Western Massachusetts Master Gardener Assoc., 20th Annual Spring Gardening Symposium, April 2, 2016

Patty Gambarini, Senior Environmental Planner
Pioneer Valley Planning Commission

Catalyst for Regional Progress
PVPC

Soak up the Rain

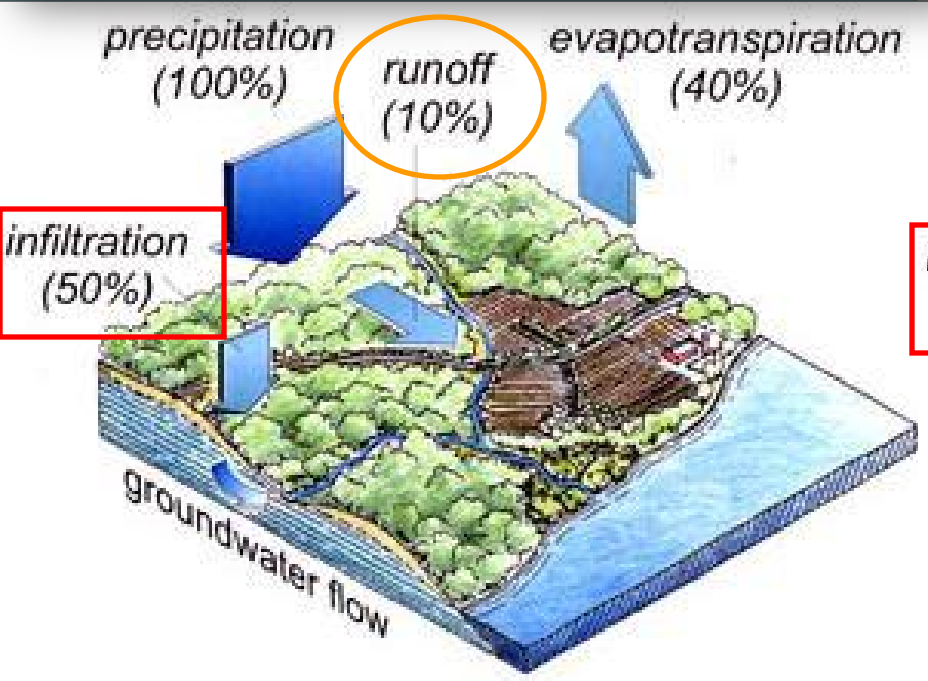
- Developed by EPA, New England

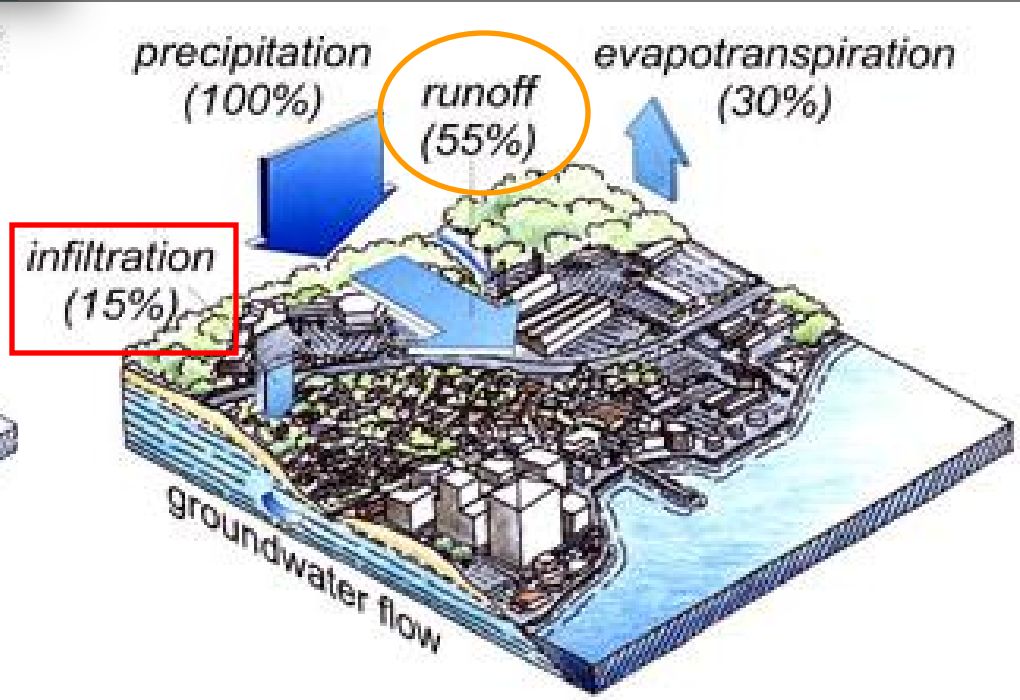
http://www.epa.gov/region1/soakuptherain/

- Adapted for the Pioneer Valley

http://soakuptherain.pvpc.org/

Development of land increases surface runoff





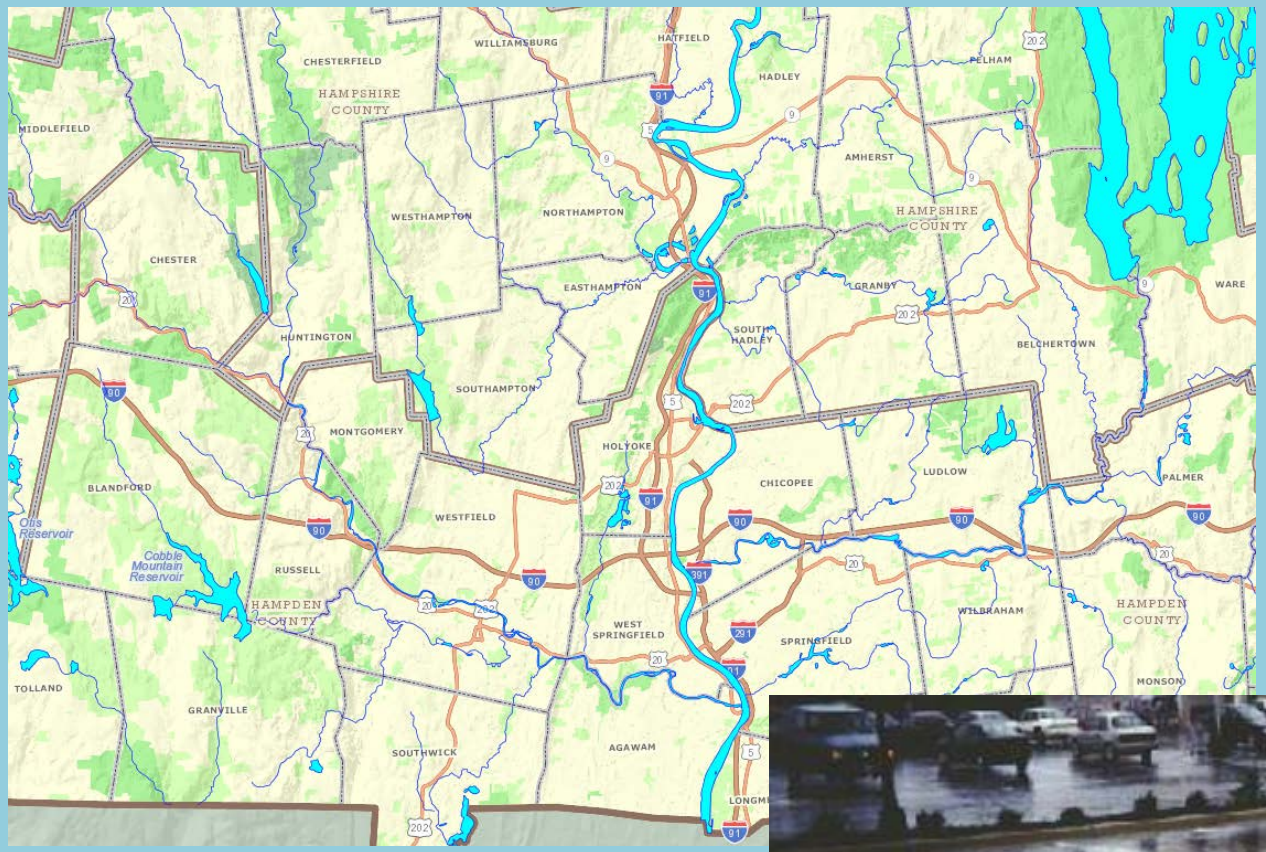

RUNOFF FROM ROOF
LAWN RUNOFF
GUTTER RUNOFF
STREET RUNOFF
STREET RUNOFF
STORMWATER RUNOFF ENDS UP IN LOCAL STREAMS, CREEKS, RIVERS AND LAKES.
Courtesy NCDENR

Stormwater impacts

Rule of Thumb: At ~10% watershed impervious cover we see:

- Water quality issues
- Increased flooding
- Reduced baseflow and recharge
- Stream erosion
- Impacts to biological communities
- Loss of recreational uses
- Shellfish bed closures

Water quality issues



- 76 rivers, streams, lakes and ponds in Pioneer Valley “impaired”
- Pioneer Valley contributing to ~3 million pounds of nitrogen flowing from CT River to Long Island Sound annually

Water quality issues

Cities & Towns

Section B

TUESDAY, AUGUST 19, 2014

AMHERST/EASTHAMPTON/NORTHAMPTON/TOWNS/OBITUARIES

Daily Hampshire Gazette • gazettenet.com Page B1

Warning: E. coli levels high in Connecticut, Mill rivers

By CHAD CAIN
Staff Writer

NORTHAMPTON – The deluge of rain ast Wednesday has elevated levels of E. coli bacteria at select spots on the Connecticut and Mill rivers, prompting health officials to warn people not to swim or boat there.

Water samples taken Thursday in Northampton at a Connecticut River oat dock, in the Elwell Recreation rea and near the Coolidge Bridge, as vell as at a popular swimming hole on he Mill River between Smith College nd Federal Street, were returned Friday with "really high" levels of E. coli bacteria, said Merridith O'Leary, director of public health.

The warning did not dissuade some people from enjoying the Connecticut River on Monday afternoon, including kayaker Jon Stahl, who headed north from his home in Agawam for an afternoon paddle. Although he normally looks for advisory signs warning of bacteria before he enters the water closer to his home, Stahl said he did not think to look during his first trip to the boat dock near the Coolidge Bridge.

"I just figured this far north there would not be as much urban refuse," said Stahl, who was strapping a kayak to his vehicle.

To see a map of where high levels of E. coli have been found on the Connecticut and Mill rivers, visit this story at www.GazetteNET.com.

Stahl said he did not swim, but was submerged up to his waist several times. He also saw other people jet skiing and boating along the river.

High levels of E. coli were also found at other spots throughout the region, including at the Oxbow boat ramp off Route 5 in Easthampton, at a boat ramp in Sunderland and at Barton Cove in Greenfield, according to the Connecticut River Watershed Council. Council volunteers gather samples for testing from Memorial Day until Oct. 1. Samples are sent to the watershed council's water testing laboratory in Greenfield, which tests solely for the presence of E. coli because it is a reliable indicator of the presence of other harmful bacteria.

High E. coli levels increase the likelihood of sickness, including stomach pains, rashes, breathing problems, diarrhea and other intestinal issues.

