



Elements of an Effective Post- Construction Stormwater Program

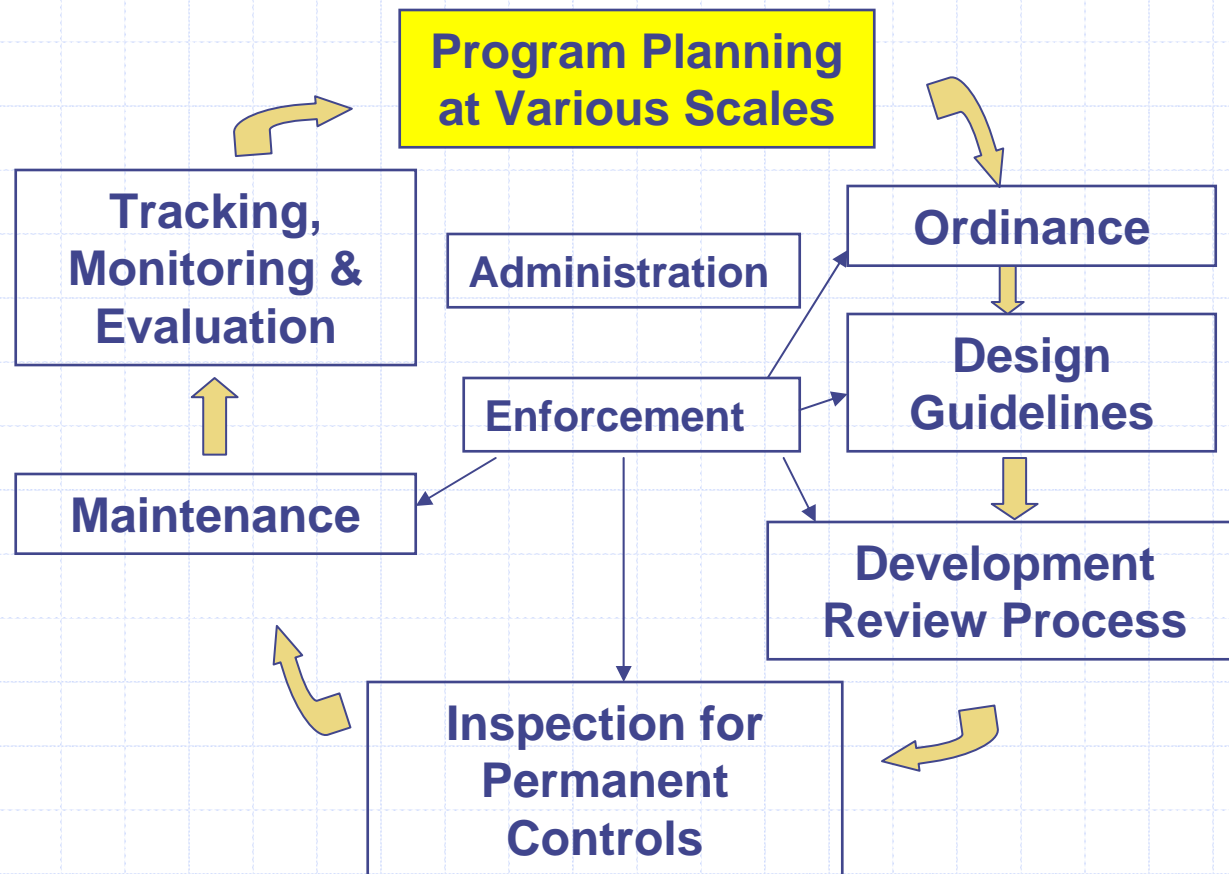
Jennifer Zielinski, P.E.
Center for Watershed Protection
8/15/06

Current State of the Program in USVI

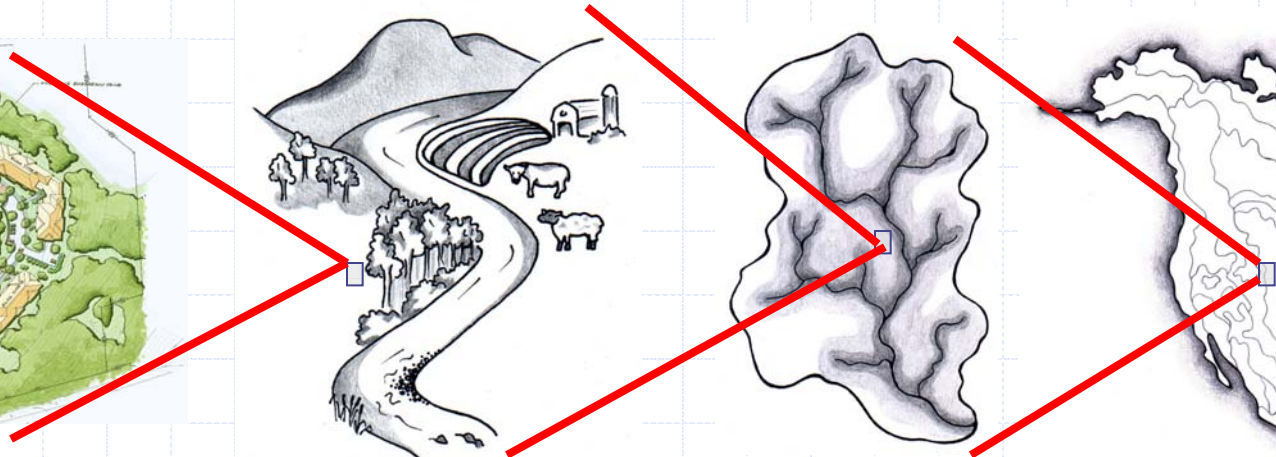
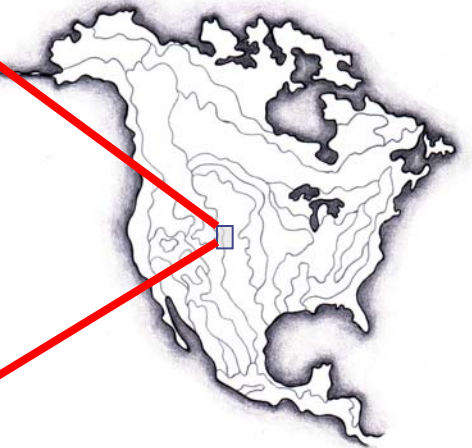
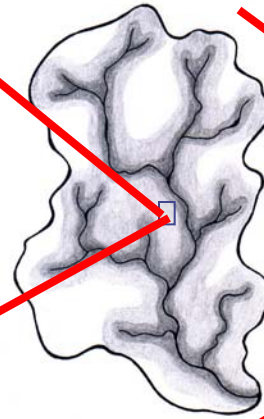
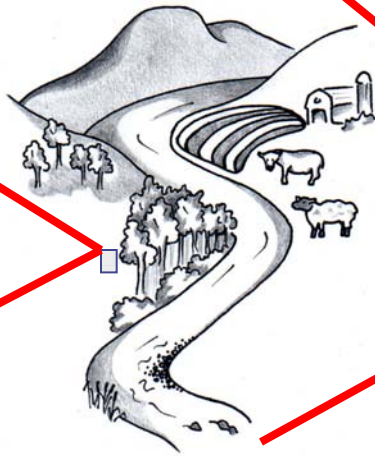
- Program plan
- Ordinance
- Design guidelines
- Development review process
- Inspection for permanent controls
- Maintenance
- Enforcement
- Tracking, monitoring & evaluation



Overview of EPA's Post-Construction Guidance



Program Planning at Various Scales



Some Possible USVI Stormwater Management Objectives...

