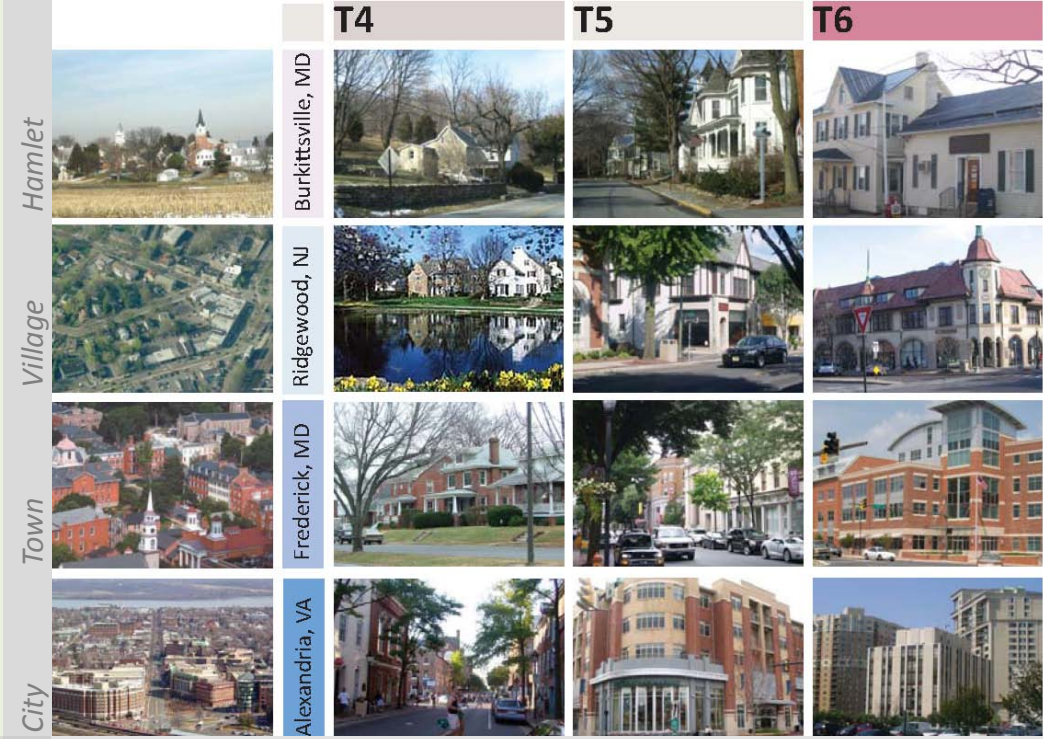

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www.TownscapeDesign.com

November 10, 2011

Coordinating ESDs and WIPs with Smart Green and Growing

MPCA Annual Meeting, Easton, Maryland

Recommendations

- Smart Growth is the best BMP
- So what's the problem: Flexibility, Regulations, Interpretation and Implementation
- Recommendations
  1. Watershed Approach
  2. Strategic Stormwater Planning
  3. Stormwater Transects
  4. Tool Kits
  5. Inter-Agency Cooperation
  6. Stormwater 'Art'
  7. Multi-use and Overlap
  8. Stormwater Clubs
  9. Maintenance and Monitoring

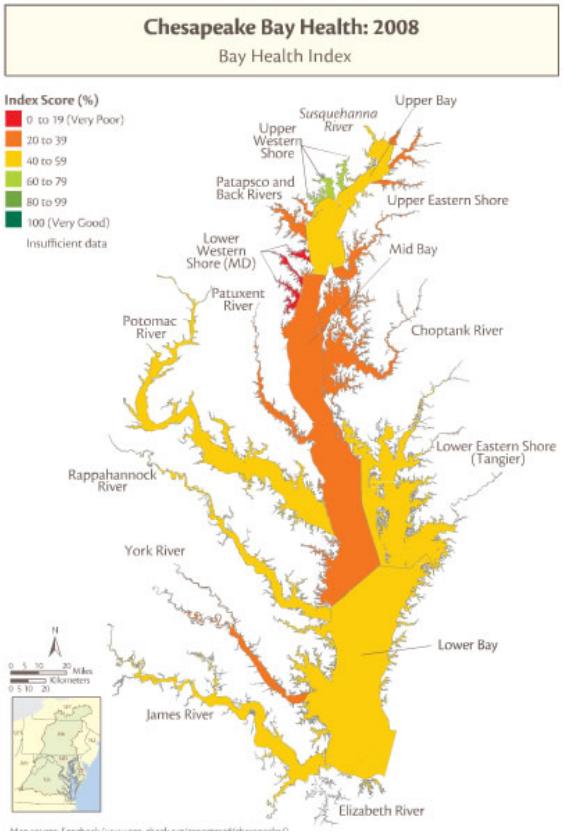
- Light Print Stormwater
- Low Impact Development
- Best Management Practices
- Environmentally Sensitive Design
- Sustainable Stormwater Management

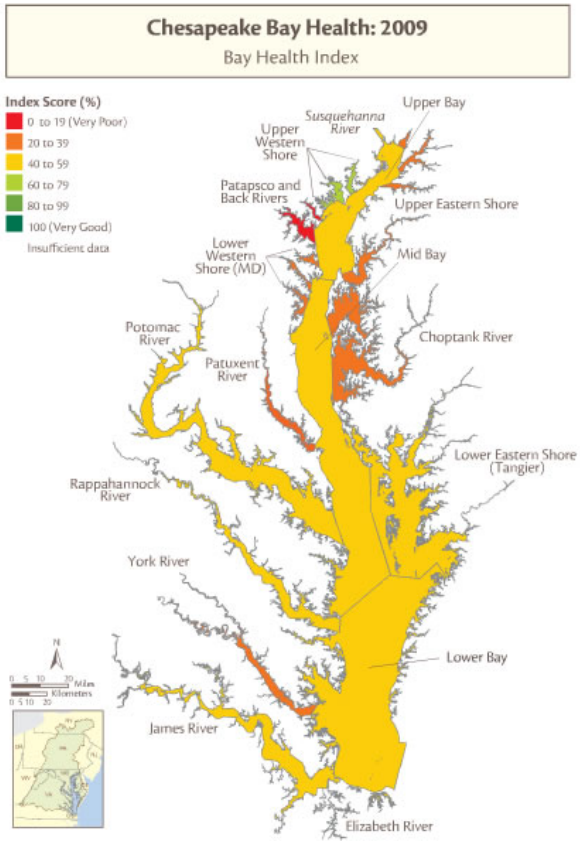
Source: Environmental Services, San Mateo County, CA and Nevue-Ngan Associates

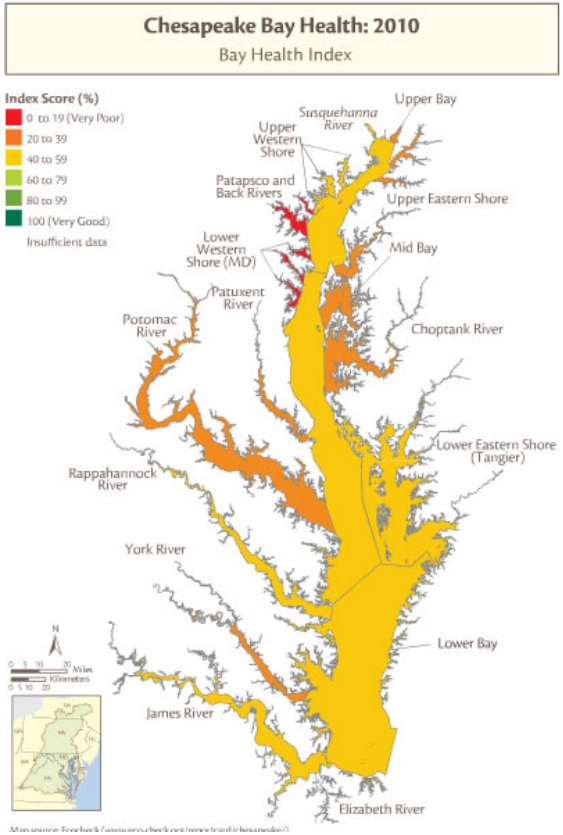
- Smart Growth
- Green Urbanism
- Walkable Urbanism
- Sustainable Urbanism
- Sustainable and Resilient Communities
- EPA's Smart Growth / Choice Neighborhoods
- EPA's Green Communities
- The Original Green
- Complete Towns

10 Smart Growth Principles

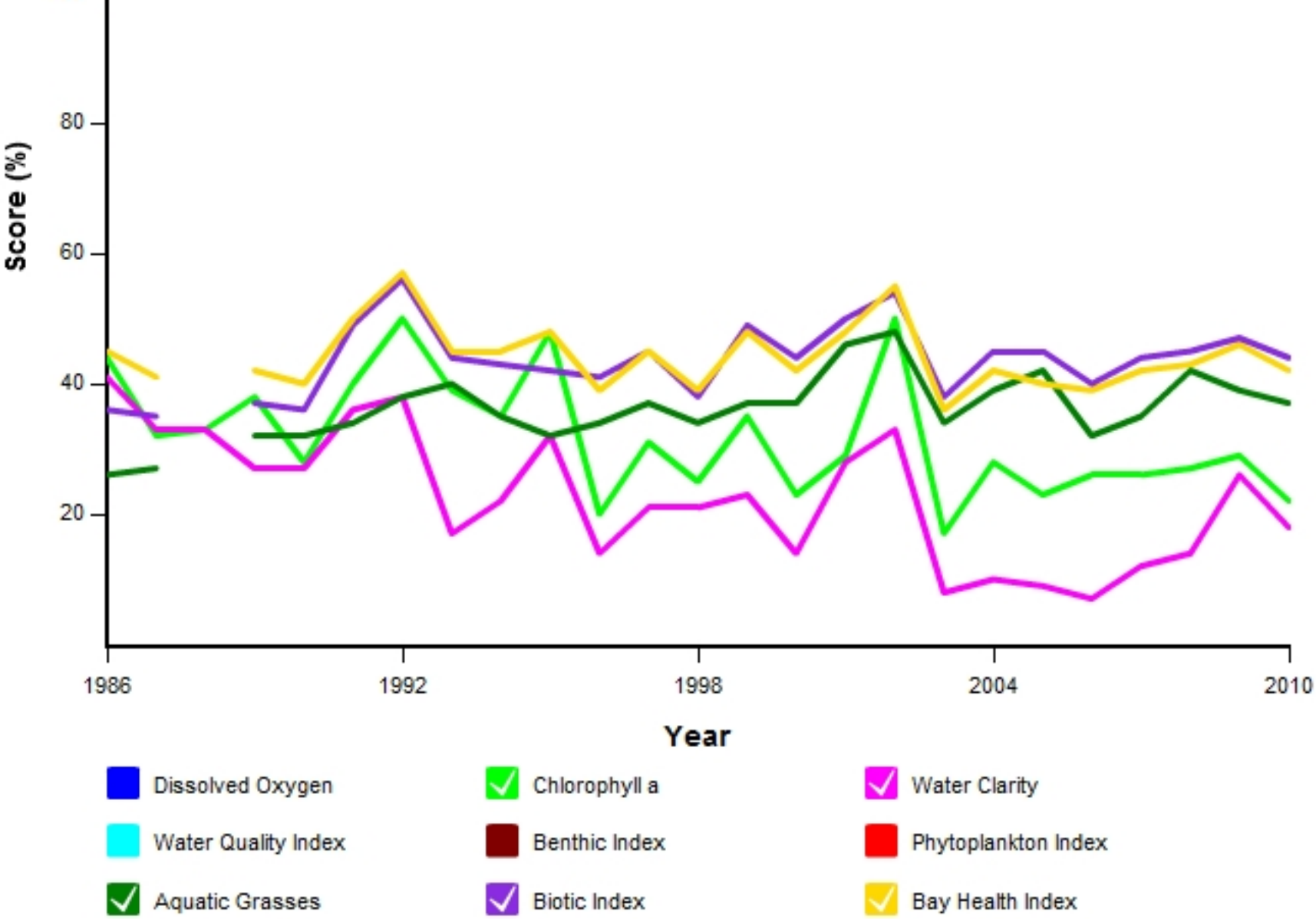
1. Create a range of housing opportunities and choices.
2. Create walkable neighborhoods.
3. Encourage community and stakeholder collaboration.
4. Foster distinctive, attractive places with a strong sense of place.
5. Make development decisions predictable, fair, and cost effective.
6. Mix land uses.
7. Preserve open space, farmland, natural beauty, and critical environmental areas.
8. Provide a variety of transportation choices.
9. Strengthen and direct development toward existing communities.
10. Take advantage of compact building design.

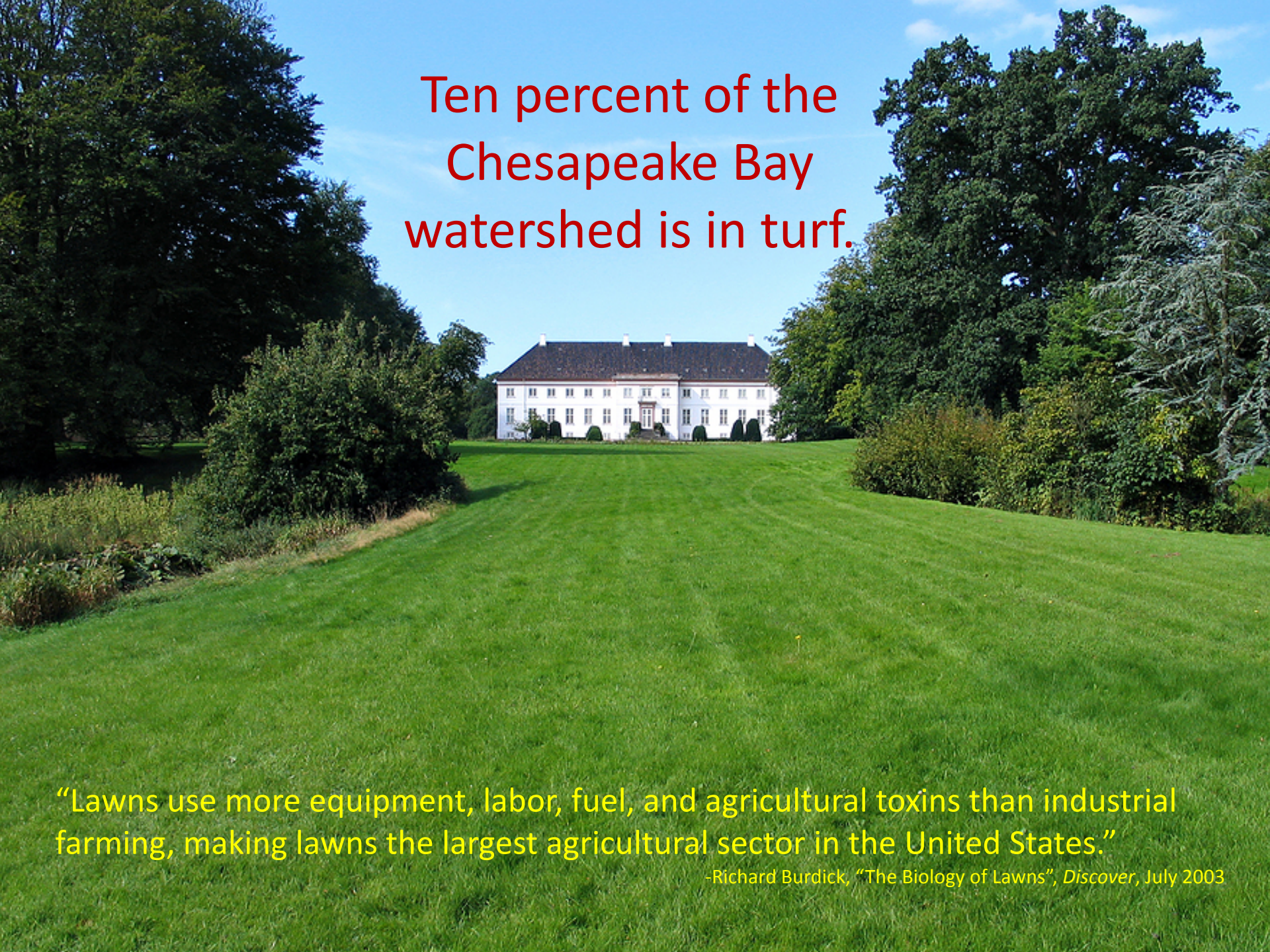






2008 C- 43% **2009 C 46%** **2010 C- 42%**


Score (%)
80
60
40
20
1986
1992
1998
2004
2010
Year
Dissolved Oxygen
Chlorophyll a
Water Clarity
Water Quality Index
Benthic Index
Phytoplankton Index
Aquatic Grasses
Biotic Index
Bay Health Index


Ten percent of the Chesapeake Bay watershed is in turf.
"Lawns use more equipment, labor, fuel, and agricultural toxins than industrial farming, making lawns the largest agricultural sector in the United States."
-Richard Burdick, "The Biology of Lawns", *Discover*, July 2003

TMDLs, Stormwater and Smart Growth

More than 40 percent of the waterways in the US are 'impaired'. Once designated as impaired, a pollution reduction strategy, and a pollution 'budget', known as Total Maximum Daily Load or TMDL is required.

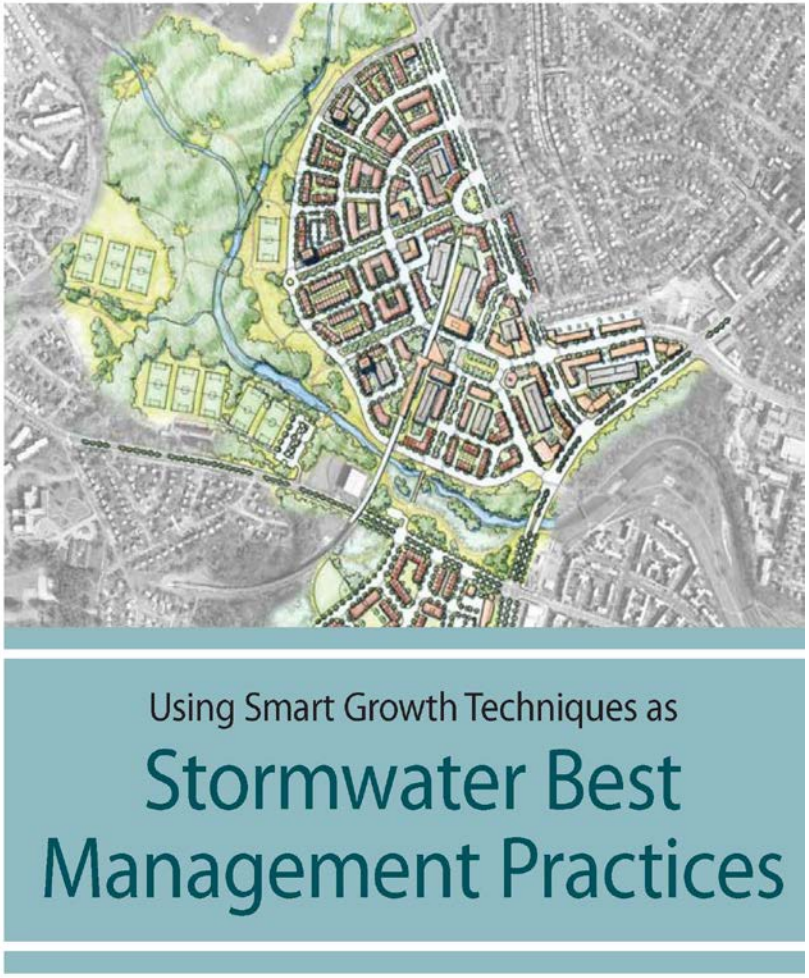
The goal is to restore the waterway by reducing pollutants. Stormwater is a major contributor and therefore is often a centerpiece to a TMDL process.

Smart growth techniques can help prevent and/or reduce stormwater volumes and thus provide pollutant load reductions.

The Chesapeake Bay is one of the major waterways in the US with a landmark pollution diet, known as the Chesapeake Bay TMDL, established by the EPA on December 29, 2010.

The Bay pollution budget calls for a 25 percent reduction in nitrogen, 24 percent reduction in phosphorus and 20 percent reduction in sediment. The TMDL - which sets Bay watershed limits of 185.9 million pounds of nitrogen, 12.5 million pounds of phosphorus and 6.45 billion pounds of sediment per year – is designed to ensure that all pollution control measures to fully restore the Bay and its tidal rivers are in place by 2025.

