Stormwater NPDES Compliance for New Developments Using Low Impact Development

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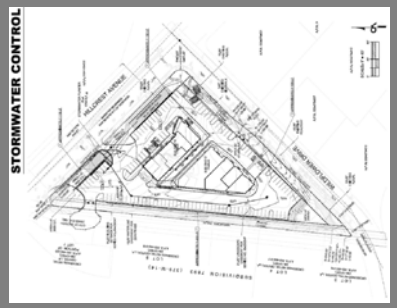
Outline

- **NPDES permit provisions matter**
- **How regulations evolved**
- **Integration of requirements in Contra Costa and Marin**
- **What's needed now to promote LID**

One day at municipal offices…

Conflicts with other mandates and design objectives

Vague requirements
= project delays
= $$$



Don’t want to seem like an advocate

Threat of noncompliance

Permit is Part of the Problem

- **Stormwater Treatment Requirements**
- **Stormwater Flow-Control Requirements (Hydrograph Modification Management)**
- **Low Impact Development Requirements**
- **Overlapping objectives with little coordination**

To solve the problem, we need

- **Clear standards for what is to be achieved**
- **Reasonable, implementable options for achieving the standards**
- **<u>One</u> site design and runoff management approach to meet treatment, flow control, and LID standards**

A Brief History of LID in CA

2003
- **Integrating Requirements**
- **Hydrograph Modification Mgt.**

2000
- **SWRCB *Bellflower* Decision**
- **Portland Stormwater Manual**

1999
- ***Low Impact Development* Manual**
- **Imperviousness and flow-control**

1994
- ***Start at the Source***
- **Stormwater NPDES Permits**

1978
- **Village Homes, Davis**

Village Homes

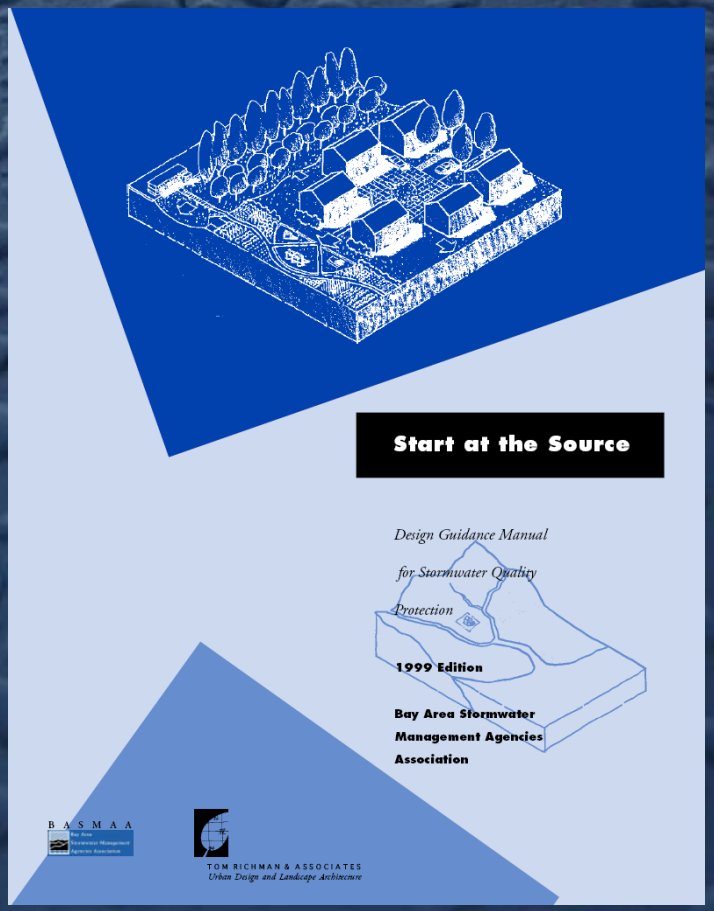
- **Narrow streets**
- **Surface drainage**
- **Swales as an amenity**

Stormwater NPDES—Early Years

- **Characterization of urban runoff**
- **Focused on demonstrating reductions of pollutant loads**
- **End-of-pipe treatment vs. BMPs**
- **Design criteria for conventional treatment facilities**
- **“Do what you can, where you can.”**

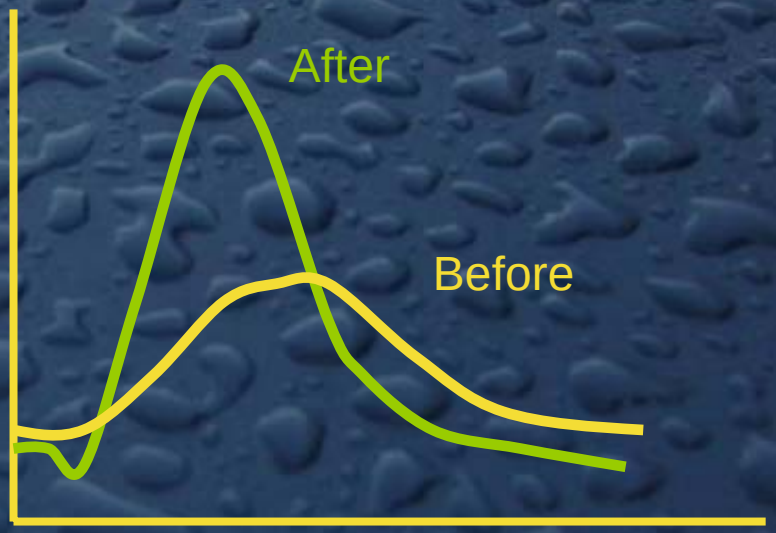
Start at the Source

- **Preceded by San Francisco Bay RWQCB "Staff Recommendations" (1993)**
- **Emphasis on reducing imperviousness to reduce pollutant loading**
- **Addressed need to identify site-design alternatives**
- **Integrates urban design and site design**
- **No regulatory mandate**



Imperviousness

- *Importance of Imperviousness* (1994)
  - Empirical relationship between watershed imperviousness and stream degradation
- Awareness of the effects of small storms and increased runoff frequency
- Peak flow control over a range of storm sizes
- Continuous simulation



Low Impact Development

- Developed as an alternative to treatment detention basins
- Addressed preserving site hydrology and natural functions
- Site design and bioretention (“rain gardens”)
- Included hydrologic criteria based on matching curve numbers

Portland Stormwater Manual

Simplified Approach for Stormwater Management Facilities

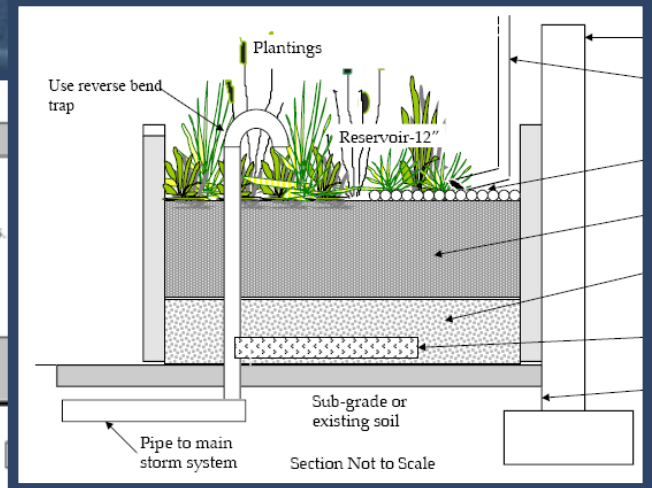
The city has produced this form to assist with a quick and simple approach to manage stormwater quality and flow control on projects.
Application of these facilities using the specified sizing factor is required for use of this form.
These facilities, when designed according to the required criteria, are considered to cover both quality and flow.
Alternative design and sizing will not be considered under this simple approach.

INSTRUCTIONS

1. Enter square footage of non-mitigated impervious area (total impervious site area or, from the Mitigation Form, Box C) in Box 1 at the bottom of column 1.
2. Select the desired management measure(s). In Column 1, enter the amount of impervious area that will be managed by the facility(ies).
3. Add all facility impervious areas in column 1 and enter in Box 2. Note Box 1 and Box 2 areas must be equal.
4. Multiply the unmitigated sf in column 1 by the sizing factor in column 2 for each facility.
5. Use the required facility surface area sf in column 3 to design the facility(s).
6. Go to the " Simplified Approach Design Requirements" for facility descriptions and other requirements.