As a result of the findings, health officials have posted advisories warning people the water was not clean for boating or swimming, although the water may have cleared up already. Bacteria levels typically drop two days after a rainstorm as long as it is dry, but the advisories will stay up until volunteers do another round of testing this week, O'Leary said.

Though the samples are taken at specific spots along the rivers, O'Leary said that does not mean there is no bacteria in other areas of the water.

"When there are really heavy rains like that, typically the entire body of water has elevated counts of E. coli," she said.

■ See E. COLI / Page B2

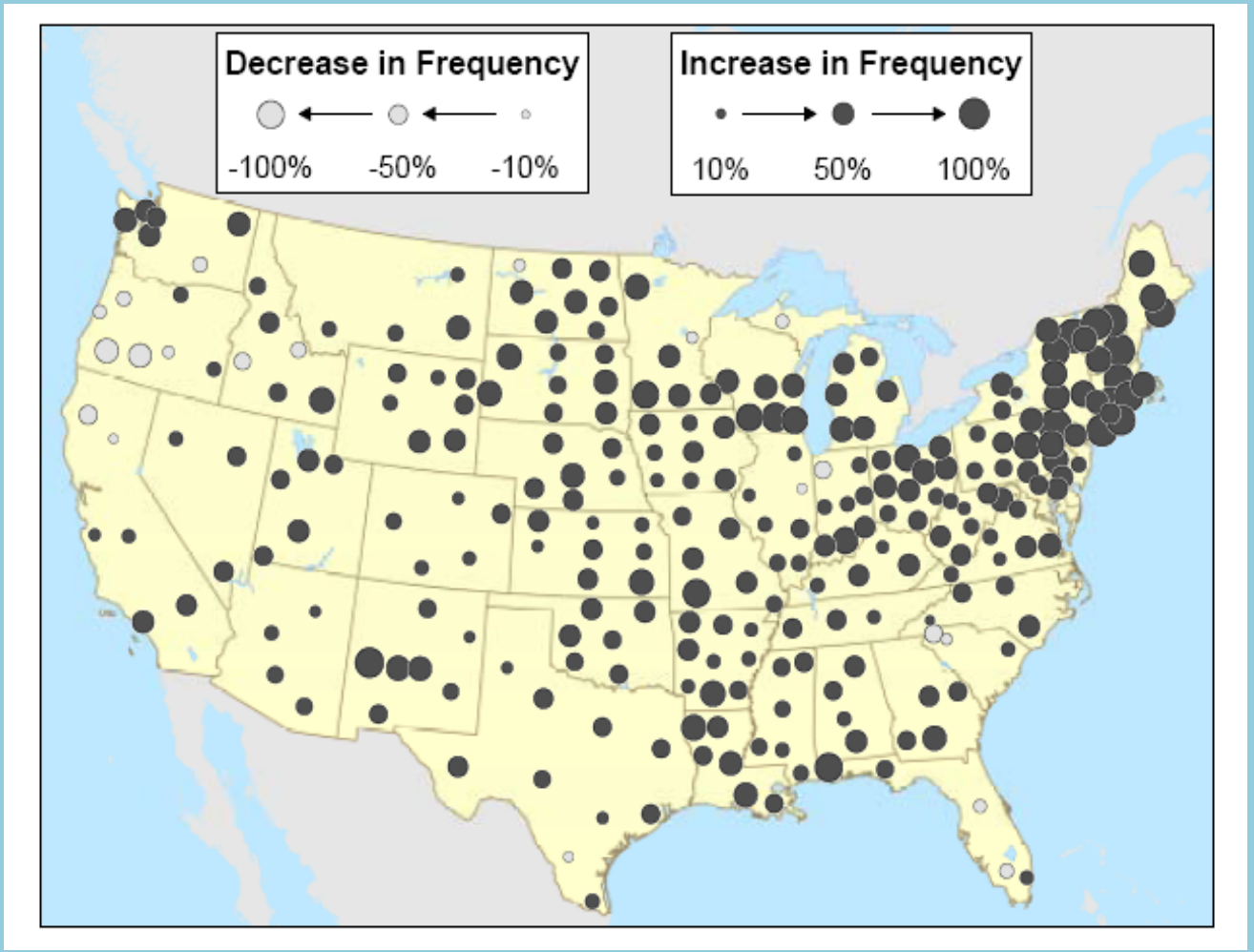
Increased flooding

The greater the impervious cover, the greater the likelihood of flooding

An equation that we are recognizing more and more

All images posted to MassLive during May 23 , 2014 storm event. Top image: Mosier Street, Holyoke. Bottom left: Prospect Street, Chicopee. Bottom right: King Street, Northampton.

Frequency of extreme downpours increasing



Source: When it Rains, It Pours by Environment America Research and Policy Center, analysis of weather records dating from 1948 to 2011.

Consequences

- Reduced economic vitality
- Health threats to people and wildlife

Source: NASA

Approach to managing stormwater - shifting

Varying scales – recognize that we are all part of a connected system

- Single lot and larger developments/redevelopments – distributed systems to capture, treat, soak up rainfall
- Municipalities – street system and public property retrofits
- Watershed – protection of key lands to promote river function

Cottages on Green, East Greenwich, RI
Photos courtesy of Jonathan Ford, Horsley Witten Group

Soaking up the rain

A strategy for our homes that extends to improving the neighborhood, town, and region where we live.

Soaking up the rain
What would the forest do?

1. Return rainfall to the atmosphere
2. Capture/collect rainfall
3. Slow flow
4. Return moisture to the soil

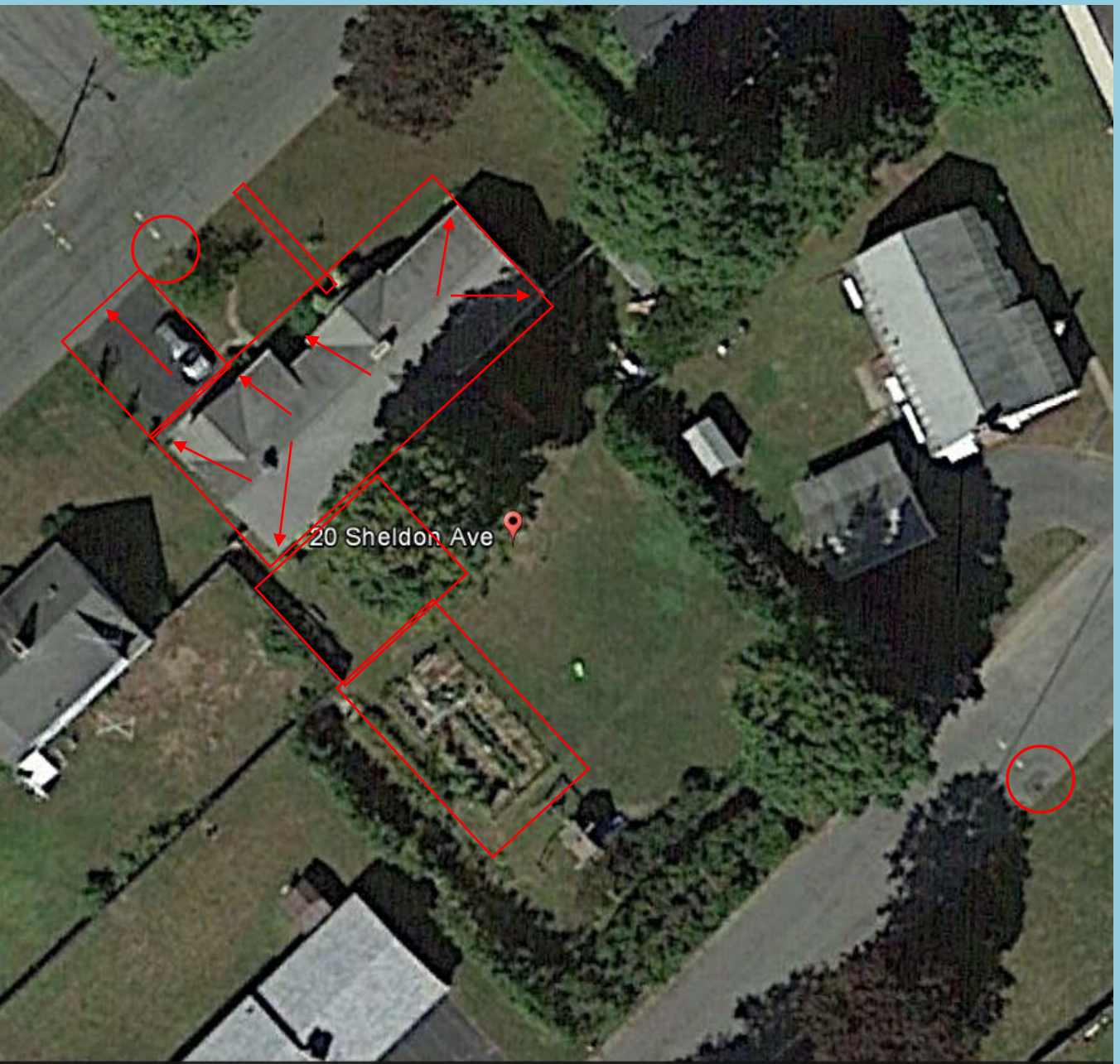
Soaking up the rain = facilitating the natural water cycle

- Manage rainfall and snowmelt as close to the source as possible – find ways to disconnect areas from draining to municipal stormwater system
- Reduce impervious cover
- Protect natural drainage systems and pathways
- Preserve natural areas and native vegetation