- Treat rainfall as a resource (and runoff as a waste)
- Promote recharge rates to replenish groundwater resources
- Keep pollutants from entering groundwater
- Save topsoil
- Keep sediment and pollutants out of coral reefs
- Reduce / prevent gut erosion
- Prevent serious floods
- Reduce costs



Post-Construction Program Self-Audit

- Intended to assess your post-construction program's existing status and map out a future course and program direction
- Audit considers three subgroups:
 - Group A – Initiating the Program
 - Group B – Enhancing the Program
 - Group C – Advancing the Program

Program Self-Audit Example

Program at Various Scales – The Planning Context

GROUP A – Initiating The Program

Place a check for every component that the program currently has in place.

Maps show existing and future land use conditions overlaid with streams	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
Internal and external program drivers reviewed and incorporated	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
Measurable goals established in MS4 permit for post-construction based on regulatory requirements and local priorities	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
Comprehensive or General Plan amended to include post-construction stormwater program goals, objectives, and strategies	<input type="checkbox"/> Yes <input type="checkbox"/> No
Public involvement strategy employed to establish program and set goals, including public notification, brochures, web sites, etc.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know

GROUP B – Enhancing the Program

Place a check for every component that the program currently has in place.

Water resources databases and maps incorporated into GIS and include:	<input type="checkbox"/> impaired waters <input type="checkbox"/> high priority local resources
---	--

Program Self-Audit Example

Action Item Development

Review the list above. For items not checked in Group A, develop short-term action items based on that component and enter it into the Years 1--5 Action Item list. For items not checked in Groups B&C, evaluate their relevance to your program and create short or long-term action items for selected elements. For any item that is checked as "Don't Know," enter identifying the status of that program element as a Year 1 action item.

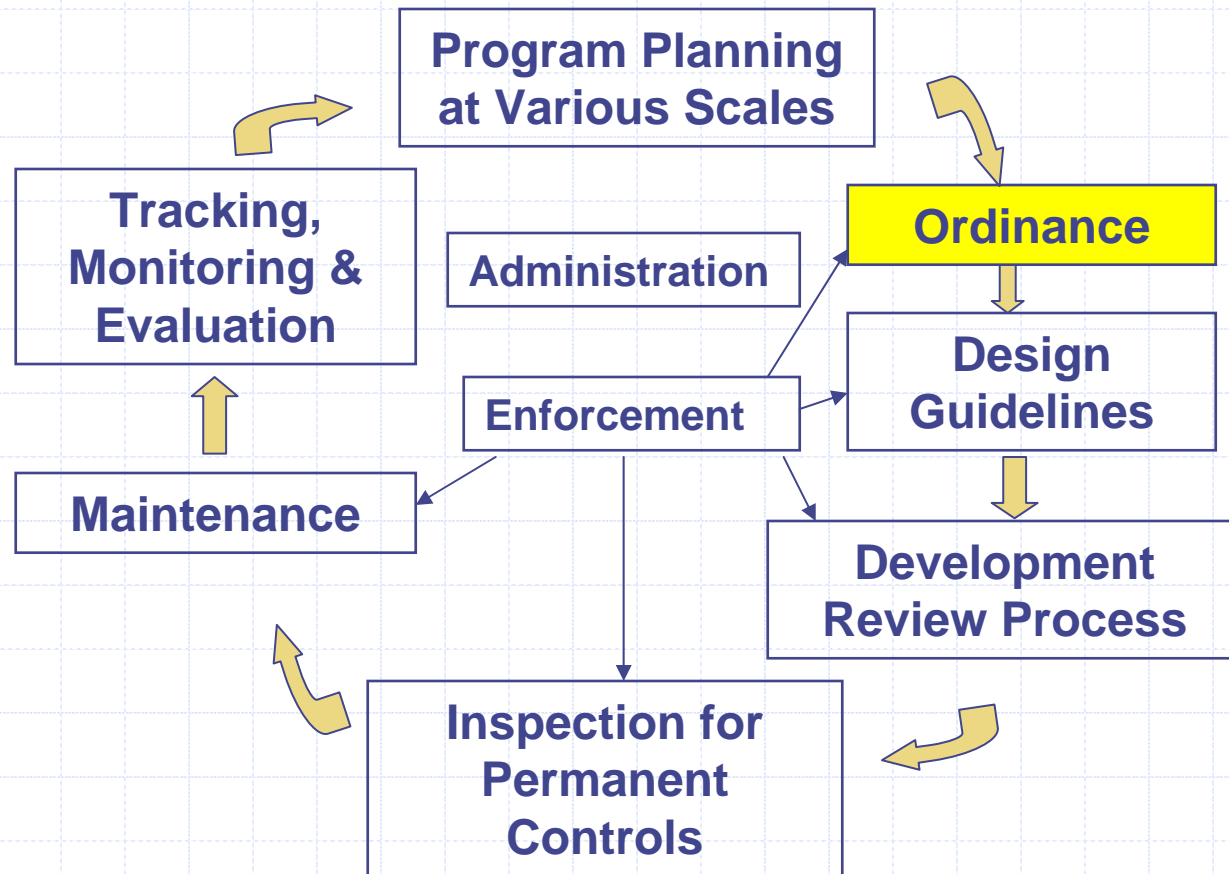
Years 1 -- 5 Program Planning Action Items:

1.	
2.	
3.	
4.	
5.	

Years 5 -- 10 Program Planning Action Items:

1.	
2.	
3.	
4.	
5.	

Overview of EPA's Post-Construction Guidance



Ordinance Decisions

- What existing authority do you have?
- Should you include credits for Better Site Design?
- Do you need to include special criteria to address specific watershed concerns?
- Do you have a stormwater design manual to refer to?

Elements of a post-construction ordinance

- General Provisions
- Definitions
- Permit Procedures and Requirements
- Post-Development Performance Criteria for Stormwater Management
- Construction Inspection for Permanent Stormwater Practices
- Ongoing Maintenance for Stormwater Practices
- Violations, Enforcement, and Penalties

