A Better City

CHALLENGE for SUSTAINABILITY

Business and Institutional Leaders Working Toward a Sustainable City

Best Practices in Water Efficiency
25 July 2012

BARR FOUNDATION

The Boston Foundation

BOSTONIA CONDITA A.D. 1630.

Agenda

Retrofitting Drinking Fountains

Chiller Condensate Recovery

Landscaping for Storm Water Mitigation

EPA Water Sense

Providing Purified Drinking Water

- Erica Mattison, Campus Sustainability Coordinator, Suffolk University

emattison@suffolk.edu

"They have been hugely popular and have helped us avoid tens of thousands of plastic disposable water bottles. They make it very fast and convenient for people to stay hydrated while using reusable travel mugs. Huge hit."

Click on picture for Suffolk Video

Providing Purified Drinking Water

- Tina Woolston, Director, Office of Sustainability, Tufts

Tina.woolston@tufts.edu

617.627.6645

Water Bottle Filling Stations

Tina Woolston
Tufts University
Office of Sustainability

Surface Mounted
Bottle filler

Combination

Retrofit

Options

Outdoor

Add-on

Stand alone

Options

Kiosk

Vending Machine

Mobile Event Unit

Features

- Counter
- Touchless
- Reverse Osmosis
- Filters
- Temperature
- Speed
- One-handed operation
- UV sterilization
- Anti-microbial

Cost

- Around $100 for goose neck
- Around $600 for add on
- $1,000 - >$2,000 for filling stations
- $2,000 - $8,000 for outdoor stations
- Office coolers are around $20/month (rental) or $500

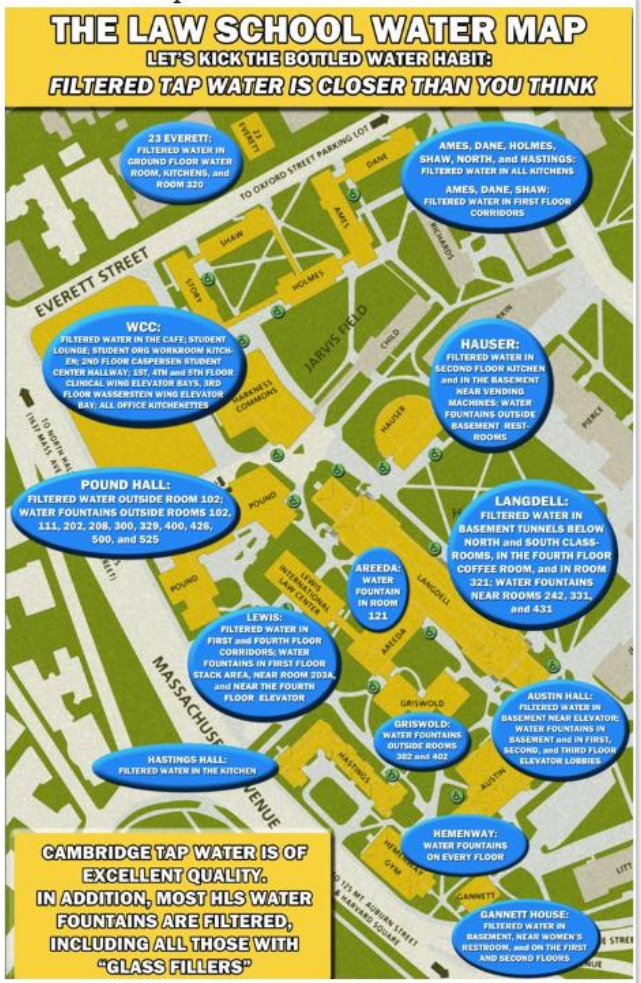
Suppliers

- Elkay EZH2O (AKA Halsey-Taylor)
- Oasis
- Pura Vida H2O
- Waterfillz
- Atlas Watersystems
- Brita
- Quench USA, Vertex, CoolerSmart, Nestle (AKA Poland Springs)

At Tufts

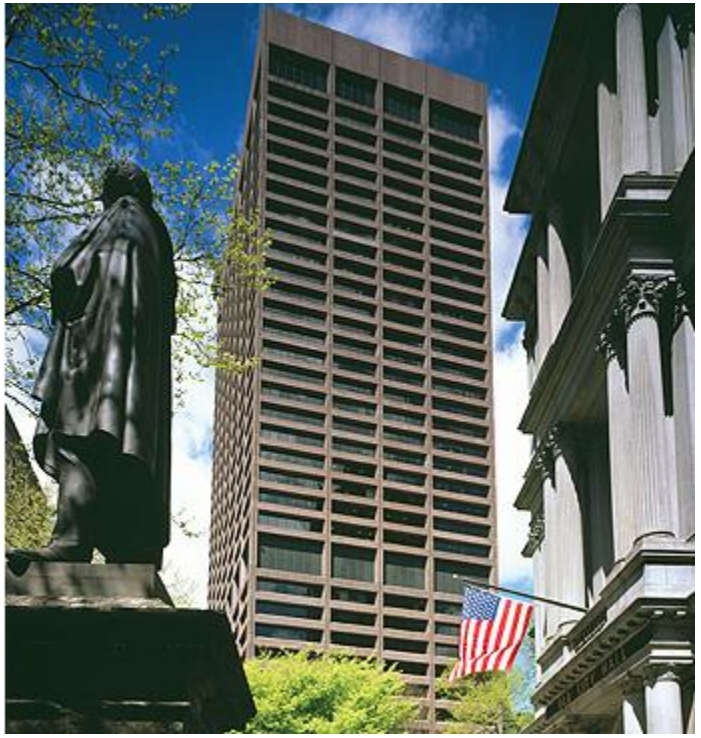
At Harvard Law School

HLS Water Map

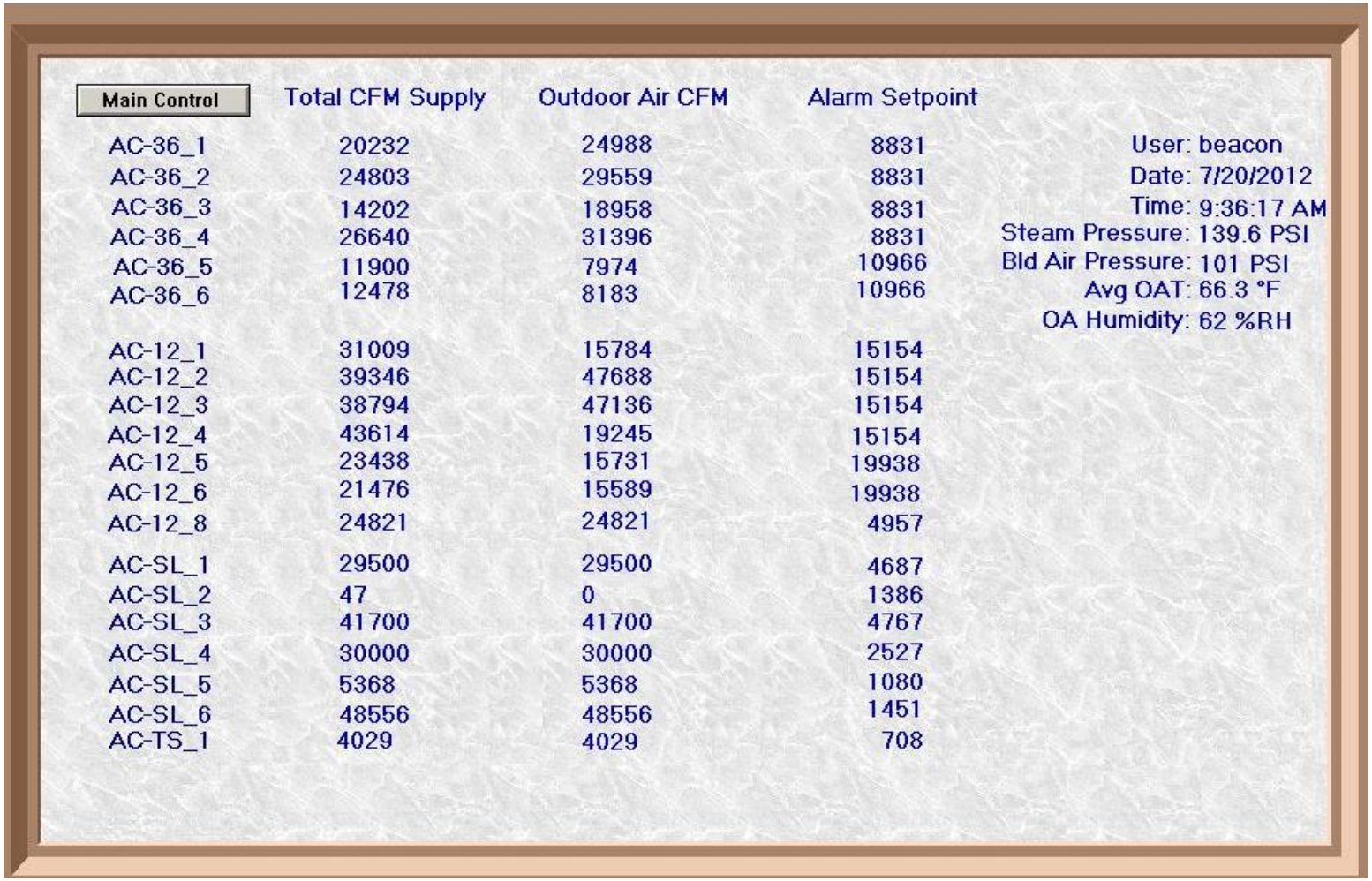


Capturing Condensate

- Fred O'Grady, Chief Engineer, CB Richard Ellis



Capturing Condensate

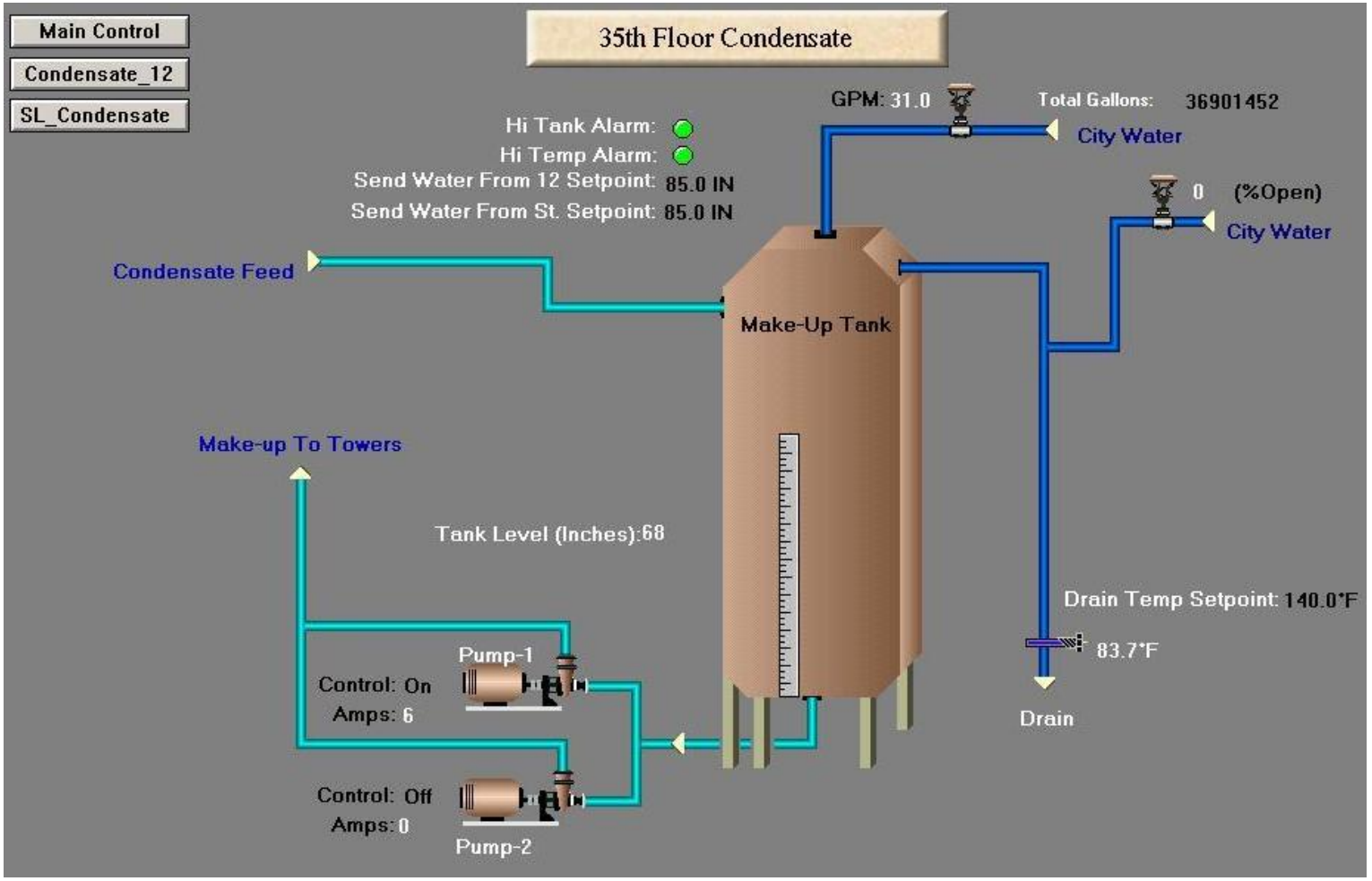


Main Control

	Total CFM Supply	Outdoor Air CFM	Alarm Setpoint
AC-36_1	20232	24988	8831
AC-36_2	24803	29559	8831
AC-36_3	14202	18958	8831
AC-36_4	26640	31396	8831
AC-36_5	11900	7974	10966
AC-36_6	12478	8183	10966
AC-12_1	31009	15784	15154
AC-12_2	39346	47688	15154
AC-12_3	38794	47136	15154
AC-12_4	43614	19245	15154
AC-12_5	23438	15731	19938
AC-12_6	21476	15589	19938
AC-12_8	24821	24821	4957
AC-SL_1	29500	29500	4687
AC-SL_2	47	0	1386
AC-SL_3	41700	41700	4767
AC-SL_4	30000	30000	2527
AC-SL_5	5368	5368	1080
AC-SL_6	48556	48556	1451
AC-TS_1	4029	4029	708

User: beacon
Date: 7/20/2012
Time: 9:36:17 AM
Steam Pressure: 139.6 PSI
Bld Air Pressure: 101 PSI
Avg OAT: 66.3 °F
OA Humidity: 62 %RH