Ways to Include Smart Growth Techniques as BMPs:



1. Couple Smart Growth planning with site design criteria in order to enhance water quality at the watershed level.
2. Implement watershed-wide or regional policies to simultaneously consider areas for growth and conservation.
3. Use better designs for reducing impervious surfaces associated with development.
4. Match BMPs to the development context (BMP transect)
5. Strategically link BMPs to meet water quality and pollution reduction goals
6. Multi-use efficiencies by rethinking and combining flood control, storm controls, water quality features, forestry and park and landscape planning.
7. Merge plans and implementation funds to cover multiple goals with a single project (ie.: sidewalk improvements and water quality enhancement)

"While the water quality and stormwater benefits of smart growth are widely acknowledged, there has been little explicit regulatory recognition of these benefits to date."

-EPA, 2005

Fairfax, Virginia

1/ Corridor Reinvestment:

Source: Urban Advantage, Design: Dover-Kohl Architects

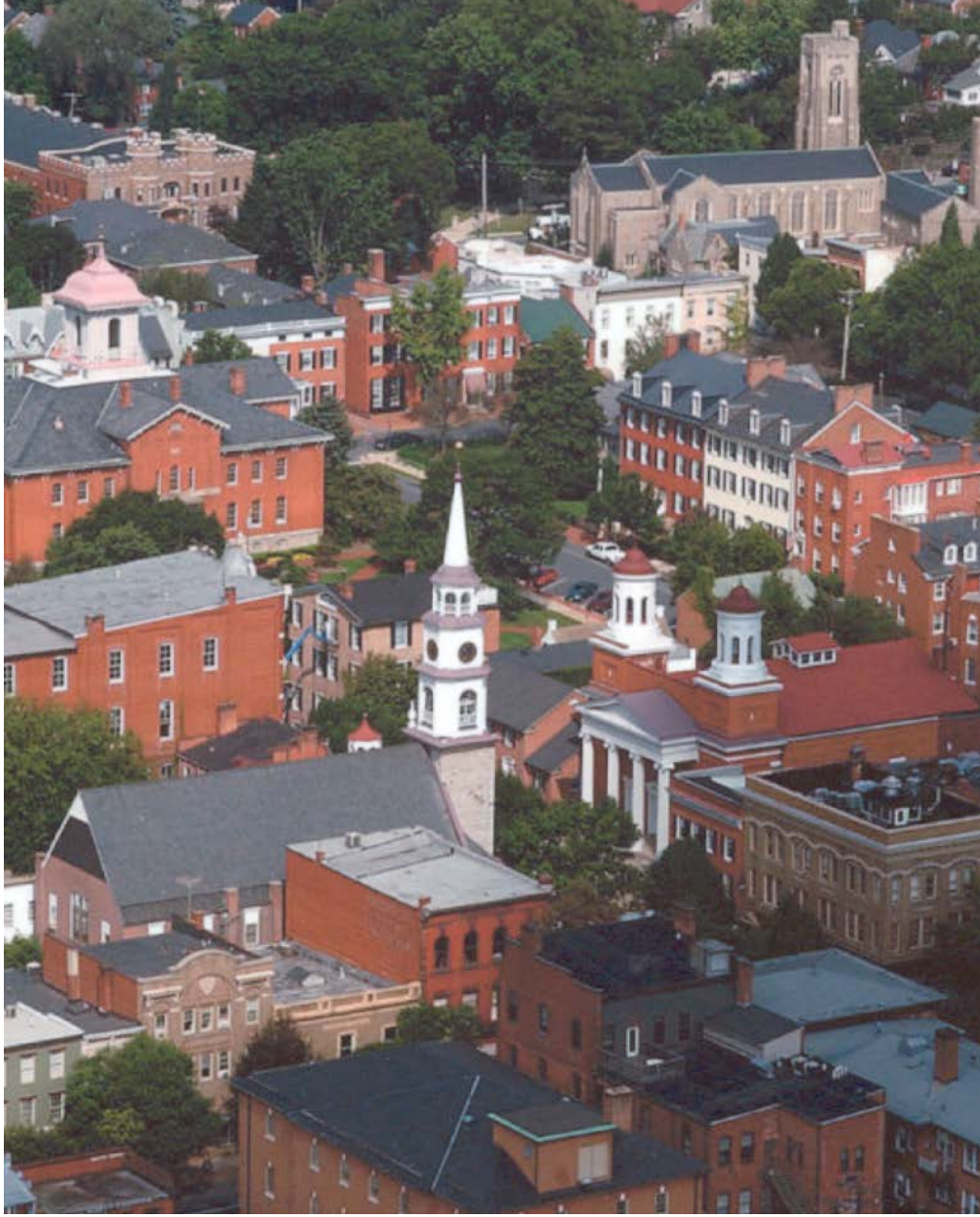
UrbanAdvantage

- *Existing conditions*
- *Attached urban buildings and street trees*
- *Green roof on parking structure*
- *Solar PV on flat roofs*

2/ Infill Development:

"Low density development at the fringe produces 10 times the runoff of a similarly scaled, mixed-use development at the urban core."

-Purdue University, Harbor, J., Engel, B., Jones, D., Pandey, S., Lim, K. and Muthukrishnan, S., A Comparison of the Long-Term Hydrological Impacts of Urban Renewal vs. Urban Sprawl. National Conference on Tools for Urban Water Resource Management & Protection, EPA, Conference Proceedings, 2000.



3/ Redevelopment:

"For every acre of brownfields redevelopment, 4.5 acres of greenfields can be preserved."

-Deason, Jonathan, Gary A. Carroll, George William Sherk. September 2001. Public policies and private decisions affecting the redevelopment of brownfields: An analysis of critical factors, relative weights and areal differentials. Washington, DC: The George Washington University.

E14th Corridor - San Leandro, CA

Source: Community, Design + Architecture

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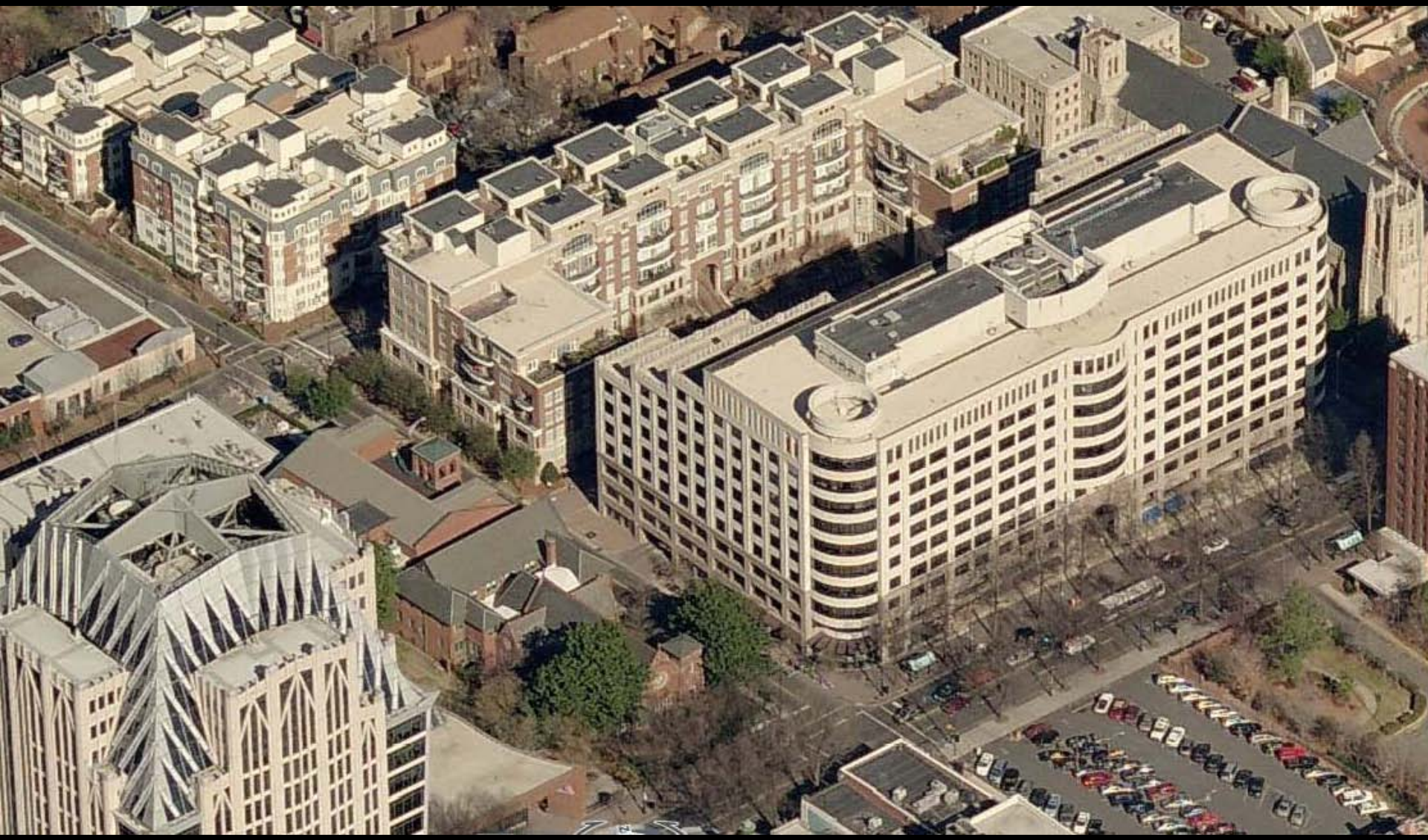
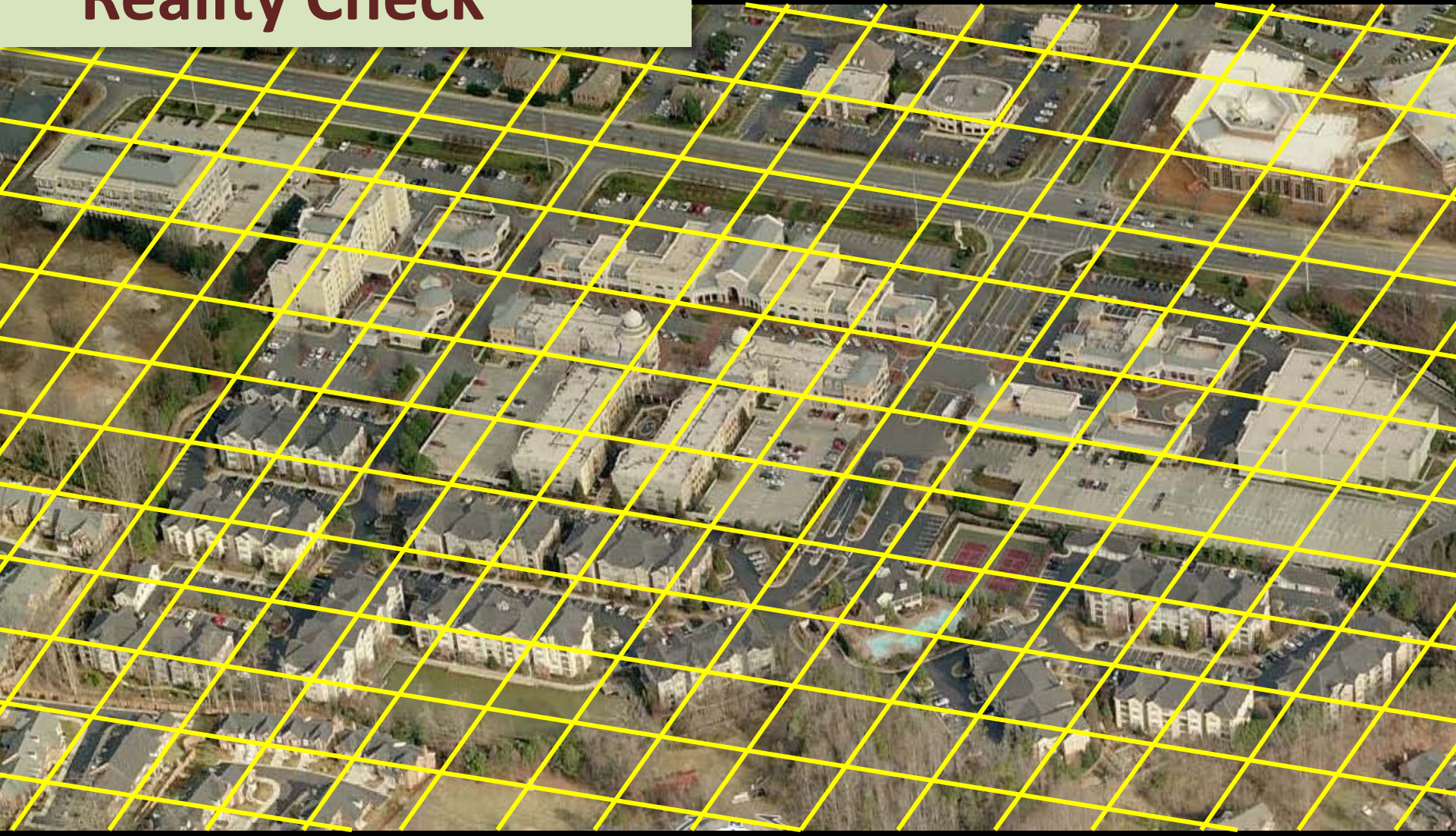