Get the Public Involved in Ordinance Development and Adoption

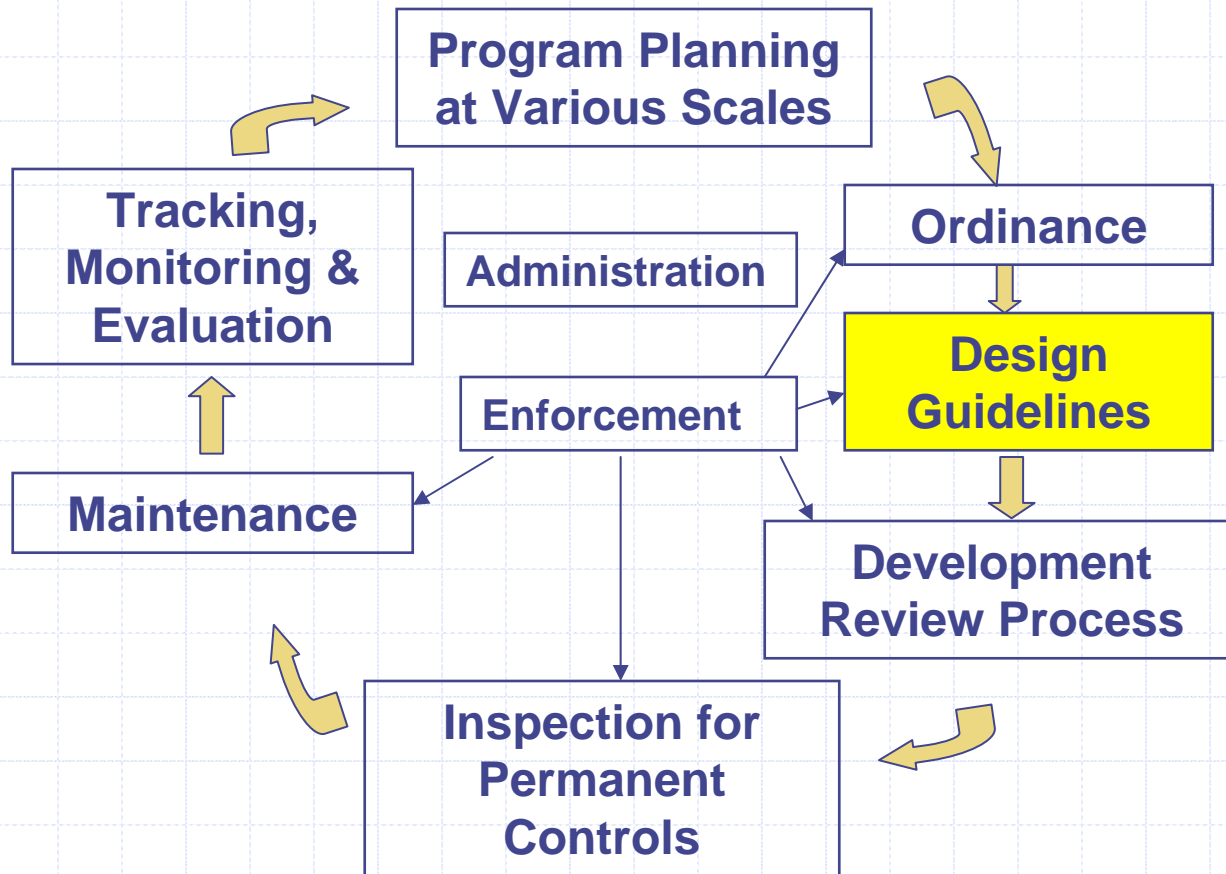
- Focus groups / stormwater committee
- Public outreach strategy



Example: WASH Template Ordinance

- Requires final inspection and certificate to installation per final design
- Inspection and maintenance agreement required
- Includes right of entry and enforcement provisions
- <http://bcn.boulder.co.us/basin/wash/>

Overview of EPA's Post-Construction Guidance



If you don't have a good plan...



Development of Stormwater Design Standards / Ordinance

- Used by both the development community and local government plan reviewers and engineers
- Sets minimally acceptable stormwater practices and sizing criteria
- Primary opportunity to include water quality benefits in projects

Maryland Stormwater Manual

- Includes Unified Stormwater Sizing Criteria
 - Water Quality Volume (WQv)
 - Recharge Volume (Rev)
 - Channel Protection Volume (Cpv)
 - Overbank Flood Protection (Qpx)
 - Extreme Flood Protection (Qf)
- Also includes stormwater credits for innovative site planning
- http://www.mde.state.md.us/Programs/WaterPrograms/SedimentandStormwater/stormwater_design/index.asp

Eastern/Western Washington Stormwater Manuals

- Stormwater Management Manuals for Eastern and Western Washington
- Requires continuous simulation modeling to size BMPs
- Western WA Manual in 5 volumes:
 - Minimum Tech. Requirements and Site Planning
 - Construction
 - Hydrologic Analysis and Flow Control Design/BMPs
 - Source Control BMPs
 - Runoff Treatment BMPs
- <http://www.ecy.wa.gov/programs/wq/stormwater/tech.html>

BMP selection table by pollutant

Pollutant of Concern	Treatment Control BMP Categories						
	Biofilters	Detention Basins	Infiltration Basins⁽²⁾	Wet Ponds or Wetlands	Drainage Inserts	Filtration	Hydrodynamic Separator Systems⁽³⁾
Sediment	M	H	H	H	L	H	M
Nutrients	L	M	M	M	L	M	L
Heavy Metals	M	M	M	H	L	H	L
Organic Compounds	U	U	U	U	L	M	L
Trash & Debris	L	H	U	U	M	H	M
Oxygen Demanding Substances	L	M	M	M	L	M	L
Bacteria	U	U	H	U	L	M	L
Oil & Grease	M	M	U	U	L	H	L
Pesticides	U	U	U	U	L	U	L

(1) Copermitees are encouraged to periodically assess the performance characteristics of many of these BMPs to update this table.

(2) Including trenches and porous pavement.

(3) Also known as hydrodynamic devices and baffle boxes.

L: Low removal efficiency

M: Medium removal efficiency

H: High removal efficiency

U: Unknown removal efficiency

Consider addressing specific activities on project plans

- Vehicle or equipment fueling areas
- Vehicle or equipment maintenance areas, including washing and repair
- Commercial or industrial waste handling or storage
- Outdoor handling or storage of hazardous materials
- Outdoor manufacturing areas
- Outdoor food handling or processing
- Outdoor animal care, confinement, or slaughter
- Outdoor horticulture activities

Include Source Control BMPs, not just Treatment Controls

- Control Peak Stormwater Runoff Discharge Rates
- Conserve Natural Areas
- Minimize Stormwater Pollutants of Concern
- Protect Slopes & Channels
- Provide Storm Drain System Stenciling & Signage
- Properly Design Outdoor Material Storage Areas
- Properly Design Trash Storage Areas
- Provide Proof of Ongoing BMP Maintenance
- Properly Design Loading/Unloading Dock Areas
- Properly Design Repair/Maintenance Bays
- Properly Design Vehicle/Equipment/Accessory Wash Areas
- Properly Design Fueling Area
- Properly Design Parking Area
- Properly Design to Limit Oil Contamination and Perform Maintenance

CITY OF LOS ANGELES – STORMWATER PROGRAM

Prescriptive Method

Standard Urban Stormwater Mitigation Plan

RESTAURANTS**OBJECTIVE**

The prescriptive method described in this bulletin meets the minimum requirements of the Standard Urban Stormwater Mitigation Plan (SUSMP) for a “stand alone” restaurant (SIC Code 5812 – Eating Places). As a prescriptive method, all requirements specified herein shall be incorporated into the approved development plan. Should an alternate method of compliance or an alternate product/manufacture be used, the applicant shall prepare a site-specific plan indicating the alternate and its details. Such plan must be submitted for review and approval.

REQUIREMENTS**Equipment/Accessory Wash Area**

- For indoor wash area, provisions shall be made to properly connect to a sanitary sewer. For sewer connection, obtain Industrial Waste Discharge permit from Department of Public Works - Bureau of Sanitation – Industrial Waste Management Division.
- For outdoor wash area, area shall be bermed (berm height shall be _ inch), equipped with a grease trap and rain diversion system, and connected to the sanitary sewer. A plumbing permit from Department of Building and Safety will be required for grease trap. IWD permit will be required from the Bureau of Sanitation – Industrial Waste Management Division for sewer connection. Refer to Appendix F of the *Development Planning Handbook* for the rain diversion system description.

