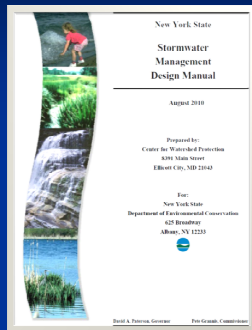


Green Infrastructure NYS Stormwater Design Standards

Shohreh Karimipour, P.E.
NYSDEC, Regional Stormwater Engineer



Design Standards Update



- 2008 –2009 State public process:
 - Integration of green infrastructure
 - Key design: **runoff reduction**
- August 2010 update:
 - Modified Sizing Criteria (Water Quality Volume -WQV)
 - Introduced GI Standards

Avoid Impact

- Preserve Natural Resources

Reduce Impact

- Impervious Cover

Manage Impact

- GI Techniques

Manage the Impact: Slow it down, Spread it out, Soak it in

Runoff Reduction (RR) Techniques:

- Conservation of natural areas
- Sheetflow to riparian buffers or filter strips
- Vegetated open swale
- Tree planting / tree box
- Rooftop Runoff disconnection
- Stream daylighting
- Rain garden
- Green roof
- Stormwater planter
- Rain tank/Cistern
- Permeable paving



Runoff Reduction Technique:

Conservation of Natural Areas



Vegetated Buffer/Filter Strips

➤ Width, slope, density



Runoff Reduction Technique:

Rooftop Runoff
Disconnection



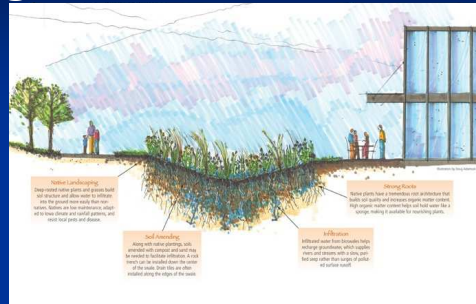
Tree Planting

- In stormwater management practices (where appropriate)
- In landscape plans
- Re-vegetated buffer areas
- Storage / area sizing



Runoff Reduction Technique: Open Vegetated Channels

- Convey & treat runoff with:
 - Natural drainage paths
 - Properly designed & constructed channels
- On right-of-way
- Slopes, velocity, depth, travel time





■ Rain Garden Applications

- treating small volumes of runoff with made soil and plants
- $WQ_v < V_{SM} + V_{DL} + (D_p \times A_{RG})$

■ Limitations

- Steep slopes, Compacted and clay soils
- Sheet / shallow concentrated flow; roof drain downspout < 1,000 sf

- Design controls (ponding, overflow, soil Specifications)



Cisterns & Rain Barrels

- Capture and store stormwater runoff for reuse or irrigation
- Limitations
 - Maintenance, Water use, Cold Climate, Community Acceptance
- Sizing based on the contributing area:
 - $Vol = WQ_v * 7.5 \text{ gals/ft}^3$
- Credits: NYC community gardens



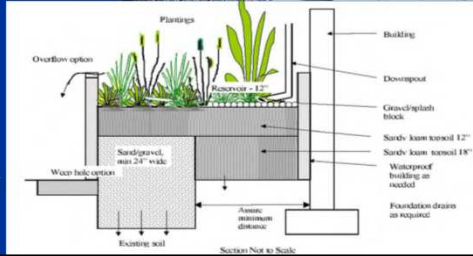


- Applications
- Limitations, benefits
- Sizing (storage)
- Design (media, plant, drainage, water proofing)
- Maintenance

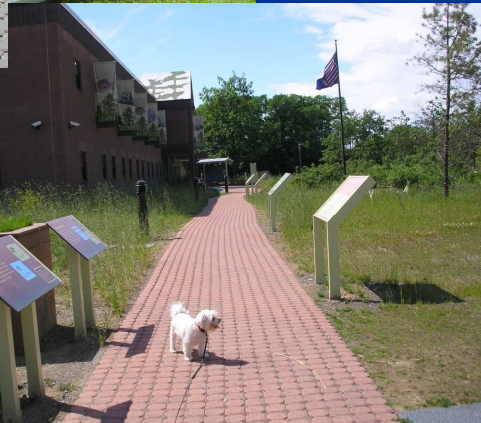
$$WQ_v \leq V_{GR} \cdot \gamma_{DL} + (D_p \times A_{GR})$$