AFI
SILVER
KIAROSTAMI'S "10"
TONIGHT
TONIGHT

Romano's
Macaroni
GRILL

Discovery
COMMUNICATIONS
Potbe
SANDWICH

Reality Check

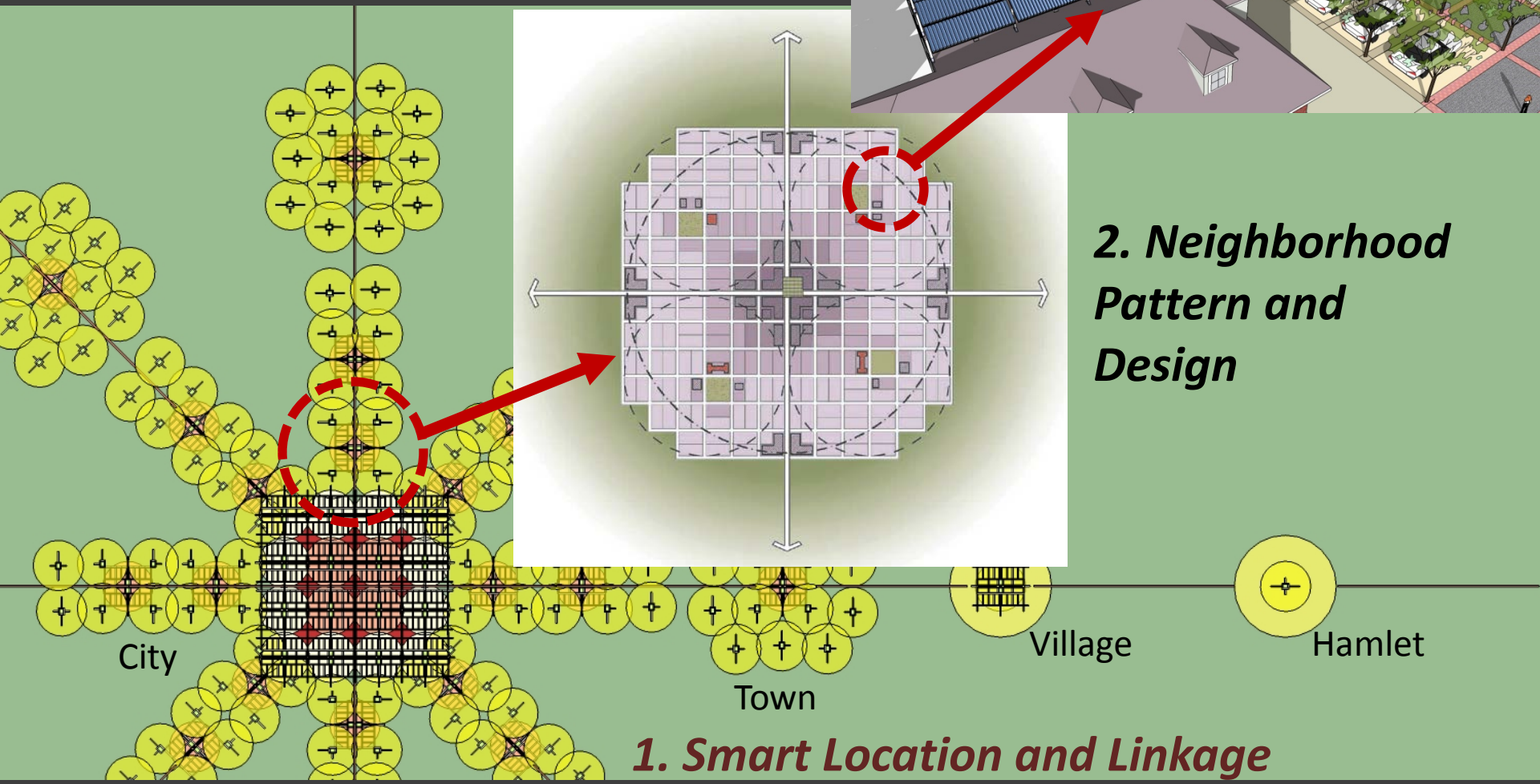


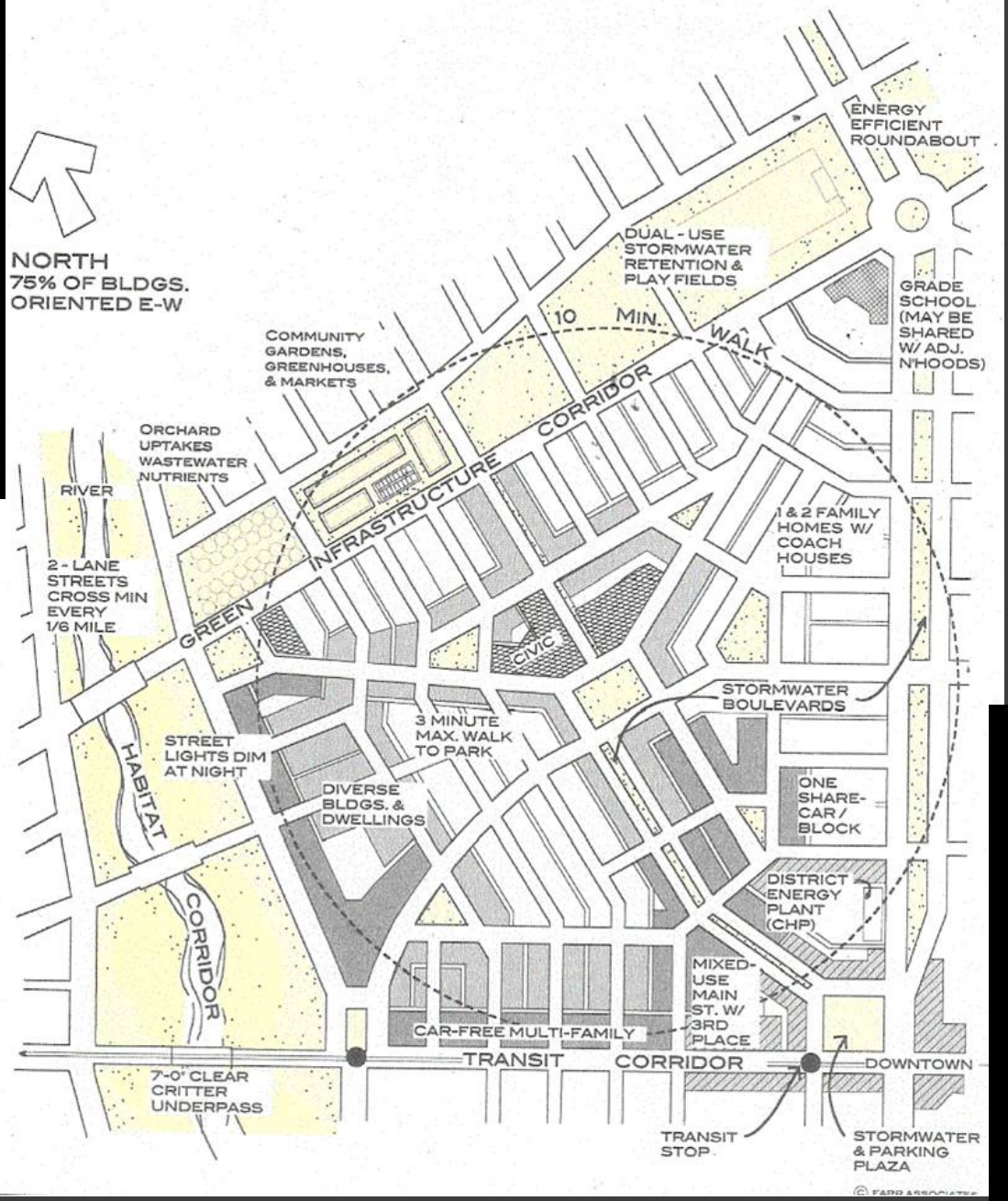
Rockville, Maryland

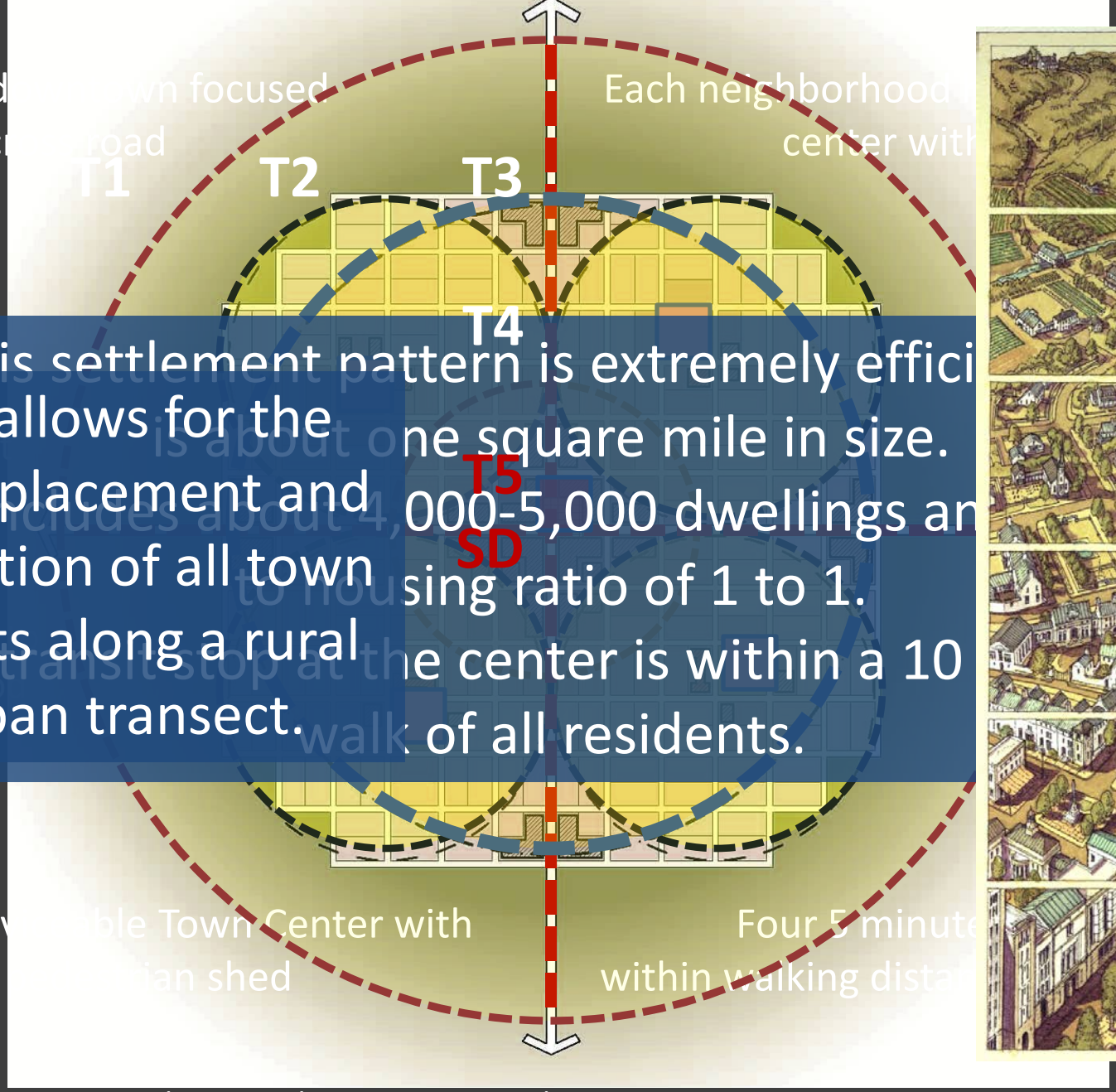
1. *Conventional office park development*
2. *New mixed-use and live-work buildings with interior structured parking shaded by overhead arbors; light rail*
3. *Green roofs on selected buildings including community garden*
4. *More parking arbors; sound wall with solar panels and wind turbines*

UrbanAdvantage

Scale and Organization

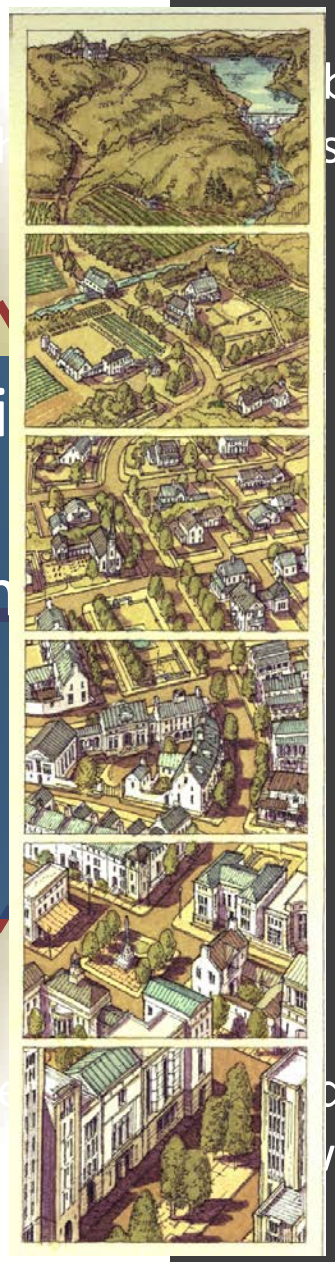



NORTH
75% OF BLDGS.
ORIENTED E-W
ENERGY EFFICIENT ROUNDABOUT
DUAL - USE STORMWATER RETENTION & PLAY FIELDS
GRADE SCHOOL (MAY BE SHARED W/ ADJ. N'HOODS)
10 MIN. WALK
COMMUNITY GARDENS, GREENHOUSES, & MARKETS
GREEN INFRASTRUCTURE CORRIDOR
ORCHARD UPTAKES WASTEWATER NUTRIENTS
RIVER
2 - LANE STREETS CROSS MIN EVERY 1/6 MILE
1 & 2 FAMILY HOMES W/ COACH HOUSES
CIVIC
STORMWATER BOULEVARDS
3 MINUTE MAX. WALK TO PARK
STREET LIGHTS DIM AT NIGHT
HABITAT CORRIDOR
DIVERSE BLDGS. & DWELLINGS
ONE SHARE-CAR / BLOCK
DISTRICT ENERGY PLANT (CHP)
MIXED-USE MAIN ST. W/ 3RD PLACE
CAR-FREE MULTI-FAMILY
TRANSIT CORRIDOR
DOWNTOWN
7'-0" CLEAR CRITTER UNDERPASS
TRANSIT STOP
STORMWATER & PARKING PLAZA

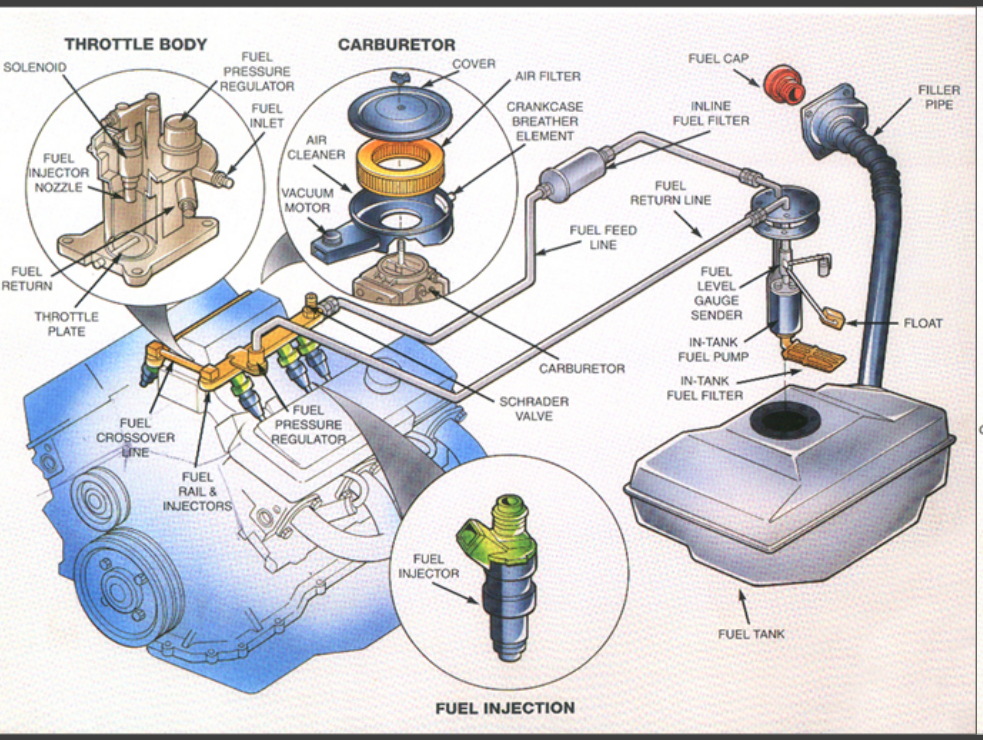


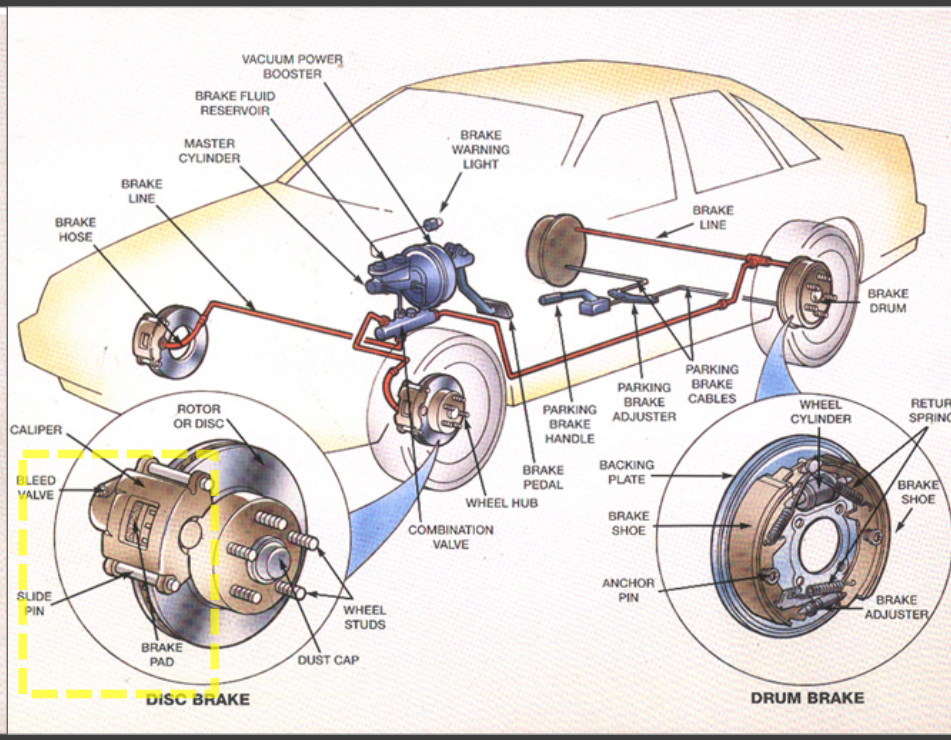
This settlement pattern is extremely effici
ne square mile in size.
000-5,000 dwellings an
sing ratio of 1 to 1.
e center is within a 10
of all residents.

And it allows for the rational placement and organization of all town elements along a rural to urban transect.



Systems


THROTTLE BODY
SOLENOID
FUEL PRESSURE REGULATOR
FUEL INLET
FUEL INJECTOR NOZZLE
FUEL RETURN
THROTTLE PLATE
CARBURETOR
COVER
AIR FILTER
CRANKCASE BREATHER ELEMENT
AIR CLEANER
VACUUM MOTOR
FUEL CAP
FILLER PIPE
INLINE FUEL FILTER
FUEL RETURN LINE
FUEL FEED LINE
FUEL LEVEL GAUGE SENDER
FLOAT
IN-TANK FUEL PUMP
IN-TANK FUEL FILTER
CARBURETOR
SCHRADER VALVE
FUEL CROSSOVER LINE
FUEL PRESSURE REGULATOR
FUEL RAIL & INJECTORS
FUEL INJECTOR
FUEL TANK
FUEL INJECTION


VACUUM POWER BOOSTER
BRAKE FLUID RESERVOIR
MASTER CYLINDER
BRAKE WARNING LIGHT
BRAKE LINE
BRAKE HOSE
BRAKE LINE
BRAKE DRUM
PARKING BRAKE ADJUSTER
PARKING BRAKE CABLES
PARKING BRAKE HANDLE
BRAKE PEDAL
WHEEL HUB
COMBINATION VALVE
CALIPER
ROTOR OR DISC
BLEED VALVE
SLIDE PIN
BRAKE PAD
DUST CAP
WHEEL STUDS
DISC BRAKE
WHEEL CYLINDER
RETURN SPRING
BACKING PLATE
BRAKE SHOE
BRAKE SHOE
ANCHOR PIN
BRAKE ADJUSTER
DRUM BRAKE

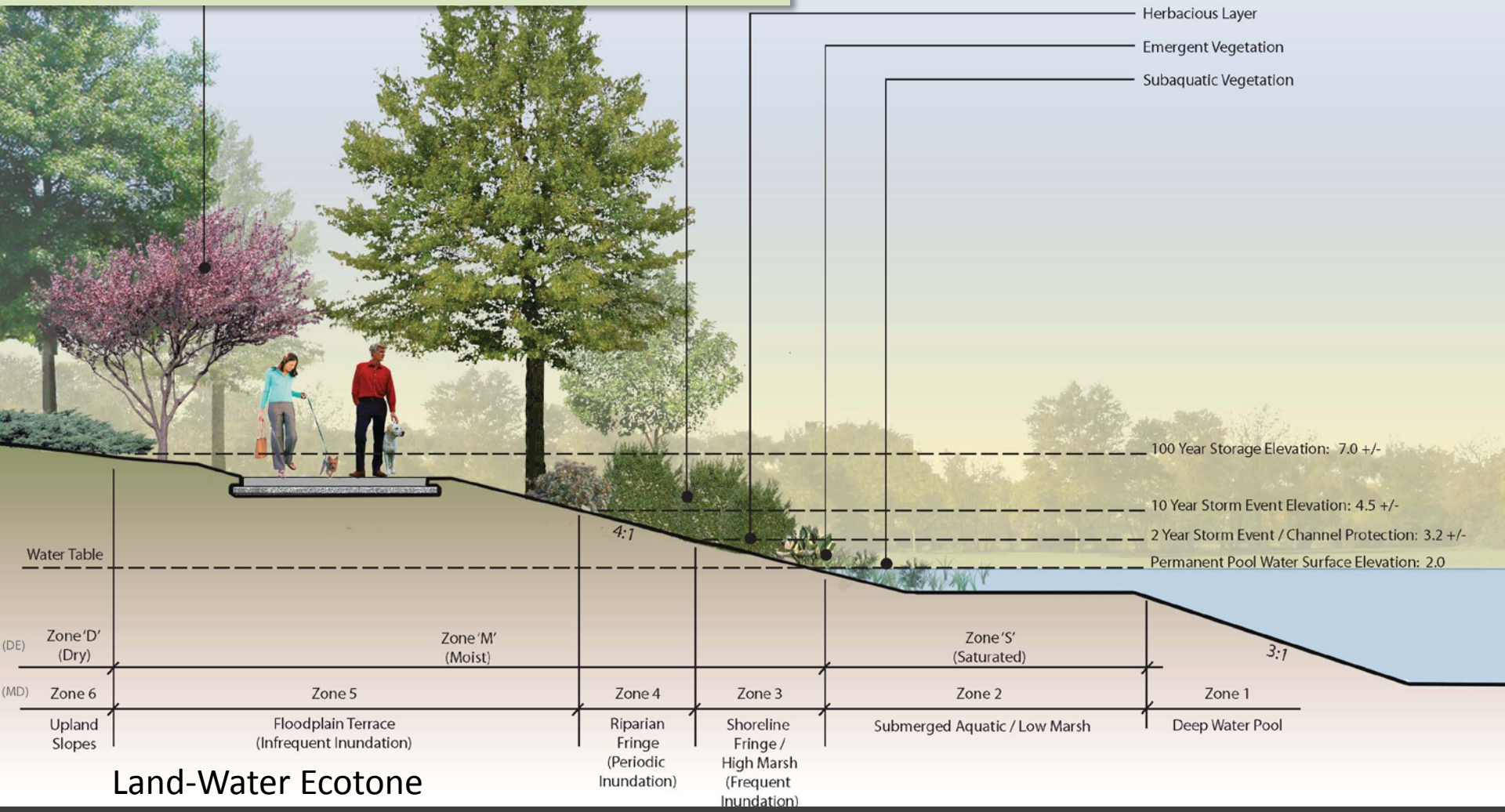
Complete Town Planning

Tool Kit Menu – Smart Locations & Linkages

System

Water

Natural Filtering Media



Land-Water Ecotone

Plants as filters

Efficiency: Applying the Right Practice

- Land Usage (Space Efficiency)
- Available Options
- Cost, Initial and Ongoing
- Treatment Efficiency
- Applicability to the Urban Context
- Visual Quality (Beauty)

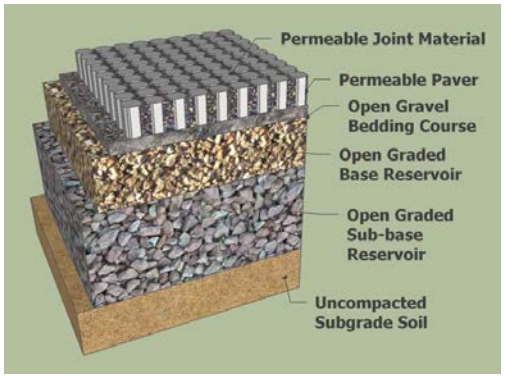
Source: Environmental Services, San Mateo County, CA and Nevue-Ngan Associates

ESD Menu – Alternative Surfaces

Initial Costs per Impervious Acre Treated

20 Year Life Cycle Cost per Impervious Acre Treated

Initial Cost of Cubic Foot Treated



$146,000 to ?/ac
$164,000 to ?/ac
$110 to $220/cf

Source: Chesapeake Stormwater and American Wick Drain Corp.