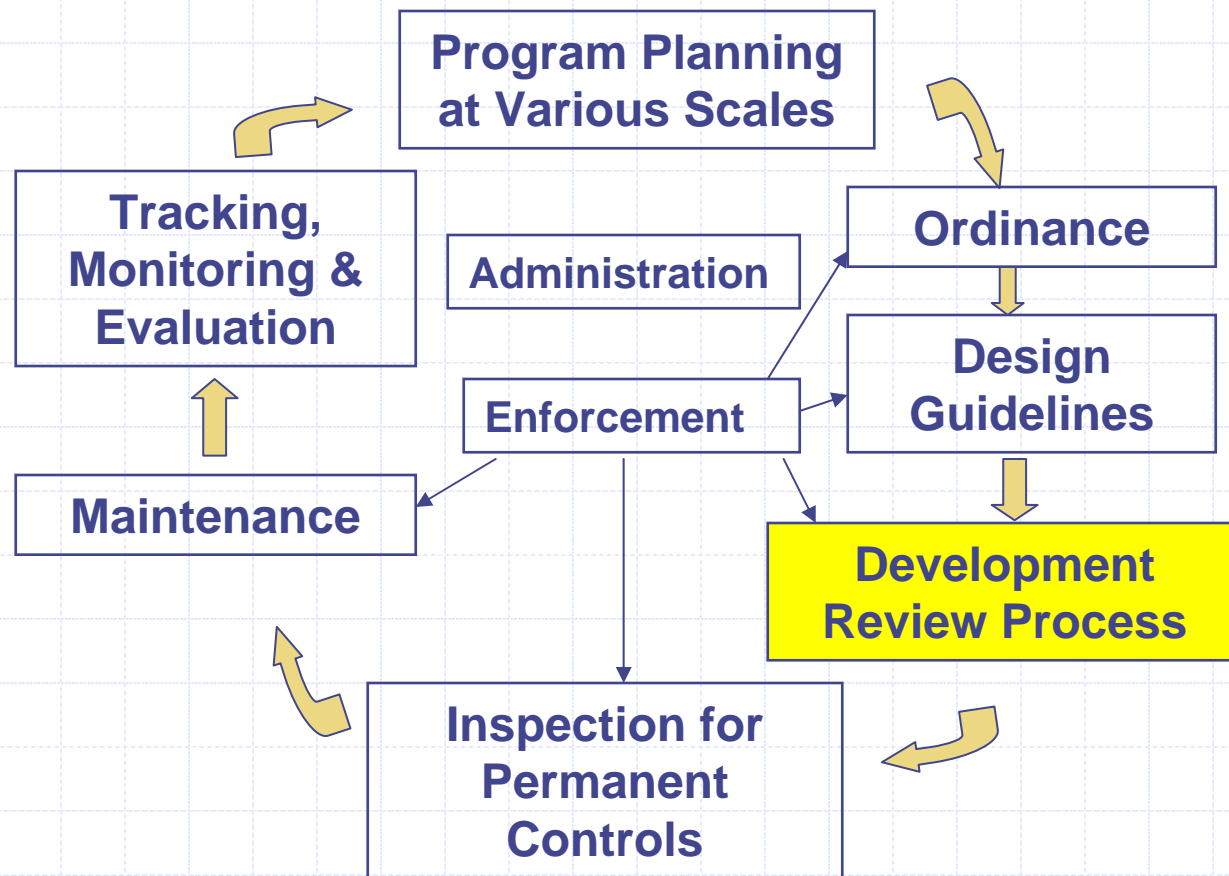
Outdoor Material Storage Area (If included)

- Must be placed in an enclosure or bermed (secondary containment). The berm height shall be _ inch.
- Must be paved to contain leaks and spills.

Trash Storage Area (If included)

- Must be screened or walled to prevent off-site transport of trash

Overview of EPA's Post-Construction Guidance



Process for Review and Approval of Stormwater Plans

- Review will be based on local stormwater design standards
- Process for plan review & approval should be documented
- Review both construction and post-construction plans
- Address requirements for long-term operation & maintenance during review

Tips for Improving the Plan Review Process

- Develop clear design guidance
- Use checklists
- Map the plan review/approval process
- Hold Pre-Application Meetings
- Create a review committee
- Require standard computation packages
- Public Notification
- Training
- Link with Inspectors

Example: Stafford County, VA Contracting plan review process

■ Pros

- No day to day plan review tasks
- Highly skilled plan reviewers (P.E.'s)
- Additional staffing to address high volume
- Responsiveness; Deadlines met often
- Interaction with applicants only

■ Cons

- Consultant staff not able to make policy decisions
- More expensive plan review fees
- Learning curve for design engineers

Example: City of San Diego Stormwater Requirements Applicability Checklist

<http://www.sandiego.gov/development-services/news /pdf/ds-5601stormwtr.pdf>

Part A: Determine Priority Project Permanent Storm Water BMP Requirements.

Does the project meet the definition of one or more of the priority project categories?*

- | | | | |
|-----|---|-----|----|
| 1. | Detached residential development of 10 or more units | Yes | No |
| 2. | Attached residential development of 10 or more units | Yes | No |
| 3. | Commercial development greater than 100,000 square feet | Yes | No |
| 4. | Automotive repair shop | Yes | No |
| 5. | Restaurant | Yes | No |
| 6. | Steep hillside development greater than 5,000 square feet | Yes | No |
| 7. | Project discharging to receiving waters within Water Quality Sensitive Areas | Yes | No |
| 8. | Parking lots greater than or equal to 5,000 square feet or with at least 15 parking spaces, and potentially exposed to urban runoff | Yes | No |
| 9. | Streets, roads, highways, and freeways which would create a new paved surface that is 5,000 square feet or greater | Yes | No |
| 10. | Significant redevelopment over 5,000 square feet | Yes | No |

* Refer to the definitions section in the Storm Water Standards for expanded definitions of the priority project categories.

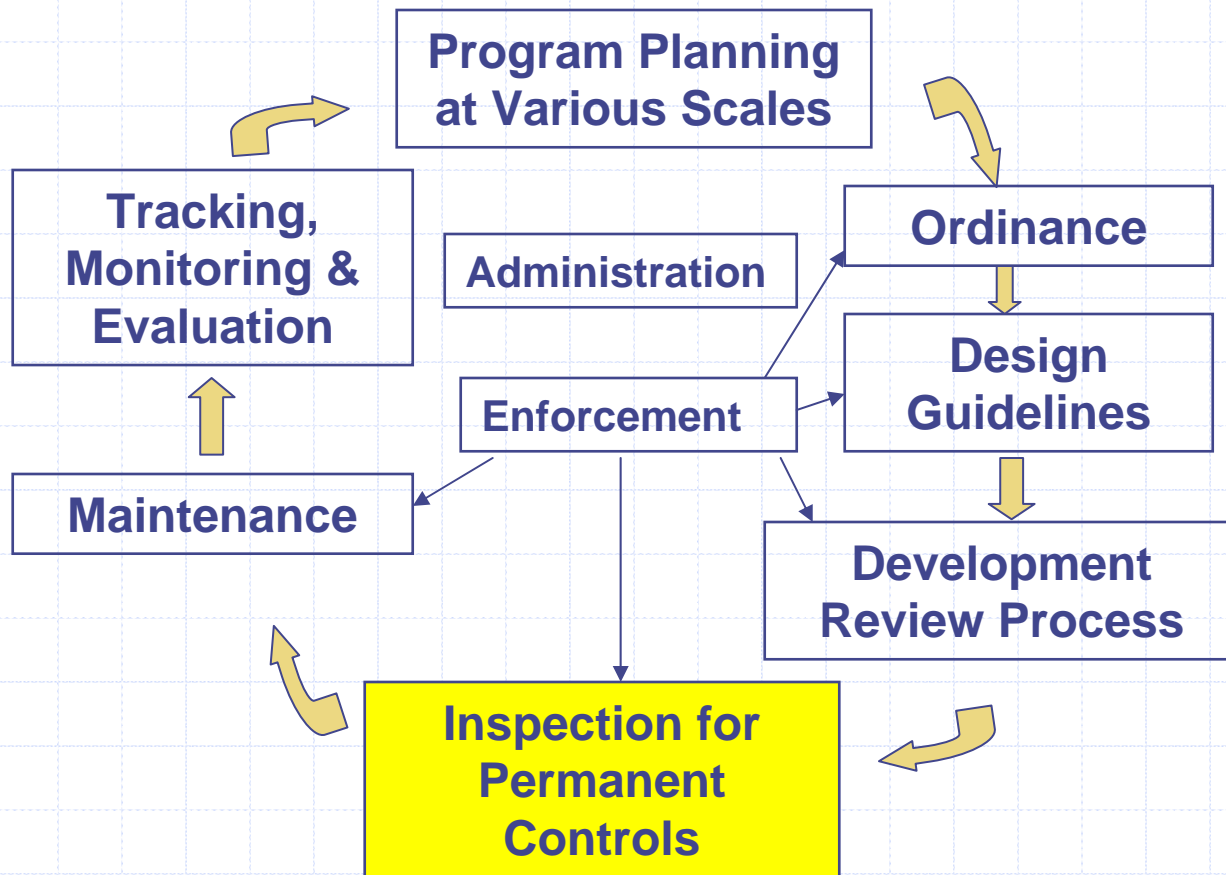
Limited Exclusion: *Trenching and resurfacing work associated with utility projects are not considered priority projects. Parking lots, buildings and other structures associated with utility projects are priority projects if one or more of the criteria in Part A is met. If all answers to Part A are "No", continue to Part B.*