Stormwater Planters

- Applications
 - On site soils, high GW table not suitable for infiltration
 - Reduction of discharge volume, velocity from impervious areas
- Design
 - Flow through, contained, infiltration
- Sizing WQv
 - Surface area, depth of soil & hydraulic conductivity



- low traffic areas, overflow parking, Residential single family home, GW recharge
- Limitations
 - suitability of the site grades, Subsoils, Drainage characteristics, Groundwater conditions
- Sizing
 - based on surface area
 - $A_p = WQv/n \times d_t$



Challenges and Opportunities

- Challenges:
 - Maintenance
 - Access
 - Cold Climate
 - Soils
 - Water table
 - Easement
 - Local Laws
- Opportunities:
 - Green initiatives across the State
 - New York State smart growth bill
 - Funding opportunities

Maintenance

- Incorporated into landscaping
- Frequent, Long term
- Access to private property
- Change of ownership
- Longevity
- O&M manuals

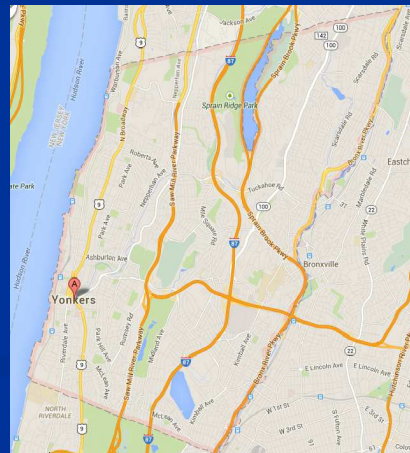
LEED Credits

Potential LEED credits with Environmental Site Design

SS 5.1	Site Dev: Protect and Restore Habitat
SS 5.2	Site Dev: Maximize Open Space
SS 6.1	Stormwater Design: Quantity Control
SS 6.2	Stormwater Design: Quality Control
SS 7.1	Heat Island Effect: Non-roof
SS 7.2	Heat Island Effect: Roof
WE 1.1	Water Efficient Landscape: Reduce by 50%
WE 1.2	Water Efficient Landscape: No Potable Water Use
WE 2	Innovative Wastewater Technologies <small>(pre-treatment?)</small>
ID	Opportunities for Innovation in Design

City of Yonkers

- 4th largest city in NYS
- Ultra urban development
 - Highly paved
- Underground utilities
 - Typical City infrastructure
- Slopes: rocky ground
- Soils: silt/clayey
- Outfalls: 143 SW, 12 CSO