$150,000 to $335,000/ac
$283,000 to $396,000/ac
$80 to $160/cf (P. Pavers)
$32 to $51/cf (P. Conc.)
$28 to $45/cf (P. Asphalt)
$29 to $35/cf (P. Sidewalk)

Source: Nevue Ngan Associates

$x to $x
$x to $x
$x

Source: Invisible Structures, Inc. and Terrafirm Enterprises

A-1

Green Roofs

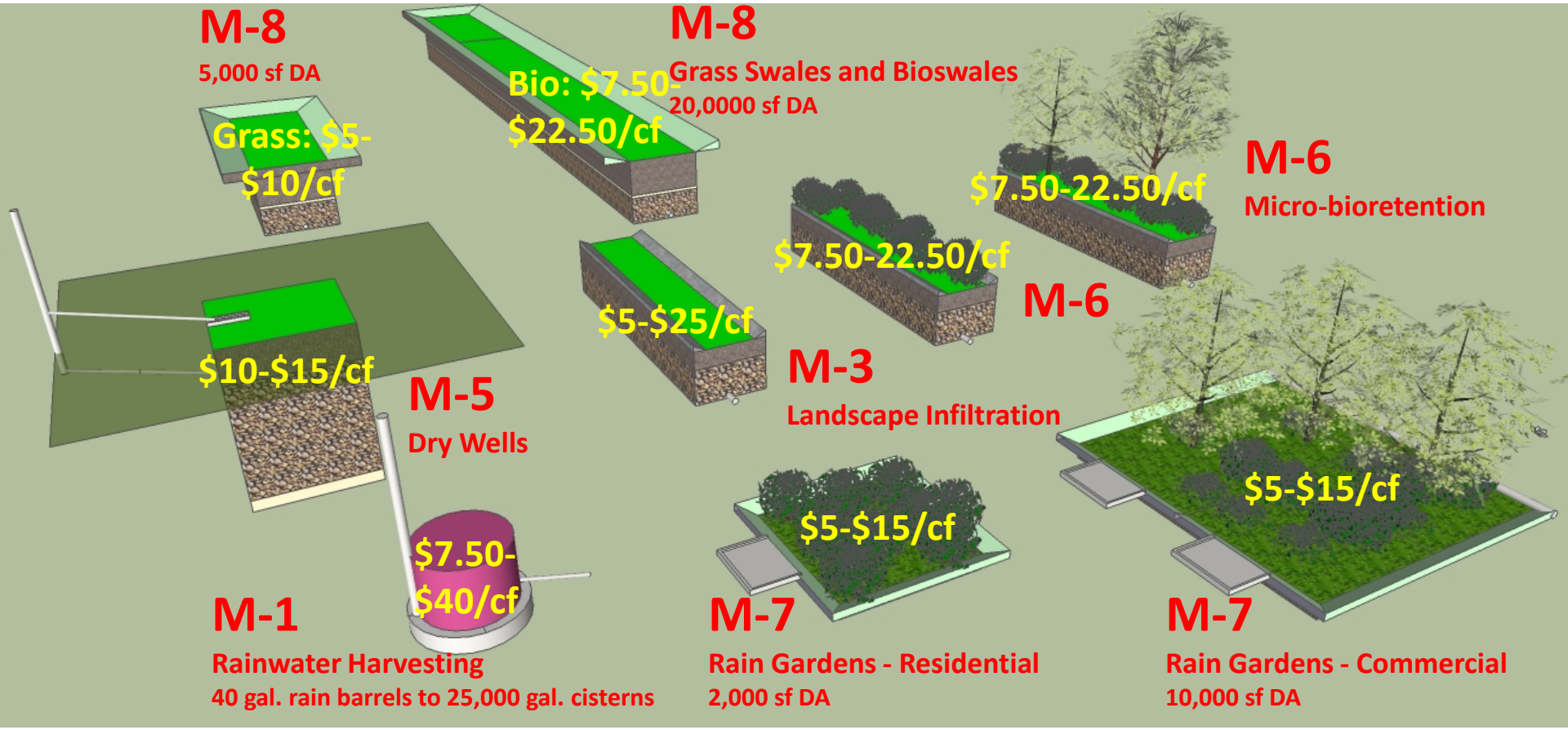
A-2

Permeable Concrete, Permeable Asphalt and Interlocking Pavers

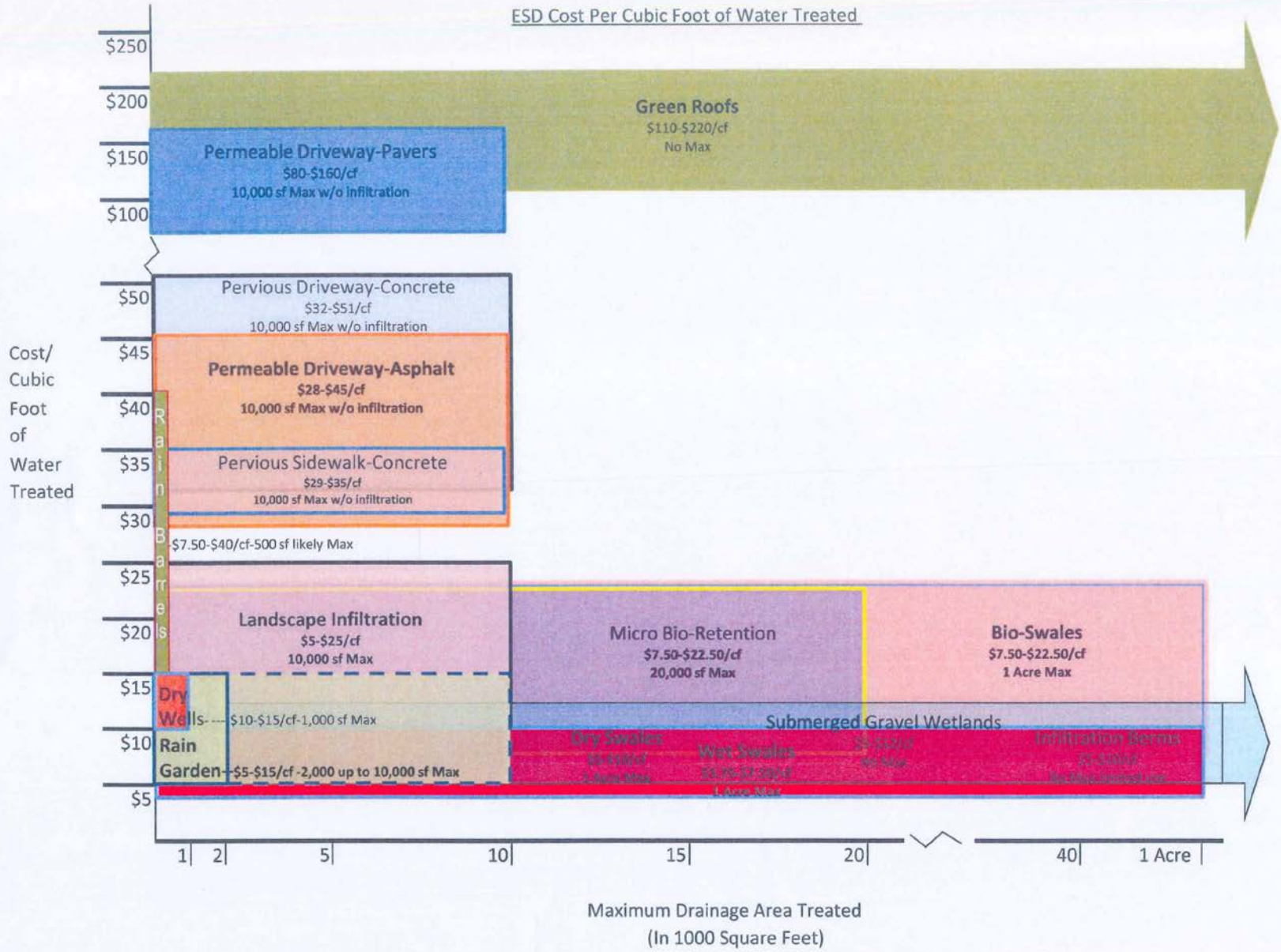
A-3

Reinforced Turf

ESD Menu – Micro Practices



Not shown: M-2 Submerged Gravel Wetlands ($3.75-$22.50/cf, M-4 Infiltration Berm ($5-$10), M-8 Wet Swales ($3.75-$7.50).



Note: The Home Builders Association of Maryland (HBAM) and the panelist of presenters obtained the information presented and distributed in this seminar from multiple sources both within and outside of Maryland. This information should therefore be used as a reference guide only. In addition, the County information presented is subject to change.

Table: Executive Summary-1 (ES-1)

Table ES-1. Summary Unit Planning Level Stormwater Cost Estimates Per Impervious Acre Treated

Stormwater Management Practice	Pre-Construction Costs[1]	Construction Costs[2]	Land Costs[3]	Total Initial Costs	Total Post-Construction Costs[4]	Total Costs over 20 Years	Average Annual Costs over 20 Years
Impervious Urban Surface Reduction	$ 8,750	$ 87,500	$ 50,000	$ 146,250	$ 885	$ 163,957	$ 8,198
Urban Forest Buffers	$ 3,000	$ 30,000	$ -	$ 33,000	$ 1,210	$ 57,207	$ 2,860
Urban Grass Buffers	$ 2,150	$ 21,500	$ -	$ 23,650	$ 870	$ 41,057	$ 2,053
Urban Tree Planting	$ 3,000	$ 30,000	$ 150,000	$ 183,000	$ 1,210	$ 207,207	$ 10,360
Wet Ponds and Wetlands (New)	$ 5,565	$ 18,550	$ 2,000	$ 26,115	$ 763	$ 41,368	$ 2,068
Wet Ponds and Wetlands (Retrofit)	$ 21,333	$ 42,665	$ 2,000	$ 65,998	$ 763	$ 81,251	$ 4,063
Dry Detention Ponds (New)	$ 9,000	$ 30,000	$ 5,000	$ 44,000	$ 1,231	$ 68,620	$ 3,431
Hydrodynamic Structures (New)	$ 7,000	$ 35,000	$ -	$ 42,000	$ 3,531	$ 112,620	$ 5,631
Dry Extended Detention Ponds (New)	$ 9,000	$ 30,000	$ 5,000	$ 44,000	$ 1,231	$ 68,620	$ 3,431
Dry Extended Detention Ponds (Retrofit)	$ 22,500	$ 45,000	$ 5,000	$ 72,500	$ 1,231	$ 97,120	$ 4,856
Infiltration Practices w/o Sand, Veg. (New)	$ 16,700	$ 41,750	$ 5,000	$ 63,450	$ 866	$ 80,770	$ 4,039
Infiltration Practices w/ Sand, Veg. (New)	$ 17,500	$ 43,750	$ 5,000	$ 66,250	$ 906	$ 84,370	$ 4,219
Filtering Practices (Sand, above ground)	$ 14,000	$ 35,000	$ 5,000	$ 54,000	$ 1,431	$ 82,620	$ 4,131
Filtering Practices (Sand, below ground)	$ 16,000	$ 40,000	$ -	$ 56,000	$ 1,631	$ 88,620	$ 4,431
Erosion and Sediment Control	$ 6,000	$ 20,000	$ -	$ 26,000	$ 10	$ 26,207	$ 1,310
Urban Nutrient Management[5]	$ -	$ 61,000	$ -	$ 61,000	$ 31	$ 61,620	$ 3,081
Street Sweeping[6]	$ -	$ 6,049	$ -	$ 6,049	$ 451	$ 15,079	$ 754
Urban Stream Restoration	$ 21,500	$ 43,000	$ -	$ 64,500	$ 891	$ 82,320	$ 4,116
Bioretention (New - Suburban)	$ 9,375	$ 37,500	$ 3,000	$ 49,875	$ 1,531	$ 80,495	$ 4,025
Bioretention (Retrofit - Highly Urban)	$ 52,500	$ 131,250	$ 3,000	$ 186,750	$ 1,531	$ 217,370	$ 10,869
Vegetated Open Channels	$ 4,000	$ 20,000	$ 2,000	$ 26,000	$ 610	$ 38,207	$ 1,910
Bioswale (New)	$ 12,000	$ 30,000	$ 2,000	$ 44,000	$ 931	$ 62,620	$ 3,131
Permeable Pavement w/o Sand, Veg. (New)	$ 21,780	$ 217,800	$ -	$ 239,580	$ 2,188	$ 283,347	$ 14,167
Permeable Pavement w/ Sand, Veg. (New)	$ 30,492	$ 304,920	$ -	$ 335,412	$ 3,060	$ 396,603	$ 19,830

[1] Includes cost of site discovery, surveying, design, planning, permitting, etc. which, for various BMPs tend to range from 10% to 40% of BMP construction costs.

[2] Includes capital, labor, material and overhead costs, but not land costs, associated implementation; for street sweeping includes only capital cost of mechanical sweeper. Nutrient management construction costs refer to the cost of an outreach campaign, not to any construction costs.

[3] For all stormwater BMPs that require land it is assumed that: 1) the opportunity cost of developable land is $100,000 per acre and 2) 50% of projects that require land take place on developable land with the rest taking place on land that is not developable. This brings the opportunity cost of land for stormwater BMPs that require land to $50,000 per acre. Actual county-specific land cost and percent developable land values can be filled in.
NOTE: The area of some BMPs may be significantly less than the impervious area treated.

[4] Combined annual operating, implementation, and maintenance costs.

[5] Best available data indicate that "retail" (i.e., direct mail) public outreach campaigns cost about $15 per household contacted. For an illustrative county, we assumed that each household has 5,941 sq ft of turf and 2,406 sq ft of impervious cover (medium density development). This means that 7.33 households need to adopt this BMP to potentially result in an acre of turf being treated, at a cost $109.98 per turf acre. Based on a review of direct mail response rates, we assumed that 2% of households contacted will respond positively to this outreach effort, bringing the cost per turf acre treated to $5,497.50/acre. The equivalent on a per-impervious-acre was based on the MDE June 2011 stormwater guidance document, which provides an equivalent for this practice of .09 acres impervious area per one acre of this practice. This estimate does not include any additional costs for soil tests by the homeowner to determine the appropriate amount of fertilizer required.

[6] Capital acquisition cost per impervious acre treated.

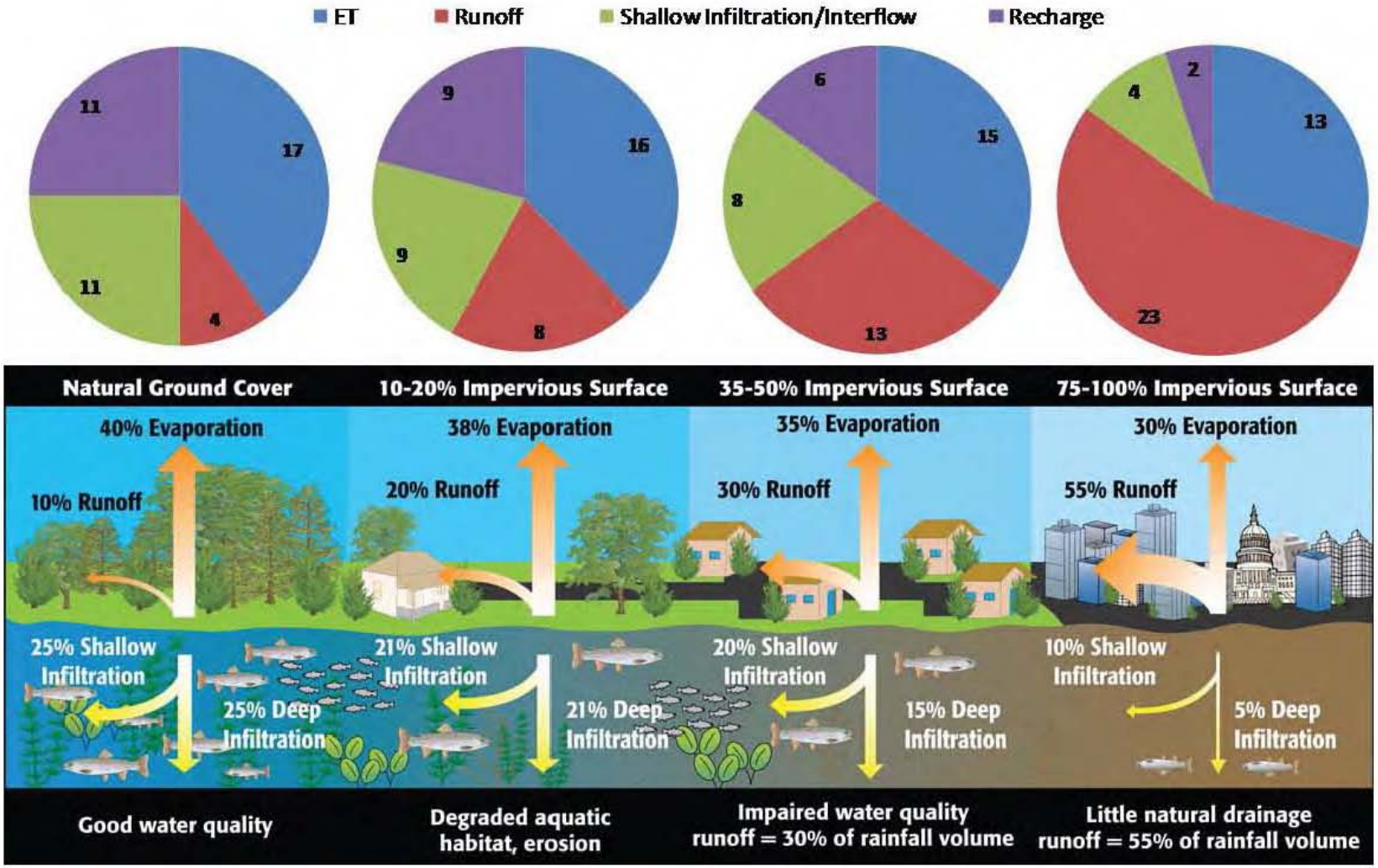


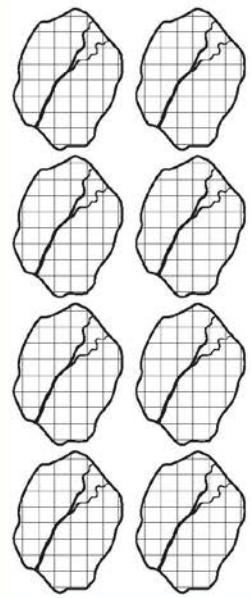
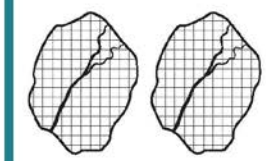
Figure 12.5. Virginia average annual water budget with urbanization. *Source: Potomac Conservancy 2008.*

12-4 *Urban Nutrient Management Handbook*

Source: Virginia Department of Conservation and Recreation

How Does Density Relate to Runoff? The Watershed Level

Housing density also affects the number of acres required to accommodate growth. At the site level, most regional and watershed managers are facing household growth estimates of several thousand units. By limiting housing production to one unit/acre, growth pressures do not cease, but rather growth goes elsewhere in the watershed, or expands to additional watersheds. Here, the higher-density scenarios consume fewer watersheds to accommodate the same number of houses. A fuller discussion of density and build-out is presented in EPA's 2005 document *Protecting Water Resources with Higher-Density Development*.

Scenario A	Scenario B	Scenario C
		
At one house per acre, 80,000 houses require 80,000 acres, or *8 watersheds*, translating to:	At four houses per acre, 80,000 houses require 20,000 acres, or *2 watersheds*, translating to:	At eight houses per acre, 80,000 houses require 10,000 acres, or *1 watershed*, translating to:
80,000 acres x 1 house x 18,700 ft^3 /yr of runoff	20,000 acres x 4 houses x 6,200 ft^3 /yr of runoff	10,000 acres x 8 houses x 4,950 ft^3 /yr of runoff
1.496 billion ft^3 /yr of stormwater runoff	**496 million ft^3 /yr of stormwater runoff**	**396 million ft^3 /yr of stormwater runoff**
8 watersheds at 20 percent impervious cover	**2 watersheds at 38 percent impervious cover**	**1 watershed at 65 percent impervious cover**

1/ Regional Planning:

1. Reduce and minimize imperviousness at the watershed level by targeting and redirecting growth.
2. Identify and preserve critical ecological areas and contiguous open spaces.
3. Maximize the use of existing infrastructure and previously developed sites.
4. Rethink the region with place type organization vs. sprawl.