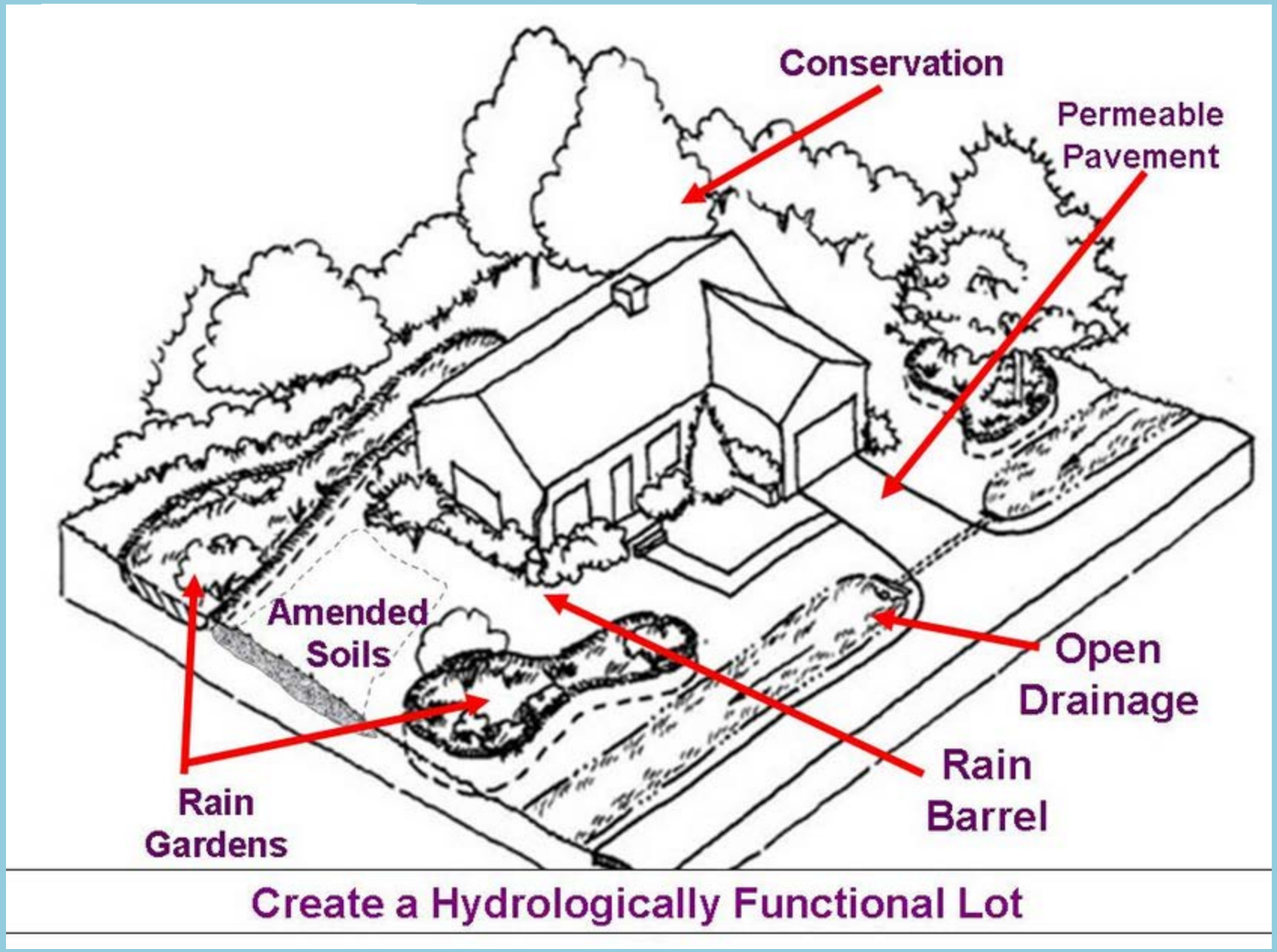
Where do you live?

- Densely urban - multi family, apartment, condo
- Village - lot < ¼ acre (10,890 sf)
- Suburban – single family home; lot ¼ acre to 1 acre
- Suburban – single family home: lot >1 acre to 2 acres
- Rural – single family home; lot 2 acres or more

Site Assessment Considerations

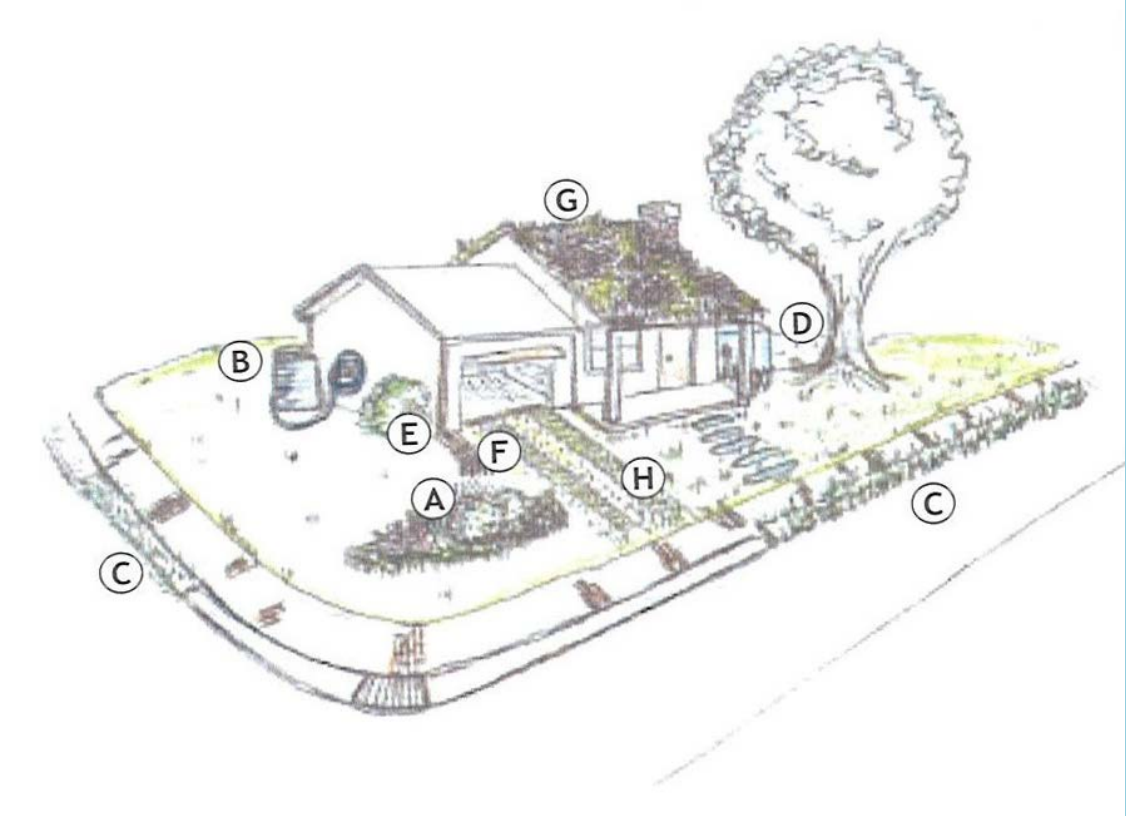


- What surfaces are generating run off?
- What is the drainage area for these surfaces?
- Where are current drainage pathways?
- Where are the opportunities to capture, slow, and/or soak up?



Create a Hydrologically Functional Lot

This home has it all!



Source: Vermont LID Guide for Residential and Small Sites

Strategies:

A. Rain garden

B. Rain barrel

C. Vegetated swale

D. Cistern

E. Rain gutter/downspout diversion

F. Infiltration trench

G. Green roof

H. Porous paving

Missing: tree, drywell

Layout & drawing by Russell Preston; pulled from 9/11/14 presentation by Jonathan Ford