Part B: Determine Standard Permanent Storm Water Requirements.

Does the project propose:

- | | | | |
|----|--|-----|----|
| 1. | New impervious areas, such as rooftops, roads, parking lots, driveways, paths and sidewalks? | Yes | No |
| 2. | New pervious landscape areas and irrigation systems? | Yes | No |
| 3. | Permanent structures within 100 feet of any natural water body? | Yes | No |
| 4. | Trash storage areas? | Yes | No |

Overview of EPA's Post-Construction Guidance





Construction inspection checklists

Some common design elements requiring inspection during construction include:

- Storage volume
- Emergency spillway (location, design, dimensions, lining, etc.)
- Pipes (material, joints, alignment, compaction, etc.)
- Embankments (slope, compaction, seepage control, etc.)
- Elevations



City of Los Angeles

**STORMWATER OBSERVATION REPORT
FORM**

**- STANDARD URBAN STORMWATER MITIGATION PLAN (SUSMP) -
- SITE SPECIFIC MITIGATION PLAN -**

STORMWATER OBSERVATION means the visual observation of the stormwater related Best Management Practices (BMPs) for conformance with the approved SUSMP/Site Specific Mitigation Plan at significant construction stages and at completion of the project. Stormwater observation does not include or waive the responsibility for the inspections required by Section 108 or other sections of the City of Los Angeles Building Code.

STORMWATER OBSERVATION must be performed by the engineer or architect responsible for the approved SUSMP/Site Specific Mitigation Plan or designated staff in their employment.

STORMWATER OBSERVATION REPORT must be signed and stamped (see below) by the engineer or architect responsible for the approved SUSMP and submitted to the city prior to the issuance to the certificate of occupancy.

Project Address:	Building Permit No.:
Name of Engineer or Architect responsible for the approved SUSMP/Site Specific Mitigation Plan:	Phone Number:
Name of SUSMP/Site Specific Mitigation Plan Observer:	Phone Number:

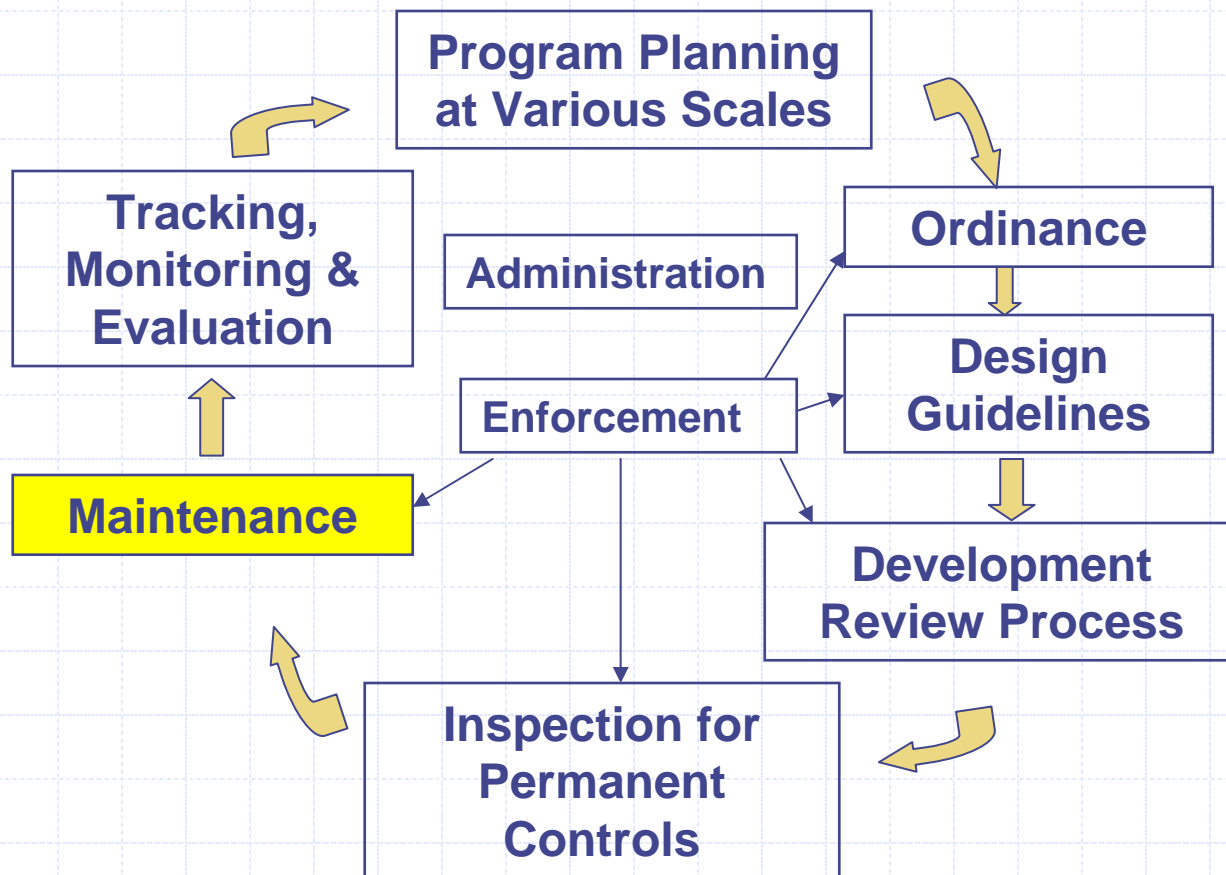
I DECLARE THAT THE FOLLOWING STATEMENTS ARE TRUE TO THE BEST OF MY KNOWLEDGE:

1. I AM THE ENGINEER OR ARCHITECT RESPONSIBLE FOR THE APPROVED SUSMP/SITE SPECIFIC MITIGATION PLAN, AND
2. I, OR DESIGNATED STAFF UNDER MY RESPONSIBLE CHARGE, HAS PERFORMED THE REQUIRED SITE VISITS AT EACH SIGNIFICANT CONSTRUCTION STAGE AND AT COMPLETION TO VERIFY THAT THE BEST MANAGEMENT PRACTICES AS SHOWN ON THE APPROVED PLAN HAVE BEEN CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH THE APPROVED SUSMP/SITE SPECIFIC MITIGATION PLAN.