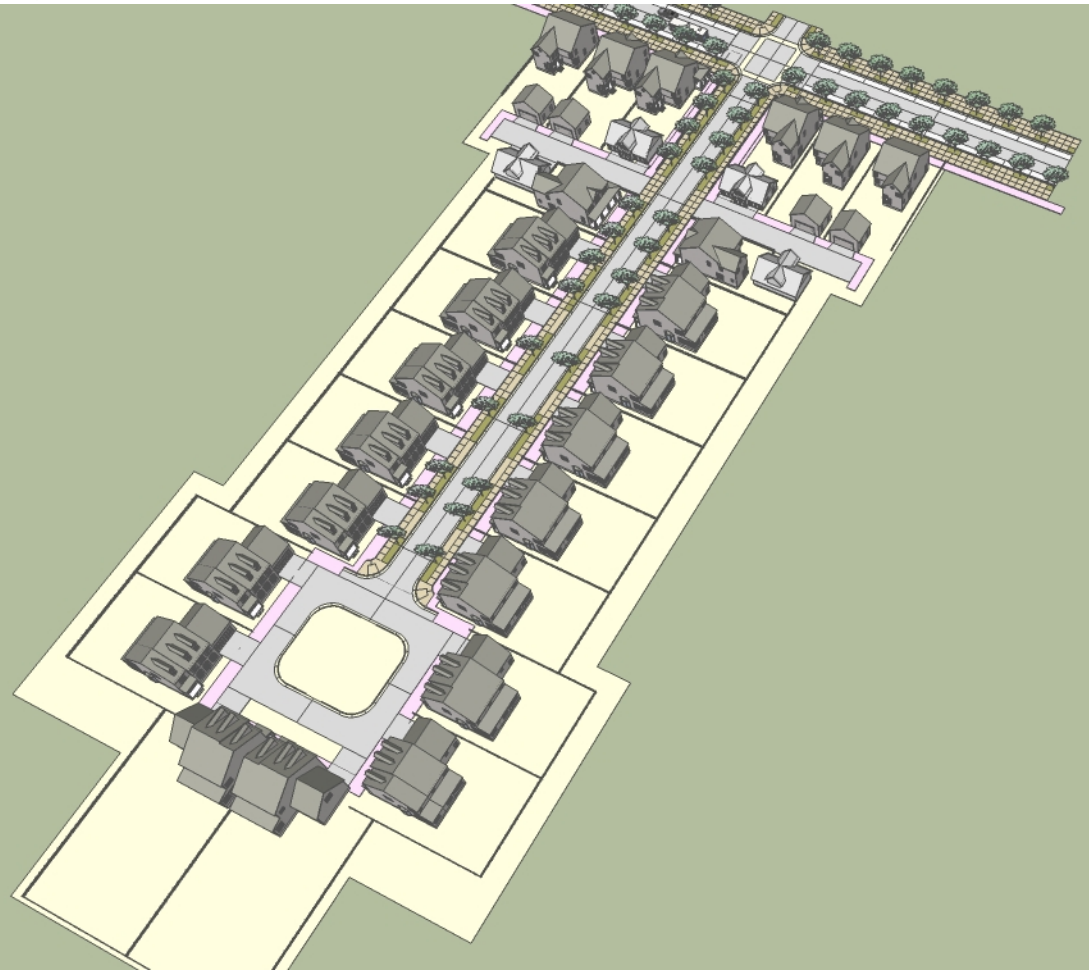
Site Area:	5.6 acres
Imp. Area:	3.0 acres
Soils:	C
Existing Imp.:	0%
Proposed Imp.:	53.8%

Single Family Detached T4
2 Story
Alley Loaded

Yield:	24 du + 4 adu
Density:	5.7 du / ac
Parking:	
- Off Street:	1.9 per du
- On Street:	1.9 per du
Construction:	Type V
Soils:	C
Existing Imp.:	0%
Proposed Imp.:	53.8%
Rainfall Depth:	1 inch
Pre-dev. RCN:	70
Targets:	
- Pe	1.8 inches
- ESDv:	19,530 cf
- WQv:	10,850 cf
- REv:	1,411 cf
- P Reduction:	4.80 lbs/yr

Site Area:	5.6 acres
Imp. Area:	2.3 acres (0.7 ac less impervious)
Soils:	C
Existing Imp.:	0%
Proposed Imp.:	41.1% (30% less impervious)

Single Family Detached T4
2 Story
Front Load



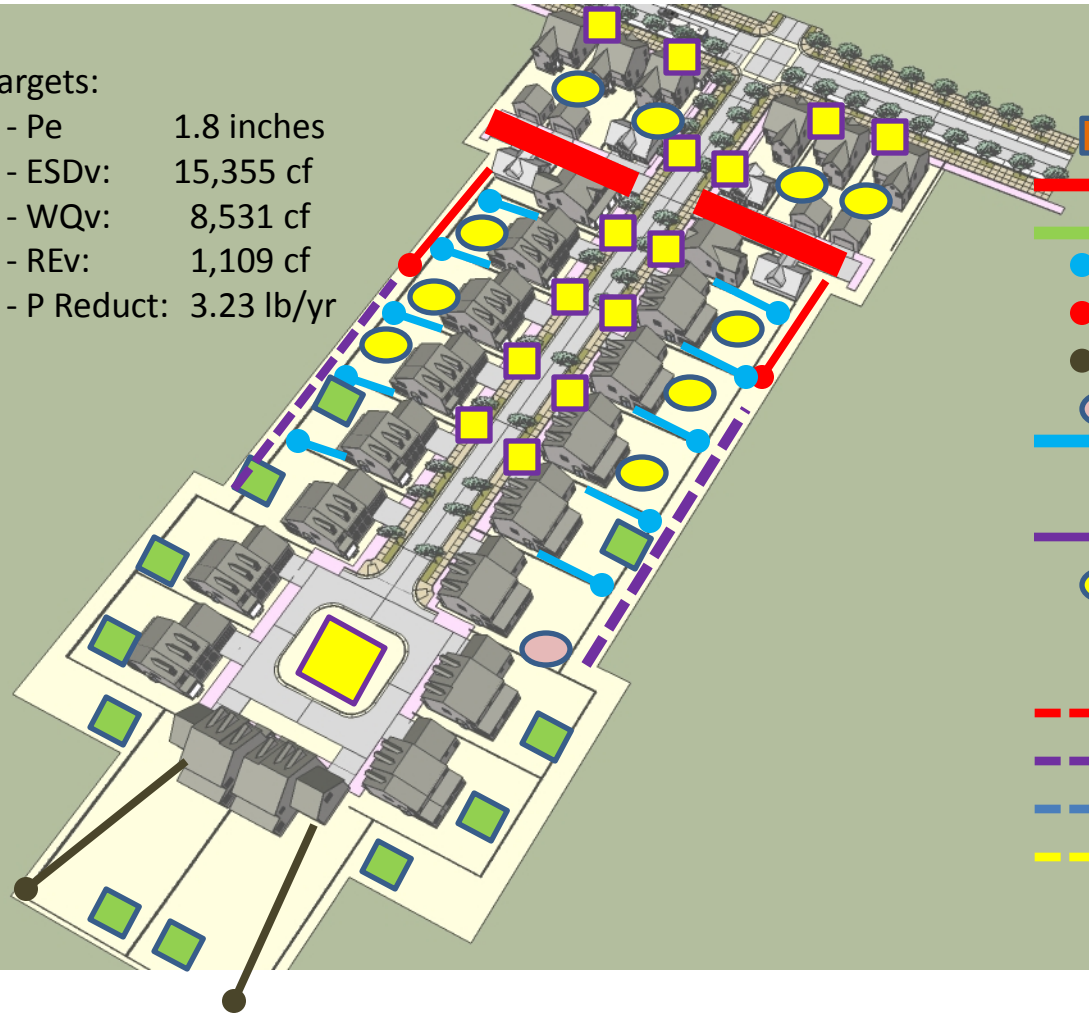
Yield:	24 du + 4 adu
Density:	5.7 du / ac
Parking:	
- Off Street:	2.5 per du
- On Street:	0.4 per du
Construction:	Type V
Soils:	C
Existing Imp.:	0%
Proposed Imp.:	41.37%
Rainfall Depth:	1 inch
Pre-dev. RCN:	70
Targets:	
- Pe	1.8 inches
- ESDv:	15,414 cf
- WQv:	8,531 cf
- REv:	1,109 cf
- P Reduction:	3.23 lbs/yr

Site Area:	5.6 acres
Imp. Area:	2.3 acres
Soils:	C
Existing Imp.:	0%
Proposed Imp.:	41.1%

Single Family Detached T4
2 Story
Front Load

Targets:

- Pe	1.8 inches
- ESDv:	15,355 cf
- WQv:	8,531 cf
- REv:	1,109 cf
- P Reduct:	3.23 lb/yr



ESD Menu:	DA (ac)	No.
A-1: Green Roof:	---	
A-2: Perm. Pavement:	0.3	2
A-3: Reinforced. Turf:	---	
N-1: Roof Disconnect.:	0.6	
N-2: Non-Roof Disconnect:	0.15	2
N-3: Sheet Flow to Cons.:	0.2	
M-1: Rainwater Harvest:	0.1	1
M-2: Sub. Gravel Wetland:	---	
M-3: Landscape Infiltration:	---	
M-4: Infiltration Berm:	---	
M-5: Dry Wells:	0.4	10
M-6: Micro-Bioretention:	1.0	15
M-7: Rain Gardens:	0.52	11
M-8: Grass Swales:	---	
M-8: Bio Swales:	0.4	2
M-8: Wet Swales:	---	
M-9: Enhanced Filter Strips:	---	
Equiv. Treatment/Practices:	3.0	43

Recommendation

1

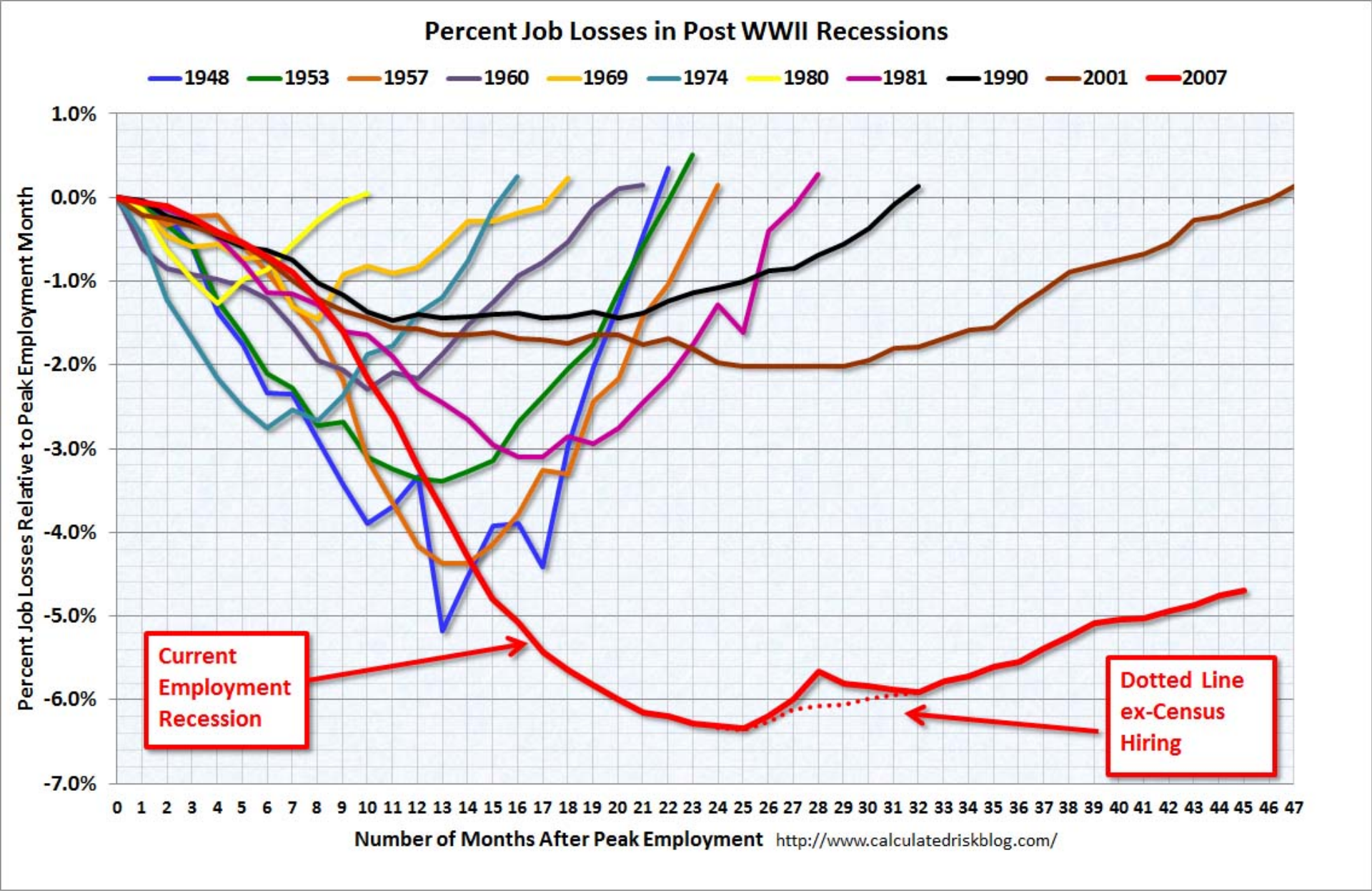
*Solve pollutant and sediment loading on a **watershed**, rather than a site basis.*

Action Item 1:
Have variable ESD criteria based on a project's location in the watershed, type of use and whether it reinforces and/or meets Smart Growth goals.

Action Item 2:
Provide a sliding scale of imperviousness.

Action Item 3:
Incentivize density. Measure results on a per capita, rather than per acre basis.

Action Item 4:
Identify rural and urban solutions simultaneously.


Percent Job Losses in Post WWII Recessions
1948
1953
1957
1960
1969
1974
1980
1981
1990
2001
2007
1.0%
0.0%
-1.0%
-2.0%
-3.0%
-4.0%
-5.0%
-6.0%
-7.0%
Percent Job Losses Relative to Peak Employment Month
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
Number of Months After Peak Employment
http://www.calculatedriskblog.com/
Current Employment Recession
Dotted Line ex-Census Hiring

Recommendation

2

*Be pro-active, have a **strategic plan** and design manual in place before the onslaught of new projects.*

Action Item 1:
Identify sites for ESD implementation. Allow mitigation 'off-site' for Smart Growth projects.

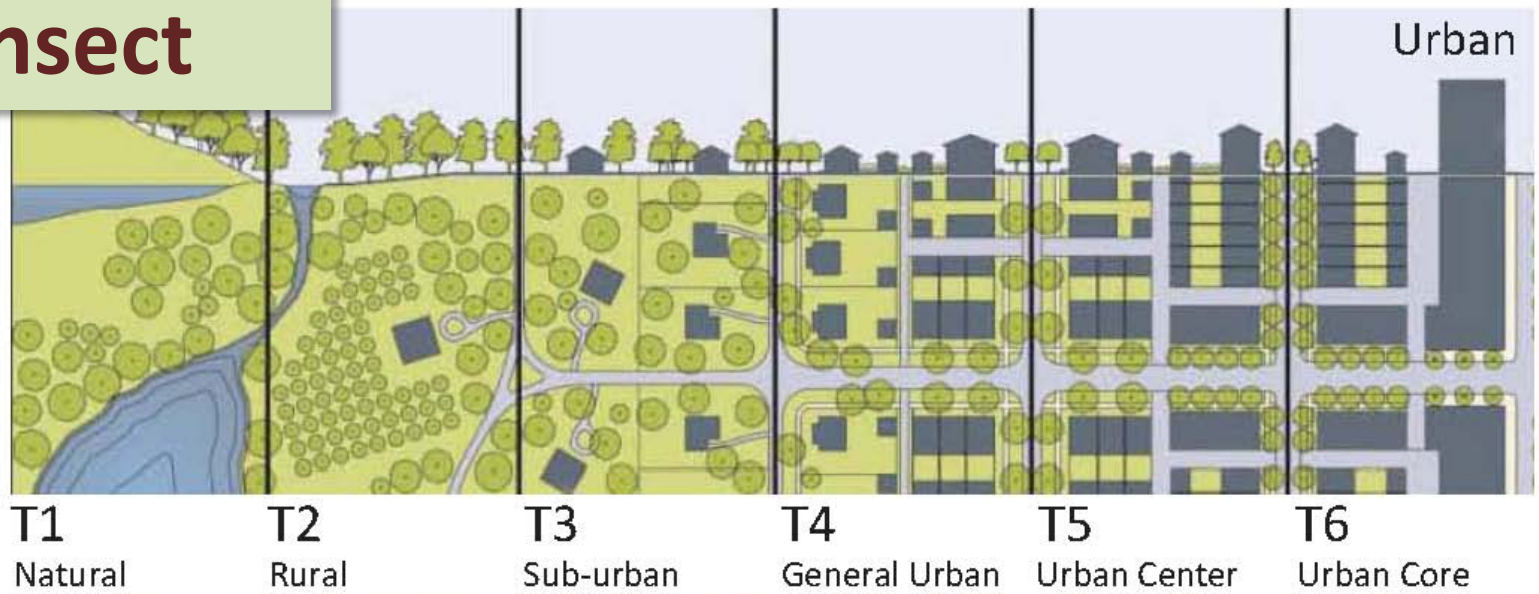
Action Item 2:
Define the MEP trigger. Don't leave it up to the applicant to 'prove the negative'.

Action Item 3:
Reduce the 'top-down' decision tree. All sustainability is ultimately local. Guide from the top down, solve from the bottom up.

Table 2: Best Management Practices and Development Context

BMP Strategies	Urban/High Density Settings	Suburban/ Urbanizing Areas	Rural and Conservation Areas
Strategies for individual buildings and building sites	Bio-infiltration cells, rooftop rain capture and storage, green roofs, downspout disconnection in older residential neighborhoods, programs to reduce lawn compaction, stormwater inlet improvements	Disconnecting downspouts, green roofs, programs to reduce lawn compaction, bio-infiltration cells, rooftop rain capture and storage	Green roofs, housing and site designs that minimize soil disruption
Low impact development (LID) or better site design strategies	Ultra-urban LID strategies: high-performing landscape areas, retrofitting urban parks for stormwater management, micro-dentention areas, urban forestry and tree canopy, green retrofits for streets	Swales, infiltration trenches, micro-detention for infill projects, some conservation design, retrofitting of parking lots for stormwater control or infill, tree canopy, green retrofits for streets. Depending on location, larger scale infiltration.	Large scale LID: forest protection, source water protection, water protection overlay zoning, conservation, aquifer protection, stormwater wetlands
Infrastructure	Better use of gray infrastructure: repair and expansion of existing pipes, installation of stormwater treatment, fix it first policies, improve street and facilities maintenance	Priority funding areas to direct development, better street design, infrastructure planning to incentivize smart growth development, improve street and facilities maintenance	Smart growth planning for rural communities using onsite systems
Structural BMPs	Commercially available stormwater control devices, urban drainage basins, repair of traditional gray infrastructure	Rain barrels, bio-infiltration techniques, constructed wetlands	
Design strategies	Transit districts, parking reduction, infill, improved use of curbside parking and rights of way, brownfields, urban stream clean-up and buffers, receiving areas for transfer of development rights	Infill, greyfields redevelopment, parking reduction, policies to foster a connected street system, open space and conservation design and rural planning, some impervious surface restrictions, stream restoration and buffers, targeted receiving areas for transfer of development, planned unit developments	Regional planning, use of anti-degradation provision of Clean Water Act, sending areas for transfer of development, watershed wide impervious surface limits, water protection overlay zoning districts
Watershed-wide or regional strategies	Transfer of development rights, waterfront restoration, participation in regional stormwater management planning/infrastructure	Regional park and open space planning, linking new transit investments to regional system, participation in regional stormwater management planning/infrastructure	Regional planning, use of anti-degradation provision of Clean Water Act, sending areas for transfer of development, watershed wide impervious surface limits, water protection overlay zoning districts, water supply planning and land acquisition

Transect

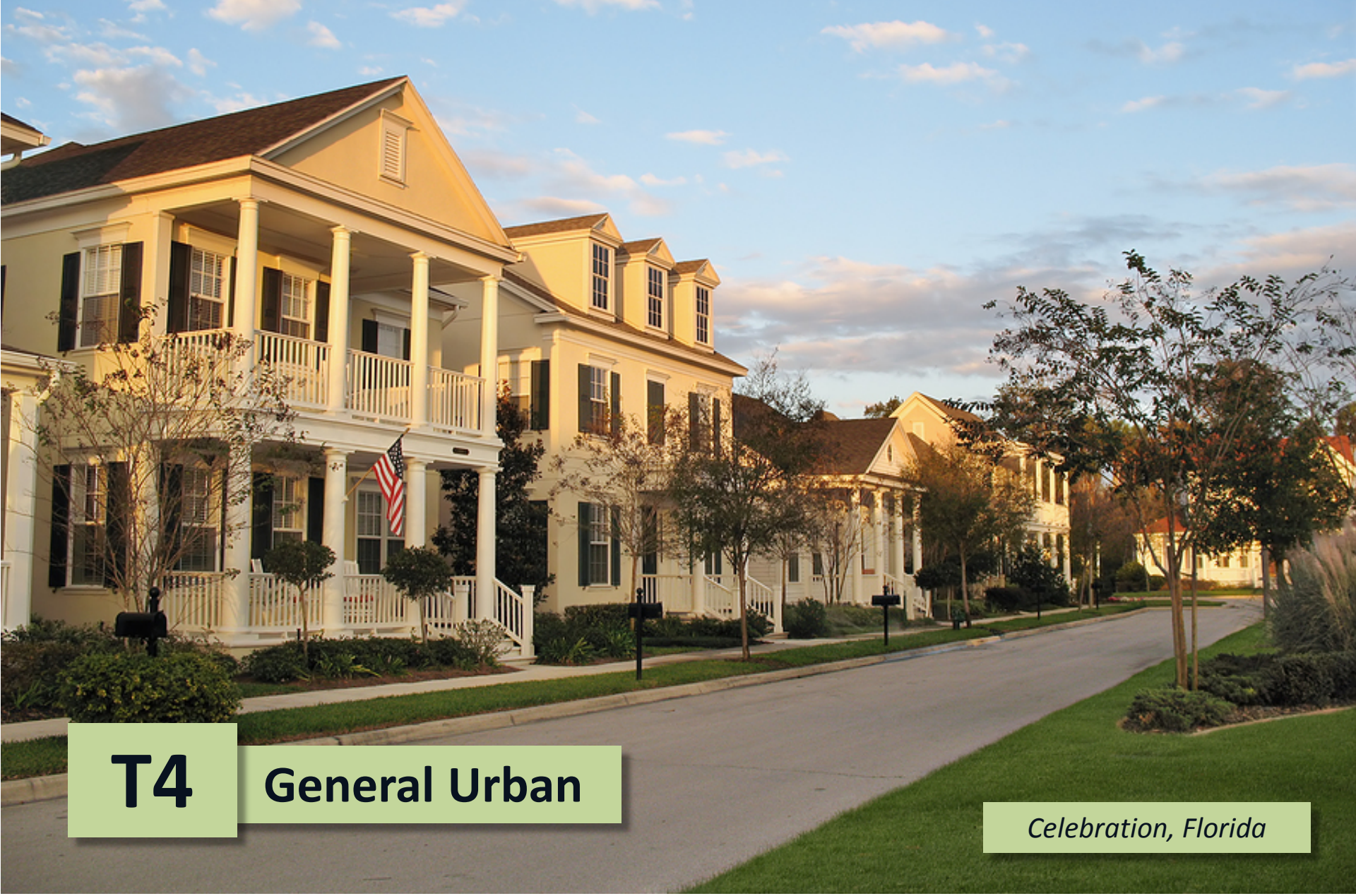

Urban
T1
Natural
T2
Rural
T3
Sub-urban
T4
General Urban
T5
Urban Center
T6
Urban Core