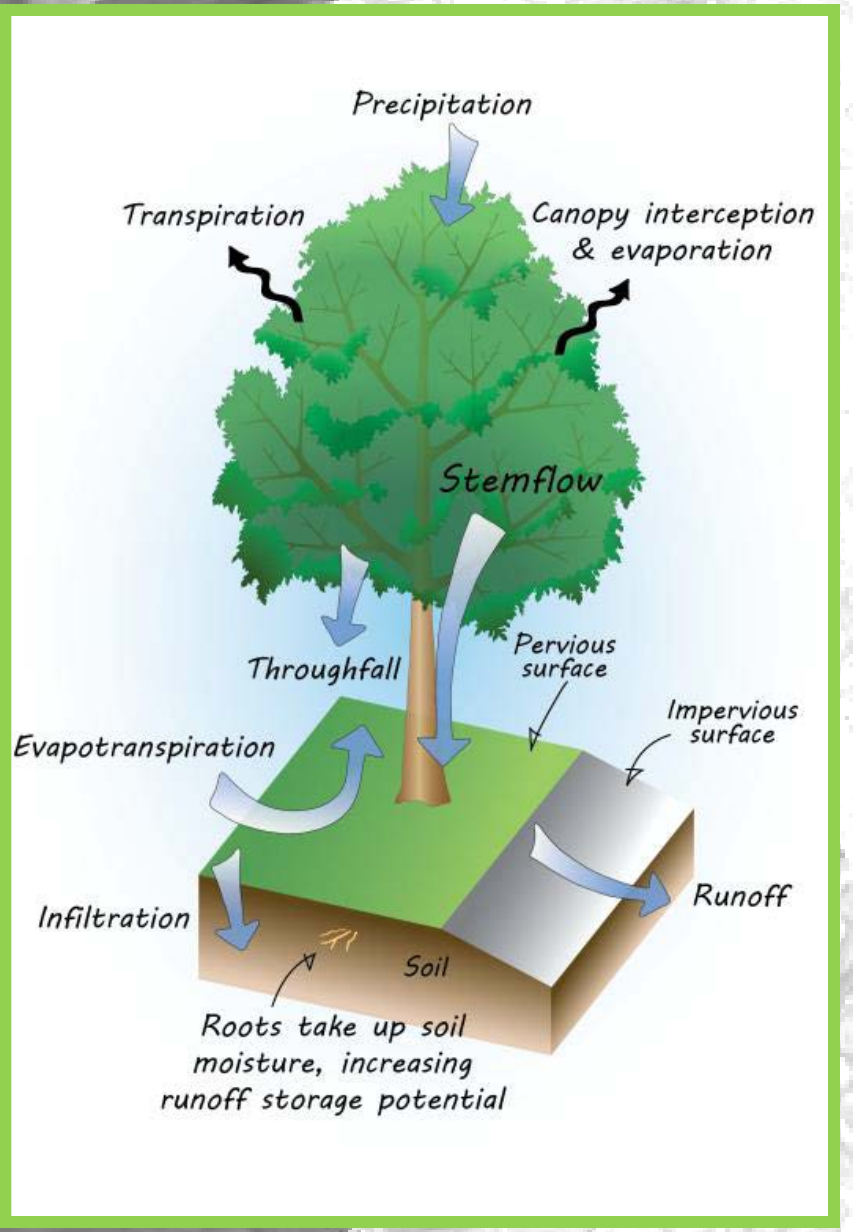
Easy fixes

- **Trees**
- **Roof gutter, downspout redirects**
- **Rain barrels**

More involved

- **Cisterns**
- **Rain gardens**
- Bioswale
- Porous paving
- Dry wells

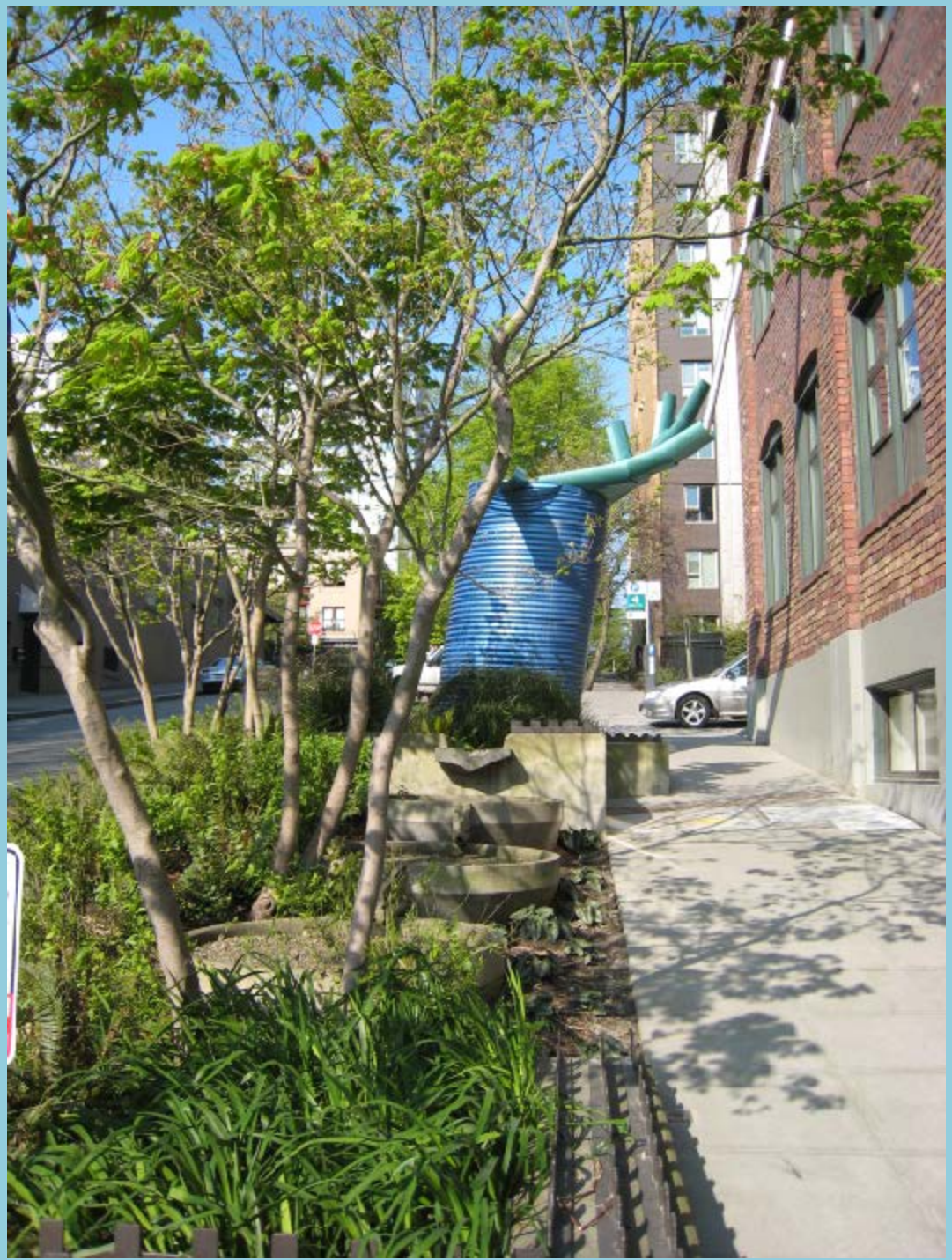
Can often use these in combination:
• roof gutter/downspout redirect to rain garden;
• cistern to drywell;
• downspout to bioswale



Trees

One large deciduous tree can reduce stormwater runoff by ~ 4,000 gallons per year

- Canopy and branches intercept and store rainfall, facilitating evaporation
- Roots take up moisture that is then transpired into air
- Root growth and decomposition increase capacity and rate of rainfall infiltration into soil



Growing Vine Street project, Seattle

Roof gutter, downspout redirects

Problem: Downspout delivers flow onto driveway, street, and combined sewer system

Solution: Re-hang gutters to direct flow to new downspout that outlets to front garden

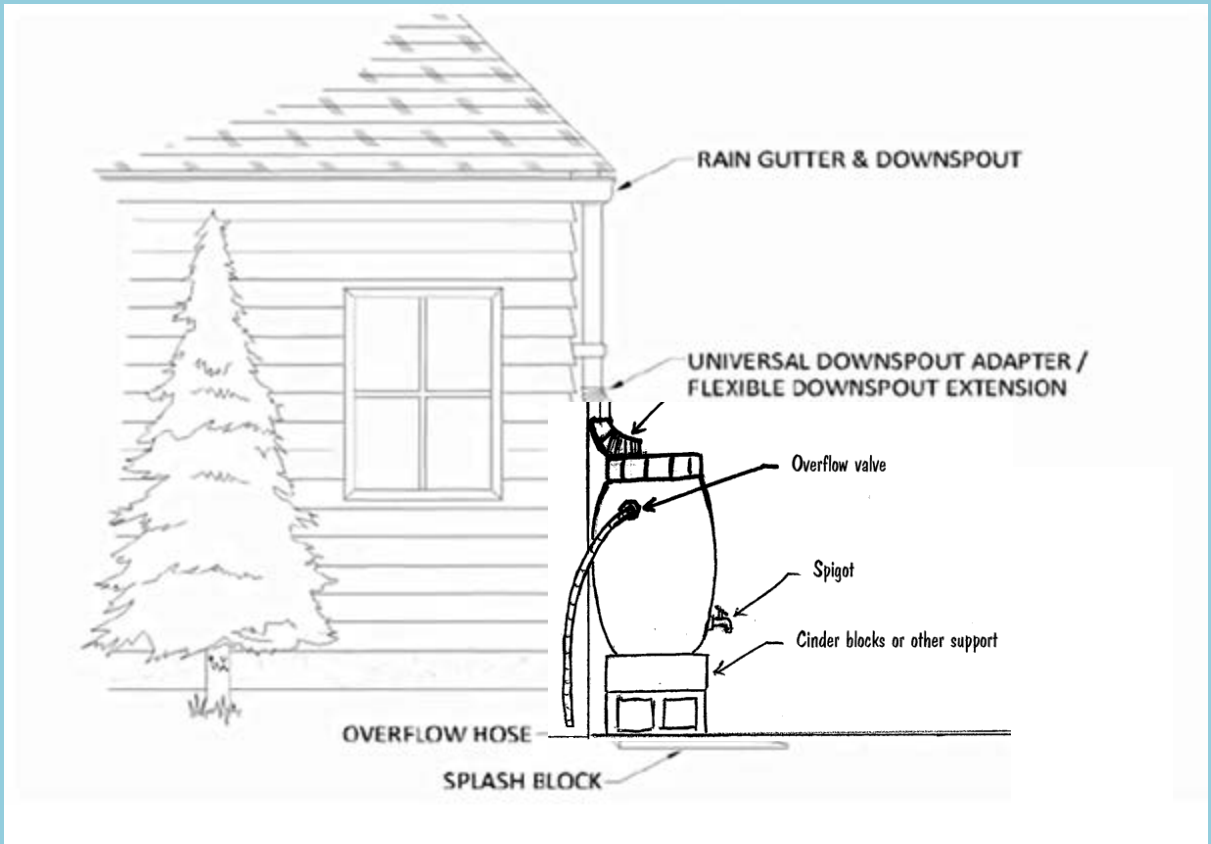
Cost:
Approx. $200

Bonus – Reduces icing on driveway in winter!

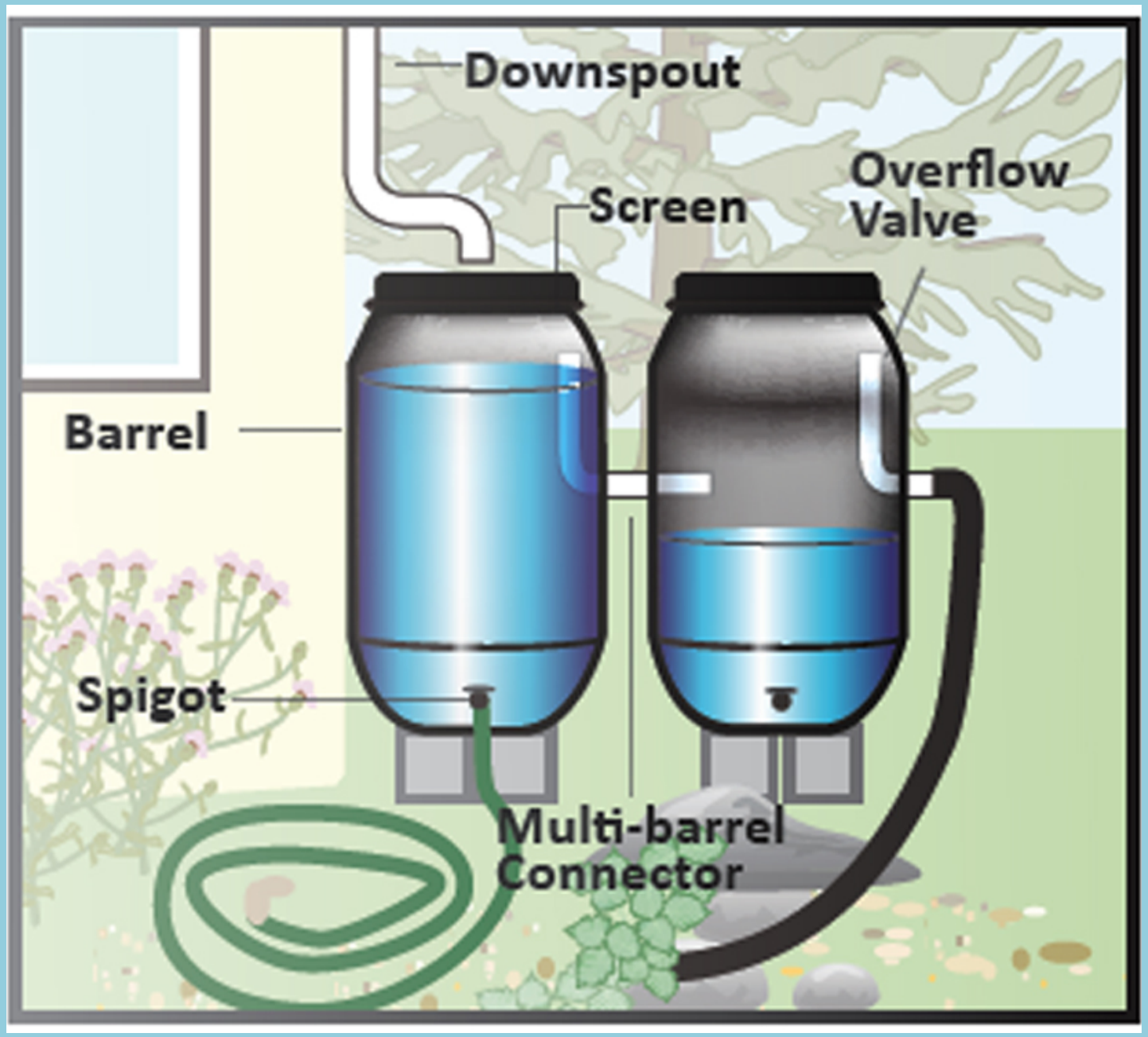
Rain water harvesting

Rain barrels

Basic set up for rain barrel




Save the Rain


Downspout
Screen
Overflow Valve
Barrel
Spigot
Multi-barrel Connector

Cisterns - residential

Charles River Watershed Association developed SmartStorm System in late 1990s and early 2000s as BMP for more urbanized locations

For collection of rainwater to be used for irrigating lawns and gardens (Bob Z says he uses the water to fill his hot tub!)

One homeowner uses to wash clothes and irrigate plants in green house

Overflow is channeled to drywell that is installed as part of system

Installed now by RainStay

Cost: $4,000 to $5,000
Capacity: 800 gallons (2, 400 gal. tanks)

Cisterns - schools

Rain water cistern, Center-Pepin School, Easthampton

- 305 gallon food-grade tank
- Roof area ~670 sq. ft.
- Overflow from cistern goes to existing ground level concrete channel that drains to municipal storm system
- Cost: $308 plus $125 delivery = $433

Is roof runoff clean enough to irrigate edibles?