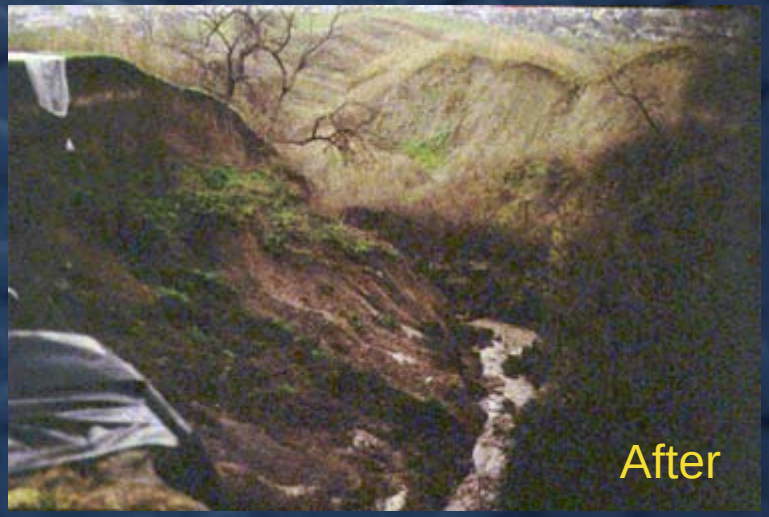
Facility	Column 1 Non-mitigated Impervious Area	Unit		Column 2 Sizing Factor			
Landscape Swale		sf	x	0.05	=		
Vegetative Filter		sf	x	0.065	=		sf
Stormwater Planter		sf	x	0.045	=		sf
Landscape Infiltration		sf	x	0.04	=		sf
Sand Filter		sf	x	0.045	=		sf
*East Side Soakage Trench		sf	x	0.05	=		sf
*West Side Soakage Trench		sf	x	0.075	=		sf
Total Areas		Box 2					
Total non-mitigated impervious area Total impervious area on the site, or the amount of non-mitigated impervious area in Box C, Form MIT		Box 1					

* Soakage Trenches are sized for stormwater disposal and water quality, and therefore cannot be reduced in size with mitigation.
Revised September 1, 2000



Bellflower Decision and HMPs

- ***Bellflower* made the L.A. RWQCB's treatment criteria a statewide "maximum extent practicable" standard**
- **San Francisco Bay Board added "Hydrograph Modification Management"**



The Growing Mandate for LID

- **San Diego's Phase I NPDES permit**
  - **Drain impervious surfaces to landscaped areas**
  - **Use pervious paving**
  - **Conserve natural areas and minimize imperviousness**
- **Draft Statewide NPDES Permit for Construction Activities**
  - **Requires post-construction runoff volume "approximate" pre-construction volume**
  - **System of "credits" for LID practices**
- **Phase II Permit to be Reissued**
- **Bay Area Municipal Regional Permit**
  - **Prefer LID facilities for stormwater treatment**

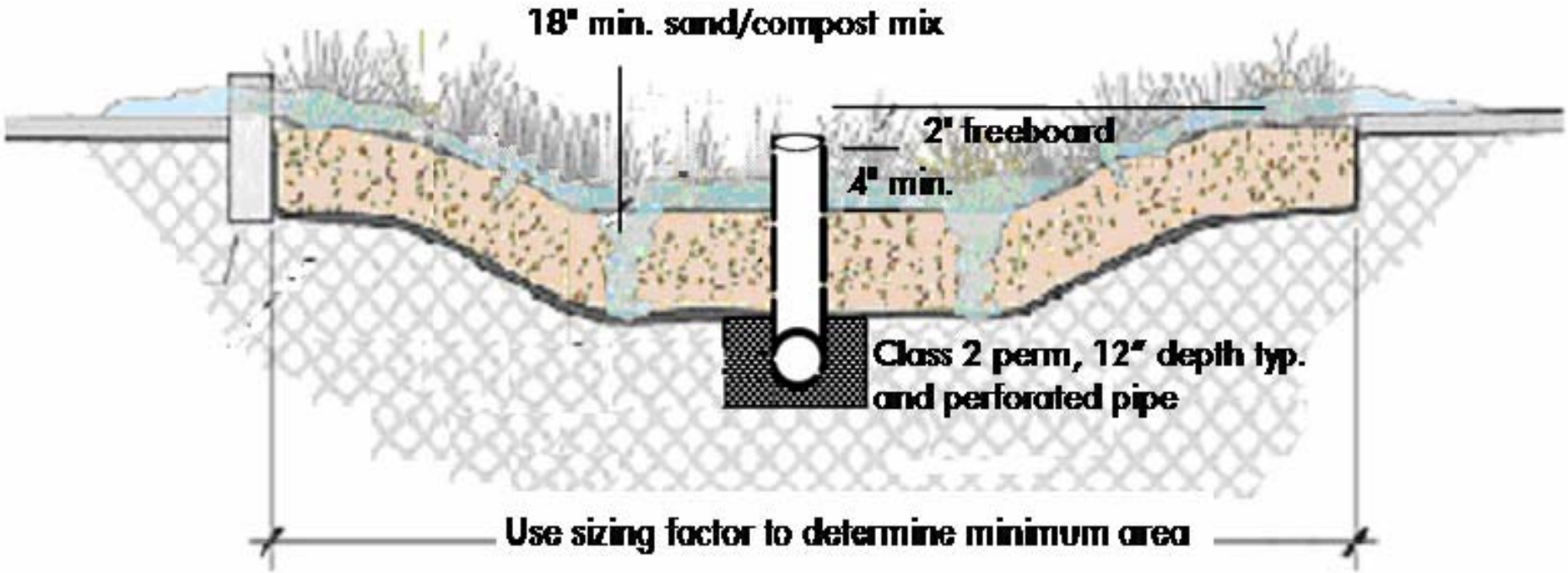
Local Regulatory Compliance

- **Ordinances reference *Guidebook***
  - **Countywide consistency**
  - **Empowers municipal reviewers**
  - **Ability to update requirements**
- **Options and flexibility**
- **Design criteria and specifications**

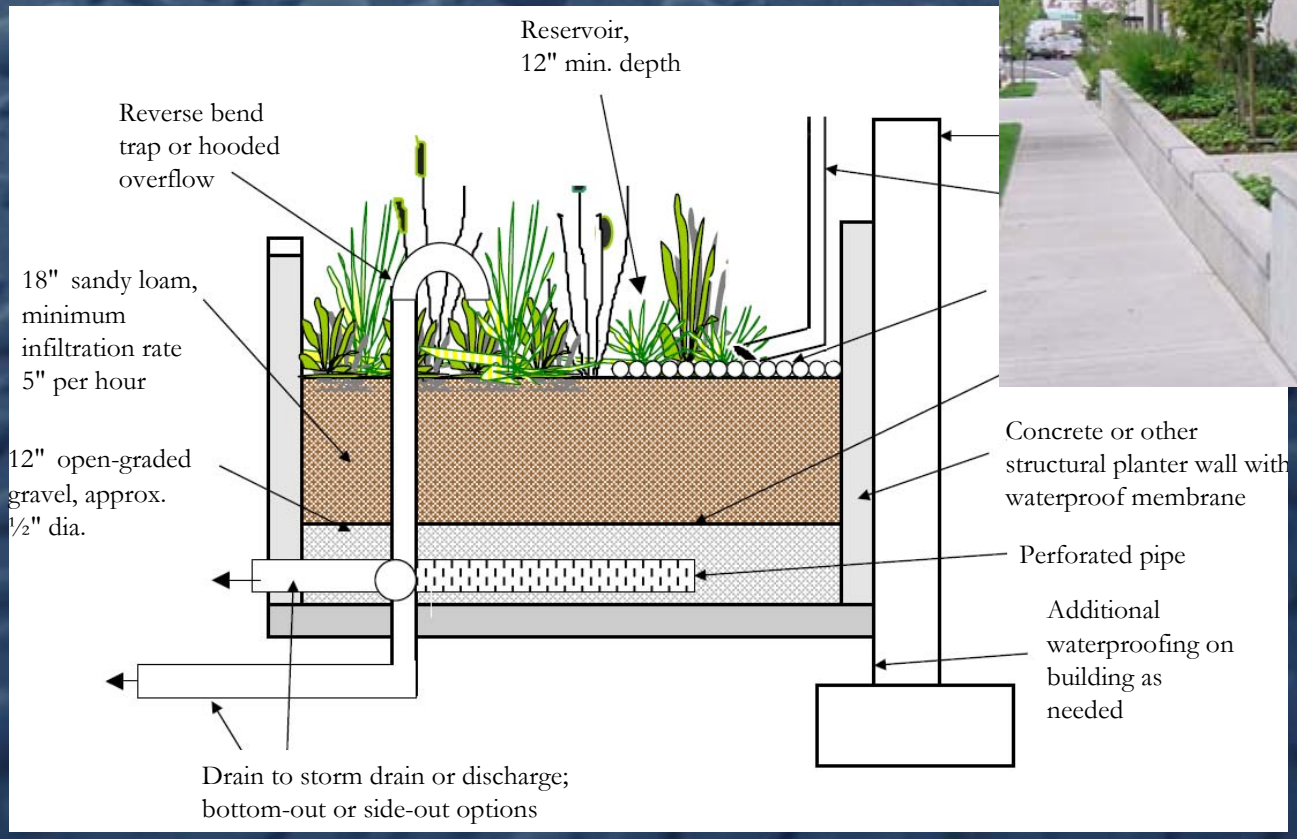
Low Impact Development

- **Stormwater treatment *and* flow control**
- **Minimize imperviousness**
- **Disperse runoff**
- **Use Integrated Management Practices (IMPs)**