Capturing Condensate



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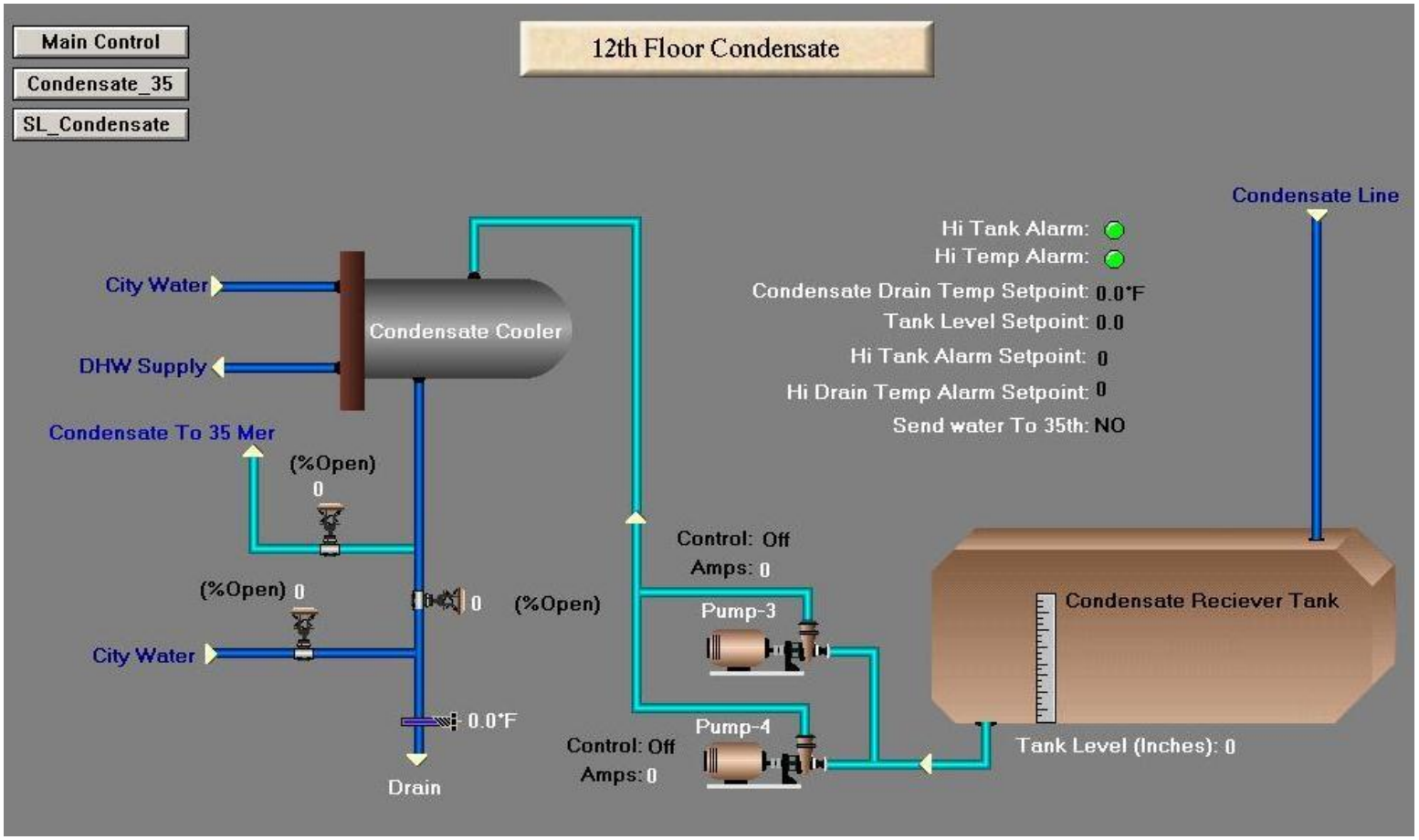

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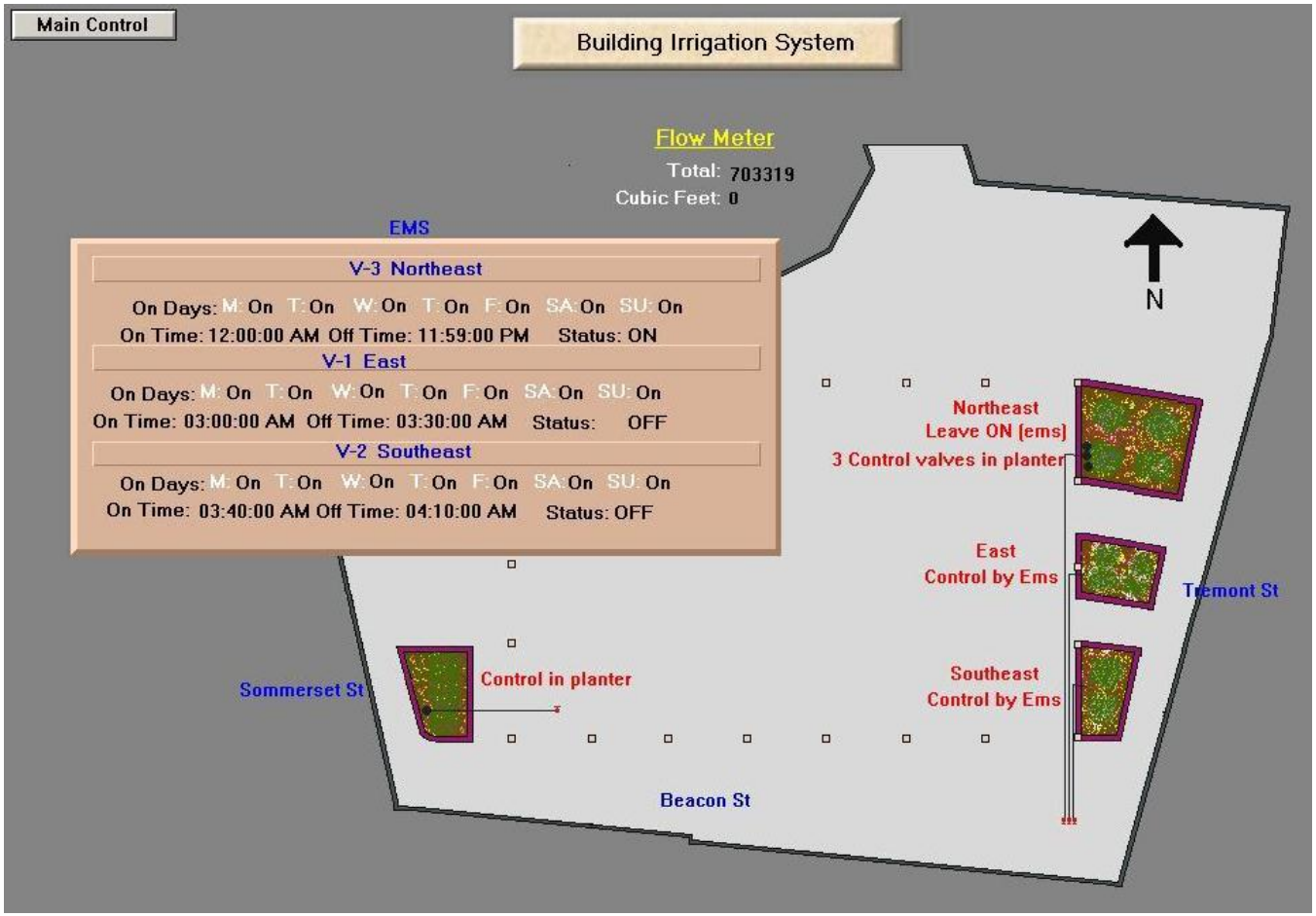

Capturing Condensate

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Capturing Condensate

Capturing Condensate

One Beacon Street Fan Coil Condensation recovered for Make-up				
	Start	Stop	Constant	Usage
January	0	0	10	0 Gallons
February	0	0	10	0 Gallons
March	0	0	10	0 Gallons
April	0	0	10	0 Gallons
May	0	0	10	0 Gallons
June	0	270	10	2700 Gallons
July	270	2119	10	18490 Gallons
August	2119	4014	10	18950 Gallons
September	4014	5443	10	14290 Gallons
October	5443	5898	10	4550 Gallons
November	5898	6373	10	4750 Gallons
December	6373	6405	10	320 Gallons
	Total Recovered:			**64050** gallons

Summary (2011):

Fan Coil Condensate Recovered for Make-up:

64,050 Gallons

One Beacon Street Fan Coil Condensation recovered for Make-up				
	Start	Stop	Constant	Usage
January	6405	6405	10	0 Gallons
February	6405	6405	10	0 Gallons
March	6405	6405	10	0 Gallons
April	6405	6555	10	1500 Gallons
May	6555	6911	10	3560 Gallons
June	6911	7262	10	3510 Gallons
July	7262	8851	10	15890 Gallons
August	8851	8851	10	0 Gallons
September	8851	8851	10	0 Gallons
October	8851	8851	10	0 Gallons
November	8851	8851	10	0 Gallons
December	8851	8851	10	0 Gallons
	Total Recovered:			**24460** gallons

Summary (2012):

Fan Coil Condensate Recovered for Make-up:

24,460 Gallons

Capturing Condensate

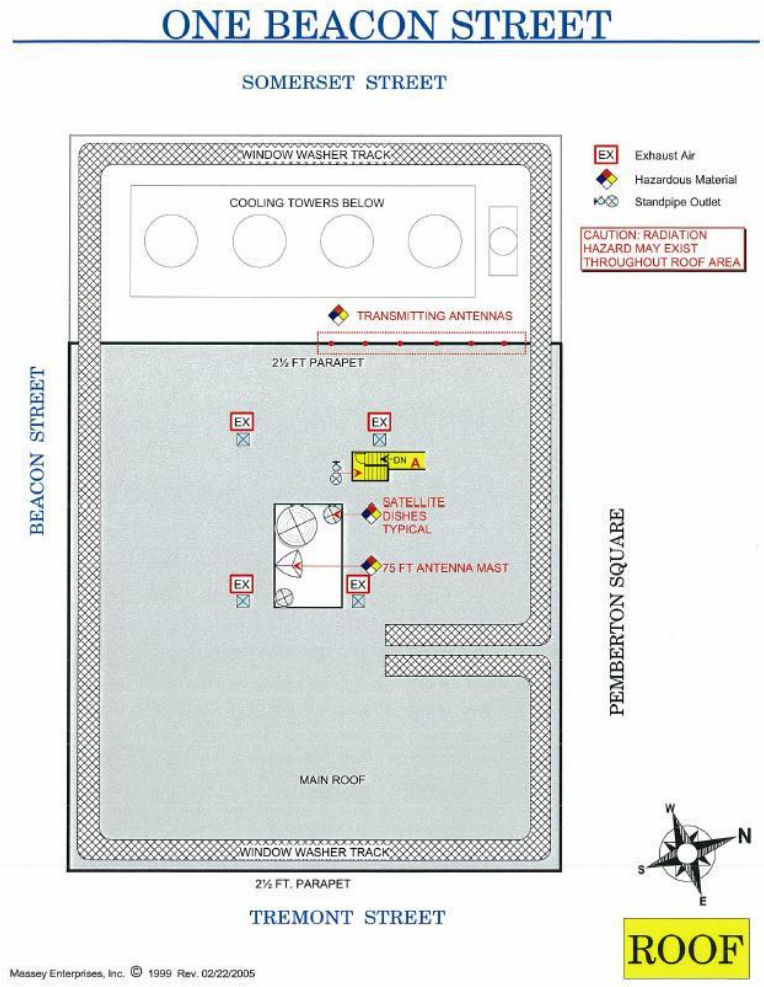
One Beacon Street Indoor Process Water - 2010

	Cell #1 Makeup Meter		Meter			Cell #2 Makeup		Meter	
	Start	Stop	Constant	Usage		Start	Stop	Constant	Usage
January	373490	373490	10	0		423290	423290	10	0
February	373490	374049	10	5590		423290	425411	10	21210
March	374049	374928	10	8790		425411	426863	10	14520
April	374928	375972	10	10440		426863	431378	10	45150
May	375972	375972	10	0		431378	431378	10	0
June	375972	379683	10	37110		431378	454876	10	234980
July	379683	382370	10	26870		454876	477737	10	228610
August	382370	384335	10	19650		477737	498344	10	206070
September	384335	385678	10	13430		498344	512979	10	146350
October	385678	385920	10	2420		512979	517692	10	47130
November	385920	385920	10	0		517692	517692	10	0
			10	0		517692	517692	10	0
				124300					944020

Total Main Cooling Tower Usage: 1068320

Summary (2010):				
Main Cooling Tower Usage:	1,068,320	Cubic Ft.	7,991,034	Gallons
EDP Cooling Tower Usage:	192,390	Cubic Ft.	1,439,077	Gallons
Total Process Water Usage:	1,260,710	Cubic Feet	9,430,111	Gallons

Capturing Condensate



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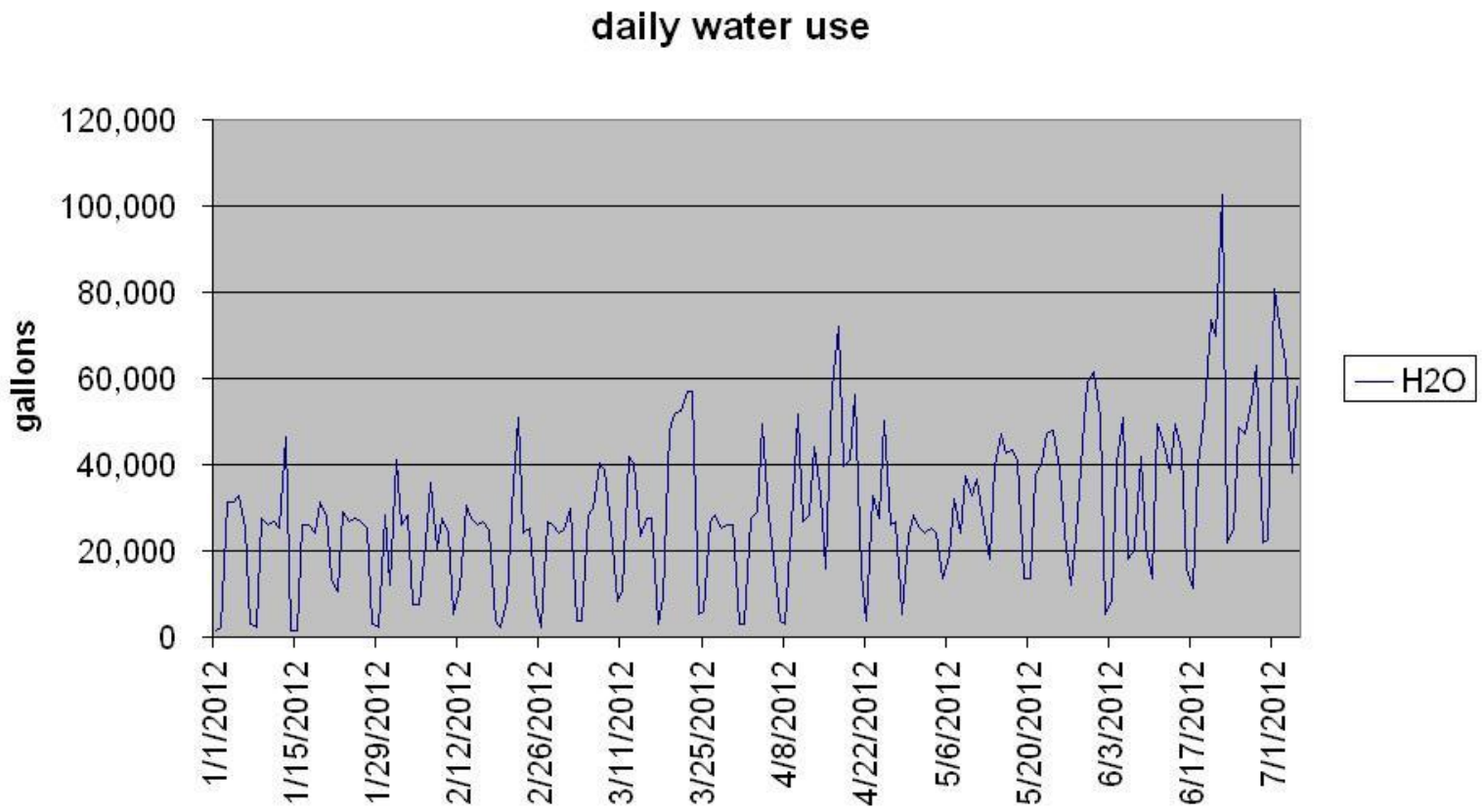