Rutgers Cooperative Extension study (2013)

- 12 rain barrels at homes with asphalt shingle roofs urban/suburban settings
- Collected and tested roof runoff over 4-month period
- Lead and zinc levels below level of concern, suitable for irrigating crops
- Poly aromomatic hydrocarbons (associated with combustion and petroleum products) not detectable

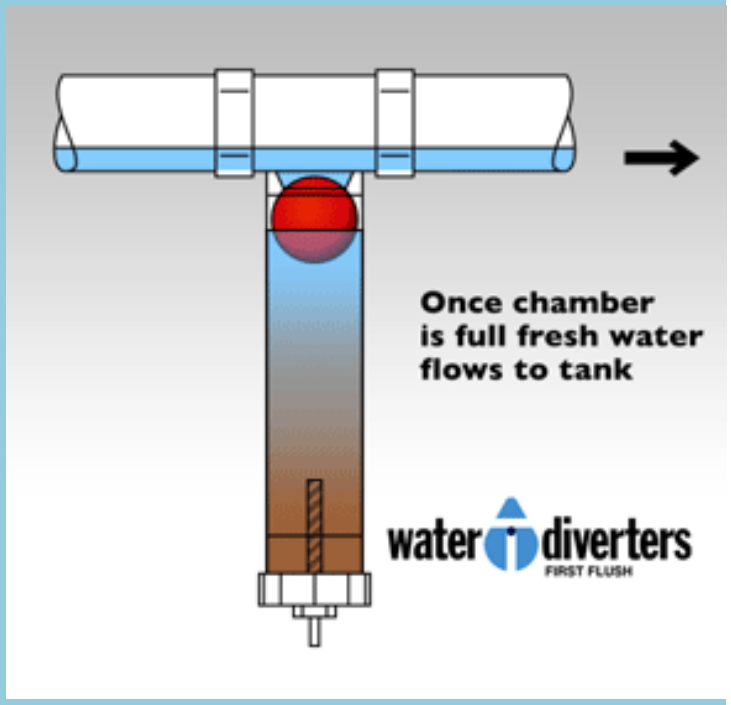
Washington State Dept. of Ecology study (2014)

- Used 18 4x8-foot panels with different roofing materials
- Collected and tested runoff from 10 events in 2013 and 10 events in 2014
- Did not have other components typical to roofs (gutters,flashing, etc.)
- Copper roofs had high levels of copper
- Treated wood shake roofs high levels of arsenic

Consider not only roofing material, but also bird/other animal waste on roof.

Best practices for rainwater harvesting

- Consider your roofing materials
- Don’t collect 1st flush
- Water the soil; not the food
- Clean rain barrel annually (1/8th cup bleach in 5 gallons of water)



Diversion Recommendations for the Roof

Minimal Pollution: divert 0.0125 gallons per square foot of roof area
Open field, no trees, no bird droppings, clean environment

1.25 gallons per 100 sf

Substantial Pollution: divert 0.05 gallons per square foot of roof area
Leaves and debris, bird droppings, various animal matter, e.g. dead insects, lizards, etc.

5 gallons per 100 sf

Example for a minimal polluted roof of 1,000 square feet:
1000 square feet X 0.0125 = 12.5 gallons to be diverted

Example for a heavily polluted roof of 1000 square feet:
1000 square feet X 0.05 = 50 gallons to be diverted

200 sf x 0.05 = 10 gallons

PVC Pipe Specifications

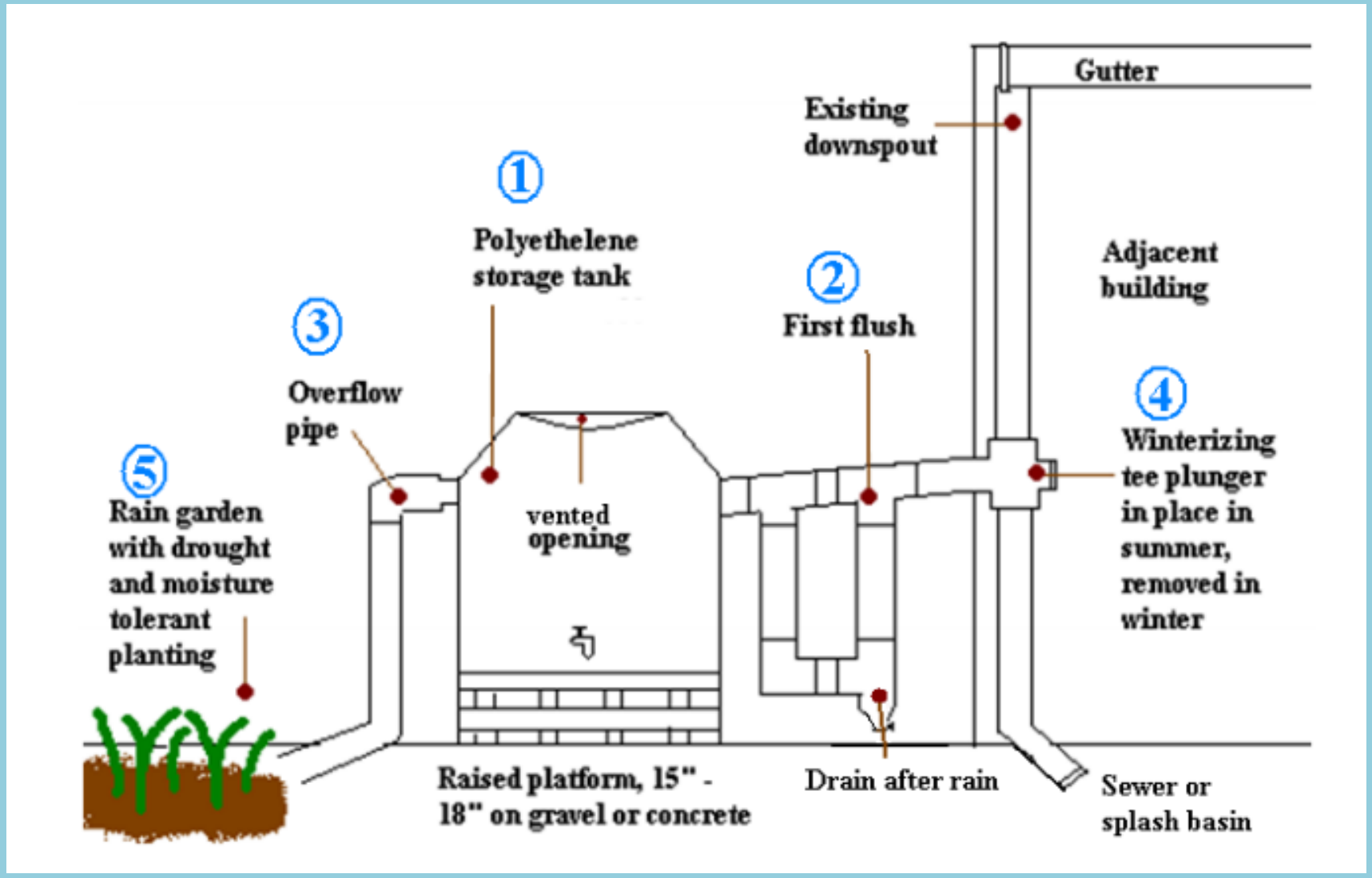
3" Downspout diverters: Use 3" Schedule 40 PVC
(not sewer and drain pipe)
Storage capacity: Each 3 foot section of 3" PVC holds approximately 1.1 gallons of water (0.3840341 gal/ft)

4" Downspout diverters: Use 4" Schedule 40 PVC
(not sewer and drain pipe)
Storage capacity: Each 3 foot length of 4" PVC holds approximately 2 gallons of water. (0.661312 gal/ft)

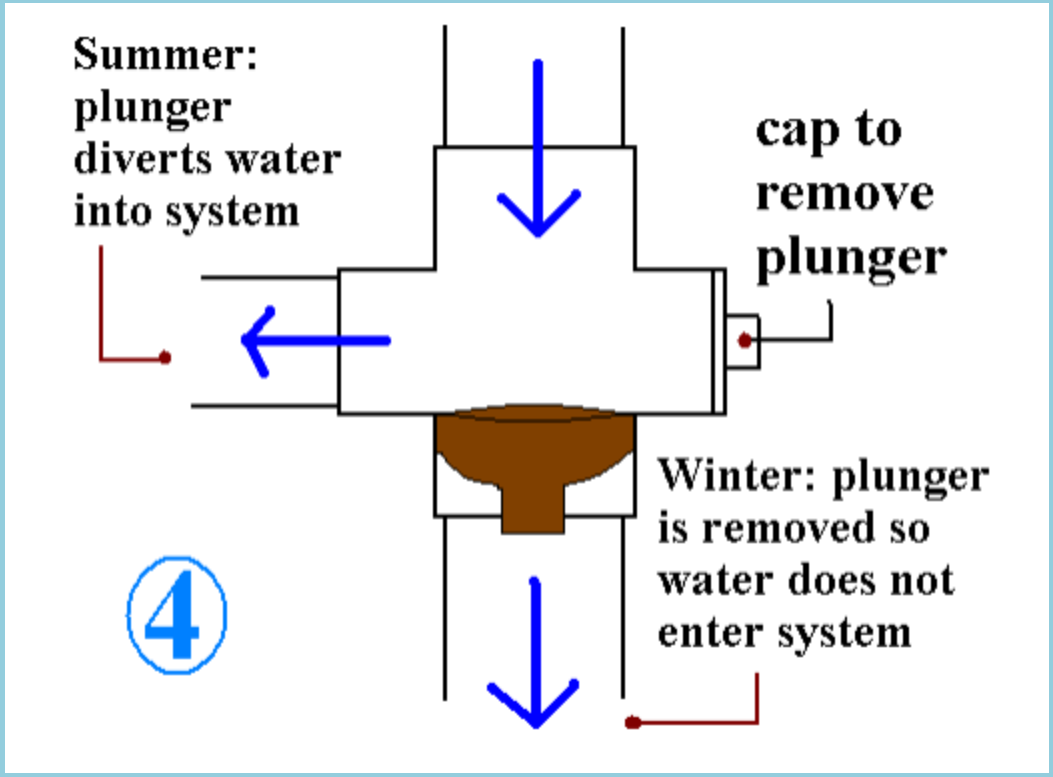
15 feet of 4” PVC

12" First flush diverters: Use 12" Schedule 40 PVC
Storage capacity: Each foot of 12" PVC holds approximately 6 gallons of water. (5.81463286 gal/ft)

Source: Rain Harvest Systems

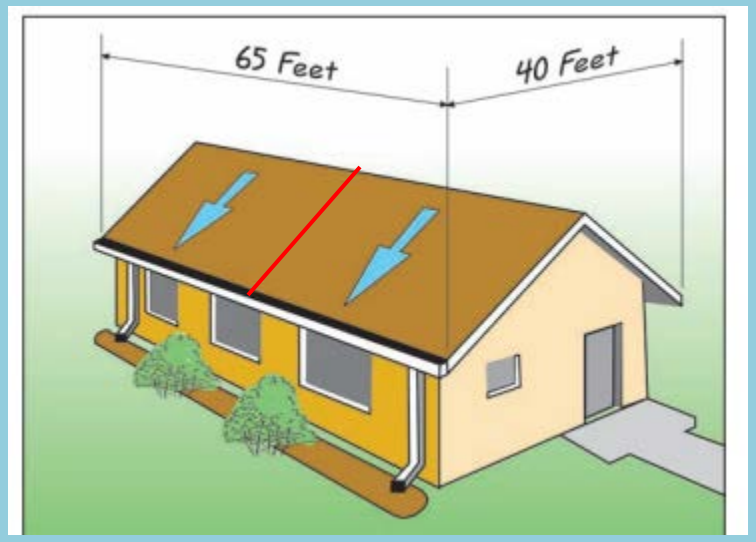


Source: Rainwater Harvesting 101, Grow NYC



Source: Rainwater Harvesting 101, Grow NYC

Calculating for water harvesting - 1



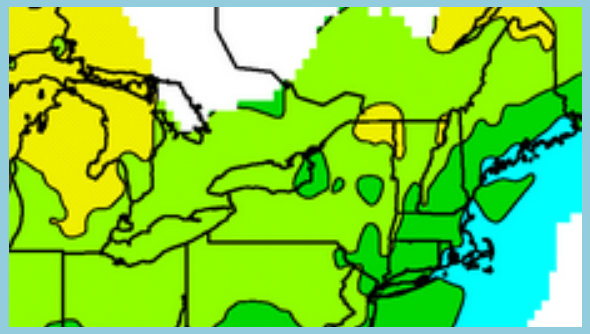
1. What is drainage area?