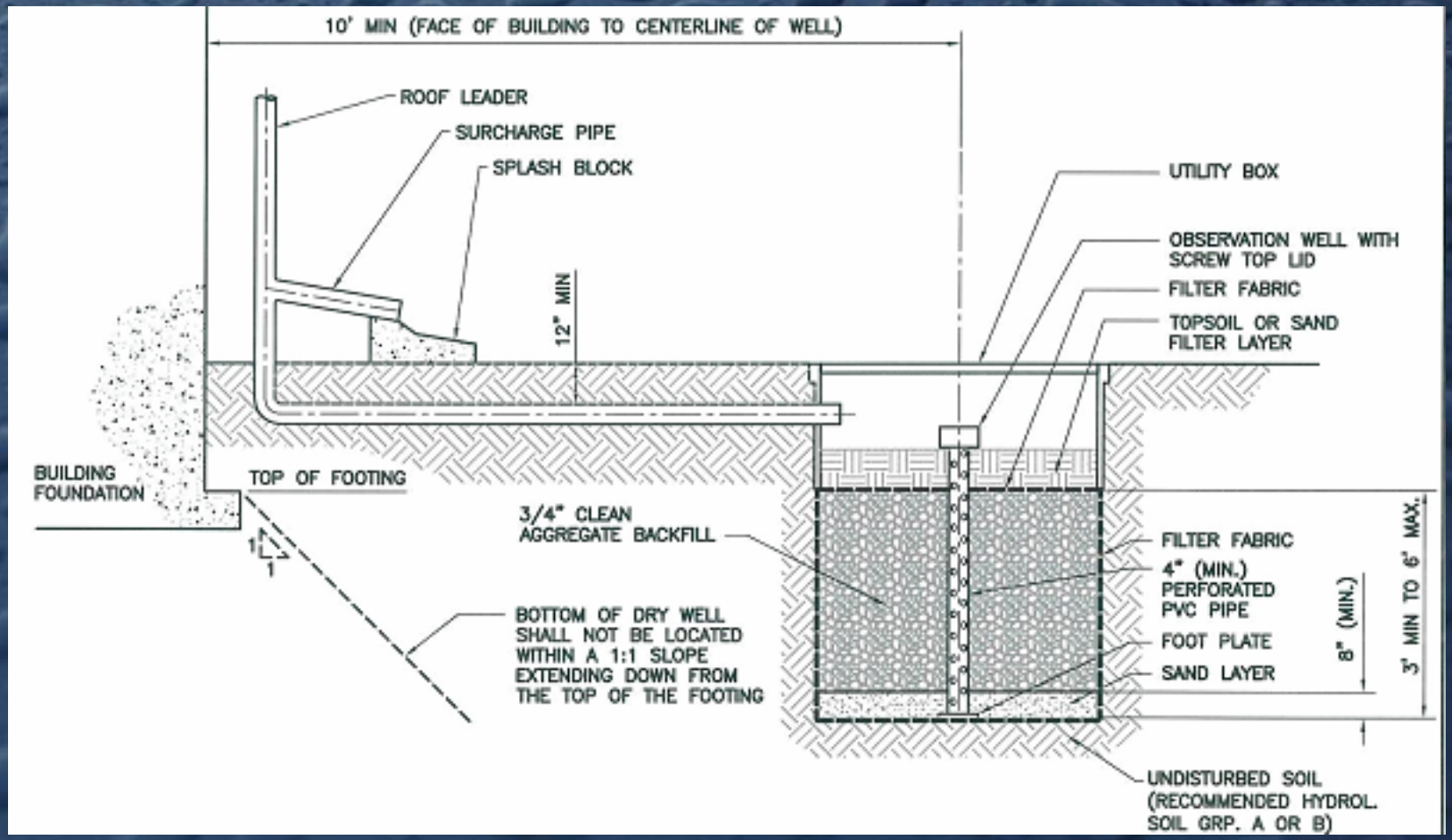
Bioretention



Planter Box

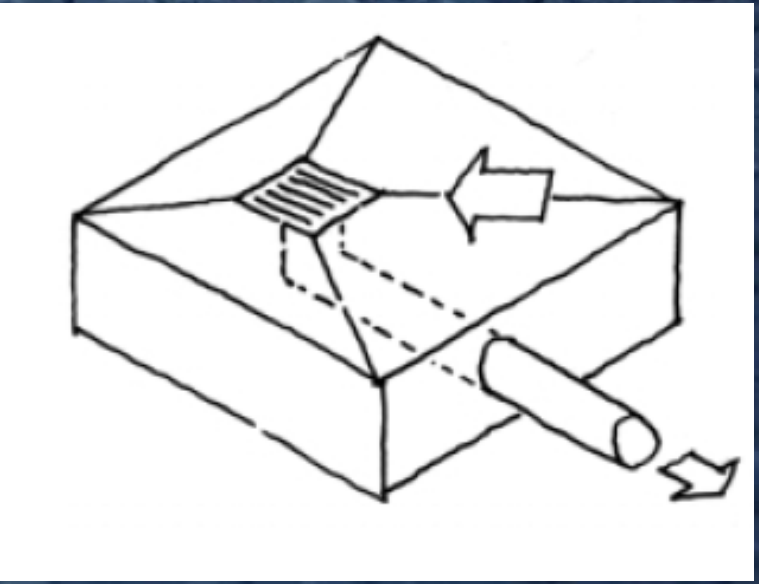

Reservoir,
12" min. depth
Reverse bend
trap or hooded
overflow
18" sandy loam,
minimum
infiltration rate
5" per hour
12" open-graded
gravel, approx.
½" dia.
Concrete or other
structural planter wall with
waterproof membrane
Perforated pipe
Additional
waterproofing on
building as
needed
Drain to storm drain or discharge;
bottom-out or side-out options