Capturing Condensate

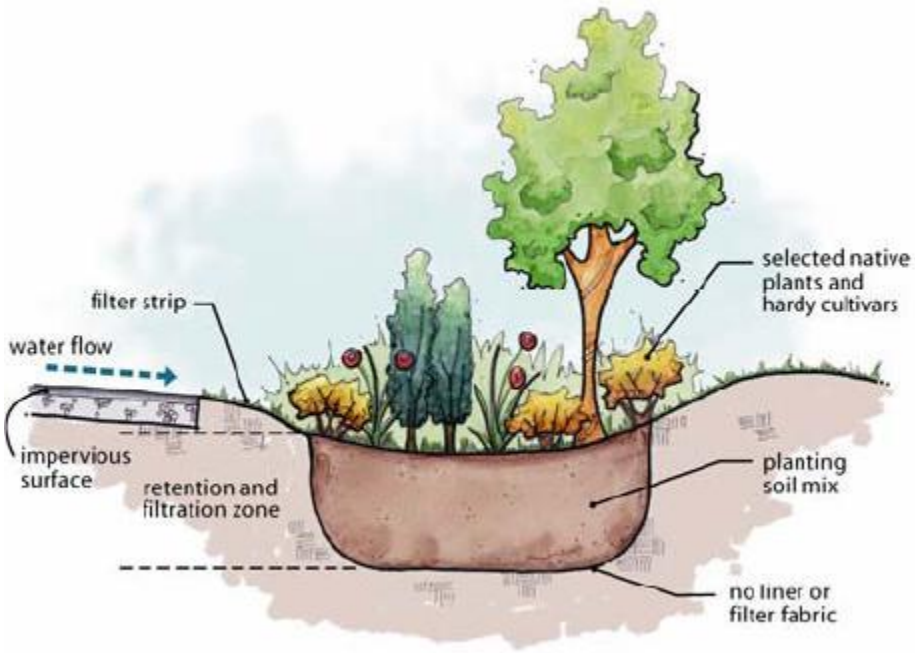
Annual Storm Water from Rainfall	
Average Annual Boston Rainfall	41.5 inches
Area of Roof	30,000 square feet
* 144 square inches per sq. ft. =	4,320,000 square inches
41.5 * 4,320,000 =	179,280,000 cubic inches
1 gallon = 231 cubic inches	
179,280,000 / 231 =	**776,103 gallons**

Innovative Methods in Landscaping

- Scott Horsley, Lecturer, Tufts

shorsley@horsleywitten.com

508-833-6600



Green Infrastructure

Innovative Stormwater Management Techniques

Scott Horsley

Horsley Witten Group, Inc.

The Groundwater Problem

Beginning in the early 1700's, sand and gravel were deposited on top of the original mud flats to expand Boston's Shawmut Peninsula and created new, buildable land. This new "made land" was not strong enough to support heavy, multi-story brick structures. Wood pilings were driven through the made land and underlying mud into hard clay typically located 30 to 40 feet below ground surface. Nearly all buildings constructed on made land through the early part of the 20th century are supported on wood pilings, which will last for centuries if they remain submerged in groundwater. However, if groundwater levels fall, the tops of the wood pilings are exposed to air and attacked by microbes. After prolonged air exposure, the wood pilings eventually rot causing building foundation problems.

Much of the surface in the affected neighborhoods has been covered by buildings and impervious blacktop and concrete, preventing rainwater from being absorbed into the ground. In addition, infrastructure upgrades such as sewers, subway lines, highway tunnels, deep garages and basements, have been built beneath the surface of made land. When these structures leak, the water that enters is often drained or pumped away. This loss of water causes surrounding groundwater levels to drop toward the level of the leak, a phenomenon called "drawdown". If groundwater levels are drawn down below the tops of the pilings, they may be exposed which allows the wood to rot.

The affected neighborhoods include "made land" areas of the Fenway, Back Bay, South End, Bay Village, flat of Beacon Hill, Chinatown, Leather District, Bulfinch Triangle, North End and Downtown waterfronts, Fort Point Channel area, and areas of East Boston.

Dear Resident:

Addressing low groundwater levels continues to be a priority for my administration and we have made substantial progress in recent years. Groundwater is important not only for our environment, but in many areas of Boston, groundwater protects properties with foundations that are supported by wood pilings.

With our partners at the Boston Groundwater Trust, and with state and federal support, a network of 800 groundwater monitoring wells has been installed in Boston providing updated groundwater data to local residents and policymakers. Working with community-based organizations, the City established the Groundwater Conservation Overlay Districts to further protect local properties.

Thomas M. Menino
Mayor of Boston

Check out these web sites for more information:

CITY OF BOSTON
OFFICE OF ENVIRONMENTAL AND ENERGY SERVICES
www.cityofboston.gov/environmentalandenergy

BOSTON GROUNDWATER TRUST
www.bostongroundwater.org

BOSTON WATER AND SEWER COMMISSION
www.bwsc.org

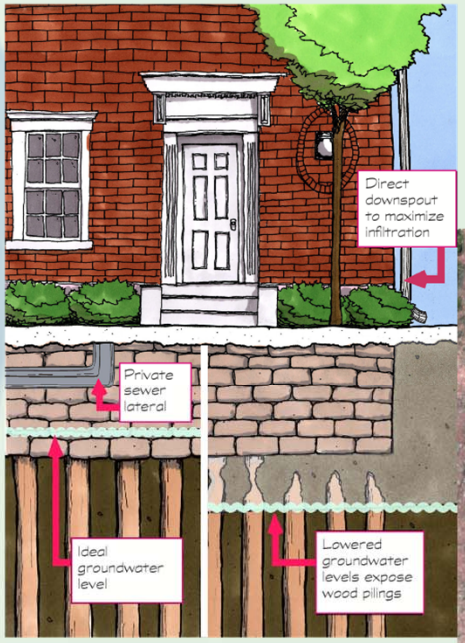
BOSTON REDEVELOPMENT AUTHORITY
www.cityofboston.gov/bra

INSPECTIONAL SERVICES DEPARTMENT
www.cityofboston.gov/isd

BOSTON COMPLETE STREETS
www.bostoncompletestreets.org

We appreciate the continued support of our partners at the U.S. Environmental Protection Agency and the State Executive Office of Energy and Environmental Affairs.

Boston Groundwater

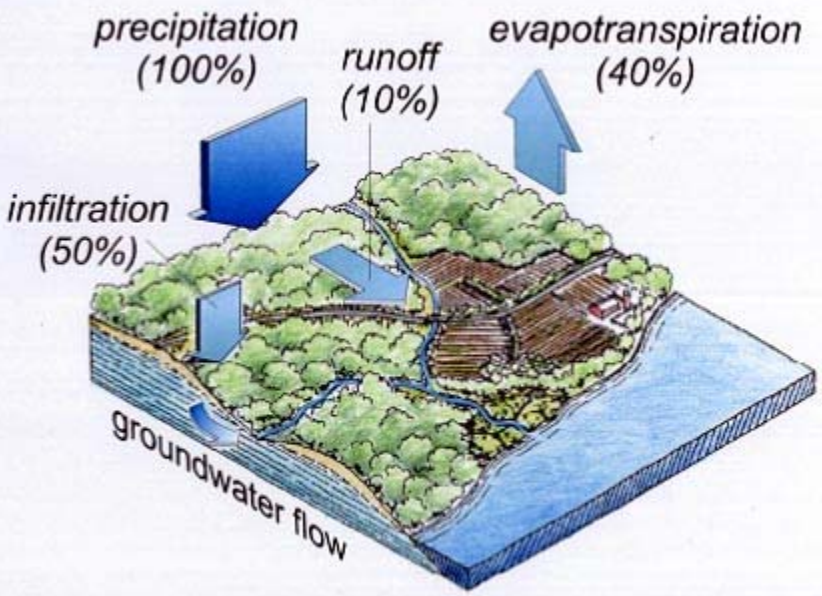


CITY OF BOSTON
Thomas M. Menino
MAYOR

The Importance of Groundwater Level

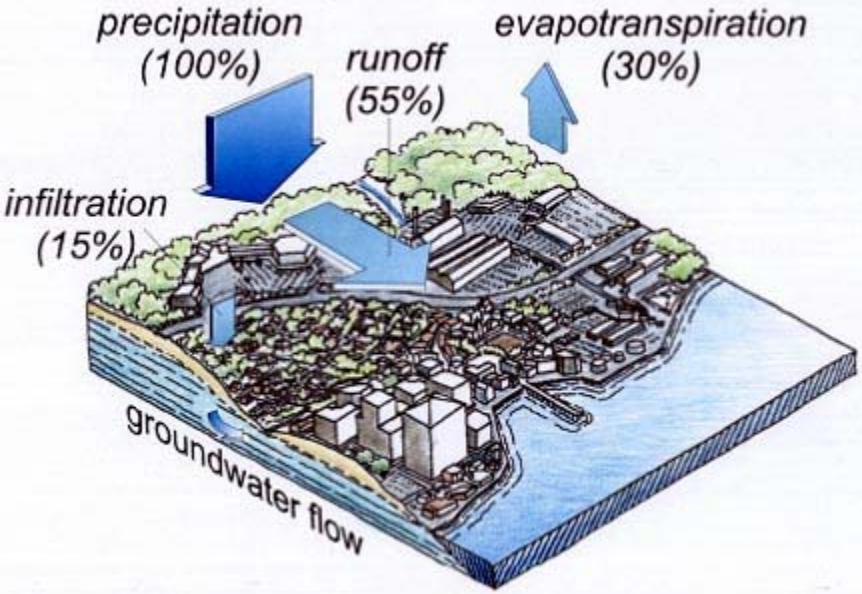
Mayor's Office of Environmental and Energy Services
Boston City Hall, Room 603
Boston, MA 02201