(account for overhangs)

32.5’ x 20’ = 650 square feet

2. What is annual rainfall?

1971 to 2000 = 46 inch average (Amherst)
Rainfall measured in feet not inches = 3.83 feet



3. What is runoff coefficient for surface?

metal roof = 0.95; asphalt shingle = 0.90

Average % of rainfall that runs off a particular surface. Roof has higher runoff coefficient than lawn as more rainfall will run off a roof.

Annual runoff from catchment

650 sf x 3.83 ft. x 7.48 gal/ft3 x .90 = **~16,760 gallons per year**

Calculating for water harvesting - 2

1. Roof area? – "drainage area"
32.5' x20' = 650 square feet

2. Storm event?
1-inch = 0.083 feet
Remember to convert inches to feet

3. Runoff coefficient for surface?
metal roof = 0.95; asphalt shingle = 0.90

4. Amount removed for first flush?
0.0125 gallons per sf = 16.25 gallons
0.05 gallons per sf = 65 gallons

Runoff from 1-inch storm event
(90% of storms in our region = 1 inch or less)

650 sf x 0.083 ft. x 7.48 gal/ft3 x .90 = **~363 gallons**

After first flush
346.75 gallons
298 gallons

What do you notice in this picture?


H&M

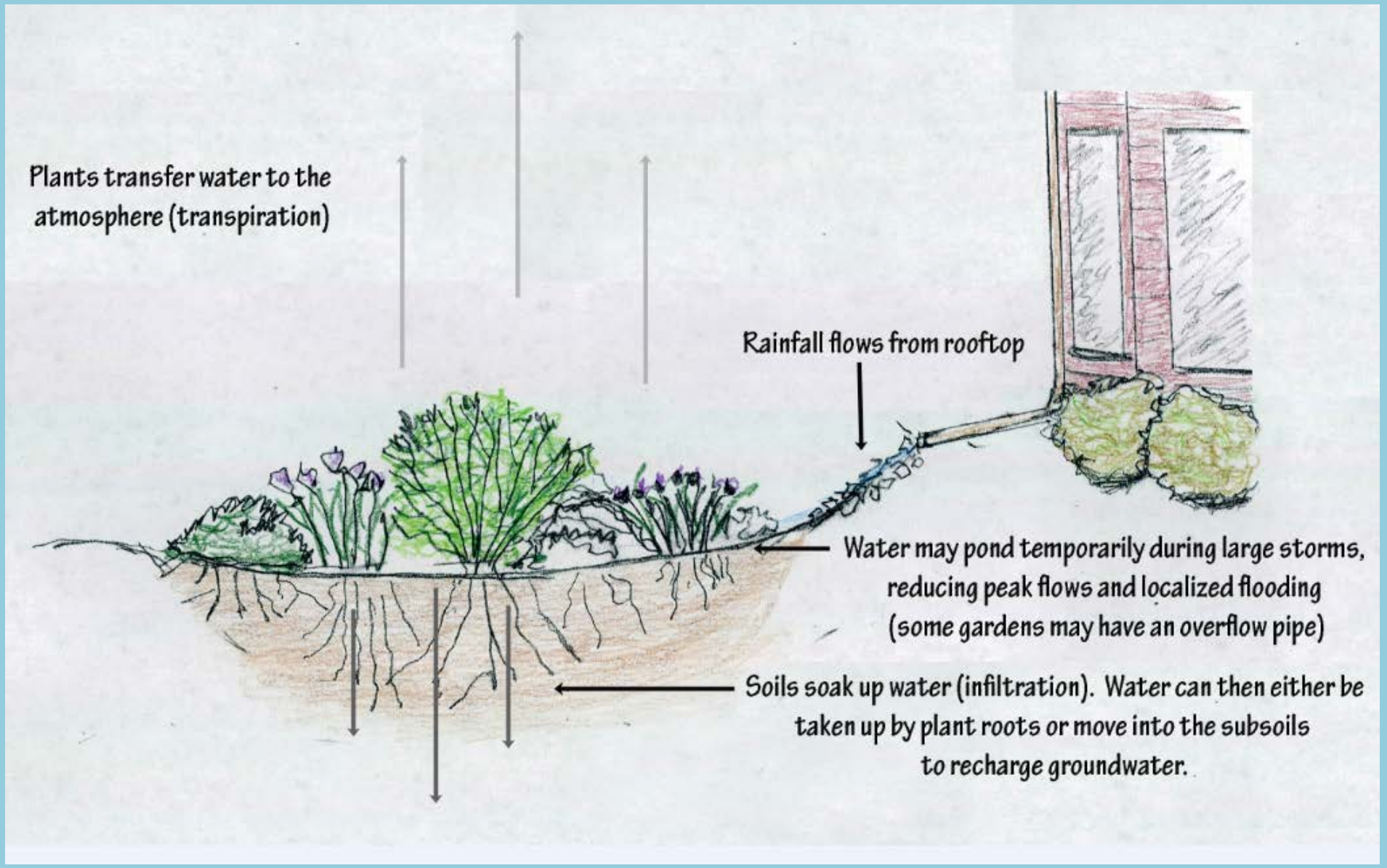

STOP WATER

Rain garden/ bioretention

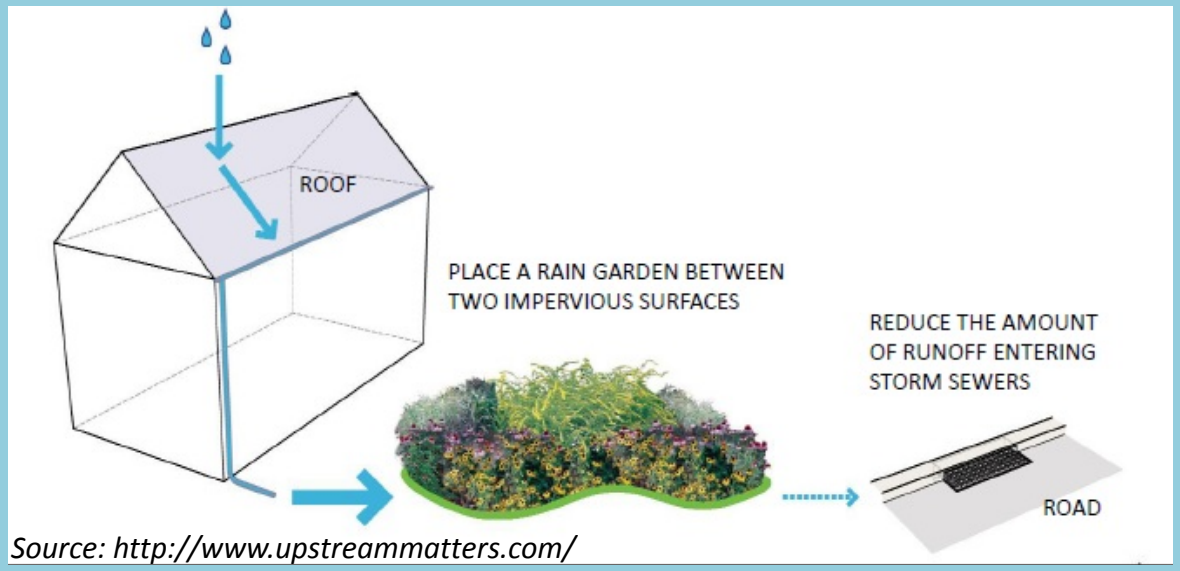
- Landscaped depression (about 6”)
- Designed with soils, variety of plants
- Receive, treat stormwater through natural processes
- Typical size = 100 to 300 sf.