Dry Well

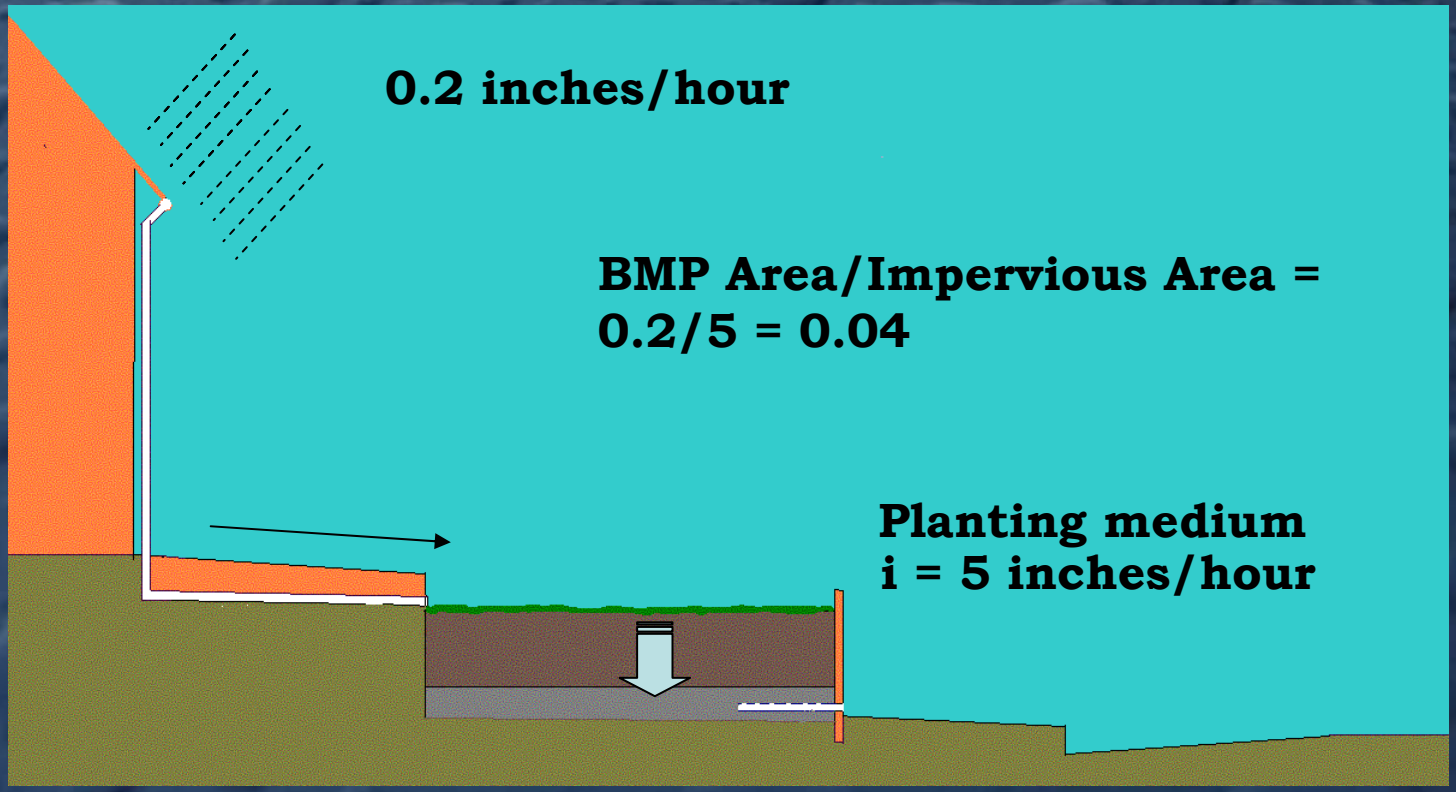

10' MIN (FACE OF BUILDING TO CENTERLINE OF WELL)
ROOF LEADER
SURCHARGE PIPE
SPLASH BLOCK
12" MIN
UTILITY BOX
OBSERVATION WELL WITH SCREW TOP LID
FILTER FABRIC
TOPSOIL OR SAND FILTER LAYER
BUILDING FOUNDATION
TOP OF FOOTING
1
1
3/4" CLEAN AGGREGATE BACKFILL
BOTTOM OF DRY WELL SHALL NOT BE LOCATED WITHIN A 1:1 SLOPE EXTENDING DOWN FROM THE TOP OF THE FOOTING
FILTER FABRIC
4" (MIN.) PERFORATED PVC PIPE
FOOT PLATE
SAND LAYER
8" (MIN.)
3' MIN TO 6' MAX.
UNDISTURBED SOIL (RECOMMENDED HYDROL. SOIL GRP. A OR B)

Showing Treatment Compliance

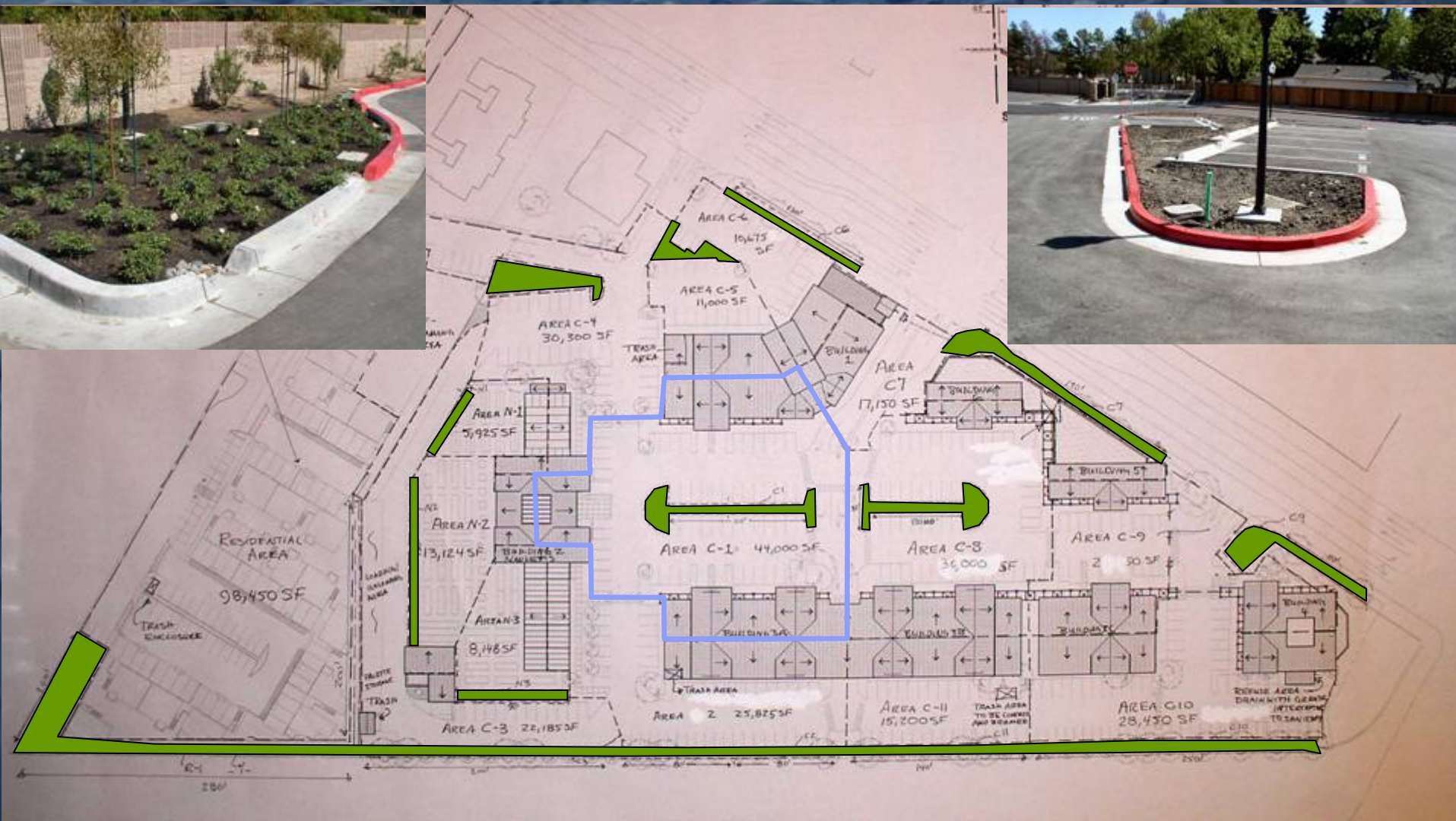
- **NPDES Permit sizing criteria for treatment control:**
  - **“collect and convey” drainage design**
  - **Conventional “end of pipe” treatment**
  - **Composite “C” factors to determine design inflow or volume**