Stamp of Engineer or Architect responsible
for the approved SUSMP

Stormwater
Observation
Report Form (for
As-Built
Certification)
City of Los
Angeles

Overview of EPA's Post-Construction Guidance



BMP Maintenance Challenges

- Locating stormwater facilities
- Identifying responsible parties
- Lack of maintenance and inspection staff
- BMP designs do not allow for easy maintenance
- Lack of enforcement authority and access
- Owners are unaware of maintenance responsibility
- Proliferation of BMPs that require intensive maintenance





Key Steps to an Effective Maintenance Program

1. Scope out the issue
 - How many, where, public vs. private, etc.
2. Policy Development
 - Who's responsible, partners?
3. Funding
 - Staff, equipment, extent and level of service
4. Ordinances and Design Guidance

Key Steps to an Effective Maintenance Program

5. Easements

- Access easements, dedicated to public?

6. Maintenance Agreements and Bonds

- Maintenance Plan, Bond

7. Inspection, enforcement, corrective actions

- Inspection frequency, standards, how / when to pursue corrective actions

Maintenance Agreements

Each agreement should contain:

- Performance of Routine Maintenance
- Maintenance Schedules
- Inspection Requirements
- Access to BMPs
- Failure to Maintain
- Recording of the Maintenance Agreement

Post Construction Long Term Maintenance Plan for *Forrest Mountain Commons*

System Description

The site consists of a series of stormwater conveyances both open channel and piped, detention / retention and water quality ponds.

- There is one stormwater detention pond sized to detain through the 100 year peak event. The orifice is designed to contain the first flush, 1 inch, for 72 hour.
- 150 ft of grassy swales.
- 200 ft of 6 inch pipe
- 4 storm drains
- 105 feet of water quality buffer 50 ft wide in next to Slop Creek. It will remain undisturbed. No trees will be disturbed in this area except under extenuating circumstances: diseased or dying trees in accordance with applicable city of Franklin regulations. See Franklin Streamside Water Quality Buffer Policy for further information.
- Upon completion of the site construction, 'as-built' drawings in electronic format of the stormwater controls will be provided to the city of Franklin for verification.
- A copy of the **INSPECTION AND MAINTENANCE AGREEMENT OF PRIVATE STORMWATER MANAGEMENT FACILITIES** that has been completed, notarized and recorded in the Land Records of the County of Williamson, Tennessee will be kept on site with this document.

Maintenance:

STORMWATER PONDS

- The outlet structure filter shall be checked regularly for clogging and shall be cleaned and repaired as necessary---monthly after it is first built then a regular sequence should be established or at least quarterly or after a large rain event.
- Check banks and bottom surface of basin for erosion and correct as necessary.
- Check at least quarterly and after each extreme storm event, the facility should be cleaned of accumulated debris. The banks of surface ponds should be checked and areas of erosion repaired. Remove nuisance wetland species and take appropriate measures to control mosquitoes.
- This maintenance typically includes sediment, floatable, and debris removal from inlets, outlets and skimmers
- Pond vegetation needs to be trimmed or harvested as appropriate, grassy areas frequently mowed. Grass should be mowed so that it does not get over 6 inches.
- Remove sediment when accumulation reached 6 inches, or if re-suspension is observed or probable.
- Some sediment may contain contaminants or which the Tennessee Department of Environment and Conservation (TDEC) requires special disposal procedure. If there is any uncertainty about what the sediment contains or it is known to contain contaminants, then TDEC should be consulted and their disposal recommendations followed. The TDEC Division of Water Pollution Control should be contacted at (615) 532-0625. Generally, special attention or sampling should be given to sediment accumulated in facilities serving industrial, manufacturing or heavy commercial sites, fueling cents or

Key Steps to an Effective Maintenance Program

8. Tracking & Documentation

- Reporting, inspections, maintenance, NOVs

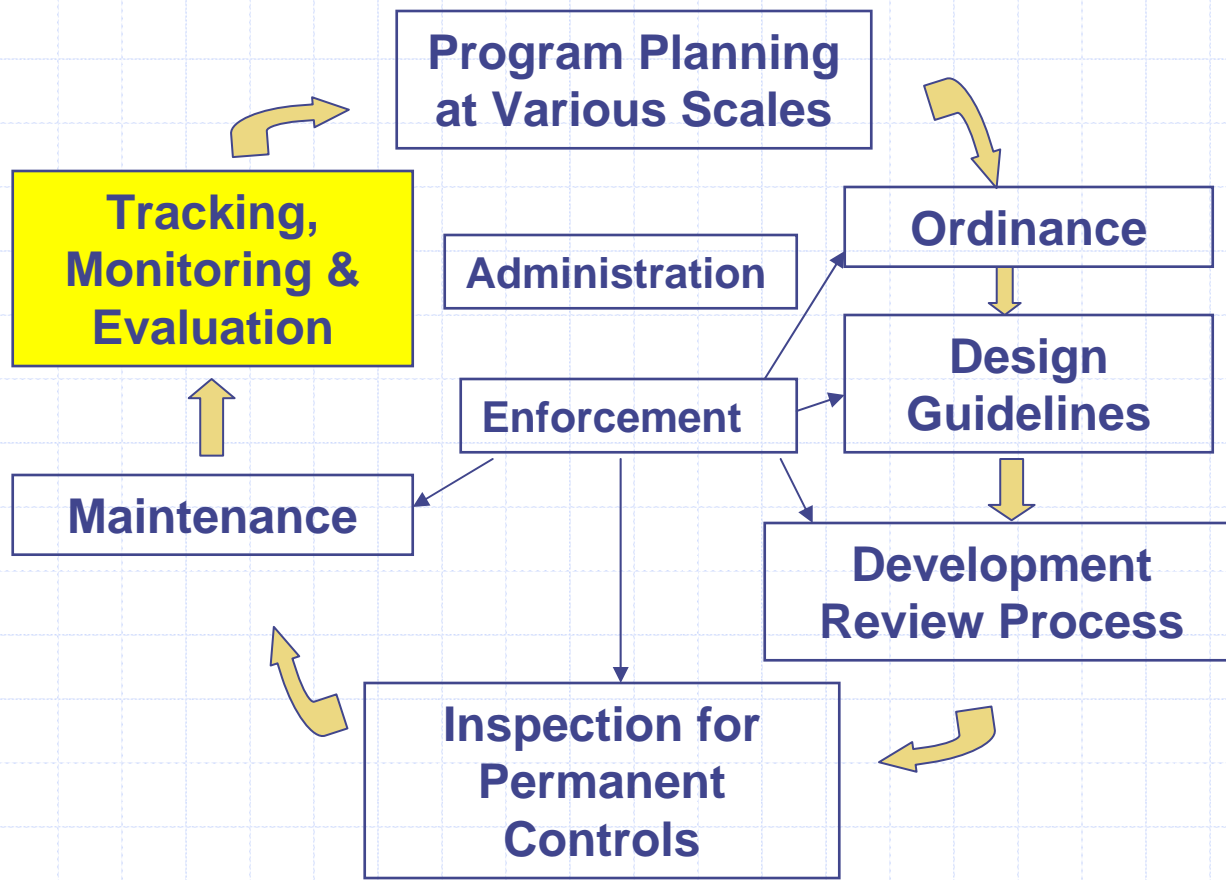
9. Education and Outreach to Target Audiences

- Publications, mailings, volunteer clean-ups, etc.