Combined Sewer Overflow

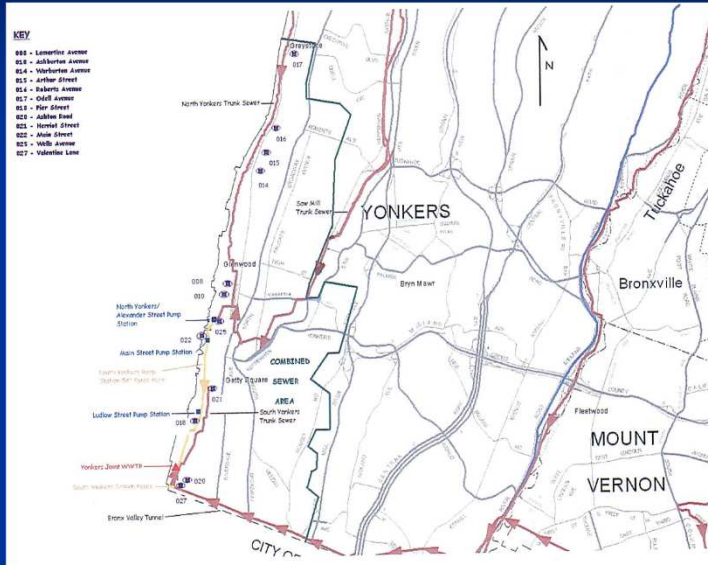
Regulators &
Trunk Sewers

CSOs Long Term
Control Plans

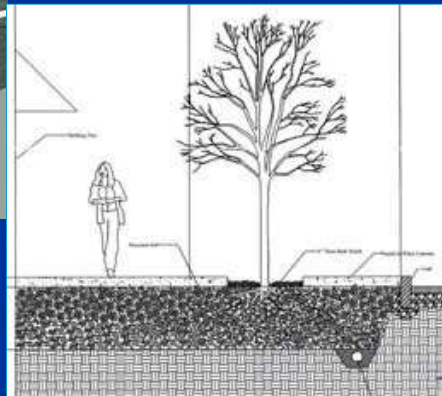
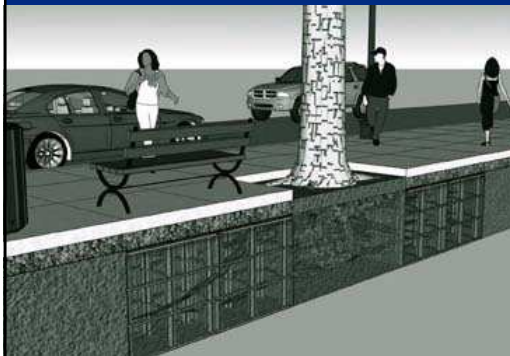
EPA 2011 Memo

Green
Infrastructure

Retention vs.
Peak Control



Innovative Approaches



Parking Lot Island Infiltration Areas



Planters



Bioinfiltration



CITY OF YONKERS, NEW YORK ENGINEERING DEPARTMENT		
STORMWATER MANAGEMENT REQUIREMENTS - DEPARTMENT OF HOUSING & BUILDINGS PERMITS (This form to be filled out <u>only</u> by the Licensed Design Professional)		
Project Address:	Block:	Lot:
Work Description:		Housing & Buildings Application Number:
Select one (A - F) of the following and provide information as required:		
A. <input type="checkbox"/>	This project results in the creation of impervious surface areas that total less than 200 square feet in size. No Engineering Department review required.	
B. <input type="checkbox"/>	This project results in the creation of impervious surface areas between 200 square feet and 499 square feet in size. Drywell storage volume for the project improvements shall be provided as indicated below: _____ sq. feet total new impervious area X 0.16 ft. runoff increase _____ cu. feet minimum drywell storage to be provided.	
C. <input type="checkbox"/>	This project results in the creation of impervious surface areas between 500 square feet and 999 square feet in size. Drywell storage volume for the project improvements shall be provided as indicated below:	
<input type="checkbox"/>	500 - 549 sq. ft.: 110 cu. feet	<input type="checkbox"/>
<input type="checkbox"/>	550 - 599 sq. ft.: 120 cu. feet	<input type="checkbox"/>
<input type="checkbox"/>	600 - 649 sq. ft.: 130 cu. feet	<input type="checkbox"/>
<input type="checkbox"/>	650 - 699 sq. ft.: 140 cu. feet	<input type="checkbox"/>
<input type="checkbox"/>	700 - 749 sq. ft.: 150 cu. feet	<input type="checkbox"/>
<input type="checkbox"/>	750 - 799 sq. ft.: 160 cu. feet	<input type="checkbox"/>
<input type="checkbox"/>	800 - 849 sq. ft.: 170 cu. feet	<input type="checkbox"/>
<input type="checkbox"/>	850 - 899 sq. ft.: 180 cu. feet	<input type="checkbox"/>
<input type="checkbox"/>	900 - 949 sq. ft.: 190 cu. feet	<input type="checkbox"/>
<input type="checkbox"/>	950 - 999 sq. ft.: 200 cu. feet	<input type="checkbox"/>
<input type="checkbox"/>	_____ cu. feet	minimum drywell storage to be provided.
D. <input type="checkbox"/>	This project results in the creation of impervious surface areas between 200 square feet and 999 square feet in size. An alternative project stormwater management analysis has been performed by the project Licensed Design Professional and is attached (25-year, 6.0 inch rainfall basis).	
E. <input type="checkbox"/>	This project results in the creation of impervious surface areas that total in excess of 1000 square feet in size. A project stormwater management analysis has been performed by the project Licensed Design Professional and is attached (25-year, 6.0 inch basis).	
F. <input type="checkbox"/>	This project disturbs an area equal to or greater than 1 acre in size. The project will be required to obtain a Stormwater Management Permit from the Engineering Deptment, in conformance to the requirements of City of Yonkers Code § 56-174 - Stormwater Management and Erosion and Sediment Control.	