Image source: http://water.epa.gov/infrastructure/greeninfrastructure

Rain garden – processes



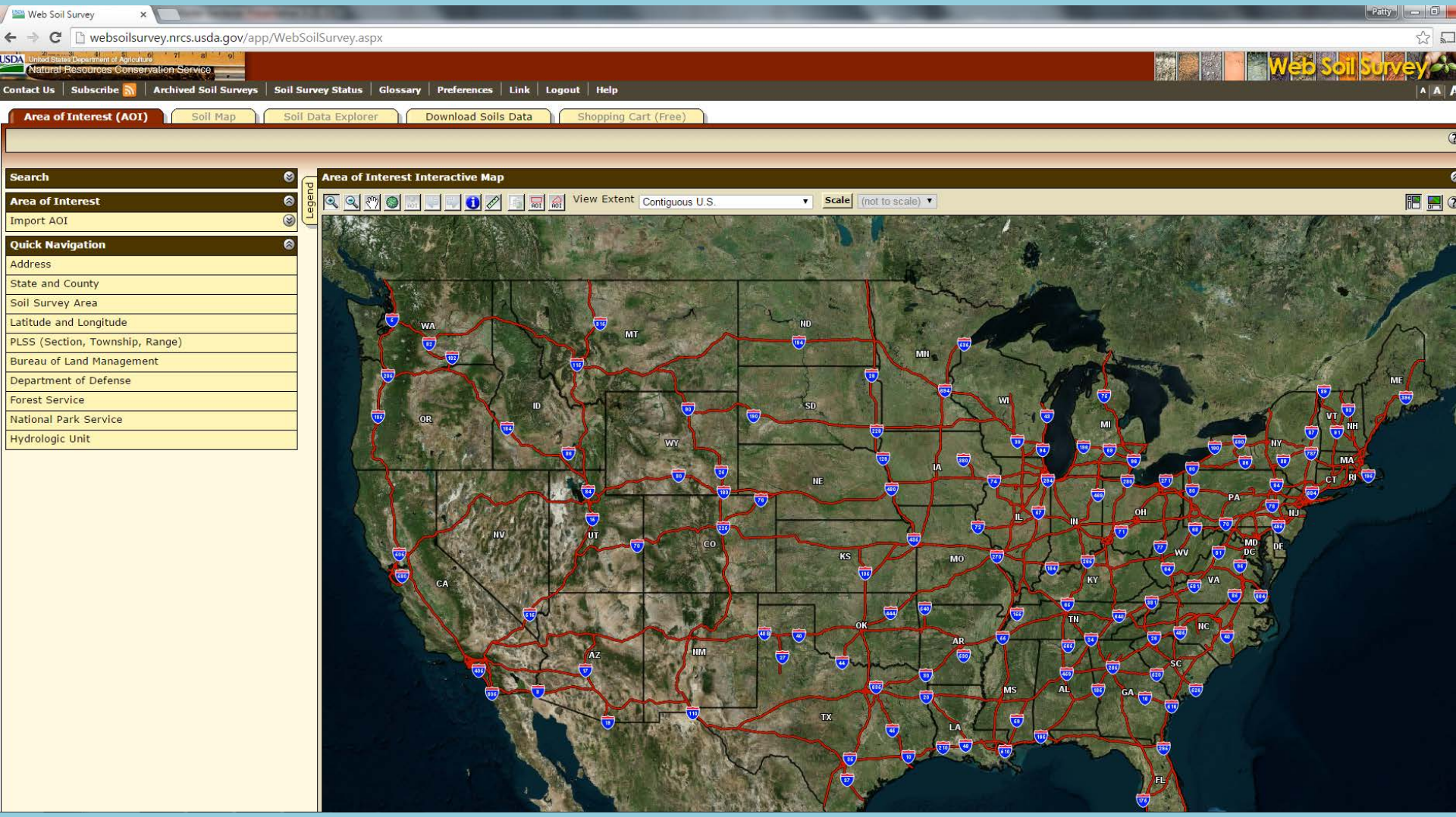
Rain garden – placement



Source: http://www.upstreammatters.com/

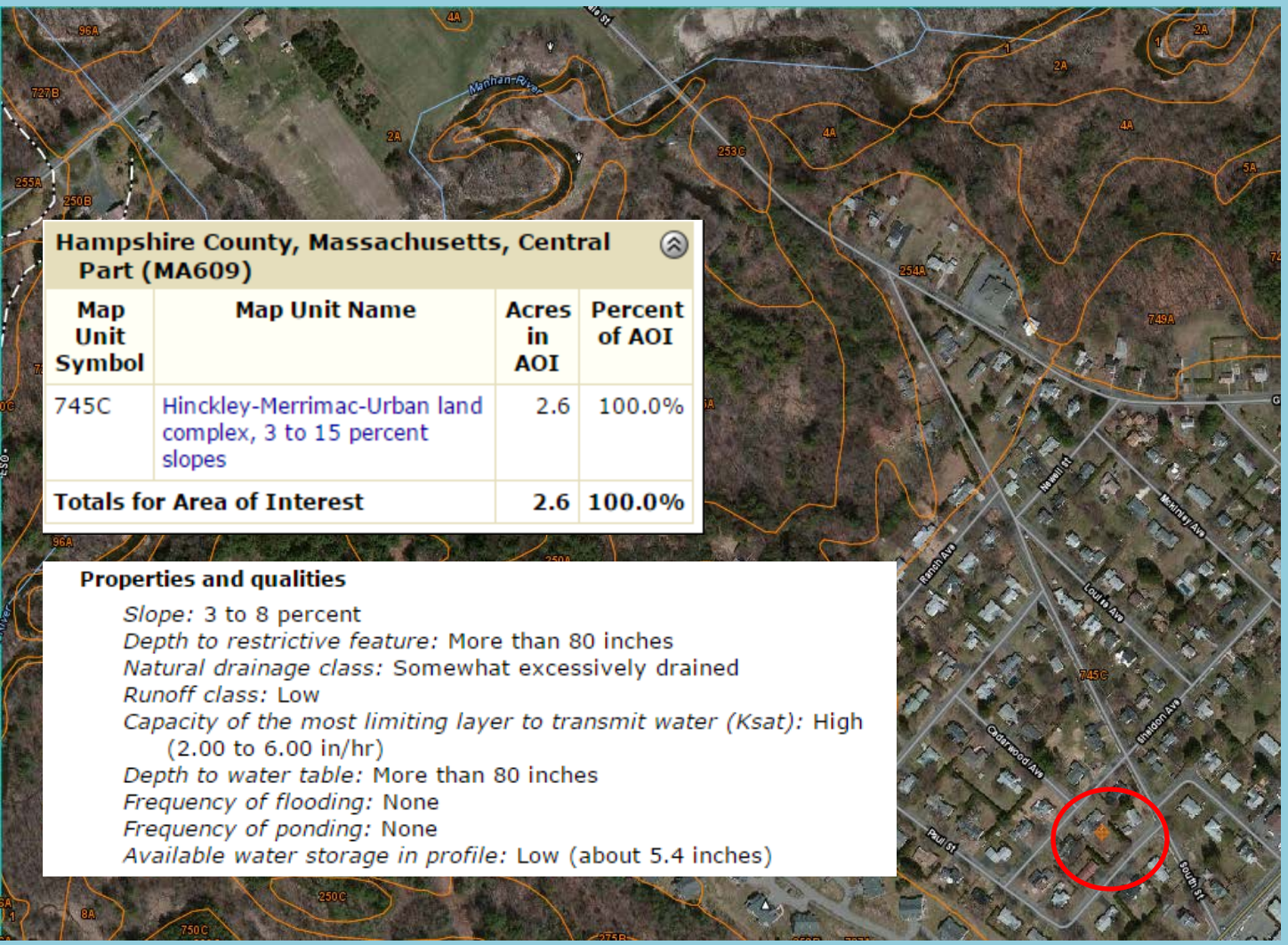
- Intercept water between downspout and storm drain
- Stay 10 feet away from foundation to avoid water damage
- Avoid wet areas
- Avoid steep slopes (more digging to make garden level)
- Avoid mature trees (roots could be disturbed/injured and tree may not tolerate additional moisture)
- Do not place near wells or over septic tank or leach field

Rain garden – soils 1



http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Rain garden – soils 2



- How well do soils drain?

http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Rain garden soils – cont'd

Percolation or pit test

1. Dig a hole about 1 to 2 feet wide and 2 feet deep
2. Fill hole with water
3. If takes more than 18 hours to drain, pick a different site

Figure 38. Dig a hole first.

Figure 39. Fill the hole with water.

Figure 40. Lastly, track time.

From: Rain Gardens Across Maryland

Ribbon test – identify soil type as sand, silt or clay

1. Grab a handful of moist soil and roll it into a ball in your hand.
2. Place the ball of soil between your thumb and the side of your forefinger and gently push the soil forward with your thumb, squeezing it upwards to form a ribbon about ¼" thick.
3. Try to keep the ribbon uniform thickness and width. Repeat the motion to lengthen the ribbon until it breaks under its own weight. Measure the ribbon and evaluate below:

Courtesy of North Dakota State University

The ribbon formed here depicts a clay soil because it is greater than 1.5" in length.

SAND: Soil does not form a ribbon at all.
SILT: A weak ribbon < 1.5" is formed before breaking.
CLAY: A ribbon > 1.5" is formed.

From: Vermont Rain Garden Manual

Rain garden - sizing

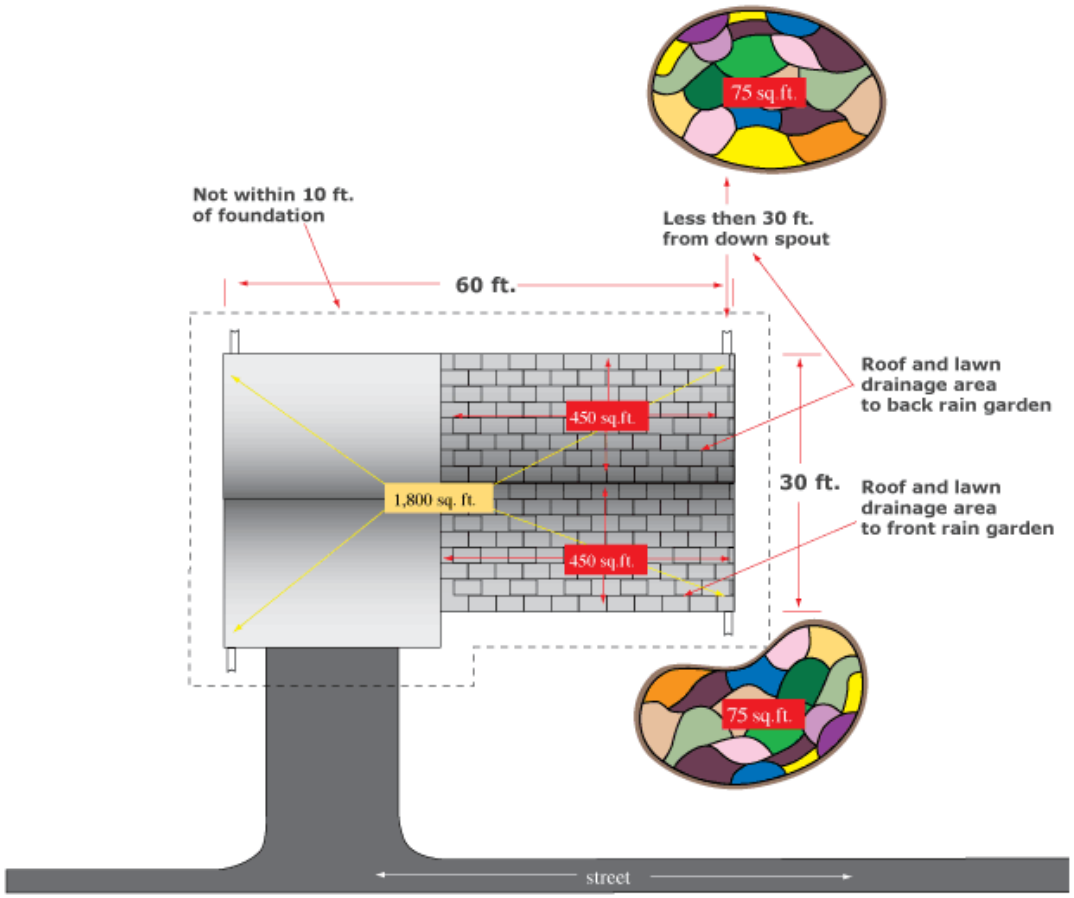
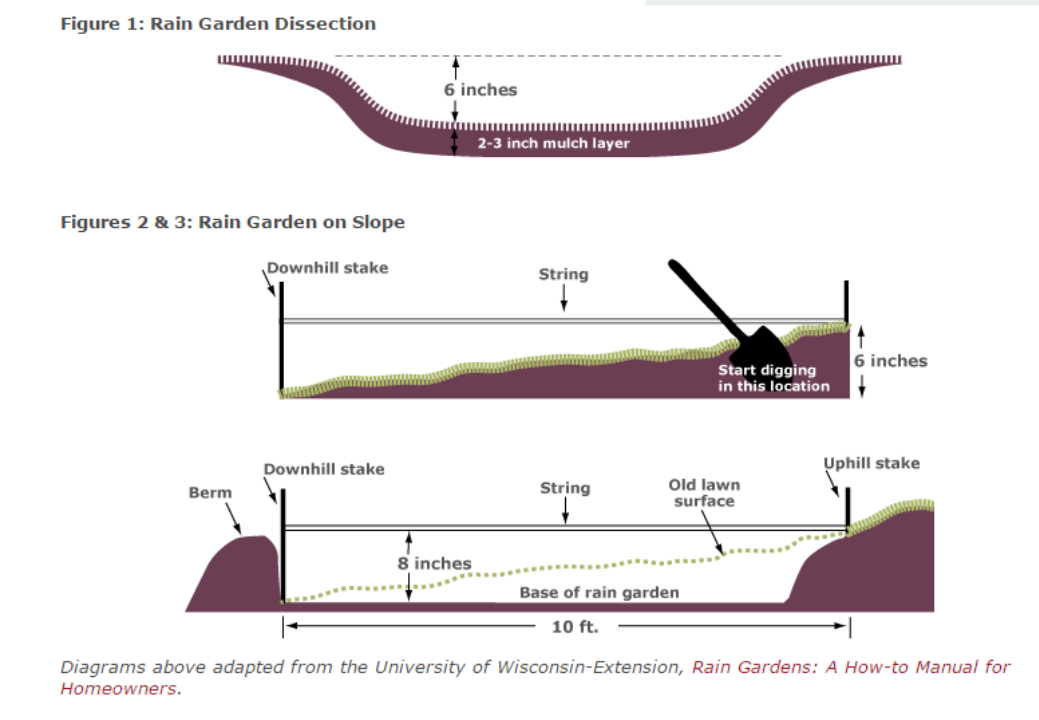