Natural Conditions

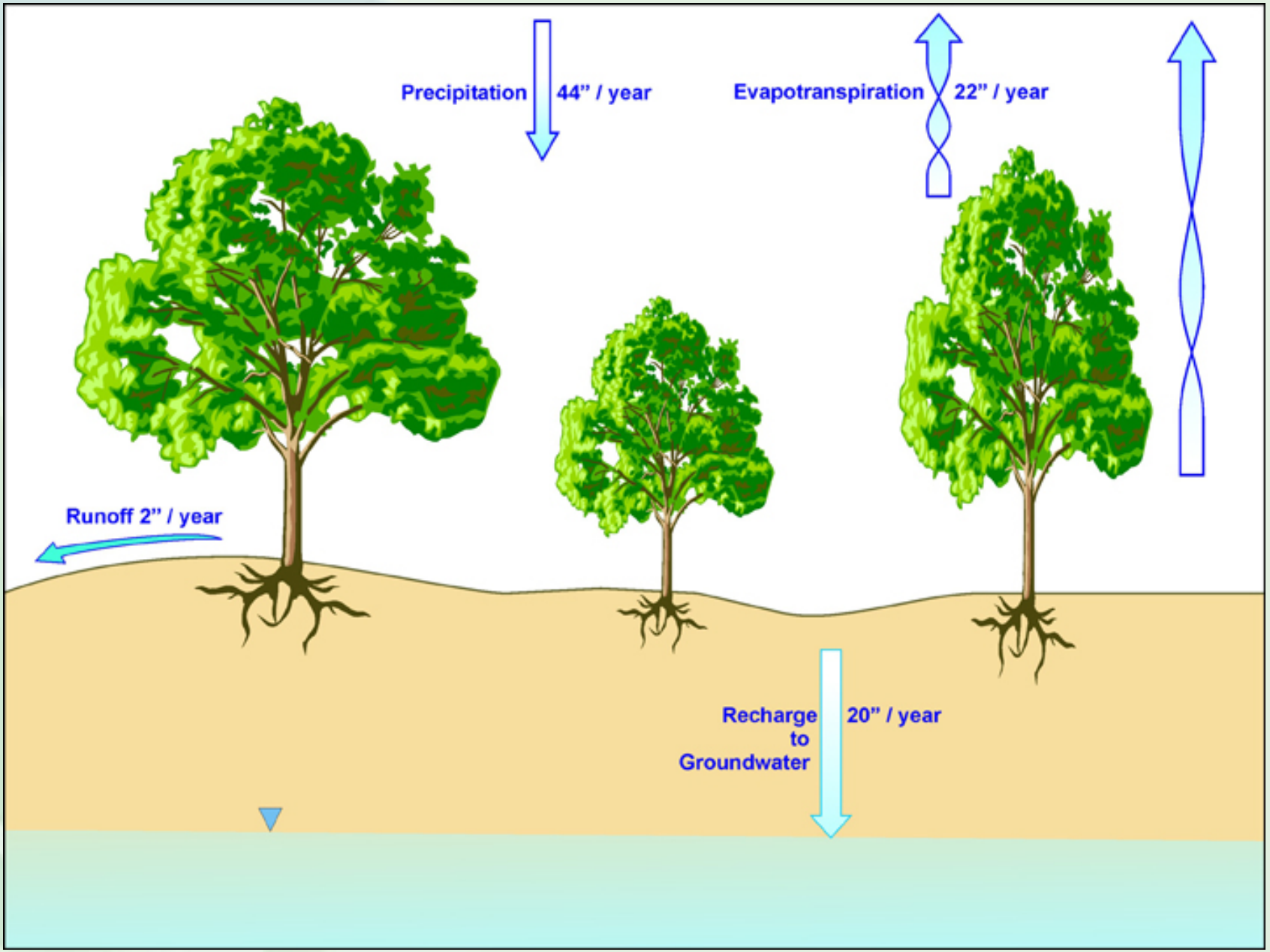


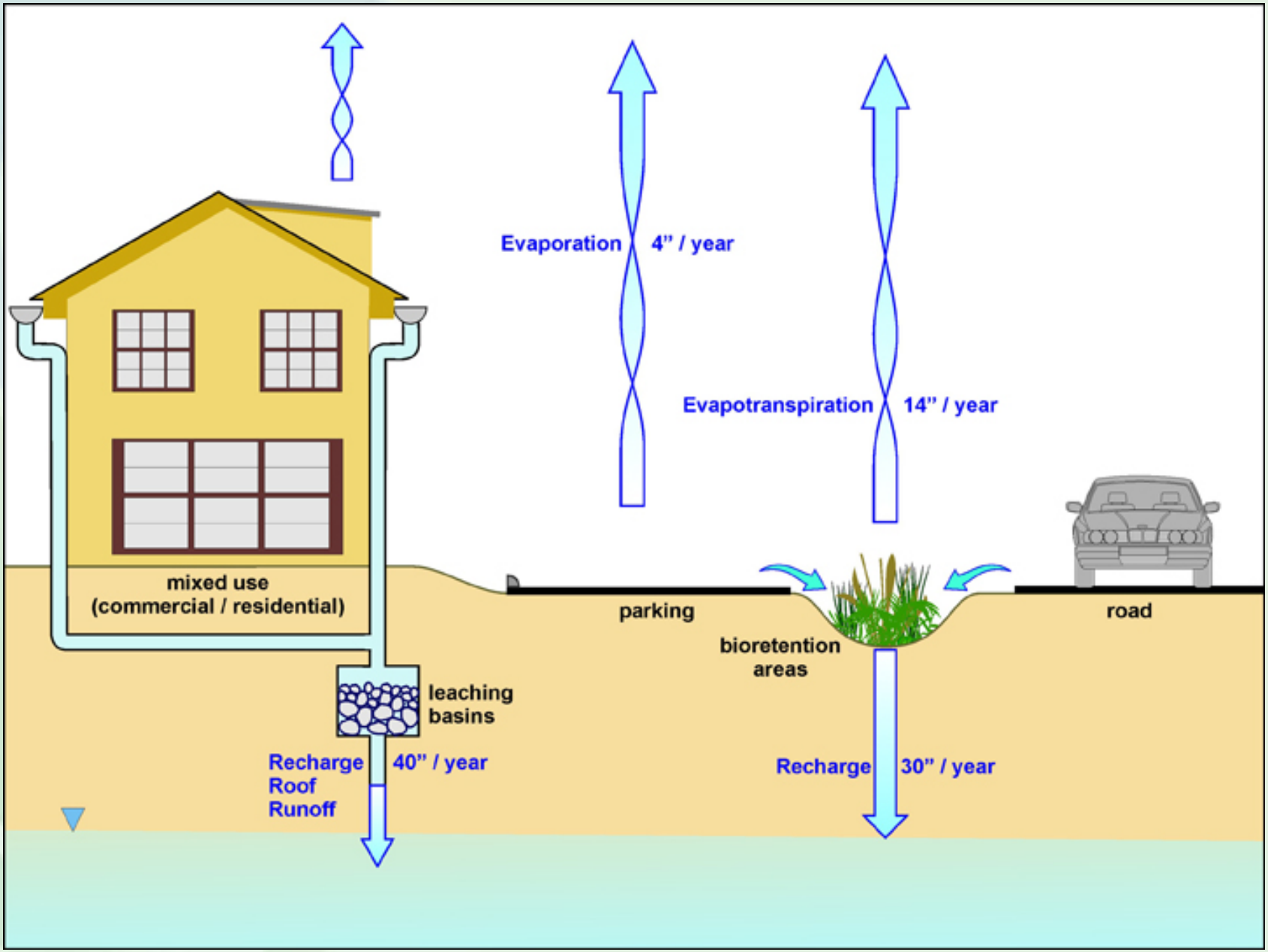
- Infiltration / recharge to groundwater supplies
- Natural filtration of pollutants by vegetation
- Minimal runoff

Conventional Development



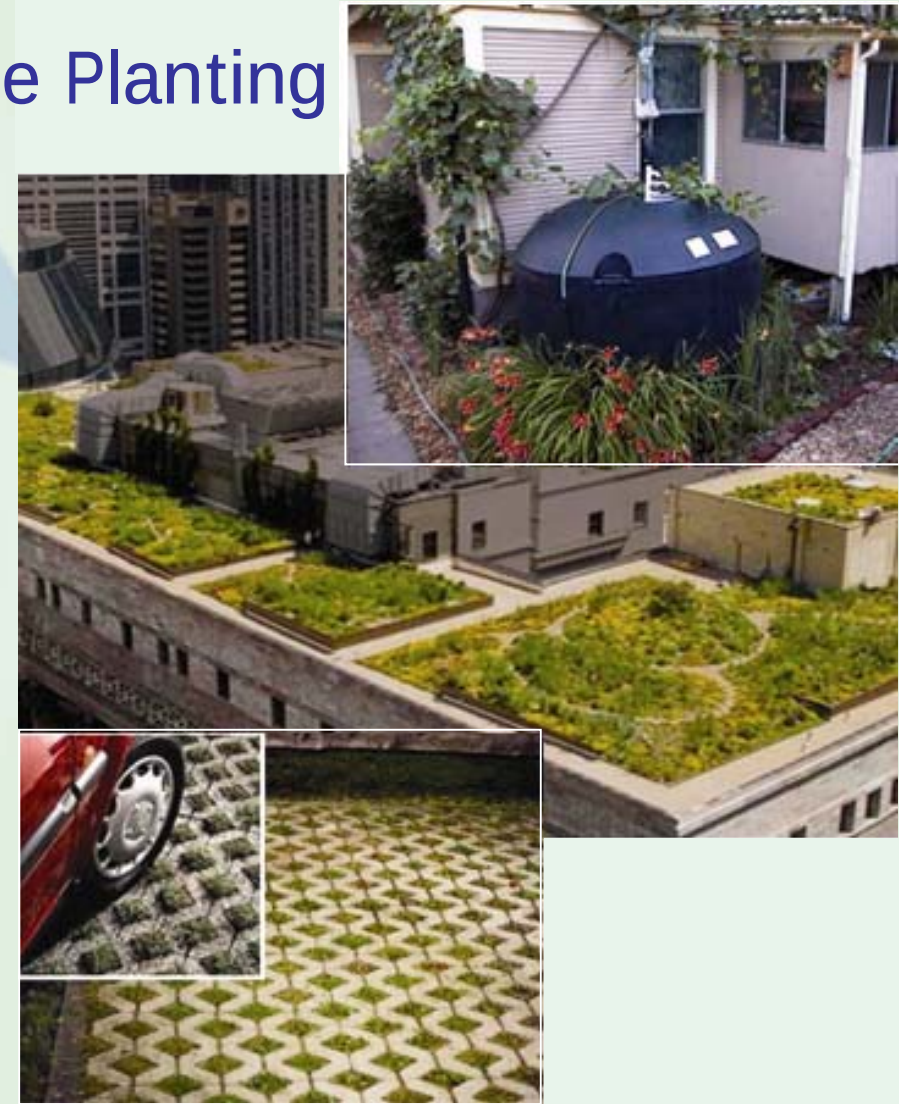
- Loss of natural land or open space
- Increased runoff / flooding
- Reduced infiltration / recharge to groundwater
- Increased infrastructure costs & maintenance


Precipitation
44" / year
Evapotranspiration
22" / year
Runoff 2" / year
Recharge
to
Groundwater
20" / year

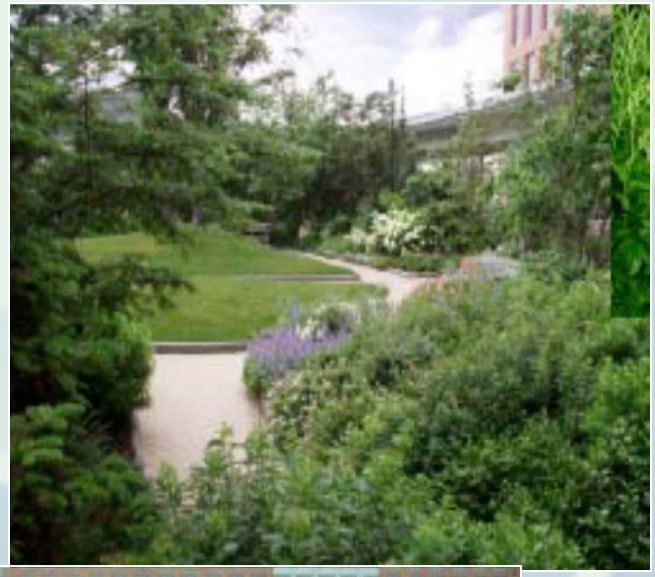

Evaporation 4" / year
Evapotranspiration 14" / year
mixed use
(commercial / residential)
parking
road
bioretention
areas
leaching
basins
Recharge
Roof
Runoff
40" / year
Recharge 30" / year

LID Stormwater Techniques

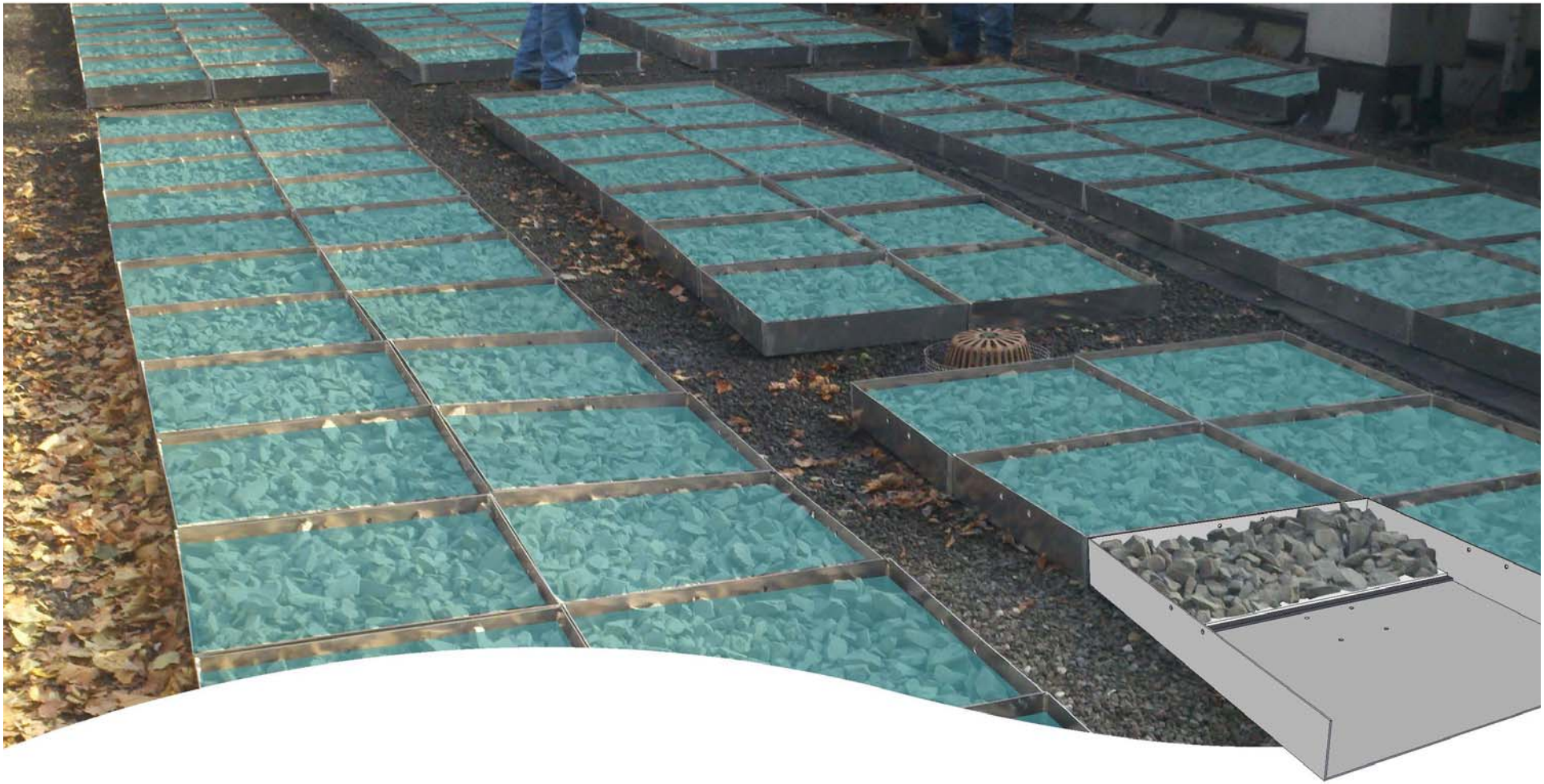
- Rain Barrels and Cisterns / Water Re-use
- Stormwater Planters, Tree Planting
- Permeable Paving
- Open Channels
- Bioretention
- Stormwater Wetlands
- Green Rooftop Systems
- Vegetative Buffers
- Infiltration



Green Roofs



- Stormwater Runoff absorption/collection
- Reduced flooding of and damage to urban streets
- Interior heating and cooling benefits of 10 degrees or more
- Air purification
- Recreational amenity
- Improved aesthetics
- Extended roof life, estimated at 40 years



Stormwater Planters

Source: City of Portland, OR

- Vegetative uptake of stormwater pollutants
- Pretreatment for suspended solids before they reach water-treatment facilities
- Aesthetically pleasing
- Reduction of peak discharge rate

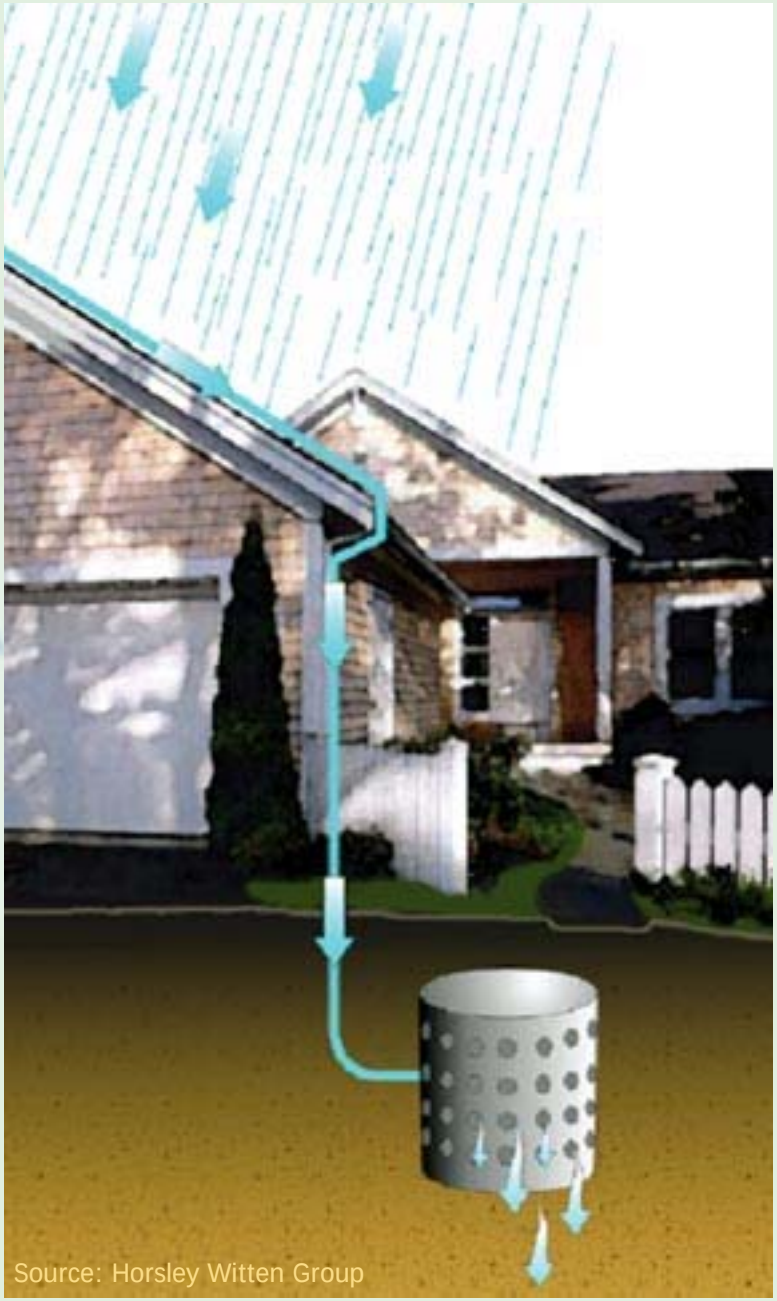
Rain Barrels and Cisterns
Runoff Reduction & Water Conservation