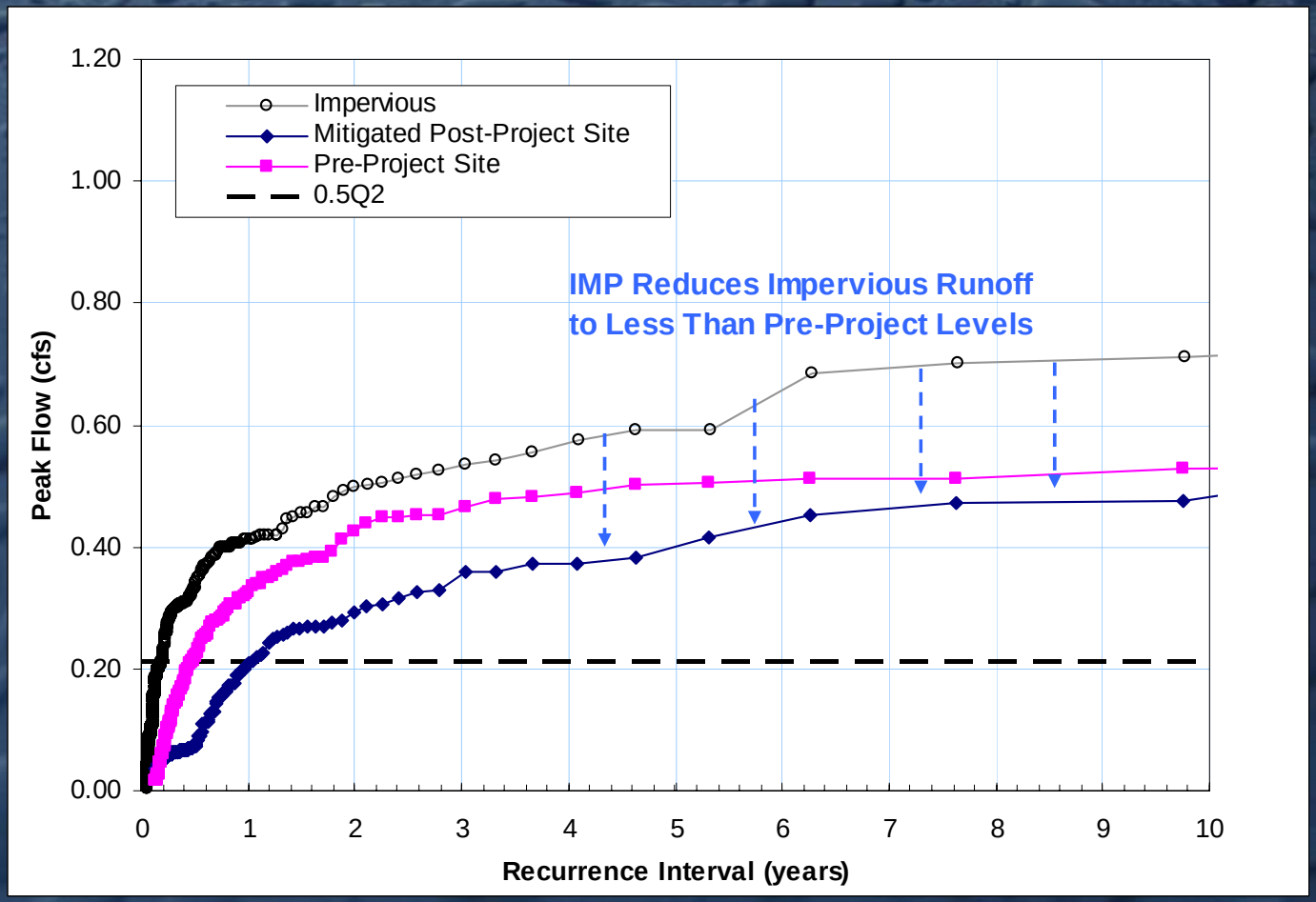
Sizing criterion for treatment



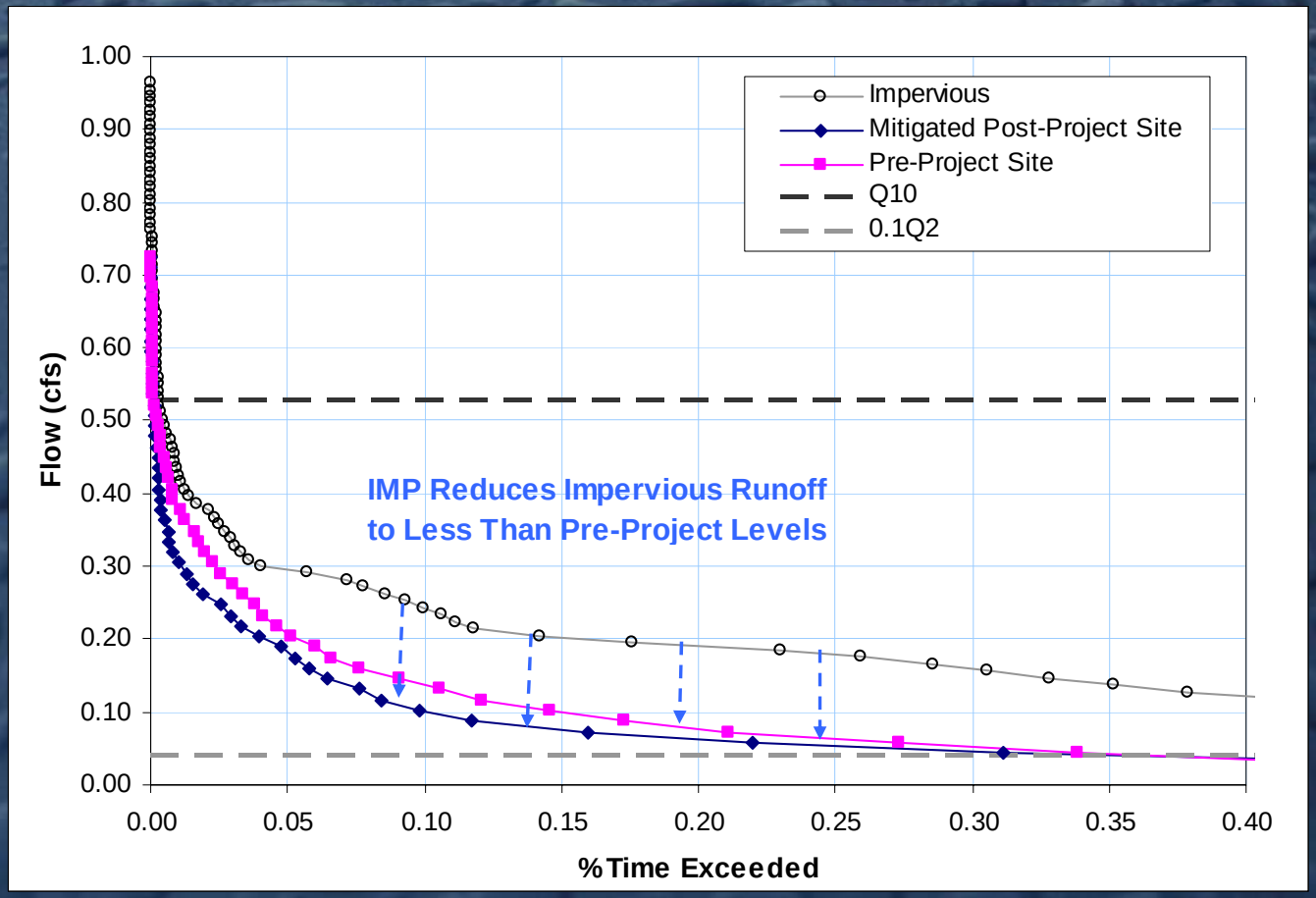
Application of sizing factor



Controlling Peak Flows



Controlling Flow Durations



LID Calcs for NPDES Compliance

1. **Divide the site into Drainage Management Areas**
2. **Use landscape to disperse and retain runoff where possible**
3. **Route drainage from remaining areas to bioretention facilities**
4. **Check facility locations for available space and hydraulic head**