10. Feedback Loop

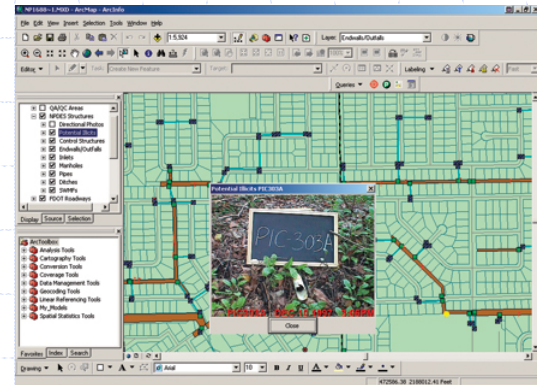
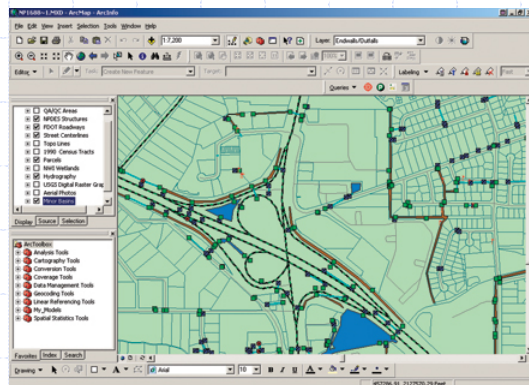
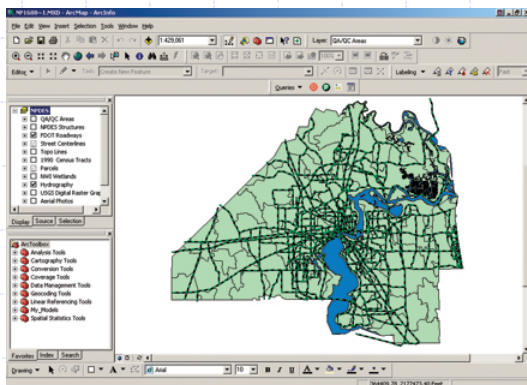
- Design modifications, Access, Complaints, Inspections, Enforcement

Overview of EPA's Post-Construction Guidance



Developing a Tracking System

- Provide an inventory of existing practices
- Track maintenance and inspection
- Streamline the inspection & maintenance process
- Provide documentation for legal action
- Relate design traits to practice performance
- Use as a tool to develop program cost estimates
- Identify future retrofit opportunities



BMP database to track sites

Microsoft Access - [DATA 1124]

File Edit View Insert Format Records Tools Window Help

SITE # YEAR BMP Location

Name GP PERMIT #

DESC Parcel

PROPADDR

PROPCITY PROPZIP

OWNER *updated

MAILADDR

MAILCITY MAILZIP

INSPECTION INFORMATION

Initial Inspection Occupancy Issues Y/N/M Rating

Issue

DET AGRM? PLANS? OWNER? Will not have impact Maint w/o plans

LETTER?

Ltr Sent

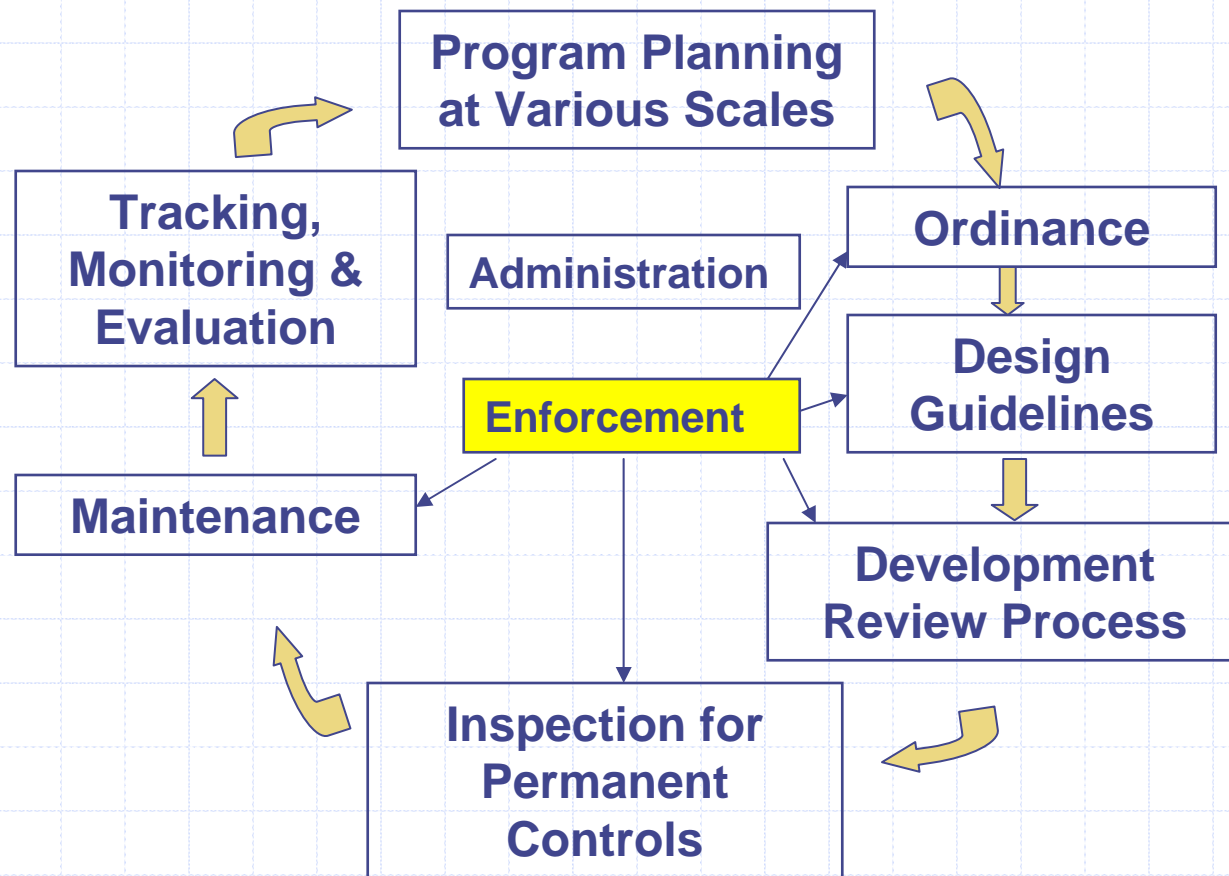
Ltr Rec

Resp Rec

Notes

Inspection needed

Overview of EPA's Post-Construction Guidance



Enforcement

- Penalties include non-monetary penalties, fines, bonding requirements, permit denial, or denial of occupancy permit.
- Develop an escalating enforcement plan to document steps that will be taken to address non-compliance
- Educate staff on how to use penalty provisions when necessary