- Downspouts directed to tanks or barrels
- 50 –10,000 gallons
- Excess diverted to drywell or rain garden
- Landscaping, car washing, other non-potable uses

Dry Well Infiltration of Roof Runoff


Source: CWP

Disconnection of Rooftop Runoff to Vegetated Swale


Source: Horsley Witten Group

Permeable Pavement

Bioretention Applications

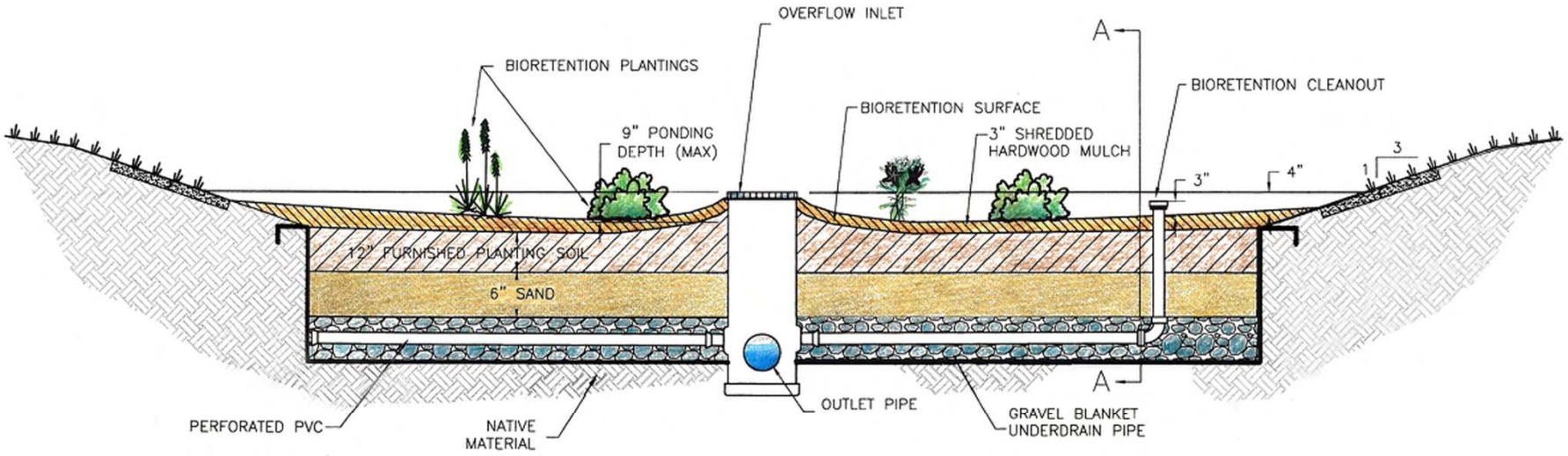
- Parking lot islands
- Median strips
- Residential lots
- Office parks

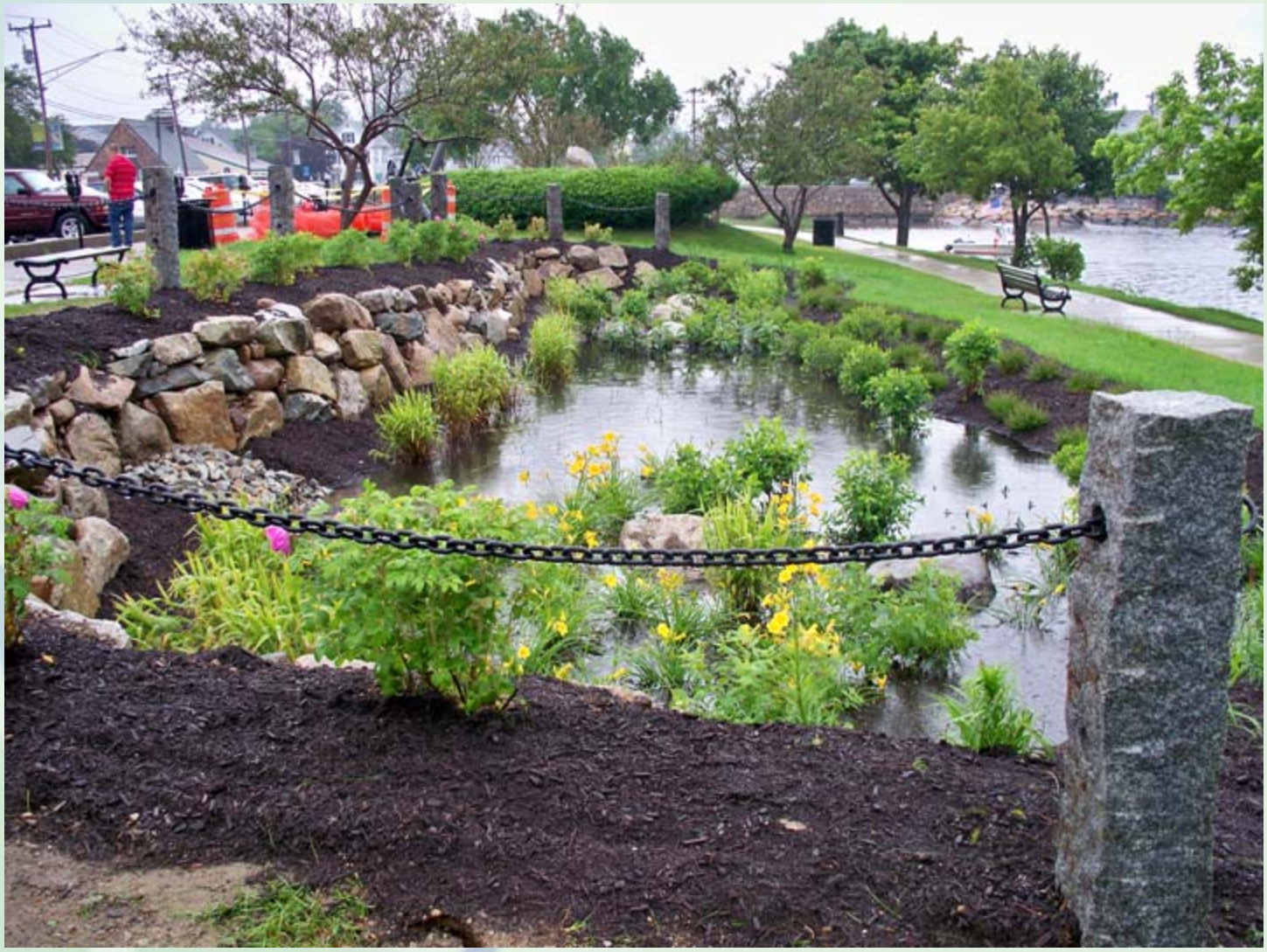

Source: Larry Gavin


Source: LID Center

Bioretention Applications

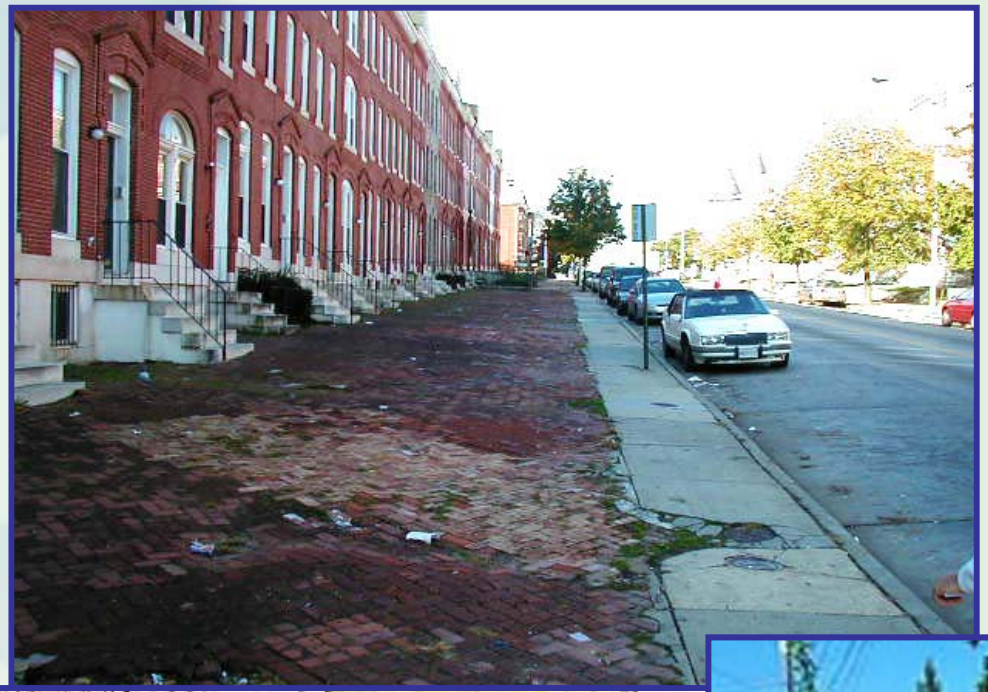
- Urban retrofits
- High-density areas


OVERFLOW INLET
A
BIORETENTION PLANTINGS
BIORETENTION CLEANOUT
BIORETENTION SURFACE
9" PONDING
DEPTH (MAX)
3" SHREDDED
HARDWOOD MULCH
3
1
3"
4"
12" FURNISHED PLANTING SOIL
6" SAND
A
PERFORATED PVC
NATIVE
MATERIAL
OUTLET PIPE
GRAVEL BLANKET
UNDERDRAIN PIPE

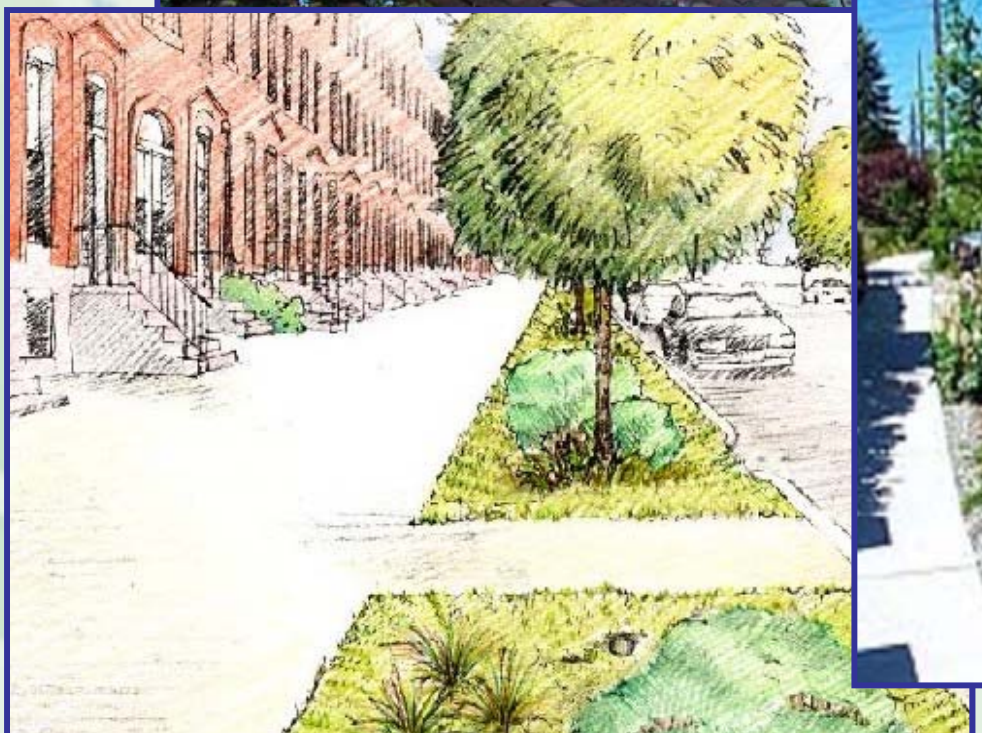


Bioretention Cell
Water Street, Plymouth Center, MA

Rain Garden



Source: City of Baltimore, MD




YOTA
JACK TAYLOR'S

Bioretention Area

Small parking lots

Vegetated Filter Strips

Pretreatment and Attenuation

- Mild vegetated slopes
- Adjacent to small parking lots and roadways
- Another opportunity for snow storage