T1 Natural

T2
Rural

T3 Sub-Urban

Sandy Spring, Maryland



T4 General Urban

Celebration, Florida

T5 Urban Center

Charleston, South Carolina

T6 Urban Core

Baltimore, Maryland

Source: Duany Plater-Zyberk & Company

T1	T2	T3	T4	T5	T6
Natural	Rural	Sub-urban	General Urban	Urban Center	Urban Core

0 to 5%	5 to 40%	25 to 65%	45 to 85%	65 to 95%

Percent Impervious

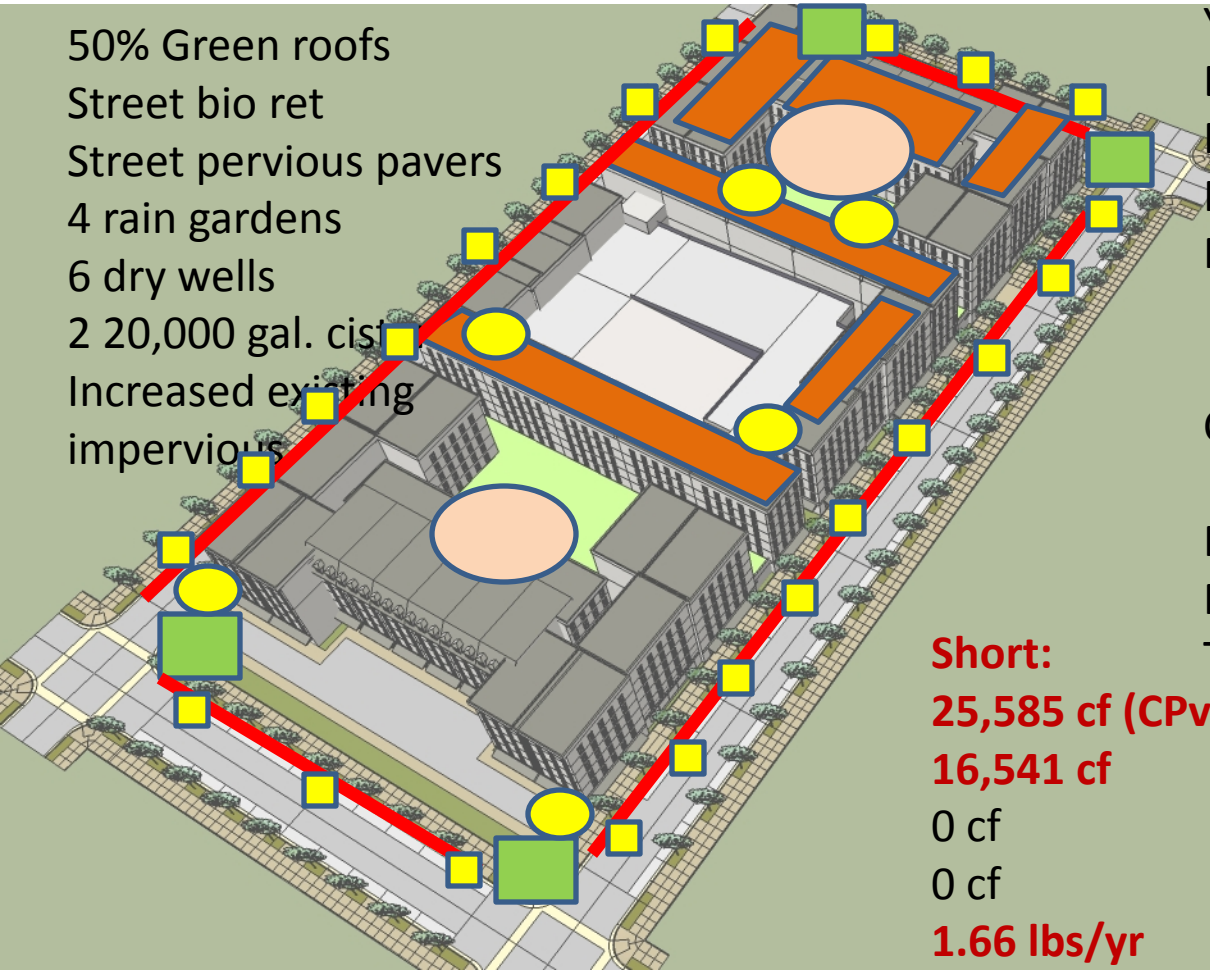
High: <10%	Marginal: <30%	Degraded: >30%

Watershed Performance

Site Area:	5.6 acres
Imp. Area:	4.8 acres (1.2 ac additional imper.)
Soils:	C
Existing Imp.:	**39%**
Proposed Imp.:	85.5% (22% more impervious)

T5 Mixed Use
5 Story over Concrete Podium
TOD / Structured Parking

50% Green roofs
Street bio ret
Street pervious pavers
4 rain gardens
6 dry wells
2 20,000 gal. cist
Increased existing impervious



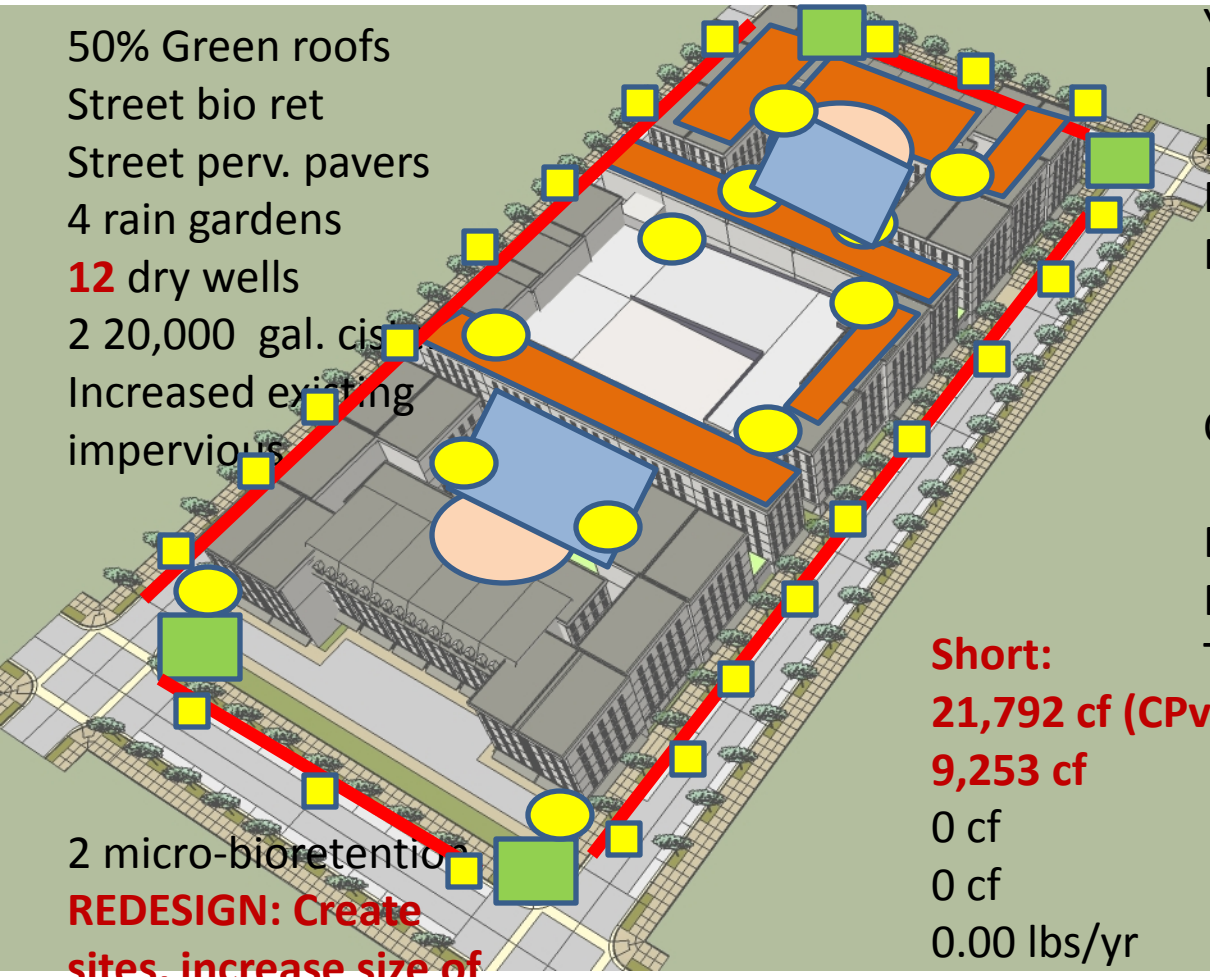
Yield:	432 du
Density:	77 du / ac
Non-Res:	39,500 sf
FAR:	1.8
Parking:	
- Total:	510
- Resid. Ratio:	1.0 per du
Construction:	Type III
Rainfall Depth:	1 inch
Pre-dev. RCN:	70
Targets:	
- Pe	2.0 inches
- ESDv:	33,265 cf
- WQv:	16,663 cf
- REv:	2,162 cf
- P Reduction:	**6.28** lbs/yr

Short:	
25,585 cf (CPv)	
16,541 cf	
0 cf	
0 cf	
1.66 lbs/yr	

Site Area:	5.6 acres
Imp. Area:	**4.5 acres (0.9 ac additional imper.)**
Soils:	C
Existing Imp.:	**39%**
Proposed Imp.:	**80.0% (18% more impervious)**

T5 Mixed Use
5 Story over Concrete Podium
TOD / Structured Parking

50% Green roofs
Street bio ret
Street perv. pavers
4 rain gardens
12 dry wells
2 20,000 gal. cis
Increased existing impervious



2 micro-bioretention
REDESIGN: Create sites, increase size of parking structure

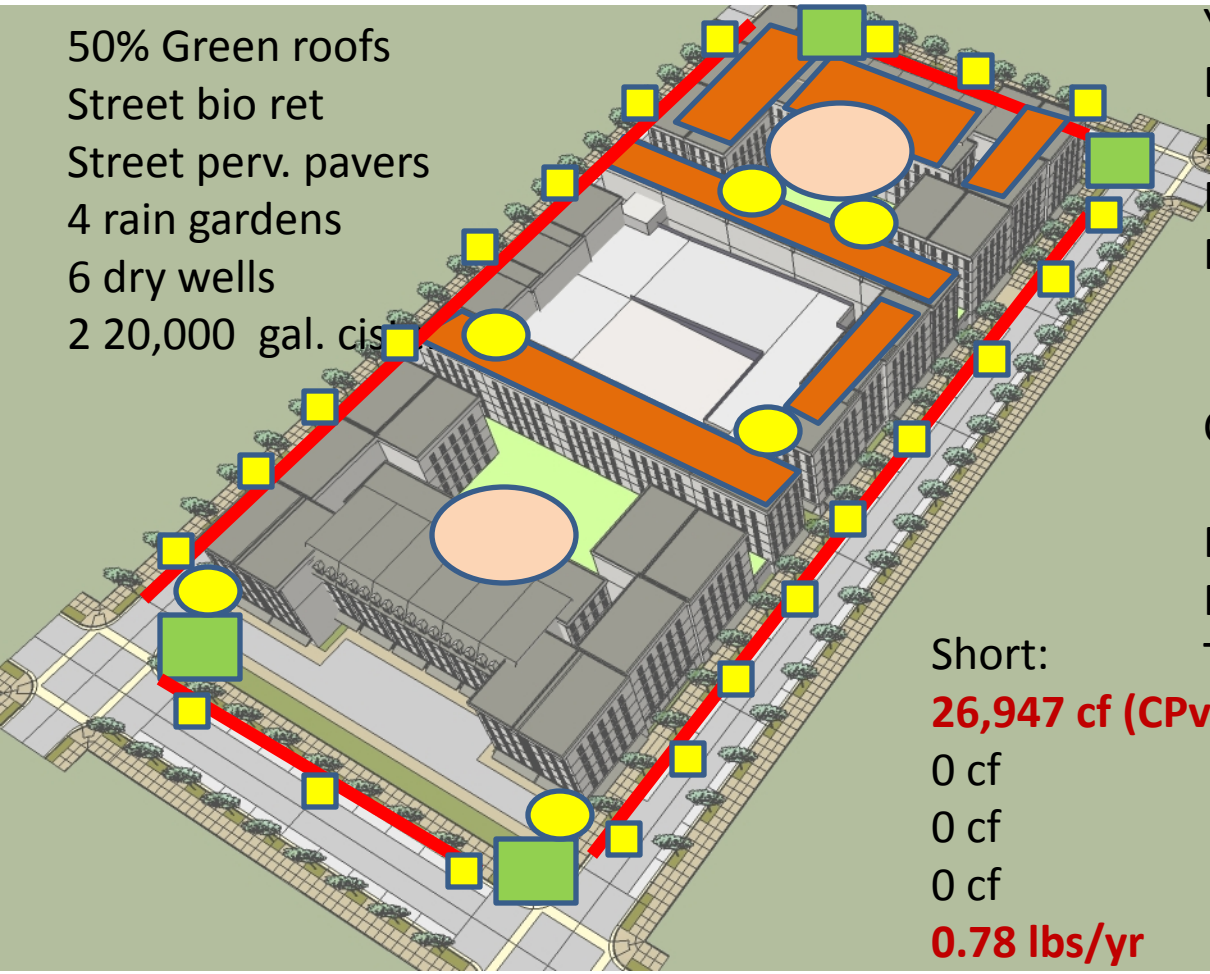
Yield:	432 du
Density:	77 du / ac
Non-Res:	39,500 sf
FAR:	1.8
Parking:	
- Total:	510
- Resid. Ratio:	1.0 per du
Construction:	Type III
Rainfall Depth:	1 inch
Pre-dev. RCN:	70
Targets:	
- Pe	2.0 inches
- ESDv:	33,265 cf
- WQv:	16,663 cf
- REv:	2,162 cf
- P Reduction:	6.28 lbs/yr

Short:	
21,792 cf (CPv)	
9,253 cf	
0 cf	
0 cf	
0.00 lbs/yr	

Site Area:	5.6 acres
Imp. Area:	4.5 acres (0.9 ac additional imper.)
Soils:	C
Existing Imp.:	**40% (REDEVELOPMENT KICKS IN)**
Proposed Imp.:	80.0% (18% more impervious from previous)

T5 Mixed Use
5 Story over Concrete Podium
TOD / Structured Parking

50% Green roofs
Street bio ret
Street perv. pavers
4 rain gardens
6 dry wells
2 20,000 gal. cis



Yield:	432 du
Density:	77 du / ac
Non-Res:	39,500 sf
FAR:	1.8
Parking:	
- Total:	510
- Resid. Ratio:	1.0 per du
Construction:	Type III
Rainfall Depth:	1 inch
Pre-dev. RCN:	70
Targets:	
- Pe	2.0 inches
- ESDv:	**19,270** cf
- WQv:	**3,862** cf
- REv:	**1,139** cf
- P Reduction:	**6.16** lbs/yr

Short:
26,947 cf (CPv)
0 cf
0 cf
0 cf
0.78 lbs/yr

Recommendation

3

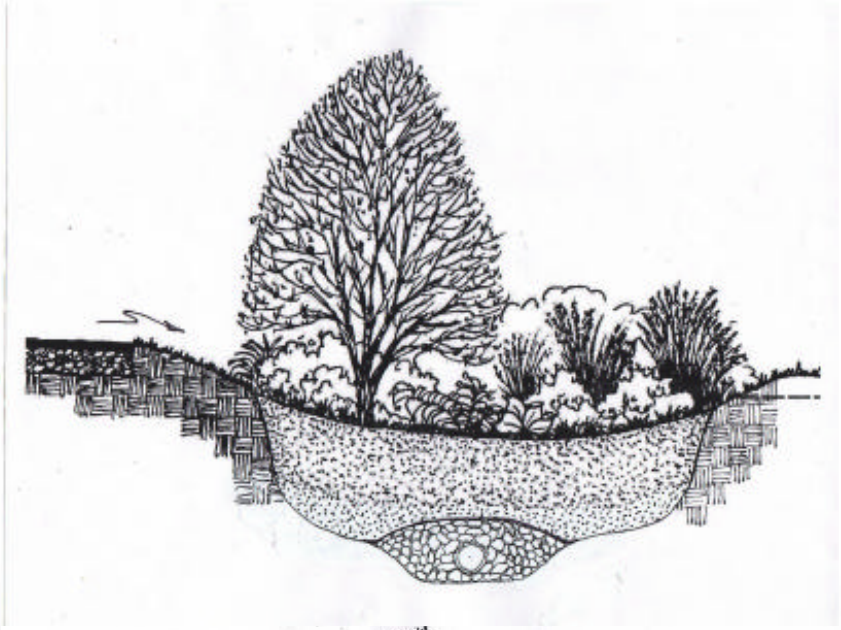
***Calibrate** the system to strengthen Smart Growth goals and objectives.*

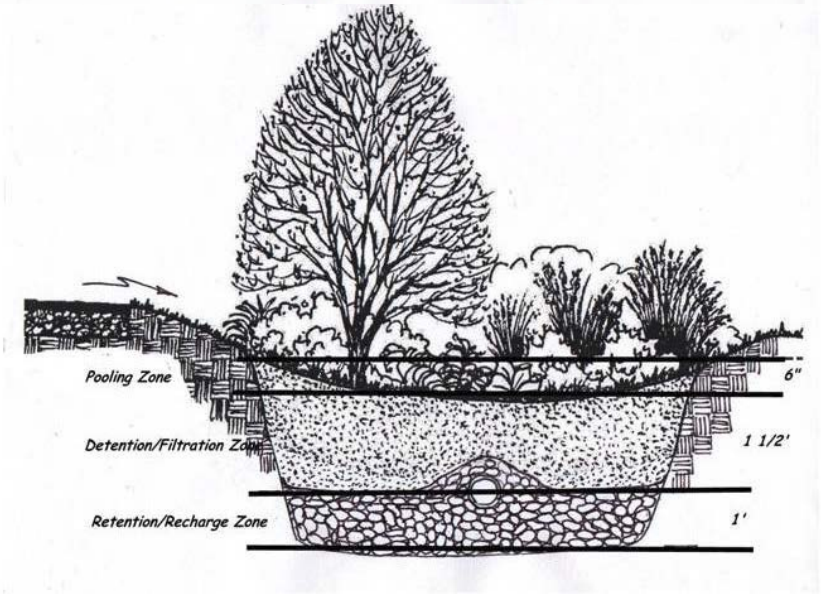
Action Item 1:
Use a stormwater transect, match the practice to the location, across the entire watershed.

Action Item 2:
Provide a gradation of incentives for redevelopment from 20 to 40 percent impervious.

