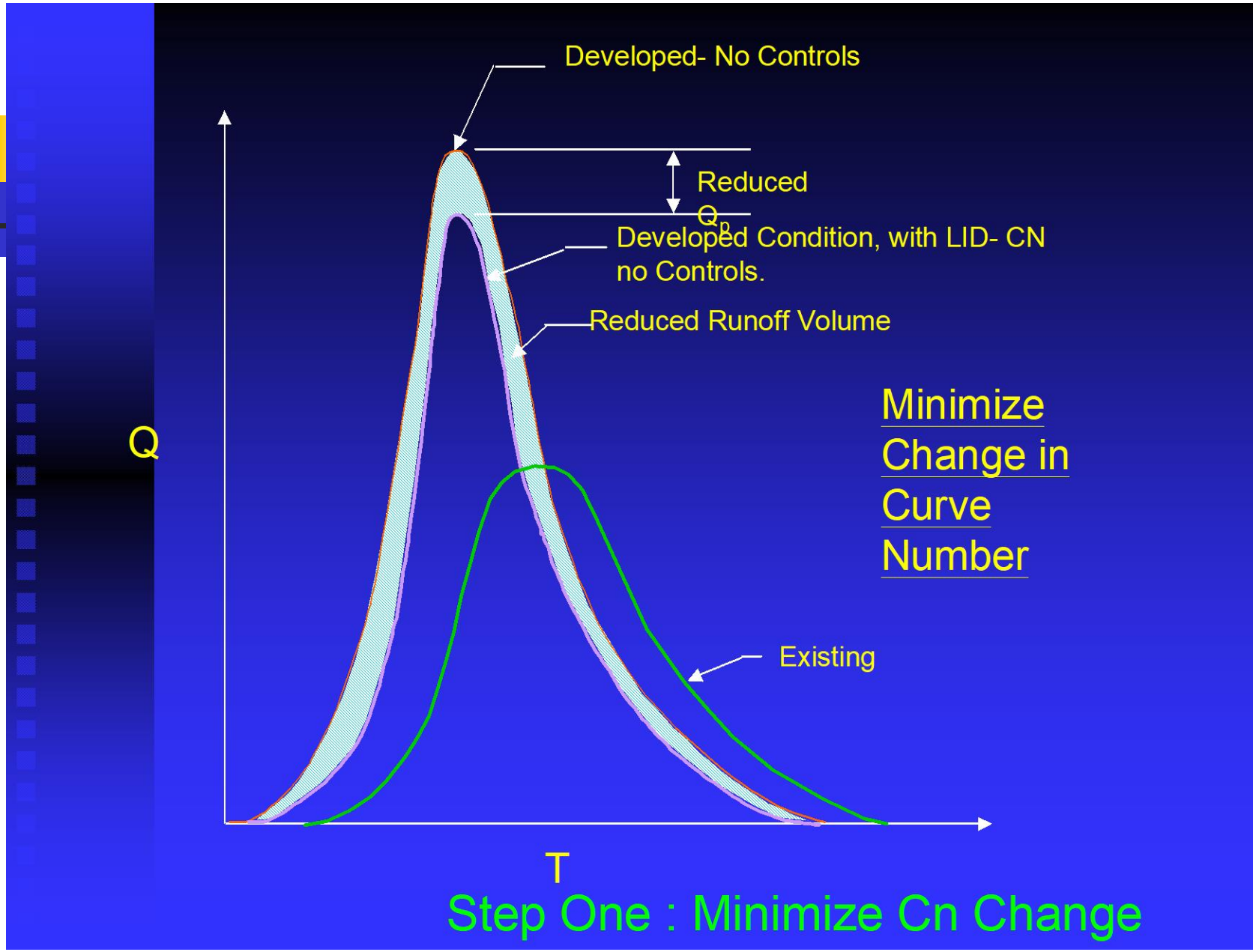
Distributed Controls

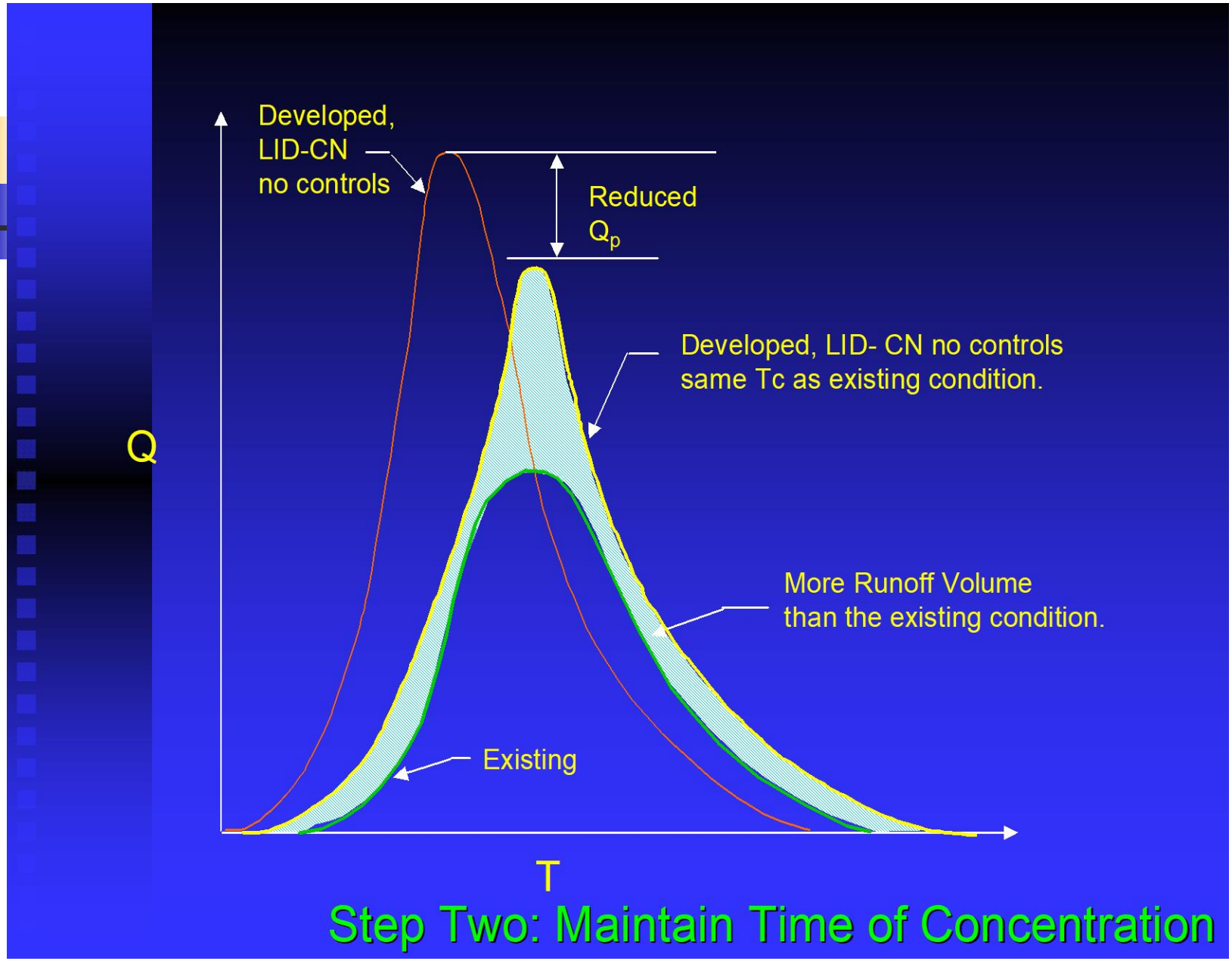


Low impact design