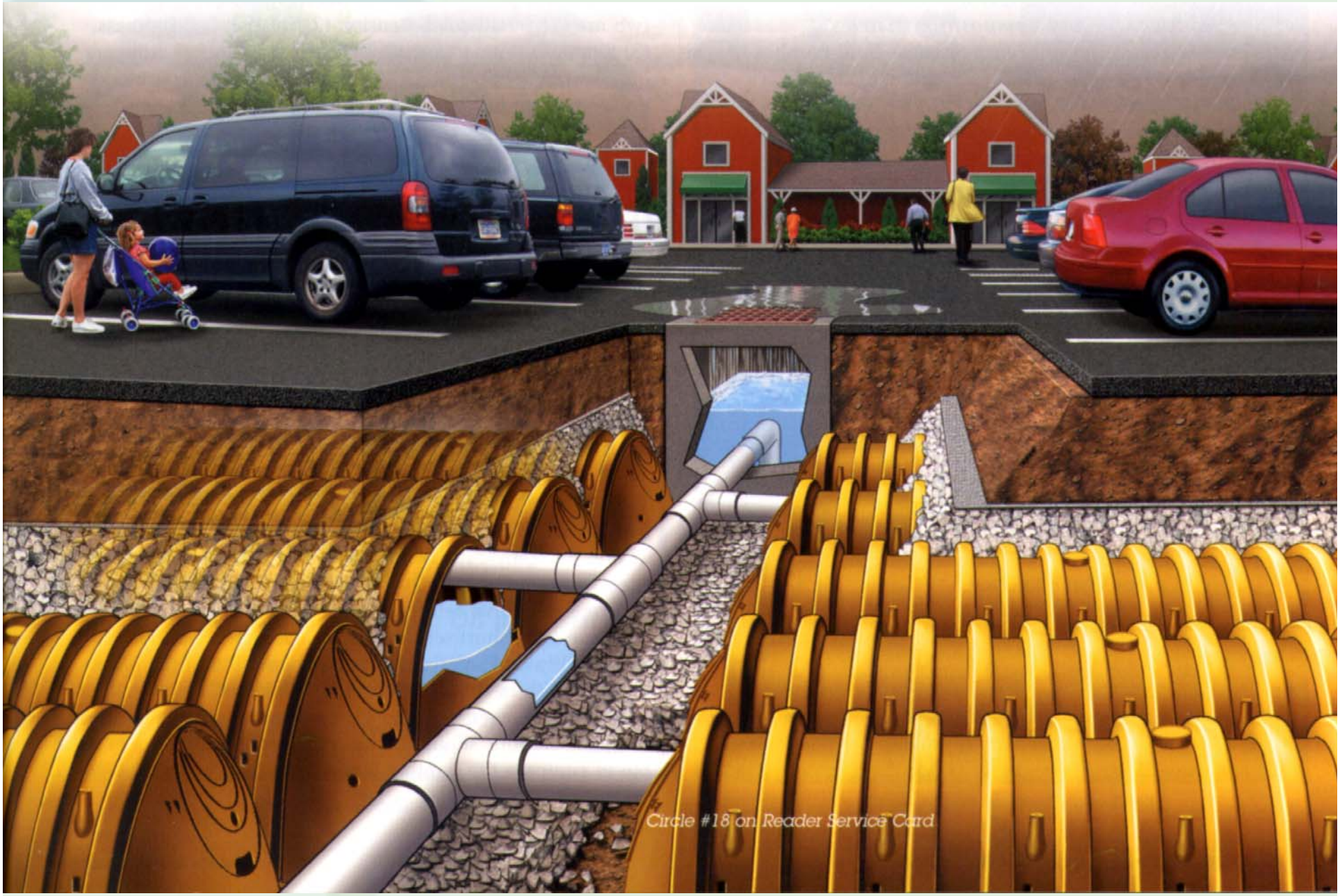

Source: City of Portland, OR


Source: City of Portland, OR

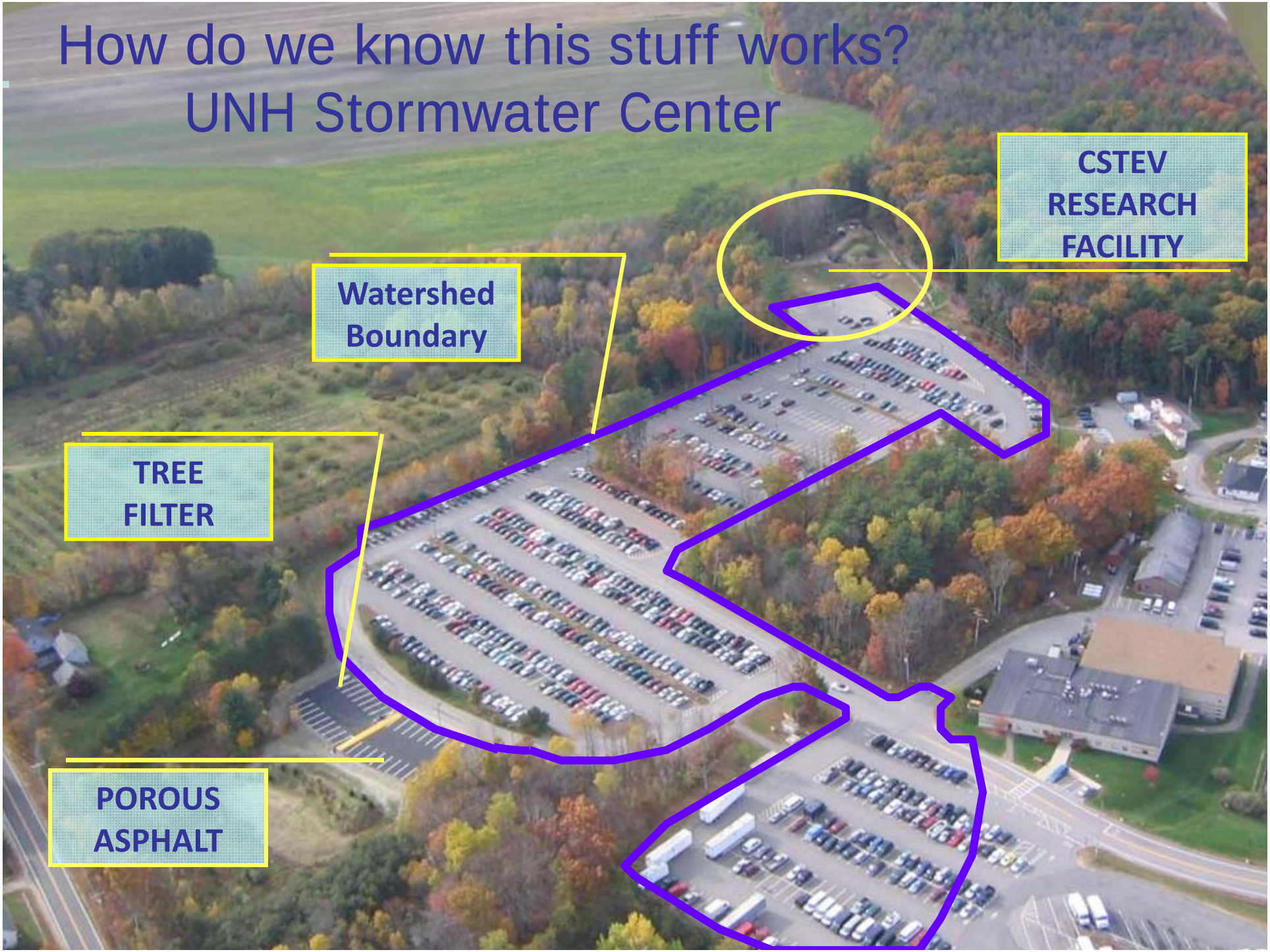
retention basin (No.1 on Site Plan) at Talbot Ave

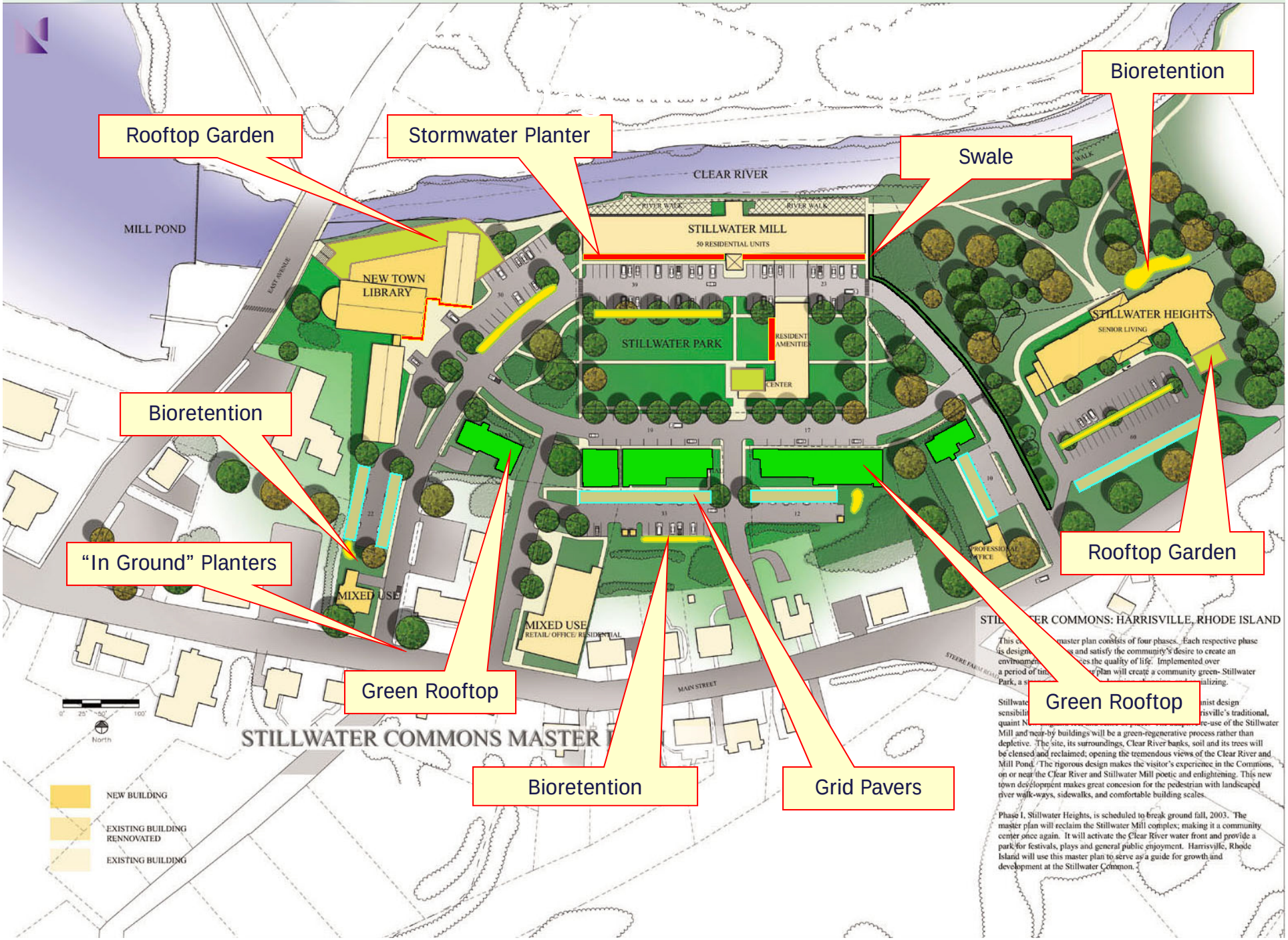
gest bioretention basin (No.5 on Site Plan) at Lower Campus Rd

ng lot bioretention strip (No.12 on Site Plan) at College Ave


Circle #18 on Reader Service Card

How do we know this stuff works?
UNH Stormwater Center

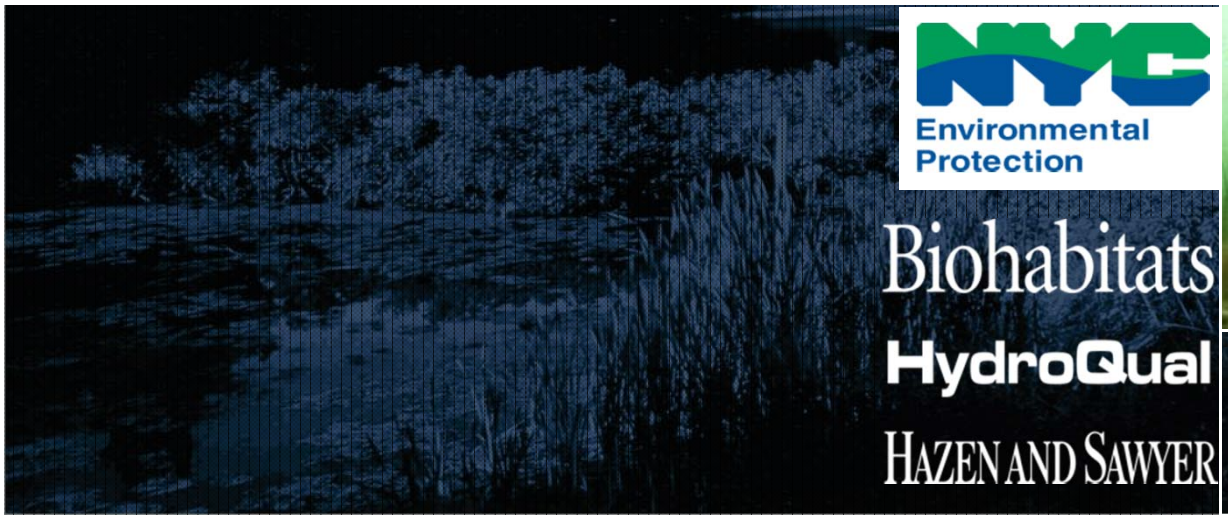



Rooftop Garden
Stormwater Planter
Swale
Bioretention
Bioretention
"In Ground" Planters
Green Rooftop
Bioretention
Grid Pavers
Rooftop Garden
Green Rooftop
CLEAR RIVER
MILL POND
STILLWATER MILL
50 RESIDENTIAL UNITS
NEW TOWN LIBRARY
STILLWATER PARK
RESIDENT AMENITIES CENTER
STILLWATER HEIGHTS
SENIOR LIVING
MIXED USE
MIXED USE
RETAIL/ OFFICE/ RESIDENTIAL
PROFESSIONAL OFFICE
MAIN STREET
STEERE FARM ROAD
EAST AVENUE
RIVER WALK
STILLWATER COMMONS MASTER
North
NEW BUILDING
EXISTING BUILDING RENNOVATED
EXISTING BUILDING
TER COMMONS: HARRISVILLE, RHODE ISLAND
master plan consists of four phases. Each respective phase
and satisfy the community's desire to create an
es the quality of life. Implemented over
plan will create a community green- Stillwater
Park, a
ializing.
nist design
risville's traditional,
re-use of the Stillwater
Mill and near-by buildings will be a green-regenerative process rather than
depletive. The site, its surroundings, Clear River banks, soil and its trees will
be clensed and reclaimed; opening the tremendous views of the Clear River and
Mill Pond. The rigorous design makes the visitor's experience in the Commons,
on or near the Clear River and Stillwater Mill poetic and enlightening. This new
town development makes great concesion for the pedestrian with landscaped
river walk-ways, sidewalks, and comfortable building scales.
Phase I, Stillwater Heights, is scheduled to break ground fall, 2003. The
master plan will reclaim the Stillwater Mill complex; making it a community
center once again. It will activate the Clear River water front and provide a
park for festivals, plays and general public enjoyment. Harrisville, Rhode
Island will use this master plan to serve as a guide for growth and
development at the Stillwater Common.