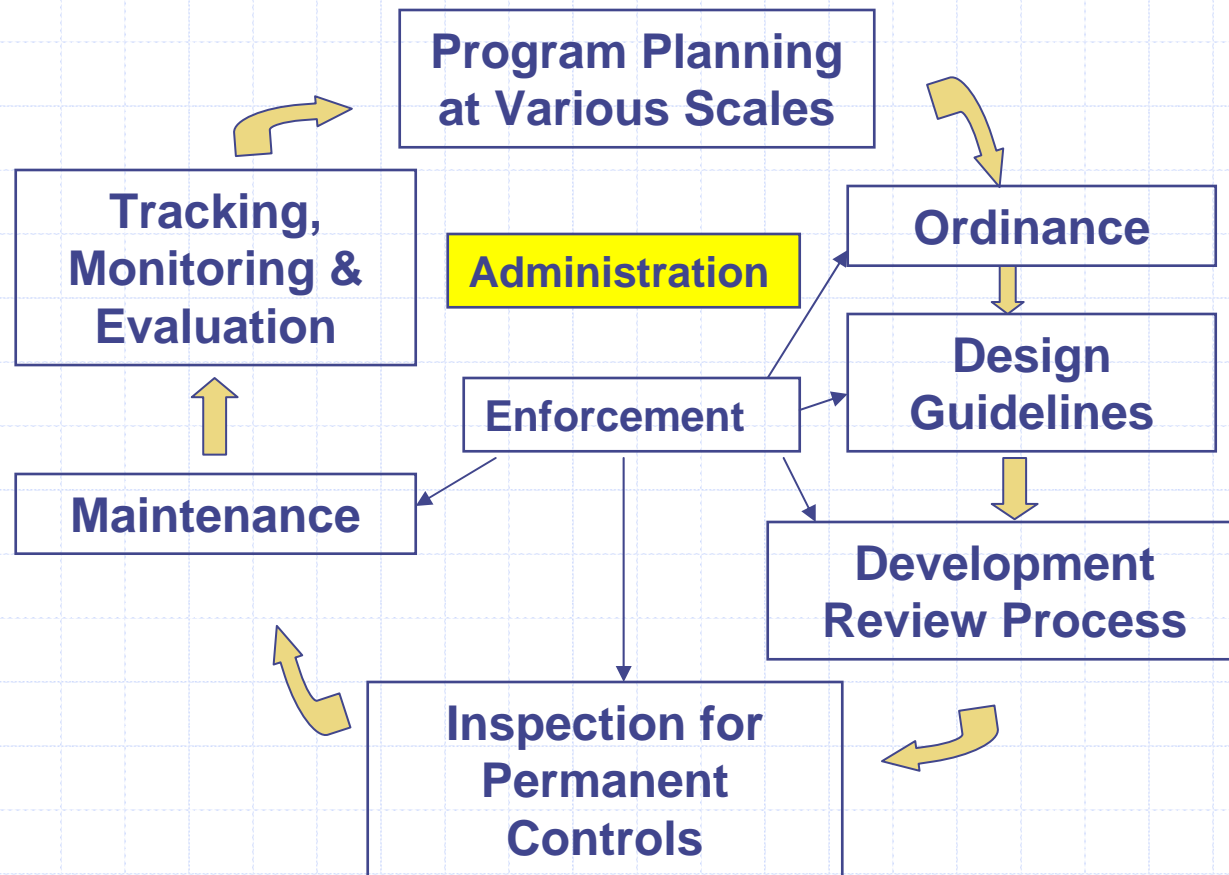
Enforcement Response Plan

- Develop a progressive enforcement plan so staff are consistent in how they enforce the ordinance

Example:

- Level 1 – education and cooperation
- Level 2 – official warning notice
- Level 3 – penalty phase

Overview of EPA's Post-Construction Guidance



Training and Education

- MS4 must train it's own staff on the post-construction program
 - Plan review staff
 - Construction inspectors
 - BMP maintenance inspectors
 - Code enforcement, others?

Educate Developers

CLEAN WATER PROGRAM

r C.3 Regulations Fact Sheet

New Rules for Development Projects

New regulations require many Bay Area development projects to treat stormwater runoff before it may be discharged to creeks or municipal storm drains.

Projects may also be required to detain or infiltrate runoff so that peak flows and durations match pre-project conditions.

Project plans must incorporate measures to prevent pollutants from entering runoff. For example, most outdoor equipment and work areas must be bermed and roofed.

In February 2003, the California Regional Water Quality Control Boards for the San Francisco Bay Region and the Central Valley Region revised Provision "C.3" in the NPDES permit governing discharges from the municipal storm drain systems of Contra Costa

County, its cities and towns. The new permit provision is being phased in from 2004 through 2006.

The new "C.3" requirements are separate from—and in addition to—requirements for erosion and sediment control and for pollution prevention measures during construction.

Project site designs must minimize the area of new roofs and paving. Where feasible, pervious surfaces should be used instead of paving so that runoff can percolate to the underlying soil. Runoff from impervious areas must be captured and treated. The permit specifies ways to calculate the required size of treatment devices.

In addition, project applicants must prepare plans and execute agreements to insure that the stormwater treatment devices are maintained

in perpetuity.

Through the Contra Costa Clean Water Program, local governments have created a *Stormwater C.3 Guidebook* to help developers comply with the new requirements.

Applicants for development review of projects that are subject to the requirements (see p. 4) should obtain and review the *Stormwater C.3 Guidebook*.

This fact sheet provides a quick summary to help you get started on planning "C.3" compliance for your site.



Step by Step: Your Path Through Project Review

Educate property owners



Commercial Stormwater Facility Maintenance

A GUIDE TO OIL/GRIT SEPARATORS,
UNDERGROUND STORAGE STRUCTURES,
AND OTHER FACILITIES

- Home ●
- Library ●
- Slideshows ●
- Manual ●
- Ordinance ●
- Monitor/Assess ●
- Program Resources ●
- Fact Sheets ●

- By Category ●
- Glossary ●

INTRODUCTION

EPA NPDES Phase II Site | EPA Office of Wastewater Management | NPDES Factsheet

Welcome to the Stormwater Manager's Resource Center!

March 14, 2006 - Both SMRC and www.cwp.org are being updated! [Please take our brief survey and help make the sites work for you!](#)

The Stormwater Manager's Resource Center is designed for officials and others that need technical assistance on stormwater management. [Center for Watershed Protection](#), the SMRC has everything you need.

- Watershed Protection Library
- Stormwater Slideshows
- Manual Builder
- Ordinance Selector
- Monitoring & Assessment
- Program Resources
- Assorted Fact Sheets
- By Category
- Glossary

Need to get more research or information on almost any topic in stormwater or urban watershed management? Click here to go to our 600-reference library to get the answers you need right away. Or, you can search more than 150 great articles on just about every aspect of watershed protection.

www.stormwatercenter.net

U.S. Environmental Protection Agency

National Pollutant Discharge Elimination System (NPDES)

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[EPA Home](#) > [OW Home](#) > [OWM Home](#) > NPDES Home

NPDES Topics | Alphabetical Index | Glossary | About NPDES

NPDES Current Issues

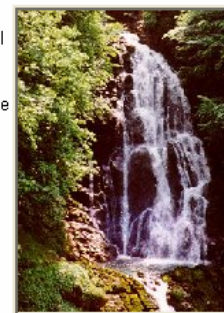
- [Proposed Revisions to CAFO NPDES Rule](#)
- [NPDES Water Transfers Proposed Rule](#)
- [Stormwater Webcast Series](#)
- [Stormwater Trainings - Getting in Step with Phase II](#)
- [Stormwater Qualifying Local Programs](#)
- [Final Oil and Gas Rule](#)
- [New and Revised Menu of BMPs](#)
- [Stormwater Education Materials](#)

OVERVIEW

Water pollution degrades surface waters making them unsafe for drinking, fishing, swimming, and other activities. As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the States. Point sources are discrete conveyances such as pipes or man-made structures. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their effluent discharges go directly to surface waters. In most cases, the NPDES permit program is administered by [authorized states](#). Since its introduction in 1972, the NPDES permit program is responsible for significant improvements to our Nation's water quality.

WHAT CAN I FIND ON THIS WEB SITE?

The site contains technical and regulatory information about the NPDES permit program. The NPDES Permits Program consists of a number of programs and initiatives. Links to each of these programs and initiatives are



- NPDES Information**
- [Recent Additions](#)
 - [FAQs](#)
 - [Publications](#)
 - [Regulations](#)
 - [Training & Meetings](#)
 - [Links](#)
 - [Contacts](#)



www.epa.gov/npdes

NPDES Information

- NPDES Permit Program Basics
- Operations
- Combined Sewer Overflows
- Pretreatment
- Sanitary Sewer Overflows
- Stormwater