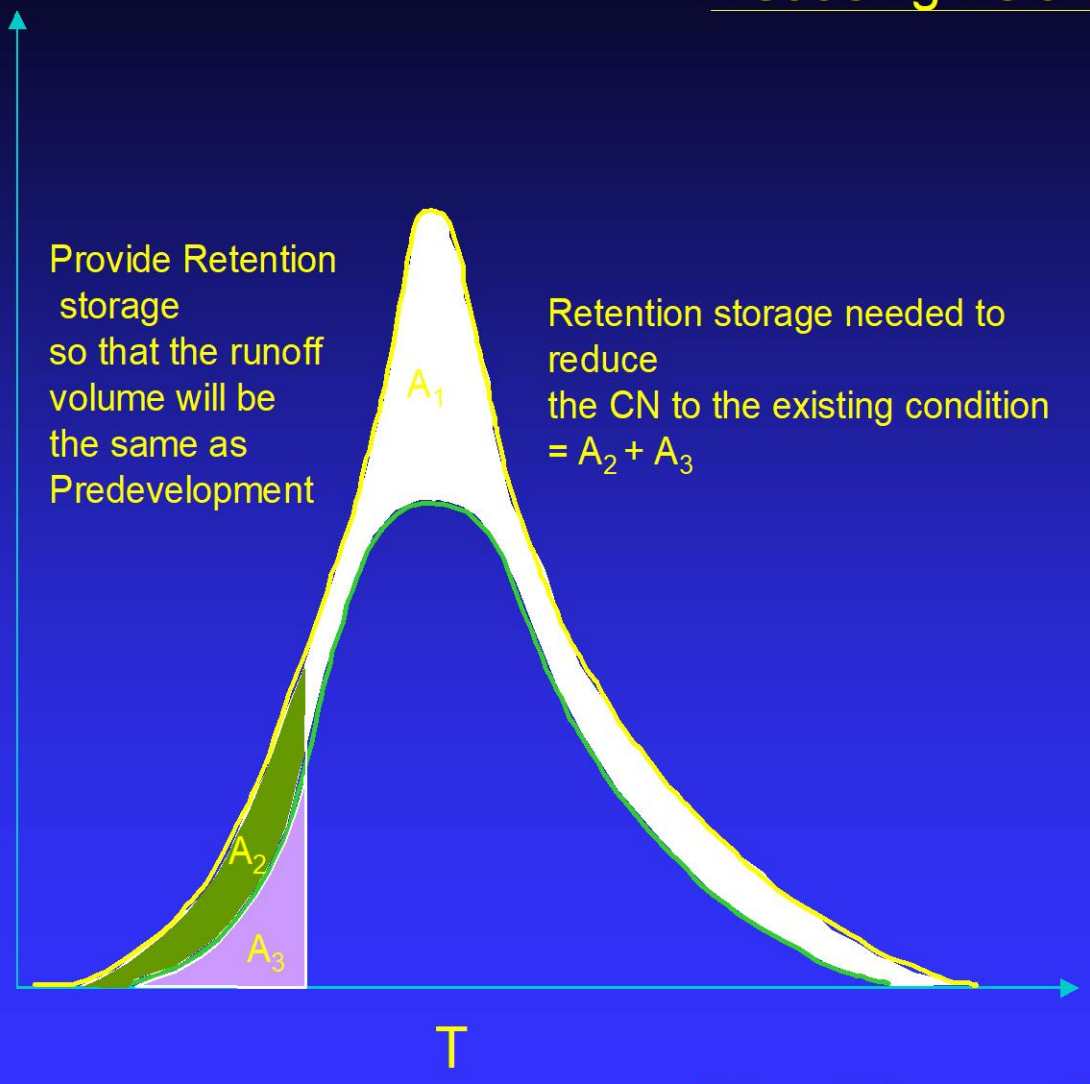
http://www.vml.org/VTC/VTC3908-2.html


Developed- No Controls
Reduced
Q_p
Developed Condition, with LID- CN
no Controls.
Reduced Runoff Volume
Minimize
Change in
Curve
Number
Existing
Q
T
Step One : Minimize Cn Change