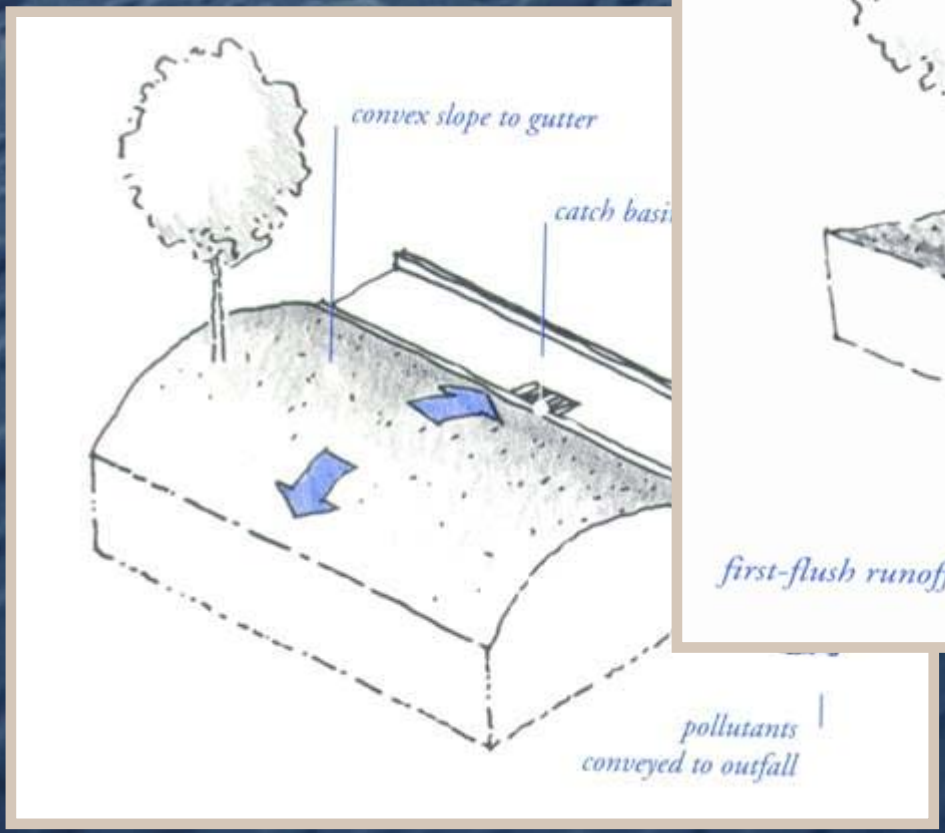
Drainage Management Areas

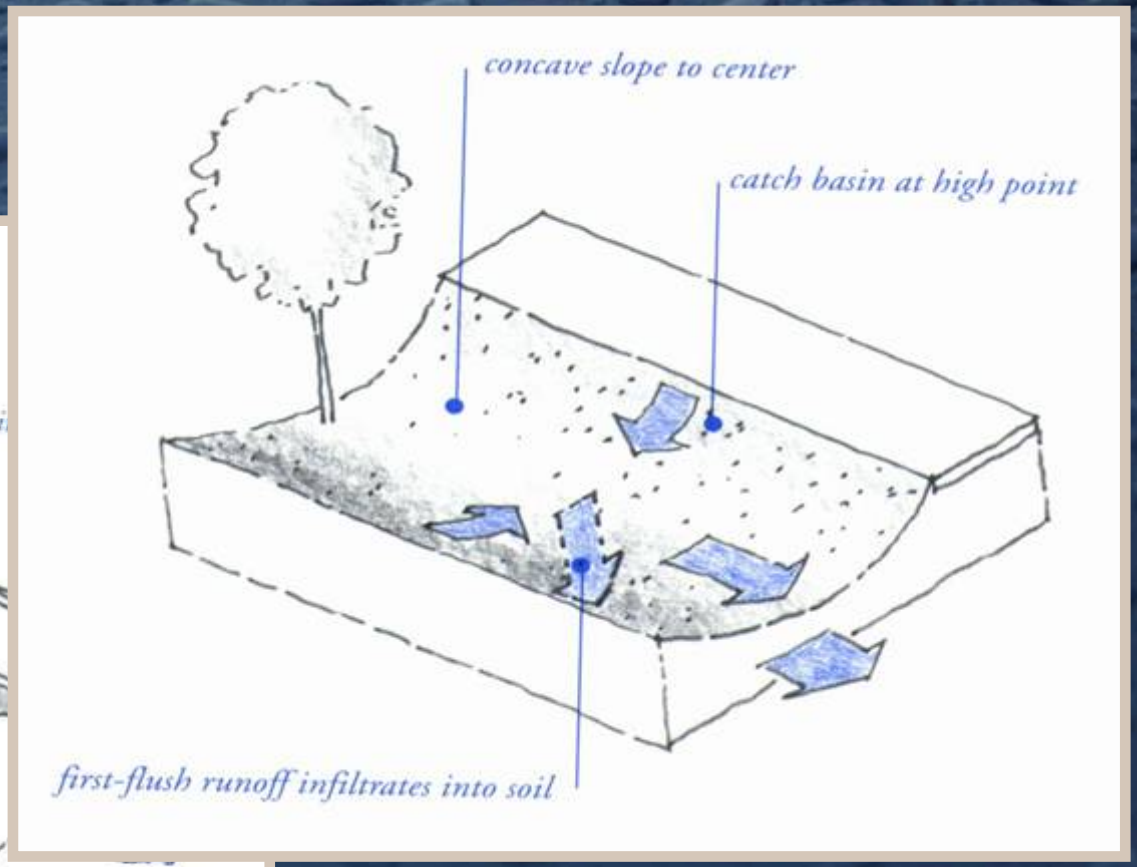
- **Four Types of Areas**
  1. **Self-treating areas**
  2. **Self-retaining areas**
  3. **Areas draining to a self-retaining area**
  4. **Areas draining to a treatment facility**
- **Only one surface type within each area**
- **Many-to-one relationship between drainage areas and facilities**

Self-treating areas

- **Must be 100% pervious**
- **Must drain offsite**
- **Must not drain on to impervious areas**
- **Must not receive drainage from impervious areas**
- **Must not drain to treatment facilities**
- **No treatment or flow control required**
- **No further calculations required**

Self-retaining areas

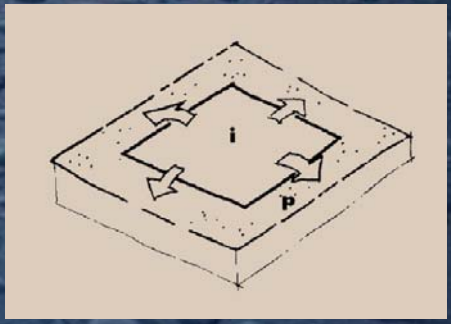




Self-retaining areas

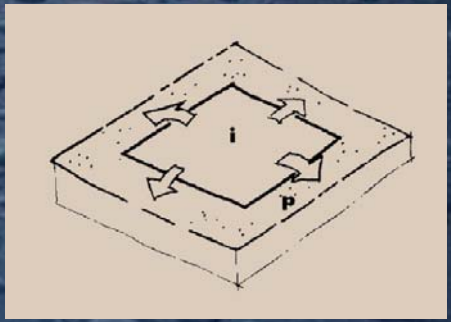
- Berm or depress grade to retain 1" rain
- Set area drain inlets above grade
- Amend soils
- Terrace mild slopes
- Have limited applicability in
  - Dense developments
  - Hillsides

Areas draining to self-retaining areas

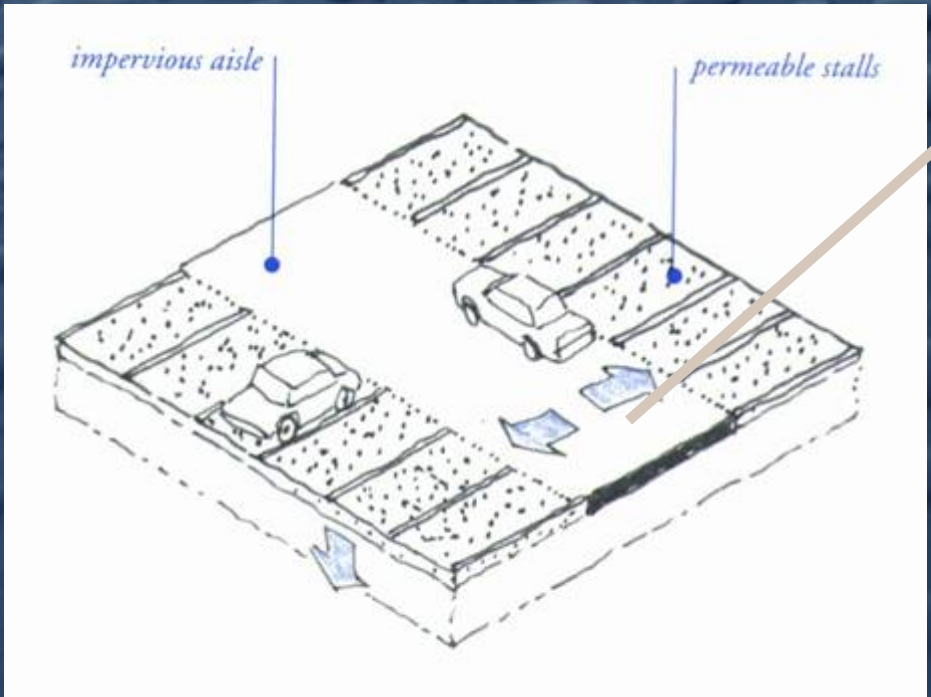


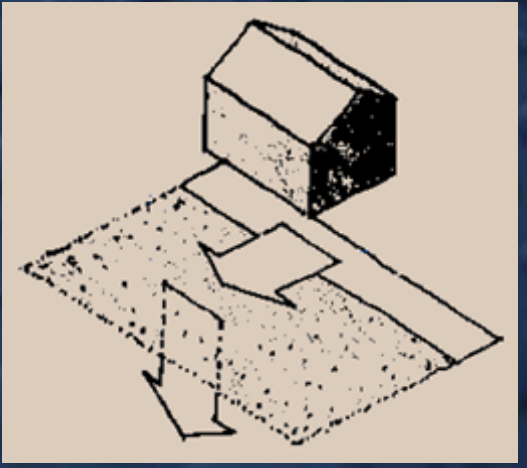
- **Impervious areas can drain on to self-retaining areas**
- **Example: Roof leaders directed to lawn or landscape**
- **Maximum ratio is 2:1 for treatment; 1:1 for flow control**
- **No maintenance verification required**