Reducing Pollution to New York City's Rivers and Harbors Using Green Infrastructure

Anne Kitchell, Horsley Witten Group
John McLaughlin and Julie Stein, NYCDEP

NEIWPCC 23rd Annual Nonpoint Source Pollution Conference
Portsmouth, NH May 15 -16, 2012



NYC Environmental Protection

Biohabitats

HydroQual

Hazen and Sawyer

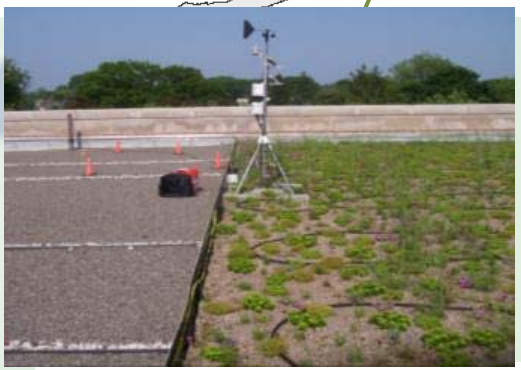
Bronx River Houses perforated pipe systems

North & South Conduit bioretention

Metropolitan Avenue blue roof trays

99th Ave. street-side infiltration swale

MTA Parking Lot wet meadow



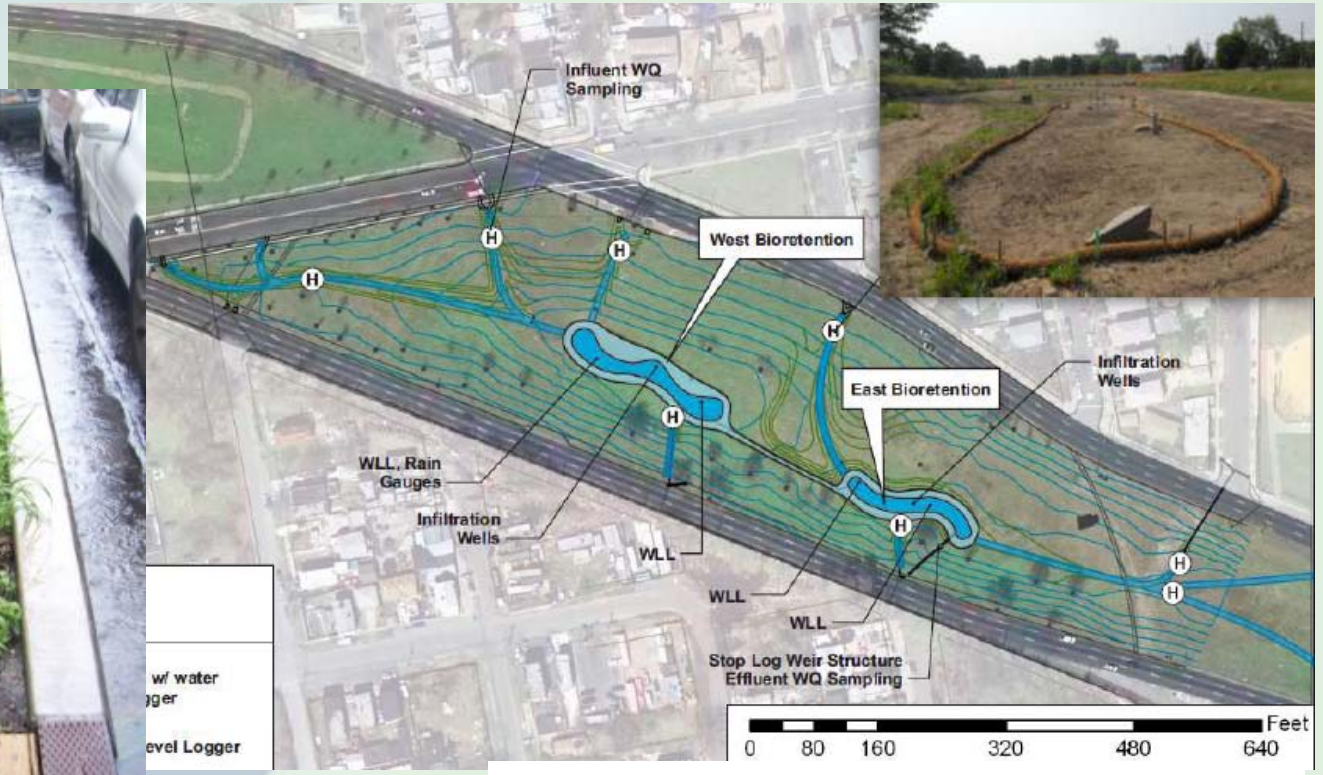
PS 118 green roof and blue roof check dams