Step Two: Maintain Time of Concentration

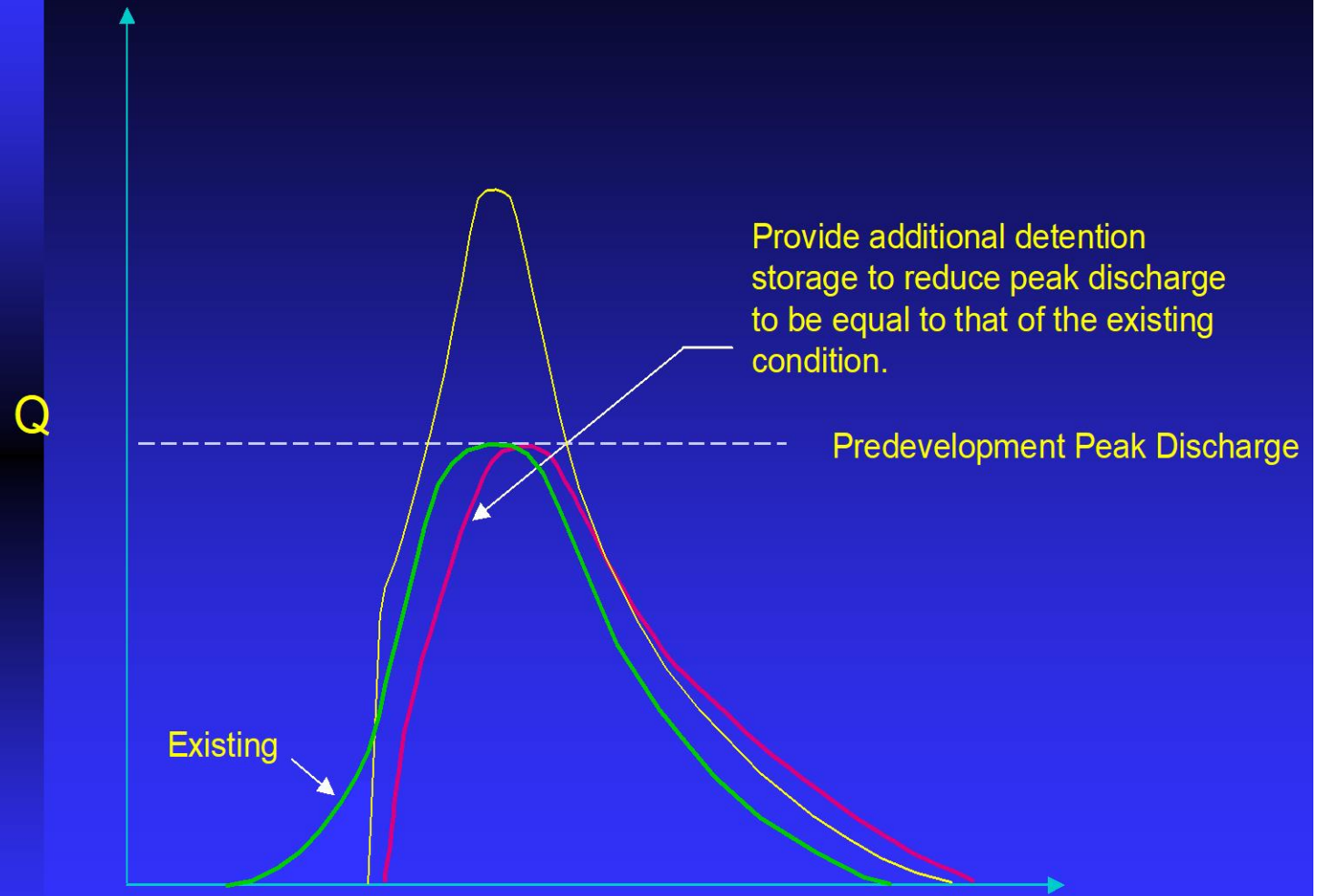
Reducing Volume



Provide Retention storage so that the runoff volume will be the same as Predevelopment