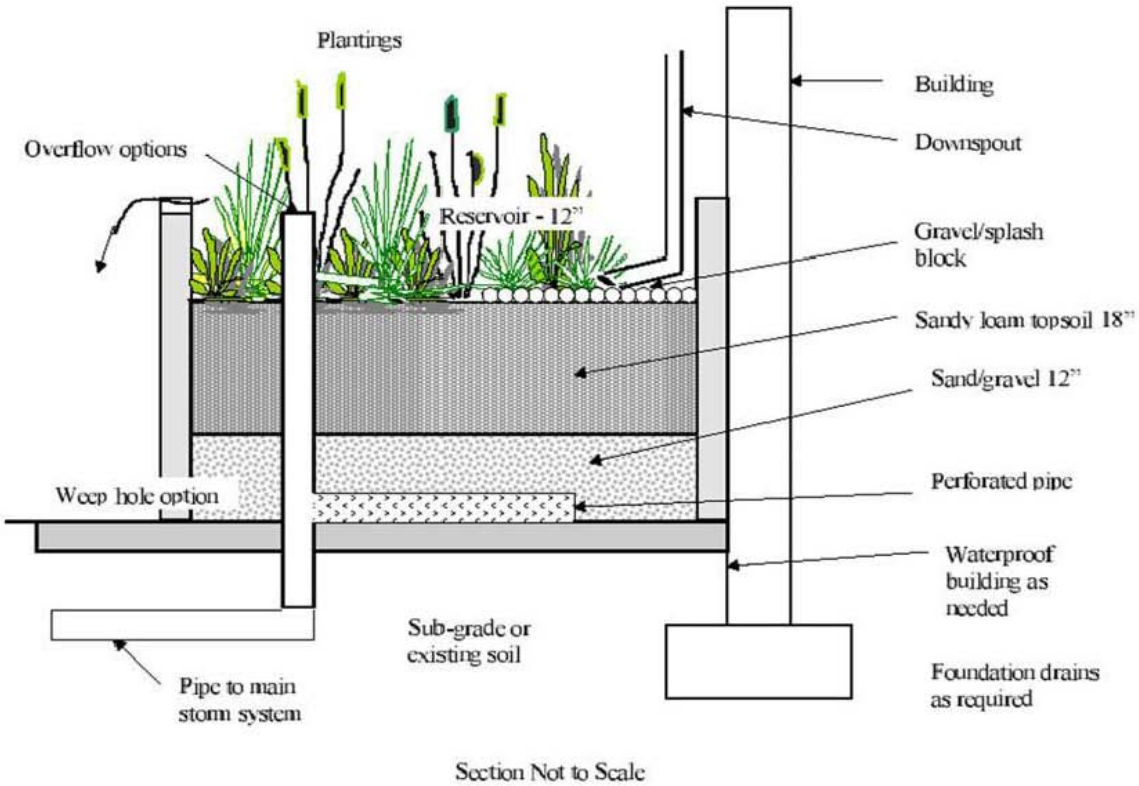
Action Item 3:
Define ESD to the MEP for Smart Growth projects that allows structural BMPs and underground solutions as a first choice.

Action Item 4:
Incentivize Smart growth with MEP calibration.




Pooling Zone
6"
Detention/Filtration Zone
1 1/2'
Retention/Recharge Zone
1'

Foundation Planters



Source: Environmental Services, San Mateo County, CA and Nevue-Ngan Associates

Recommendation

4

*Create a **performance based** design manual.*

Action Item 1:
Provide flexibility in the manual for practices to fit the multitude of various site conditions.

Action Item 2:
Limit definitions and 'typical sections'. Give designers and developers 'legal' freedom to create unique and interesting solutions.

Action Item 3:
Avoid 'command and control' language in enabling legislation, regulations and design manuals.

Action Item 4:
'Think tank' creative solutions before they are needed. Build a tool kit of approved strategies.

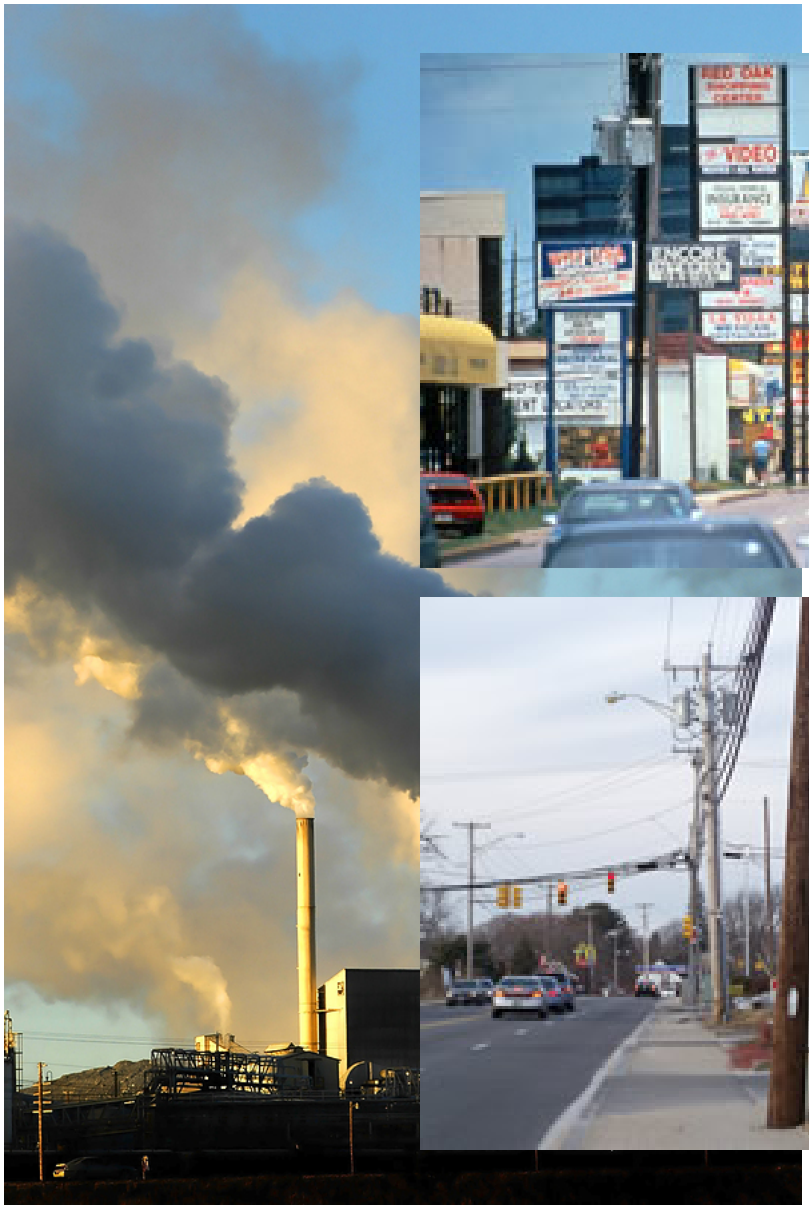
Recommendation

5

***Coordinate and communicate**. Remove 'silos', integrate horizontally and get everybody swimming in the same direction.*

Action Item 1:
Reorganize stormwater review into an integrated team. Avoid departmental frameworks and silos.

Action Item 2:
Include planners, landscape architects, soils engineers as well as stormwater engineers on the review team.



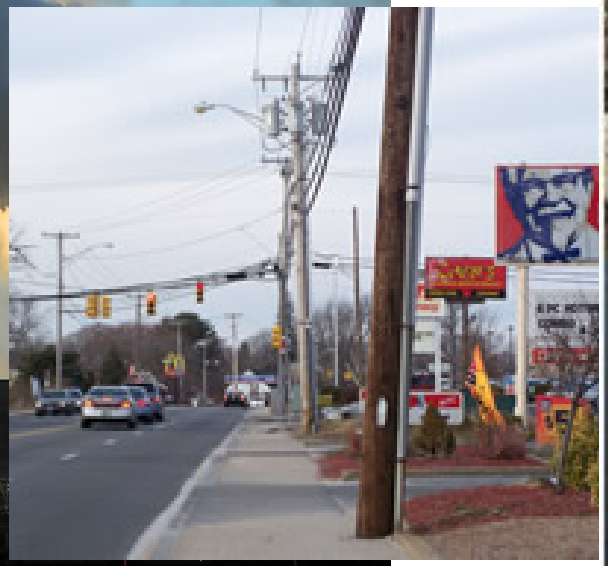


Photo by Rita Hibbard

Image used with permission, © Ehrenkrantz, Eckstut & Kuhn Architects

Recommendation 6

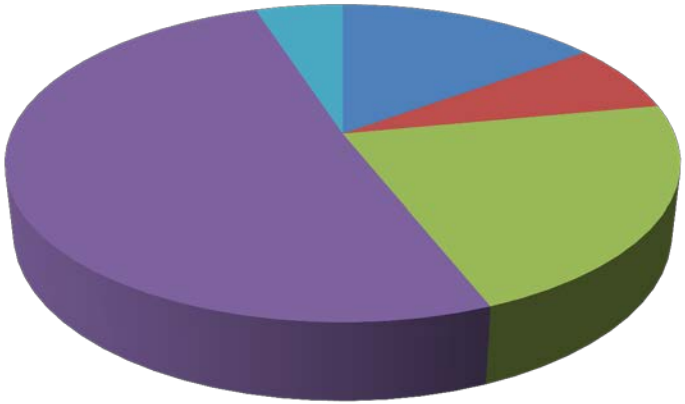
*Mandate **beauty** and seamless integration.*

Action Item 1:
More visible solutions put a stronger emphasis on beauty and integration. Don't let environmentally sensitive design be the next mandated visual clutter in the landscape.

Action Item 2:
Beauty is not only definable but can be measured objectively. ESD needs to be expressed technically, scientifically and ***artfully***.