Areas draining to self-retaining areas



$$\frac{\text{Impervious}}{\text{Pervious}} \leq 1$$





Tabulating Areas

Self-Treating Areas

DMA Name	Area (SF)

Self-Retaining Areas

DMA Name	Area (SF)

Areas Draining to Self-Retaining Areas

DMA Name	Area (SF)	Post-project surface type	Runoff factor	Receiving Self-retaining DMA	Receiving DMA Area (SF)

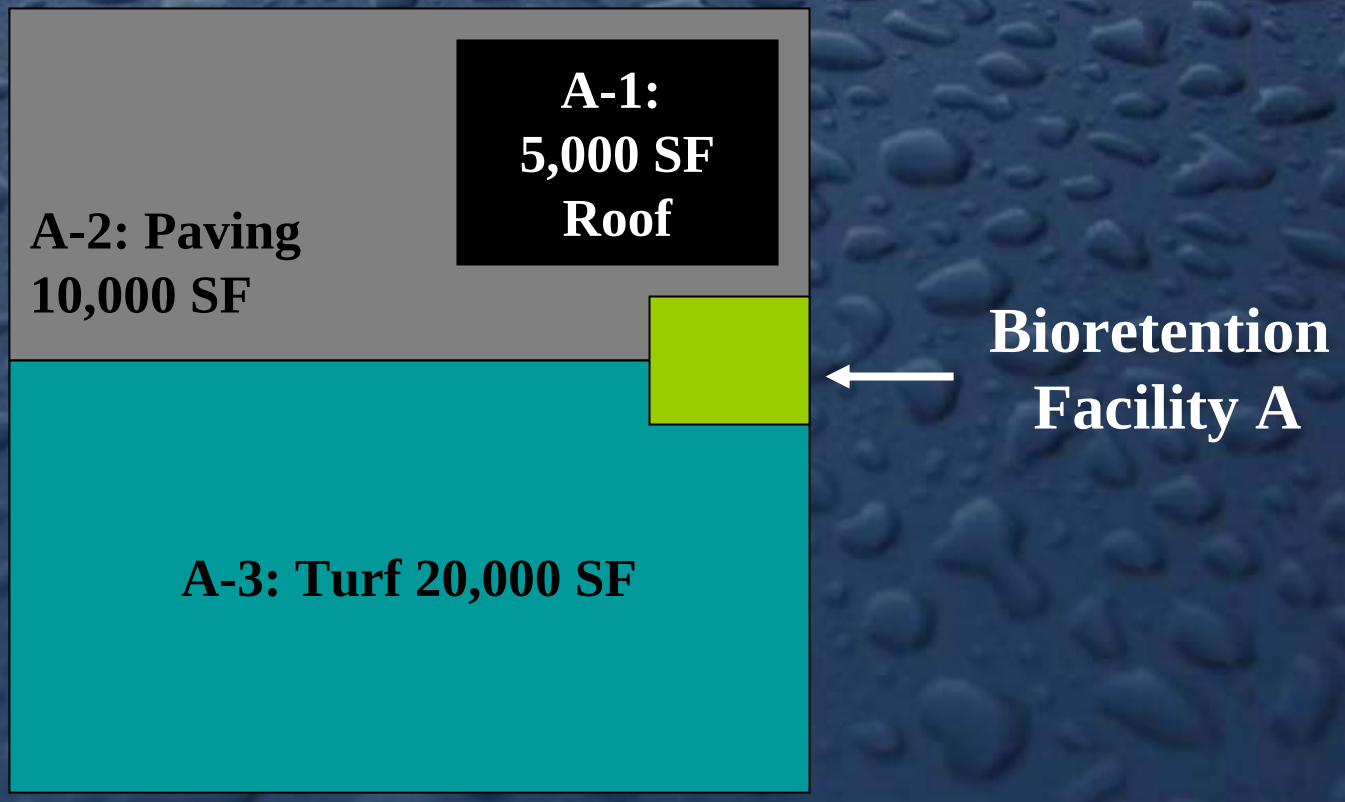
Areas draining to Bioretention Facilities

- **Areas used to calculate the required size of the bioretention facility**
- **Where possible, drain only impervious roofs and pavement to bioretention facilities**
- **Delineate any pervious areas as separate Drainage Management Areas**

DMAs draining to facilities

DMA Name	*DMA Sq. Ft*	*Surface Type*	*Runoff Factor*	*Area x runoff factor*			
					Sizing Factor	*Min. Size*	*Size Planned*
Facility A-----→							

Calculating Facility Size



DMAs draining to facilities

DMA Name	*DMA Sq. Ft*	*Surface Type*	*Runoff Factor*	*Area x runoff factor*			
A-1	**5000**	**Roof**	**1.0**	**5000**			
A-2	**10000**	**Paved**	**1.0**	**10000**			
A-3	**20000**	**Grass**	**0.1**	**2000**	***Sizing Factor***	***Min. Size***	***Size Planned***
Facility A-----→				**17000**	**0.04**	**680**	**800**