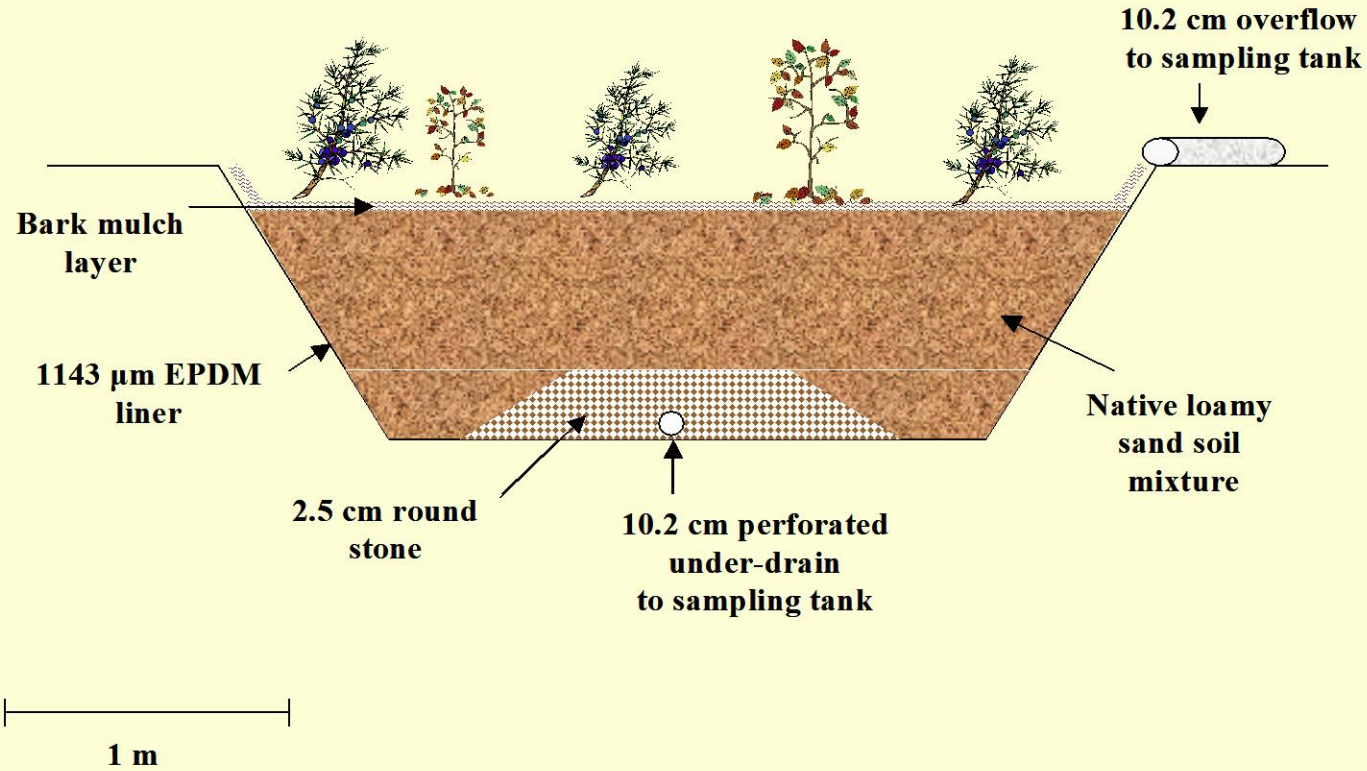
Retention storage needed to reduce the CN to the existing condition = $A_2 + A_3$

Step Three: Retention



Step Four: Detention Storage

Rain Garden Cross-Section



Residential Rain Gardens

Albemarle County, Virginia

Biofilter in a Box!

Sustainable Building & Design

Gap World HQ, California

- Conserve Energy, Water, and Other Natural Resources
- Promote Human Health, Safety, and Overall Quality of Life
- Create Higher Quality Enduring Structures
- Design for Healthier, More Affordable Buildings
- Protect Watersheds and Wildlife Habitat
- Complement Growth Management Efforts

Green Roofs

Courtesy, Mark Gaulin of MagCo

Site Design

Going Away
From This

And Moving
To This

Turning This…

Into This…

What is LEED™

Leadership in Energy and Environmental Design

- **Green Building Rating System**
- **Project of the U.S. Green Building Council – a non-profit organization of architects, construction companies, product manufacturers, engineers, consultants, local governments, and others.**

LEED Criteria & Rating System

Sustainable Sites	14 points
Water Efficiency	5 points
Energy & Atmosphere	17 points
Materials & Resources	13 points
Indoor Environmental Quality	15 points
Innovation & Design Process	5 points
TOTAL	69 points

LEED
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

LEED Certified	26-32 points
LEED Silver Rating	33-38 points
LEED Gold Rating	39-51 points
LEED Platinum	52 + points

Sustainable Sites

MD Dept. of the Environment

Prerequisite

Erosion & Sedimentation Control

Credits

Site Selection

Urban Redevelopment

Brownfield Redevelopment

Alternative Transportation

Reduced Site Disturbance

Storm Water Management

Reduction of Heat Islands

Light Pollution Reduction

Issue: Implementation in Taiwan?

- Theory vs. Practice
- Engineers vs. Ecologists or Environmentalists
- Motivation: Regulatory Framework; Water Quality and Ecological Concerns; Public Acceptance and Demand
- Background in/ Understanding of Ecological Principles for Practitioners (Planners, engineers, building community, etc.)
- Other Issues?