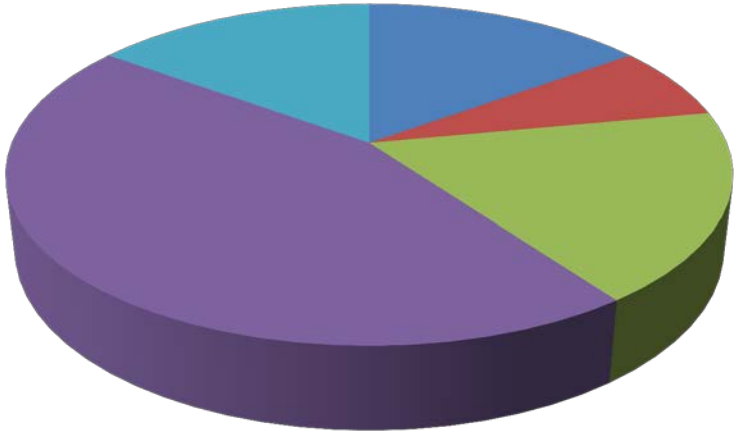
Land Use Allocations

Pre 2007



- Trees/Forest 15%
- Utilities 7%
- Paved Infr 22%
- Buildings 51%
- SWM 5%

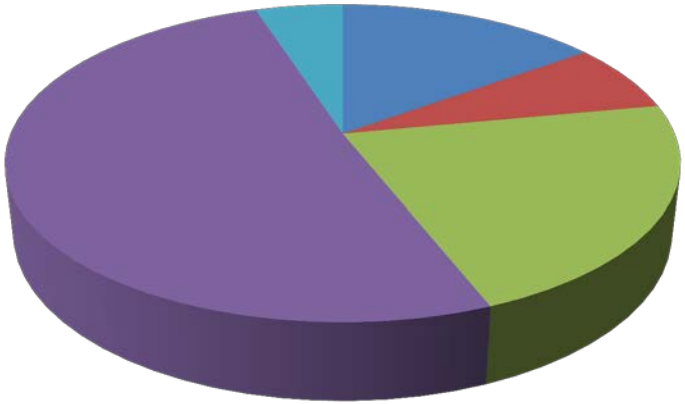
Post 2007



- Trees/Forest 15%
- Utilities 7%
- Paved Infr 18%
- Buildings 45%
- ESD 15%

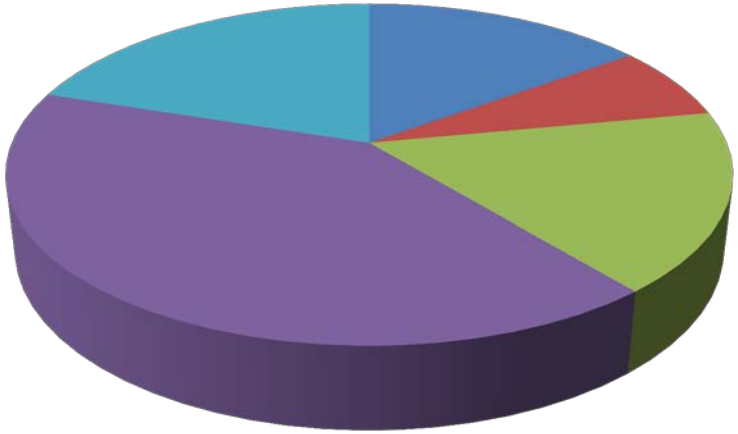
Land Use Allocations

Pre 2007

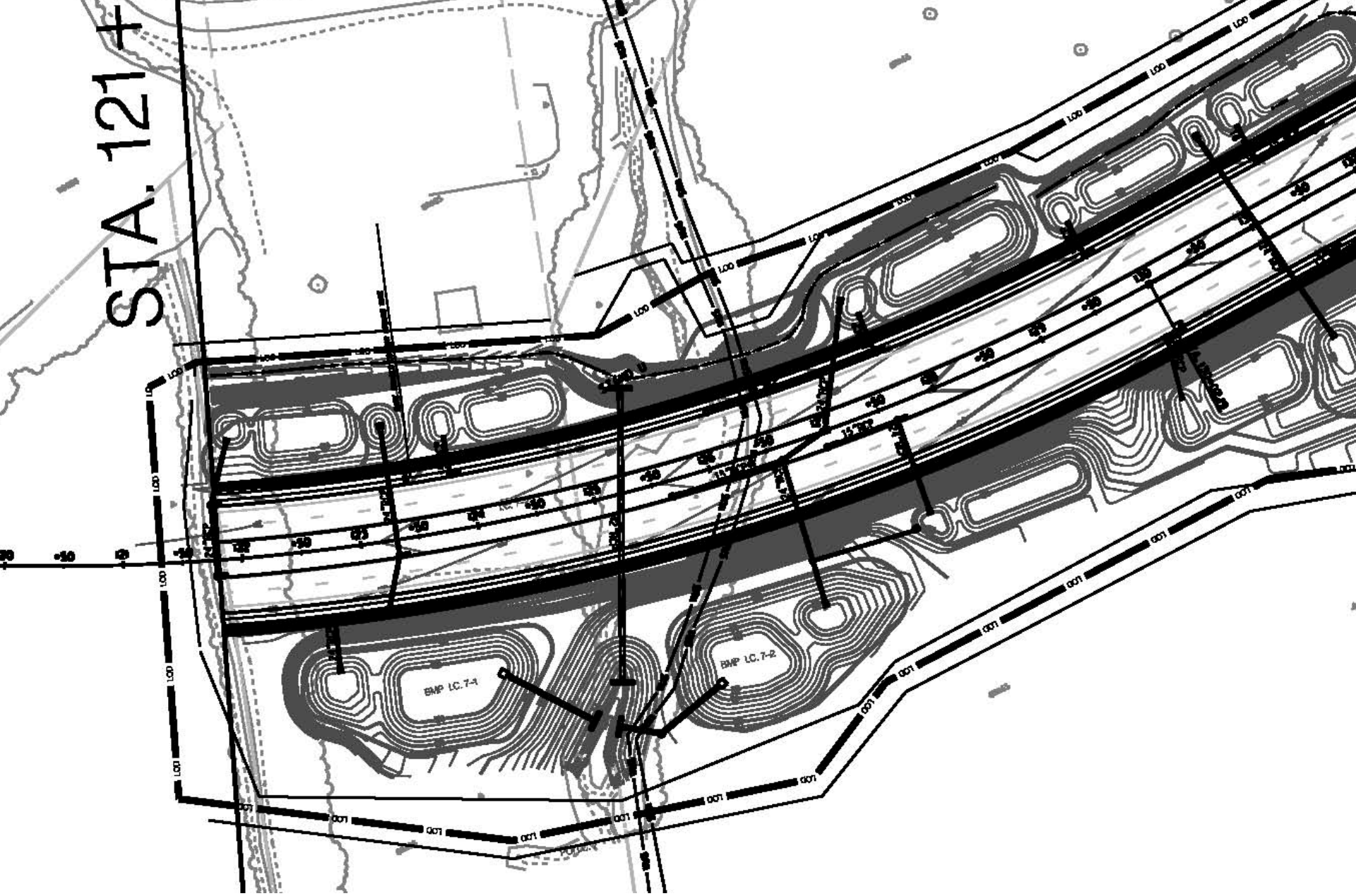


- Trees/Forest 15%
- Utilities 7%
- Paved Infr 22%
- Buildings 51%
- SWM 5%

Post 2007



- Trees/Forest 15%
- Utilities 7%
- Paved Infr 17%
- Buildings 41%
- ESD 20%

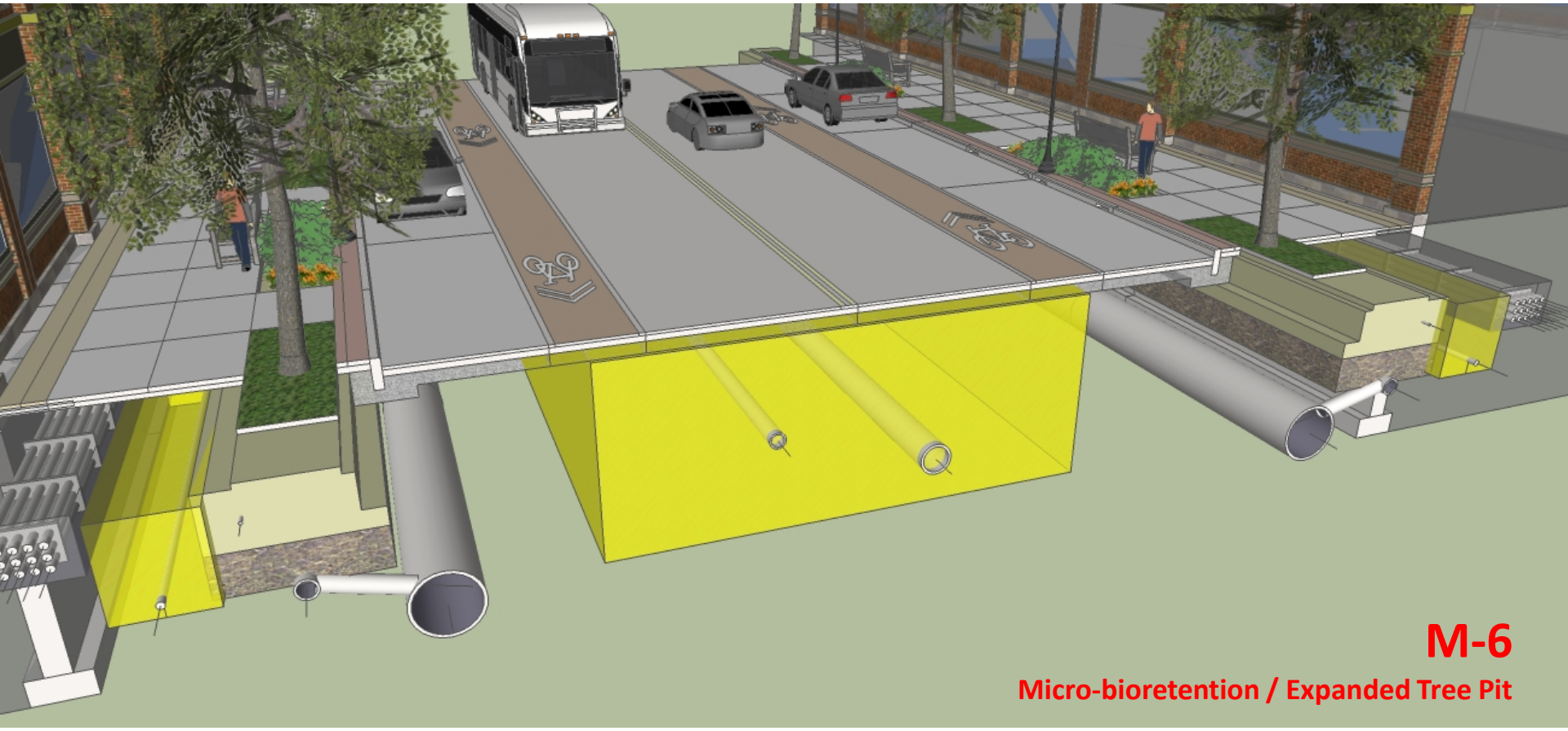

STA. 121+
BMP LC.7-1
BMP LC.7-2

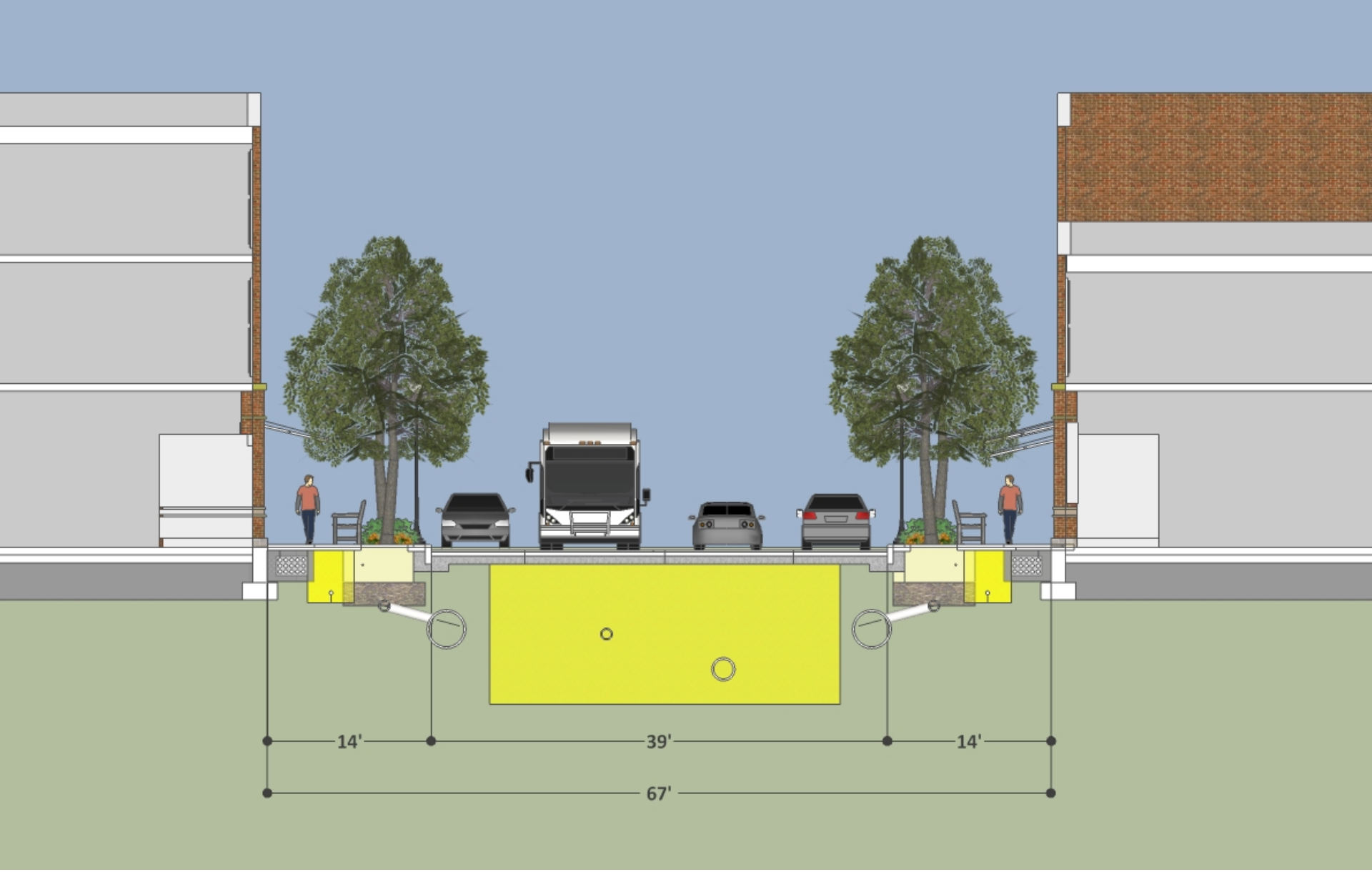
Mt. Rainier, Maryland

Source: Urban Advantage

- *Existing conditions*
- *Underground utilities*
- *Remove old trees*
- *Wide sidewalk with porous pavement, dedicated bike lane, planters, lighting and benches*
- *Double row of trees, expanded tree pits, water quality storage*
- *Renovated shop fronts, outdoor seating*
- *New mixed-use development*
- *Light rail line*

ESD Menu – Micro Practices




14'
39'
14'
67'

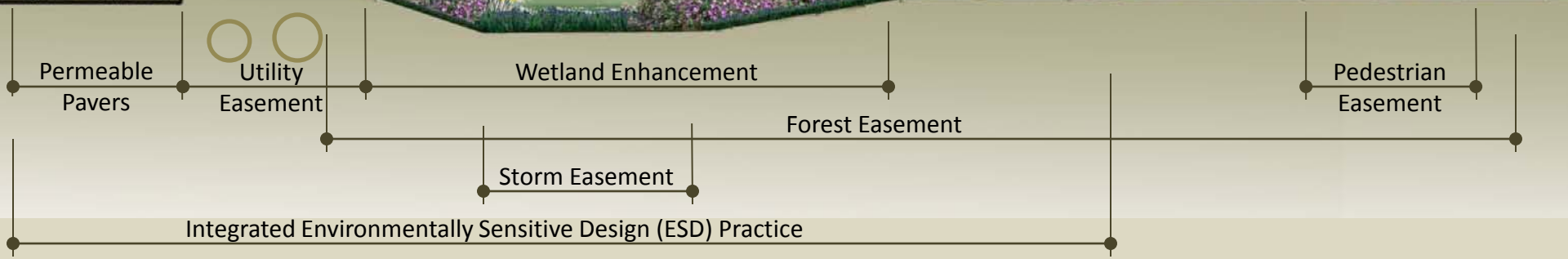
Recommendation

7

Allow cross easements and overlapping solutions that meet multiple objectives

Action Item 1:
Conserve space and maximize land usage for economic benefit while maintaining environmental standards.

Action Item 2:
Allow overlap. If a design solution solves a stormwater issue and provides needed forestry such as large urban street trees, then let that single solution be credited against both requirements.



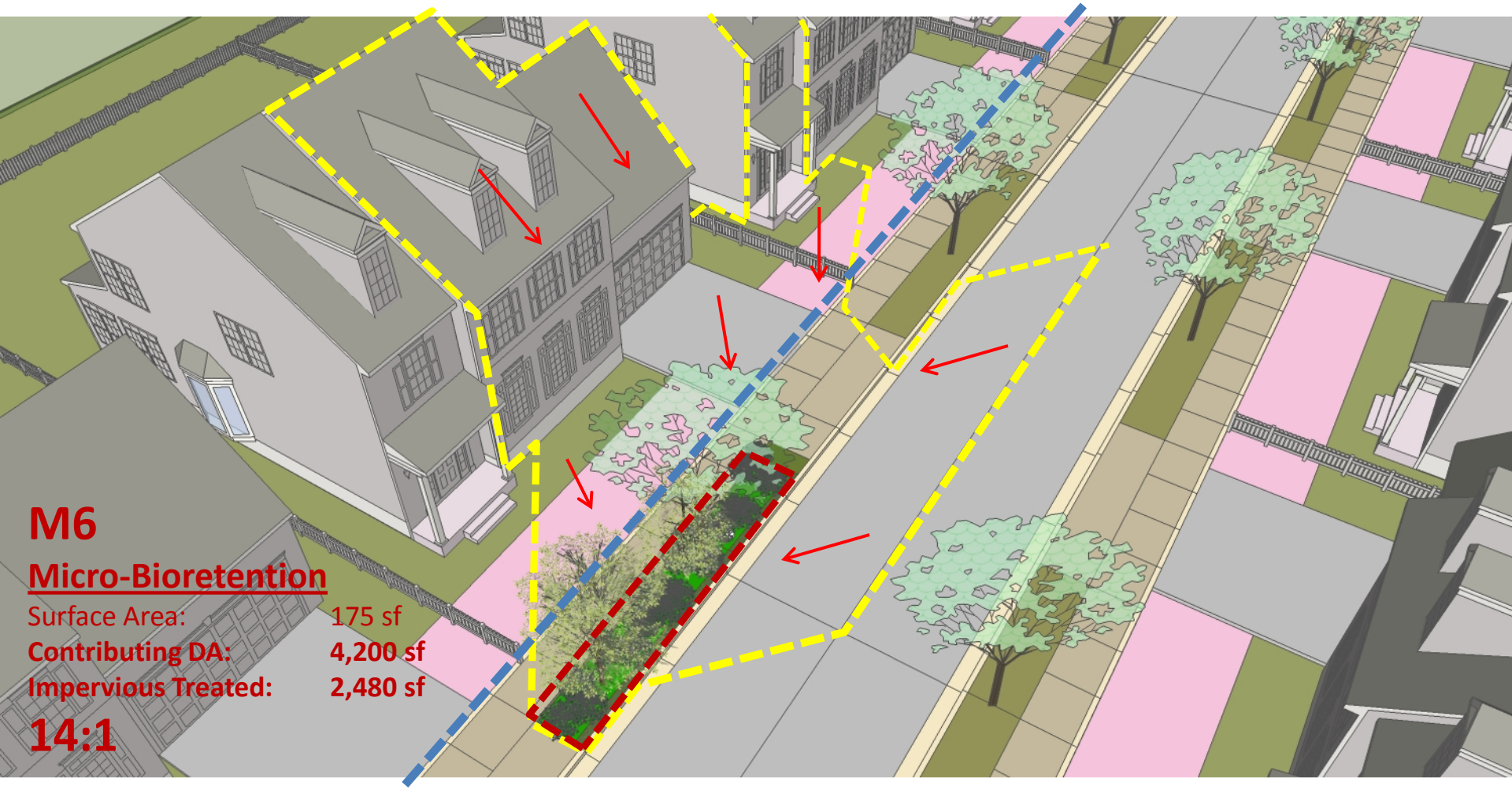
Recommendation 8

Institute watershed-wide Stormwater Management Clubs across jurisdictional borders.

Action Item 1:
Allow multiple developers to contribute funds for stream restoration and other off-site projects within the local watershed in lieu of on-site stormwater.

Action Item 2:
Emphasize off-site mitigation contributions for agricultural pollutant reductions and stream valley buffer enhancements.

Action Item 3:
Combine club contributions with other environmental and/or energy enhancements. Invest in the most cost effective remediation solutions that support Smart Growth goals.


M6
Micro-Bioretention
Surface Area: 175 sf
Contributing DA: 4,200 sf
Impervious Treated: 2,480 sf
14:1

Recommendation

9

Provide maintenance and monitoring regimens that make sense and are cost effective.

Great Places are:
...integrated, mixed, flexible, beautiful, performance based, logical and complex. Our stormwater systems should follow suit.

Recommendations

1. **Watershed**. Strategically solve pollutant loading on a watershed basis, not a case-by-case project basis.
2. **Strategic Planning.** Be pro-active, have a strategic plan in place before the onslaught of new projects after the recovery.
3. **Transect.** Calibrate the system to strengthen Smart Growth goals and objectives. Use a transect and watershed based solution. Define the MEP trigger to enhance Smart Growth. Don't leave it up to the applicant to "prove the negative". Calibrate the MEP to the watershed transect.
4. **Tool Kits.** Create a performance based design manual. Provide flexibility for solutions that fit the multitude of various site conditions. "Think tank" creative solutions before they are needed, then build a tool kit of approved strategies.
5. **Agencies.** Break down the silos, integrate both horizontally and vertically. Reduce the 'top-down' decision tree. All sustainability is ultimately local. Guide from the top down, solve from the bottom up.
6. **Art.** More visible solutions put a stronger emphasis on beauty and integration. Don't let environmentally sensitive design be the next mandated visual clutter in the landscape.
7. **Multi-use.** Allow overlap and multiuse. If a design solution solves a stormwater issue and provides needed forestry such as large urban street trees, then let that single solution be credited against both requirements.
8. **Clubs.** Institute Stormwater Clubs across jurisdictional boundaries.
9. **Maintenance.** Provide maintenance and monitoring protocols that make sense and are cost effective.

Manuals

- ***Philadelphia Stormwater manual. Version 2,*** *released in 2008, Best on the East Coast for Redevelopment Practices.*

  http://www.phillyriverinfo.org/Programs/SubprogramMain.aspx?Id=Stormwater Manual

- ***Portland Stormwater Manual.*** *Also updated in 2008, this manual provides excellent design schematics and maintenance info for ultra-urban practices*

  http://www.portlandonline.com/bes/index.cfm?c=43428

- ***San Mateo County: Design Manual for Green Streets and Parking Lots. 2009.*** *This is one of the better design manuals for green street design, from California.*

  http://www.flowstobay.org/ms_sustainable_streets.php

Maryland

Maryland Code: Title 26, Subtitle 17, Chapter 2

MDE Chapter 5 *(October 2010)*

http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/Documents/www.mde.state.md.us/assets/document/Design%20Manual%20Chapter%205%2003%2024%202009.pdf

MDE ESD - Process and Computations Link *(July 2010)*

http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/Documents/www.mde.state.md.us/assets/document/ESD%20Process%20Computations%20Review.pdf

MDE ESD - Redevelopment Examples *(October 2010)*

http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/Documents/ESD%20Redevelopment%20Example.pdf

Maryland Stormwater Management Guidelines for State and Federal Projects *(April 15, 2010)*

EPA, Stormwater and Smart Growth

***Guidance on Smart Growth and Stormwater**. 2009. This EPA policy report presents strategies to integrate stormwater and smart growth.*
http://www.epa.gov/dced/stormwater.htm

Urban BMP Performance Tool
http://cfpub.epa.gov/npdes/stormwater/urbanbmp/bmpeffectiveness.cfm

***Protecting Water Resources with Higher Density Development**, EPA, 2005.*

***Using Smart Growth Techniques as Stormwater Best Management Practices**, EPA, 2005.*

***Build-out Analysis** EPA's Green Communities: www.epa.gov/greenkit/2tools.htm*

***Protecting Water Resources with Smart Growth**, EPA, 2004.*

EPA

Understanding the Clean Water Act *www.cleanwateract.org*

EPA's stormwater program site *www.epa.gov/npdes*

EPA's stormwater guidance documents and publications:
http://cfpub.epa.gov/npdes/stormwater/swphases.cfm

NPDES and MS4 Programs: *www.stormwaterauthority.org*

Coastal Zone Management Act: *http://coastalmanagement.noaa.gov/czm/*

EPA's 'Surf your Watershed: *www.epa.gov/surf*

EPA's Build-out Analysis Tools: *www.epa.gov/greenkit/2tools.htm*

EPA's Safe Drinking Water and Source Water Assessments Website:
www.epa.gov/safewater/source/contacts.html

Other Sites and Resources

Univ. of MD Center for Environmental Science *http://www.umces.edu/*

Potomac Conservancy: *http://www.potomac.org/site/*

Chesapeake Stormwater Network: *http://www.chesapeakestormwater.net/*

CSN Permeable Paver Spec *http://www.chesapeakestormwater.net/baywide-design-specifications2/*

CSN Green Roof Spec *http://www.chesapeakestormwater.net/baywide-design-specifications2/*

The Greenbelt Alliance, Smarter Infill, *www.greenbelt.org*

Other Sites and Resources

Trust for Public Land's Report on Safe Drinking Water:
www.tpl.org/tier3_cd.cfm?content_item_id=1337&folder_id=195

American Metropolitan Planning Organizations (MPOs): *www.ampo.org*

Center for Watershed Protection, Builders for the Bay and Site Design Roundtable,
www.cwp.org

Center for Watershed Protection, Smart Sites Initiative, *www.cwp.org/smartsites.pdf*

Maryland's Guide to BMP Selection and Location,
www.mde.state.md.us/assets/document/chapter4.pdf

Smart Growth America, Choosing Our Community's Future,
www.smartgrowthamerica.org

Other Sites and Resources

Brownfield Remediation, *www.epa.gov/swerosps/bf/index.html*

USGBC LEED-ND, *www.usgbc.org/leed/leed_main.asp*

Trust for Historic Preservation Main Street Program, *www.mainstreet.org*

Natural Resources Defense Council's "Stormwater Strategies", *www.nrdc.org/water/pollution/storm/stoinx.asp*

The Chesapeake Bay TMDL, *http://www.epa.gov/chesapeakebaytmdl/*

Chesapeake Executive Order 13508 (May 12, 2009), *http://executiveorder.chesapeakebay.net/EO/file.axd?file=2009%2f8%2fChesapeake+Executive+Order.pdf*

Innovative Development Codes, *www.cnu.org/pdf/code_catalog_8-1-01.pdf*

Other Sites and Resources

- ***Vacant Properties Campaign***, *www.vacantproperties.org*

- ***CITYGreen Software, American Forests***
www.americanforests.org/download.php?file=/graytogreen/stormwater.pdf

- ***US Department of Agriculture's Forest Service – Southern Region Tree Data Base***
www.urbanforestrysouth.org

- ***Institute for Transportation Engineers (ITE)***, *www.ite.org*
  - *Traditional Neighborhood Development Street Design Guidelines, 1999*
  - *Neighborhood Street Design Guidelines, 2003*
  - *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities, 2008*

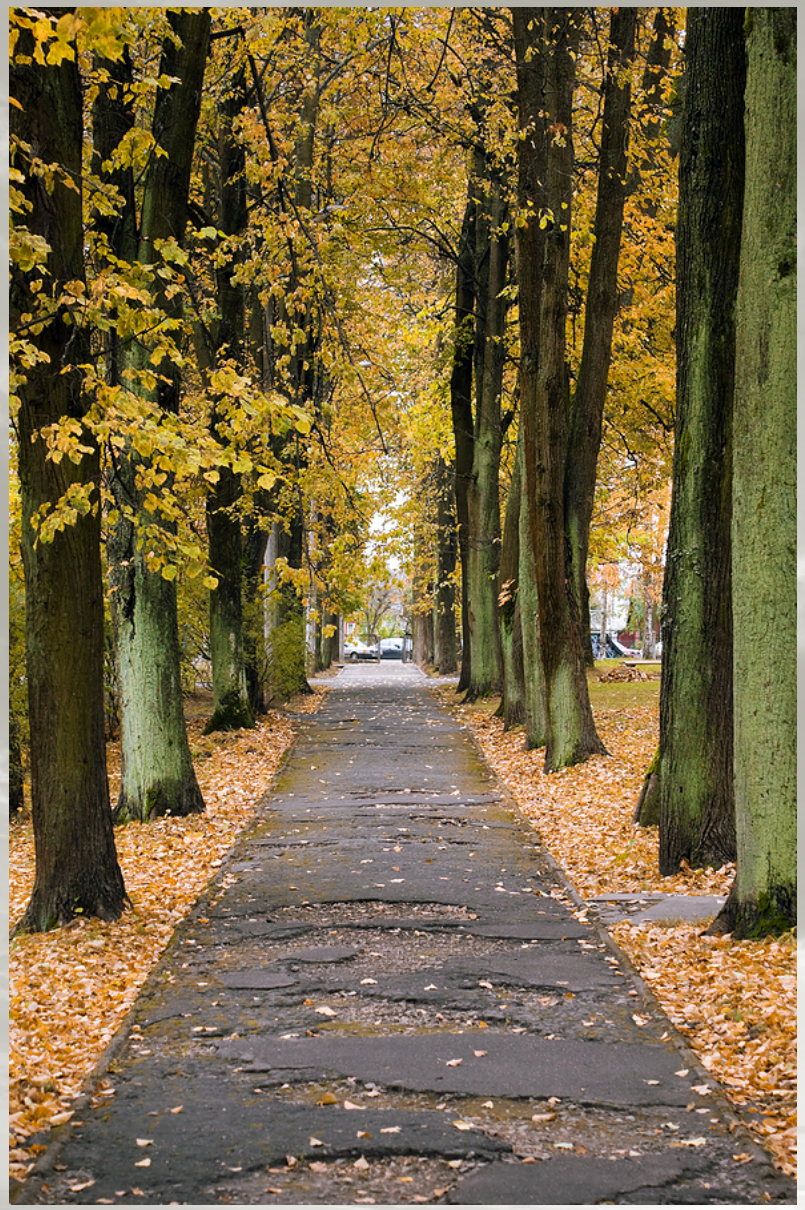
- ***Portland Livable Streets 2040,***
http://www.oregonmetro.gov/index.cfm/go/by.web/id=235

- ***US HUD, Smart Codes in Your Community: A Guide to Building Rehabilitation Codes,***
http://www.huduser.org/publications/destech/smartcodes.html

Other Sites and Resources

Maryland Department of the Environment, TMDL Central
http://www.mde.state.md.us/programs/water/tmdl/Pages/Programs/WaterPrograms/tmdl/index.aspx

University of Maryland Center for Environmental Science (UMCES), *Costs of Stormwater Management Practices in Maryland Counties, prepared for MDE, Linked excel spreadsheets of Tables 2a, 2b, and 2c:*
http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Pages/PhaseIIBayWIPDev.aspx



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