Far Rockaway porous pavement

Public Housing Pilots

Public Right-of-ways

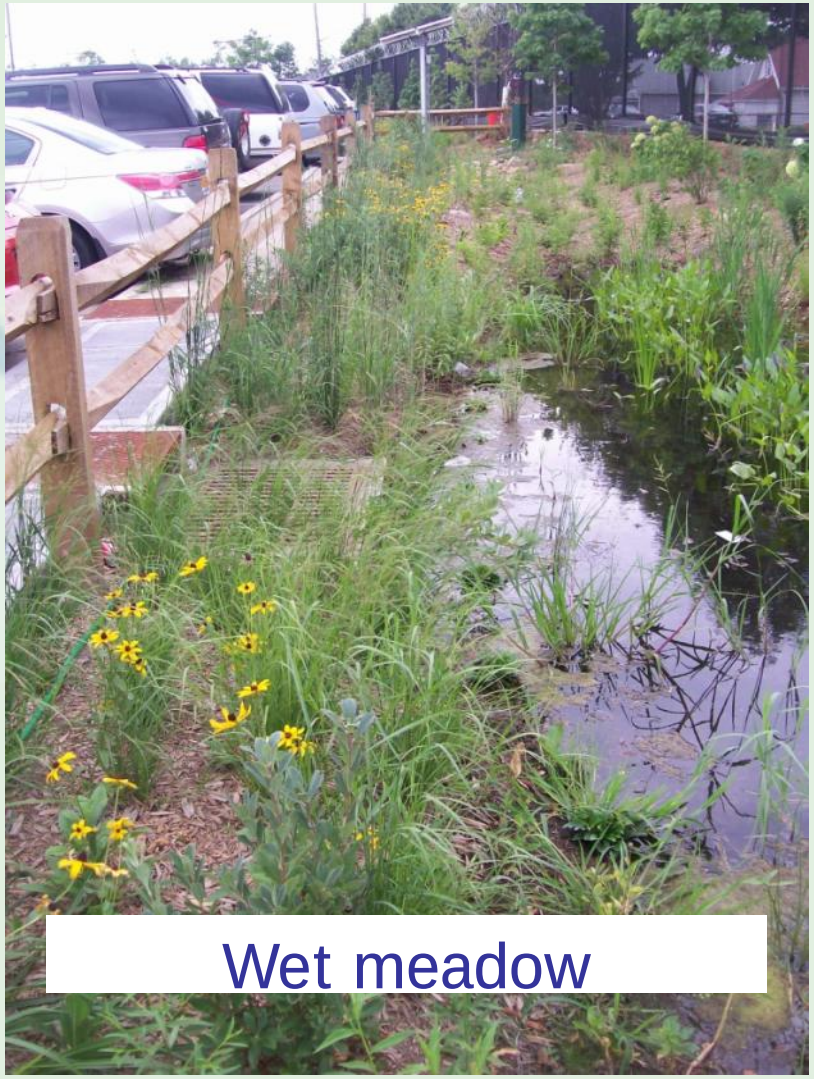
Street-side



Road Median

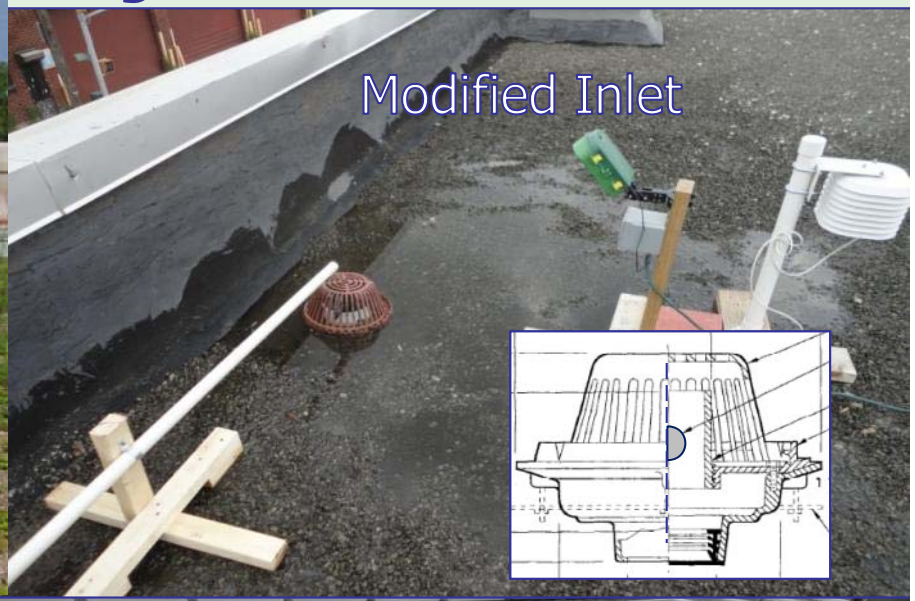
Public Parking Lots

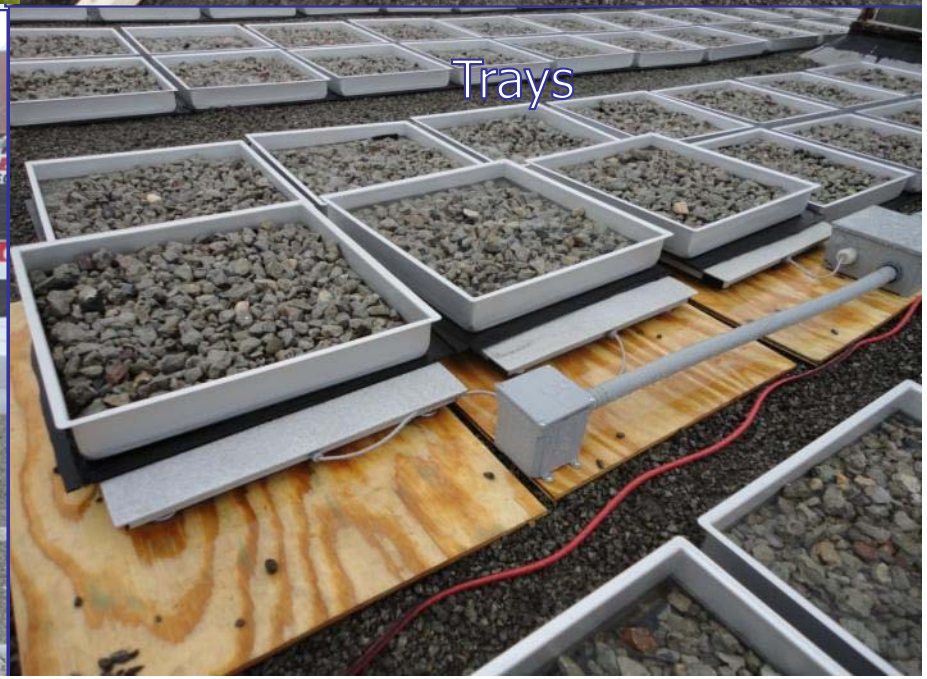
Permeable pavement



Wet meadow

Public Facility Roofs





EPA WaterSense

- Holly Cannon, Environmental Scientist, ERG

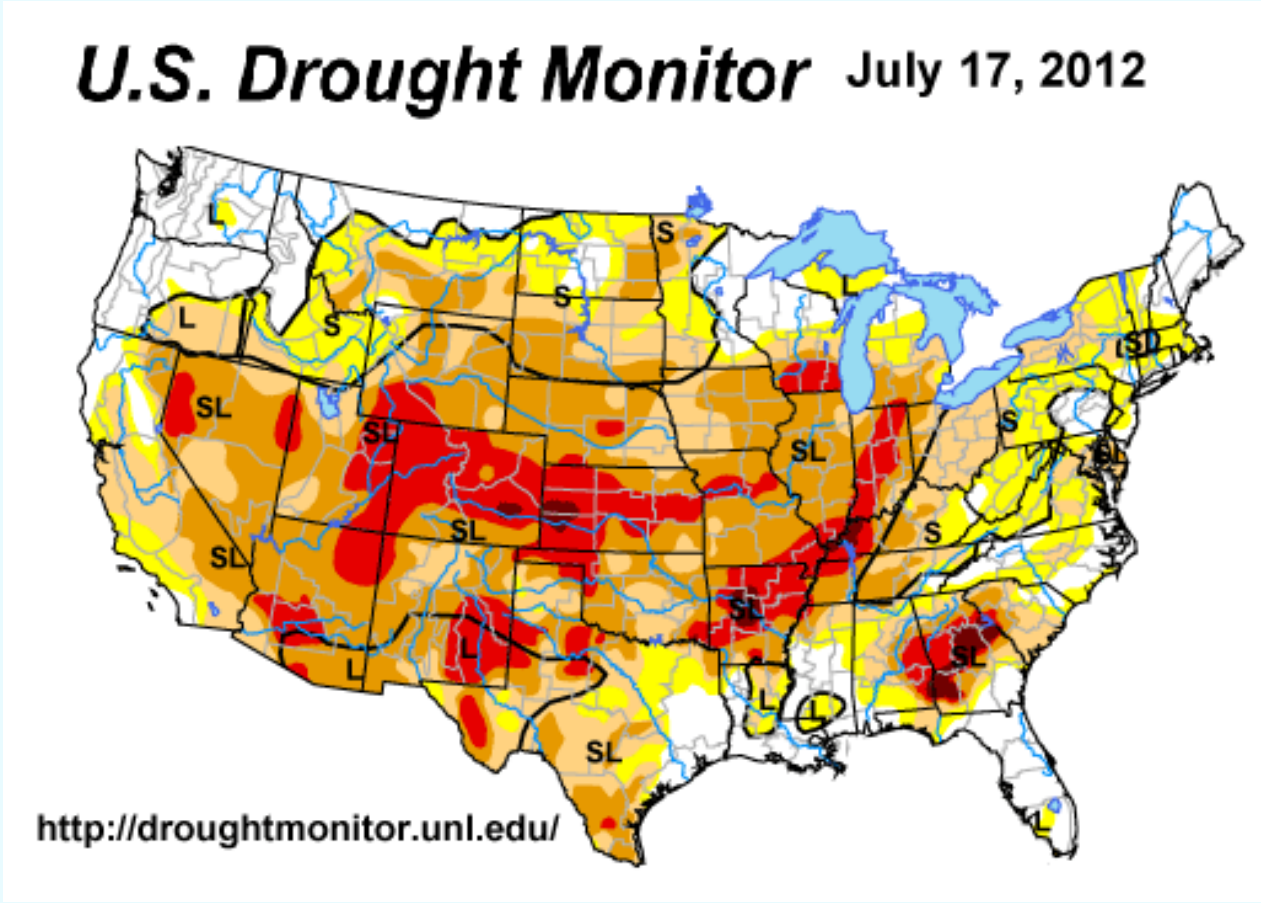
holly.cannon@erg.com
540.552.1018

EPA WaterSense

Introducing WaterSense®

U.S. Environmental Protection Agency

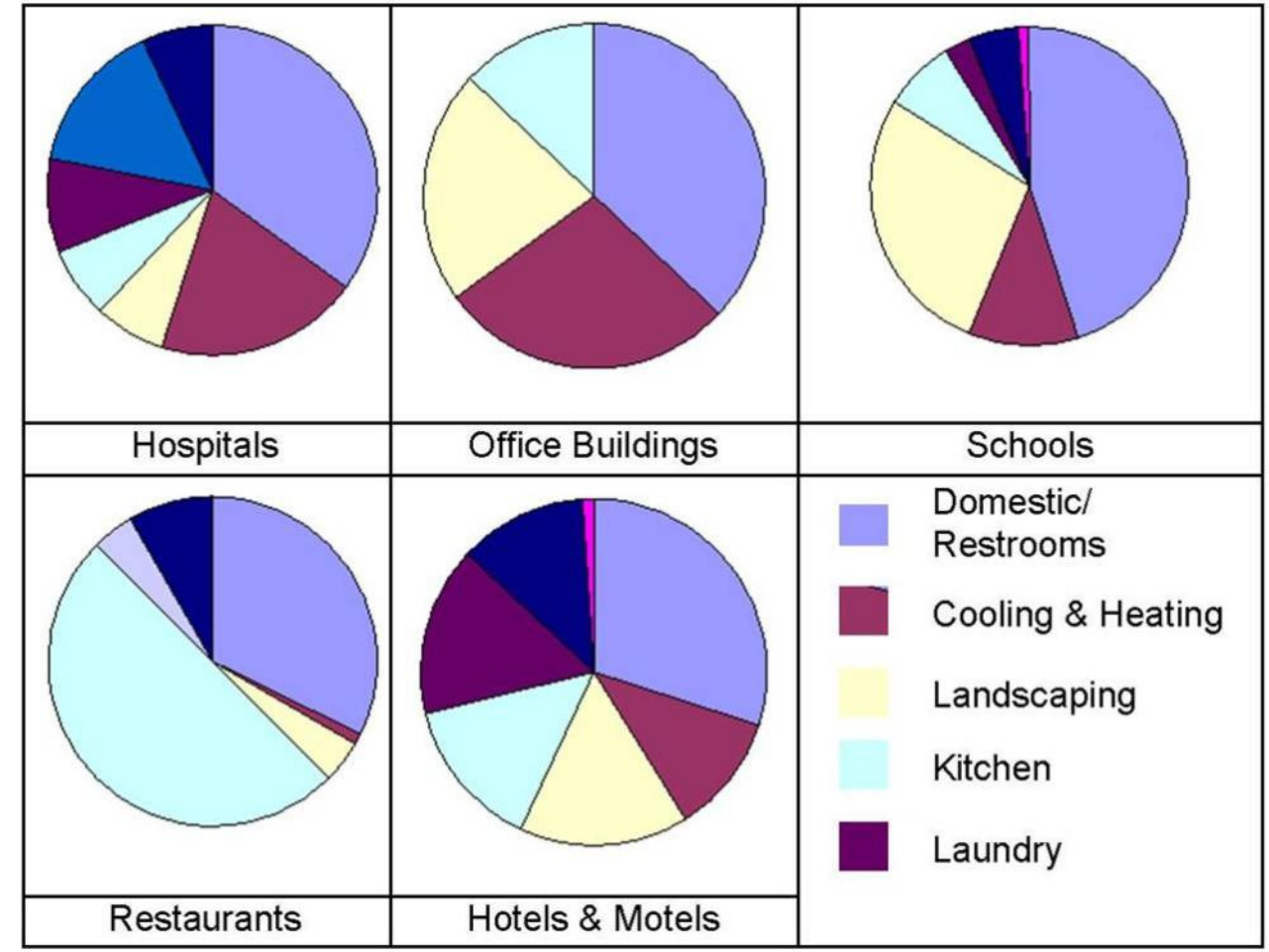
Water Scarcity is a Reality



- 61% of the continental U.S. in moderate to exceptional drought
- USDA designated 1,297 counties in 29 states disaster areas

EPA WaterSense

Water Use in Commercial Facilities



EPA WaterSense

What is WaterSense?

WaterSense is voluntary partnership and labeling program launched by EPA in 2006

- Addresses water efficiency and performance
- Labeled products are independently certified to use at least 20% less water

WaterSense
Meets EPA Criteria

EPA WaterSense

WaterSense Labeled Products

Flushing Urinals

Tank-Type Toilets

Irrigation Controllers

Showerheads

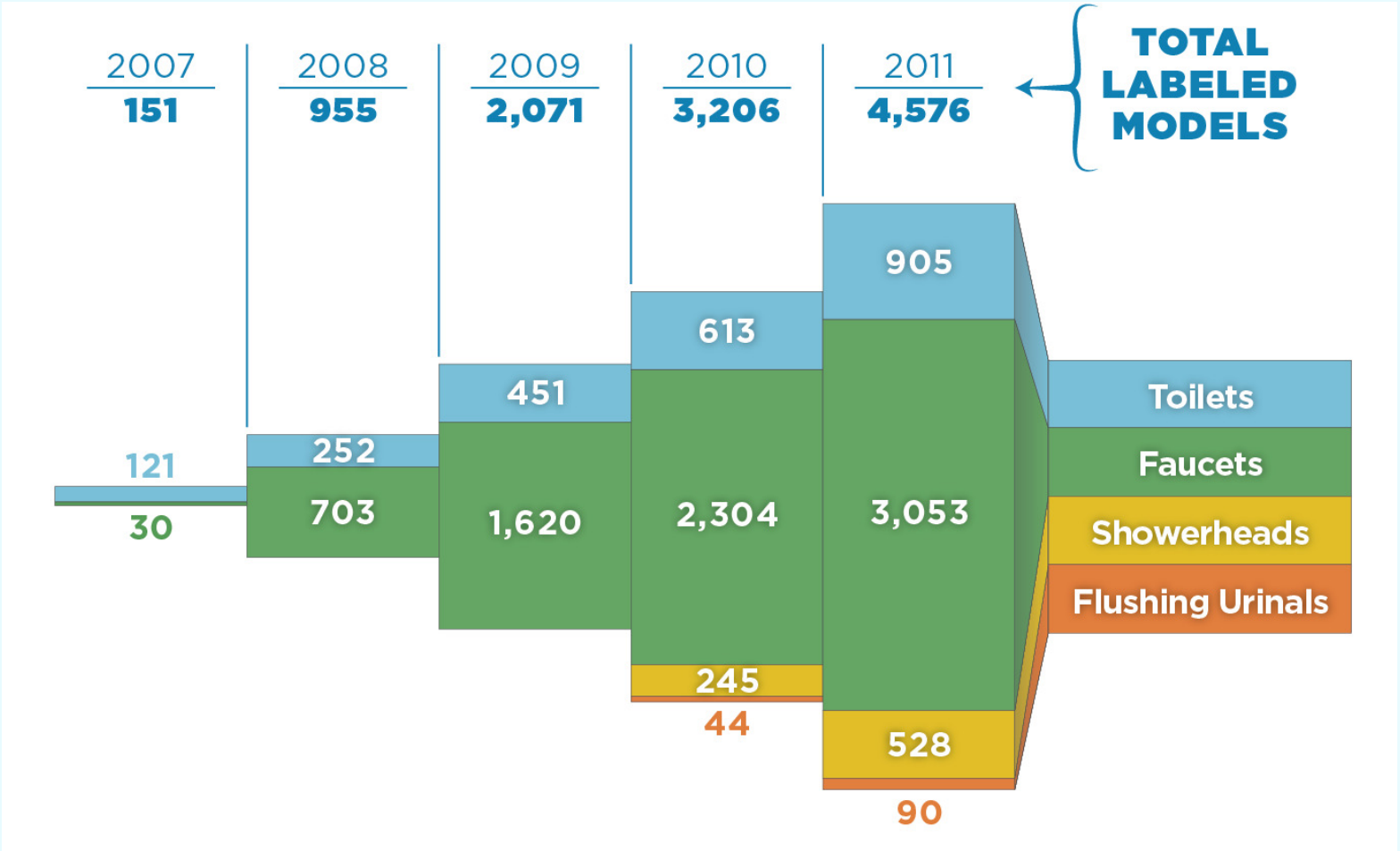
Lavatory Faucets

Labeled products are listed at:

www.epa.gov/watersense/products/index.html

EPA WaterSense

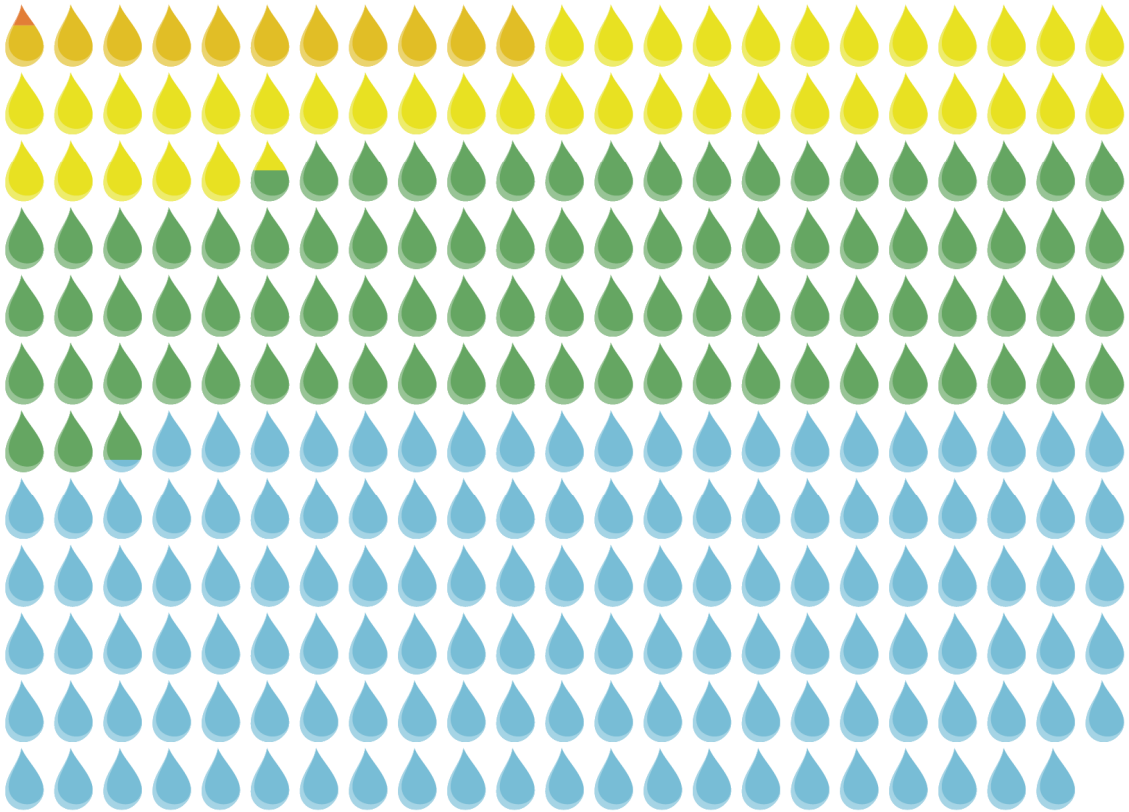
WaterSense Labeled Products Expanding



EPA WaterSense

Years of Savings

287 billion **gallons of water** saved since 2006!



143 billion gallons saved in 2011

EPA WaterSense

Coming Soon: *WaterSense at Work*

- Comprehensive document covering best management practices for water efficiency
- Aimed at facility managers, property managers, purchasing agents, and decision-makers in commercial and institutional facilities
- 30+ best management practices
  - Overview of technology/practice
  - Operation, maintenance, and user education
  - Retrofit options
  - Replacement options
  - Savings potential

EPA WaterSense

Coming Soon: *WaterSense at Work*

Best Management Practices	
Water Management Planning	***Leak Detection & Repair***
Sanitary Fixtures	***Commercial Kitchen Equipment***
Landscaping & Irrigation	***Mechanical Systems***
Pools & Spas	***Employee & Customer Education***
Onsite Alternative Water Sources	***Laboratory & Medical Equipment***

http://www.epa.gov/watersense/commercial/index.html

EPA WaterSense

Water Management Planning

- Measure water use with properly installed meters and sub-meters
- Set efficiency goals
- Conduct a facility water assessment
- Prioritize and implement water projects
- Incorporate water efficiency into procurement language and policies

EPA WaterSense

Measurement is Key

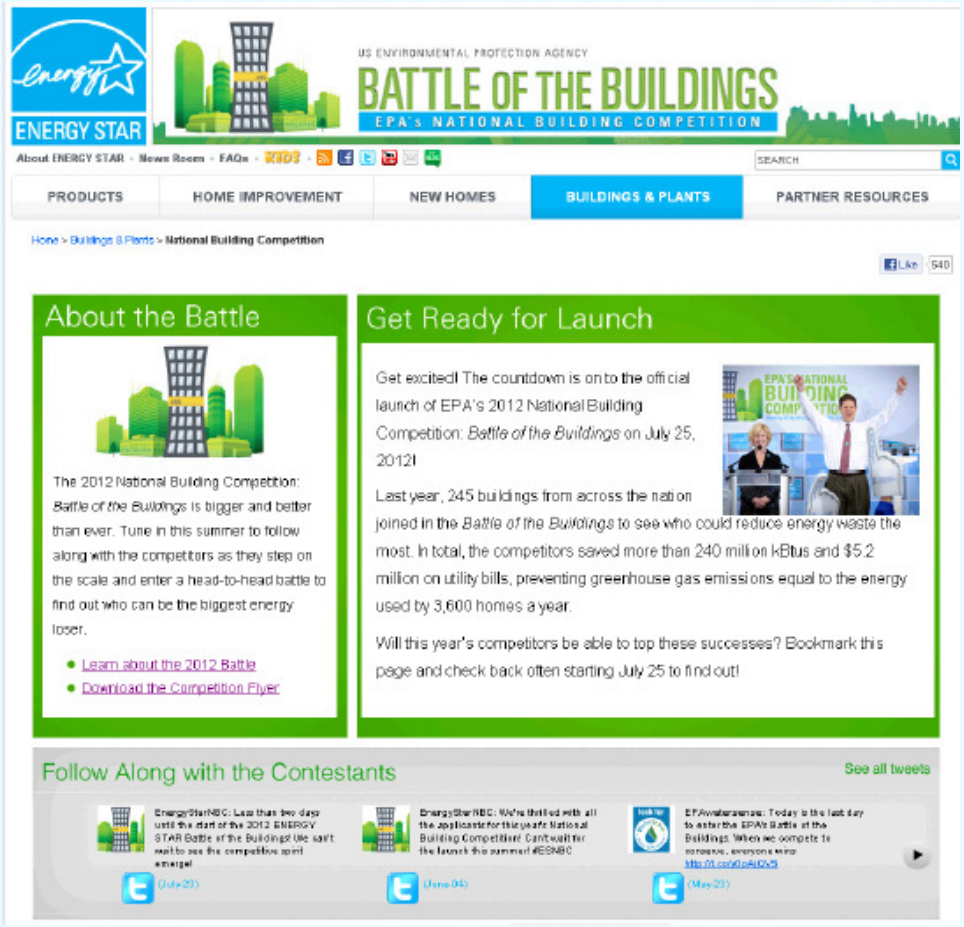
You can't manage what you don't measure

ENERGY STAR's Portfolio Manager can help track building water and energy use

EPA WaterSense

WaterSense and ENERGY STAR®

- Water included in ENERGY STAR's 2012 National Building Competition
  - Top water savers will be recognized!



EPA WaterSense

Additional Resources

- Best Management Practices and Manuals (coming soon—*WaterSense at Work)*

  http://www.epa.gov/watersense/commercial/index.html

- ENERGY STAR's Battle of the Buildings and Portfolio Manager

  http://www.energystar.gov/index.cfm?fuseaction=buildingcontest.index

  http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

- Other Guidebooks (IFMA, AZ, NC, CA, etc.)

EPA WaterSense

For More Information

Visit us online!

- www.epa.gov/watersense
- www.facebook.com/epawatersense
- www.twitter.com/epawatersense

Questions?

E-mail: watersense@epa.gov

Helpline: (866) WTR-SENS (987-7367)

Or contact Holly Cannon at holly.cannon@erg.com, 540-552-1018

look for WaterSense Meets EPA Criteria

EPA WaterSense

Fun Resources on Water

- Degrees of Thirst
- Story of Stuff – Bottled Water