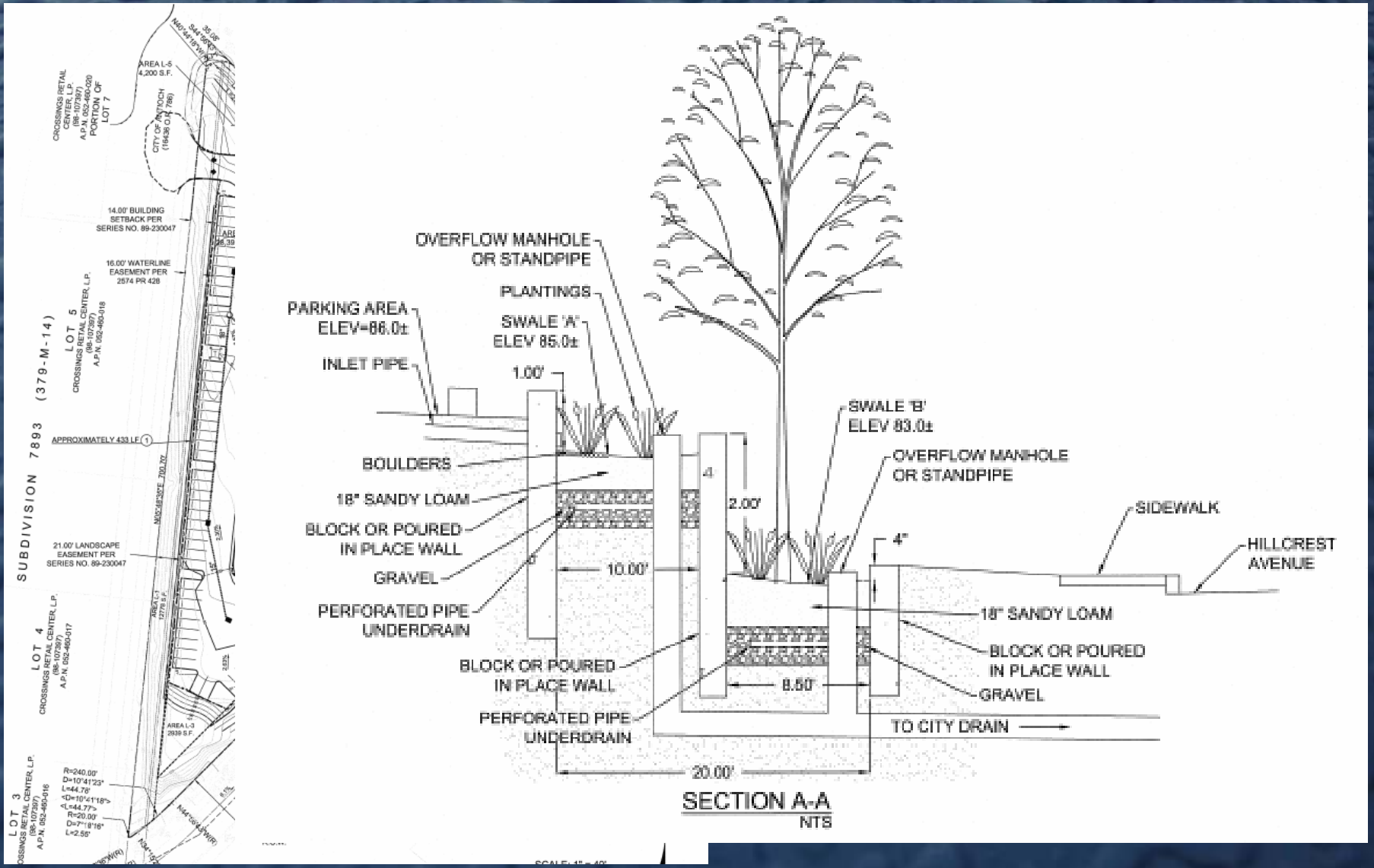
Commercial Parking Lot

Residential Subdivision

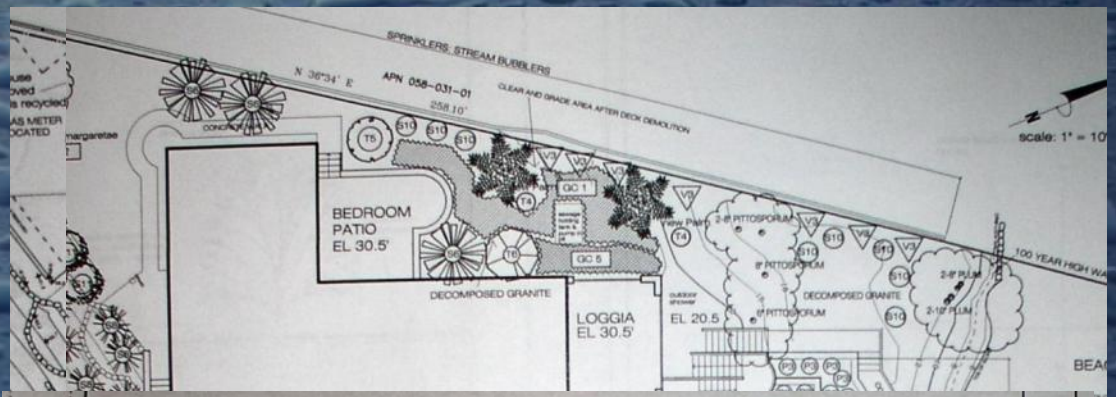
Office/Retail

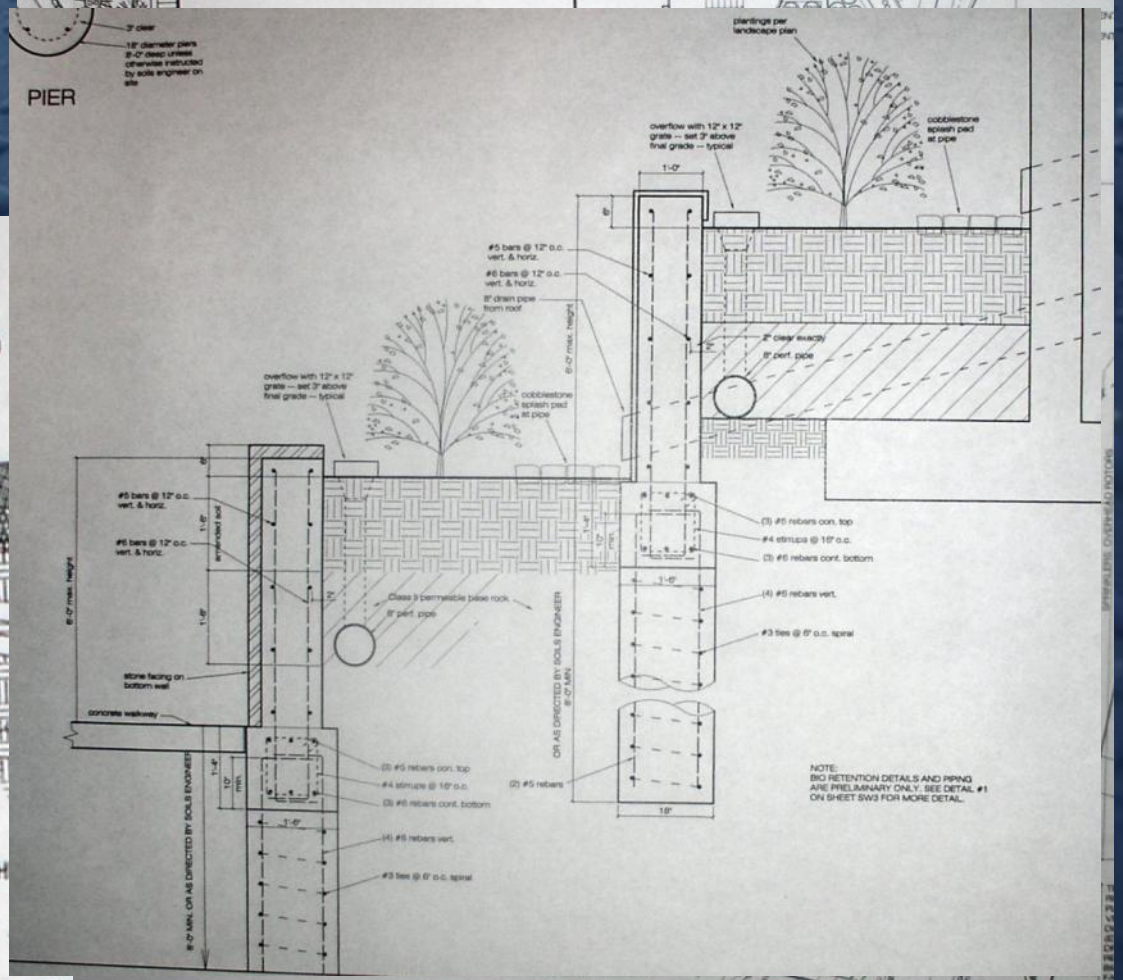
Large Hillside Development

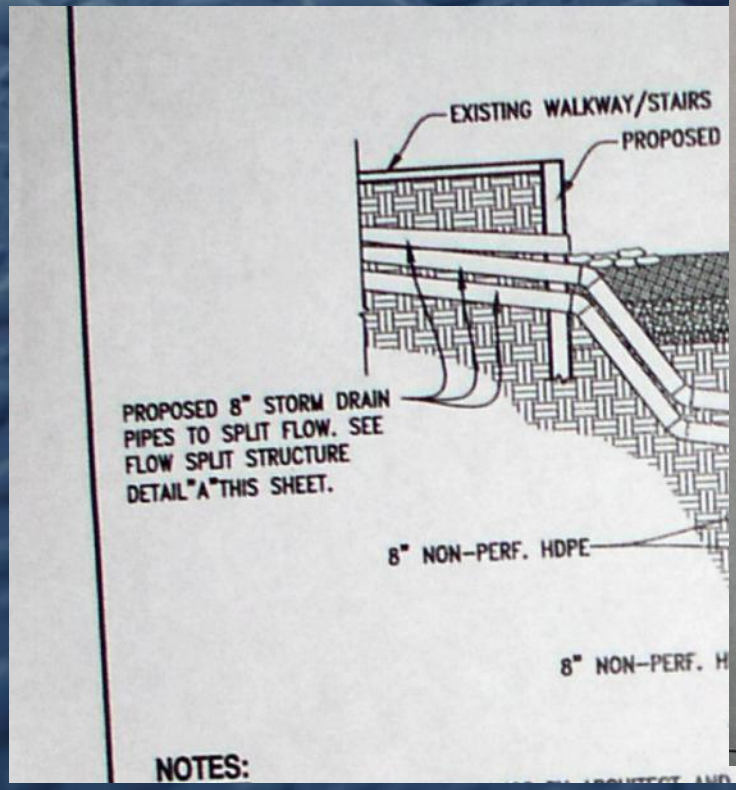
Commercial Development



Bayside Single Residential

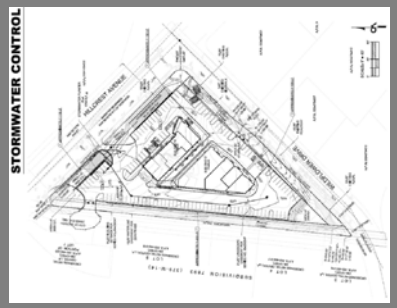






Church

One day at municipal offices…



What's needed now

- **NPDES permits should allow LID for treatment and flow control**
- **Specify design standards applicable to LID**
- **Improve design and construction**
- **Learn from the results**
- **Take a watershed approach**