Diagram above adapted from the University of Wisconsin-Extension, Rain Gardens: A How-to Manual for Homeowners.

- What is drainage area?
- Divide area by 6 (sizes garden to hold 1 inch of runoff from drainage area in a garden 6 inches deep).
- Result is square feet area needed for rain garden.

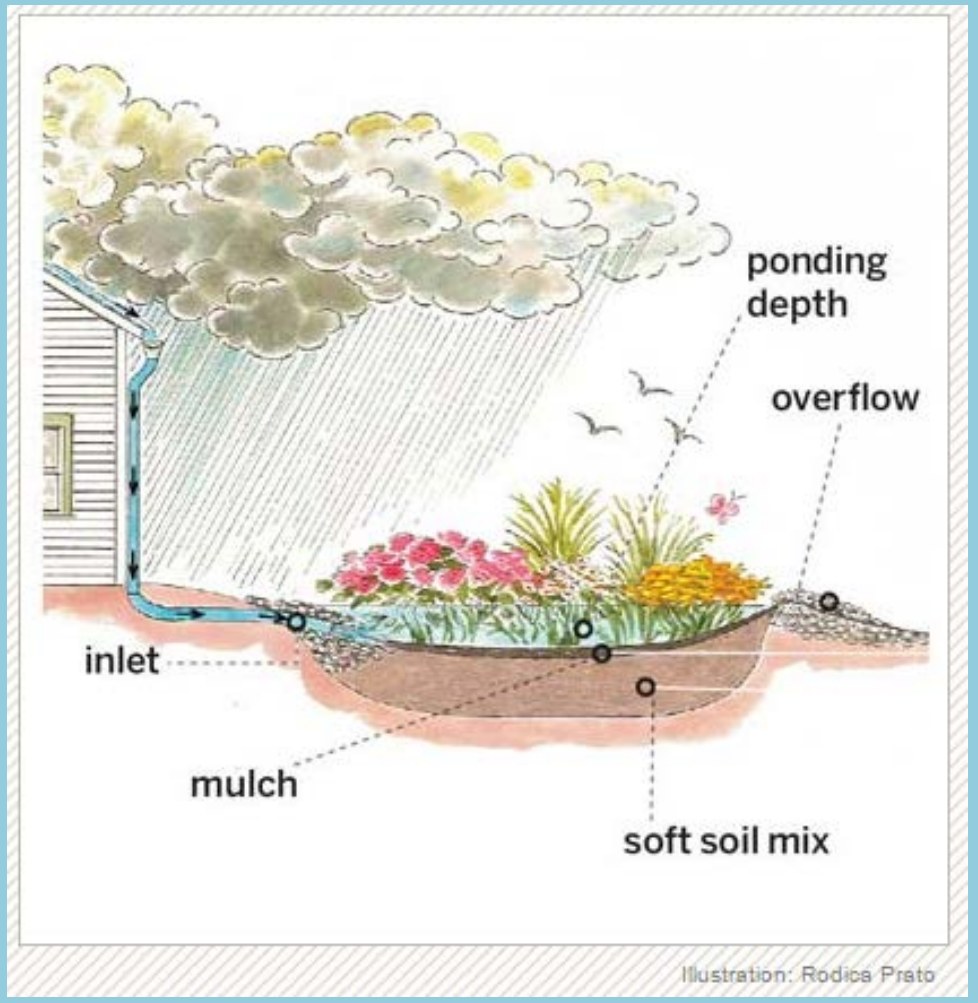
Short cut calculation from UConn Rain Garden program (for sandy loamy soils)

Rain garden - design



- Mark out area for garden based on area calculated
- Remove 8 to 9 inches of soil from the whole area
- Shape gentle slope from bottom of garden to surrounding lawn area
- Use some soil to build a berm at lower end of garden
- Try to keep same level across top of berm so that flow not concentrated in any one location

UConn's Rain Garden Guru Mike Dietz at Extension Center demo site



- Place stones where water enters garden to dissipate energy during intense storms
- Plan for overflow in event of severe storm – where will overflow go?
- Call Dig Safe before digging to avoid underground pipes and utilities

Rain garden - plants

SUGGESTED RAINGARDEN PLANTING LIST:

Native Plants for Wet Soils --- Sunny Areas:

- Sweet Flag (Acorus calamus)
- Giant Hyssop* (Agastache foeniculum)
- Canada Anemone (Anemone canadensis)
- Marsh Milkweed* (Asclepias incarnata)
- New England Aster* (Aster novae-angliae)
- Marsh Marigold (Caltha palustis)
- Tussock Sedge (Carex stricta)
- Turtlehead* (Chelone glabra)
- Joe Pye Weed* (Eupatorium maculatum)
- Boneset (Eupatorium perfoliatum)
- Queen of the Prairie* (Filipendula rubra)
- Sneezeweed (Helenium autumnale)
- Blueflag Iris (Iris versicolor)
- Soft Rush (Juncus effusus)
- Great Blue Lobelia (Lobelia siphilitica)
- Switchgrass* (Panicum virgatum)
- Prairie Phlox (Phlox pilosa)
- Mountain Mint (Pycnanthemum virginianum)
- River Bulrush (Scirpus fluviatilis)
- Softstem Bulrush (Scirpus validus)
- Riddell's Goldenrod (Solidago riddellii)
- Tall Meadow Rue* (Thalictrum dasycarpum)
- Culvers Root* (Veronicastrum virginicum)
- Golden Alexander (Zizia aurea)

** Likely to grow taller than three feet*

Native Plants for Wet Soils --- Shady Areas:

- Caterpiller Sedge (Carex crinita
- Cardinal Flower* (Lobelia cardinalis)
- Ostrich Fern* (Matteuccia struthiopteris)
- Virginia Bluebells (Mertensia virginica)
- Sensitive Fern (Onoclea sensibilis)

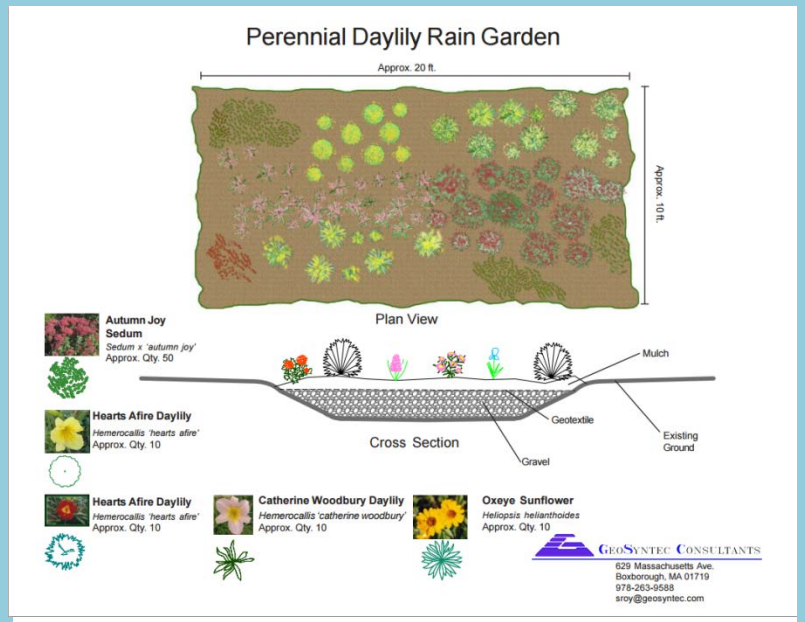
Shrubs --- Sunny or Shady Areas:

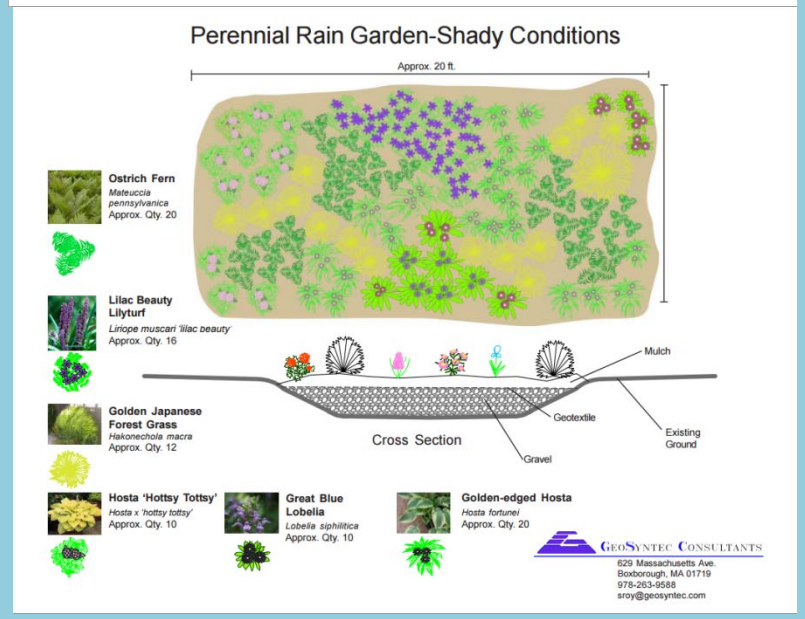
- Black Chokeberry (Aronia melanocarpa)
- Red Osier Dogwood (Cornus serecia)
- Low Bush Honeysuckle (Diervilla lonicera)
- Pussy Willow (Salix caprea)
- Blue Arctic Willow (Salix purpurea 'Nanna')

Shrubs --- Sunny Areas Only:

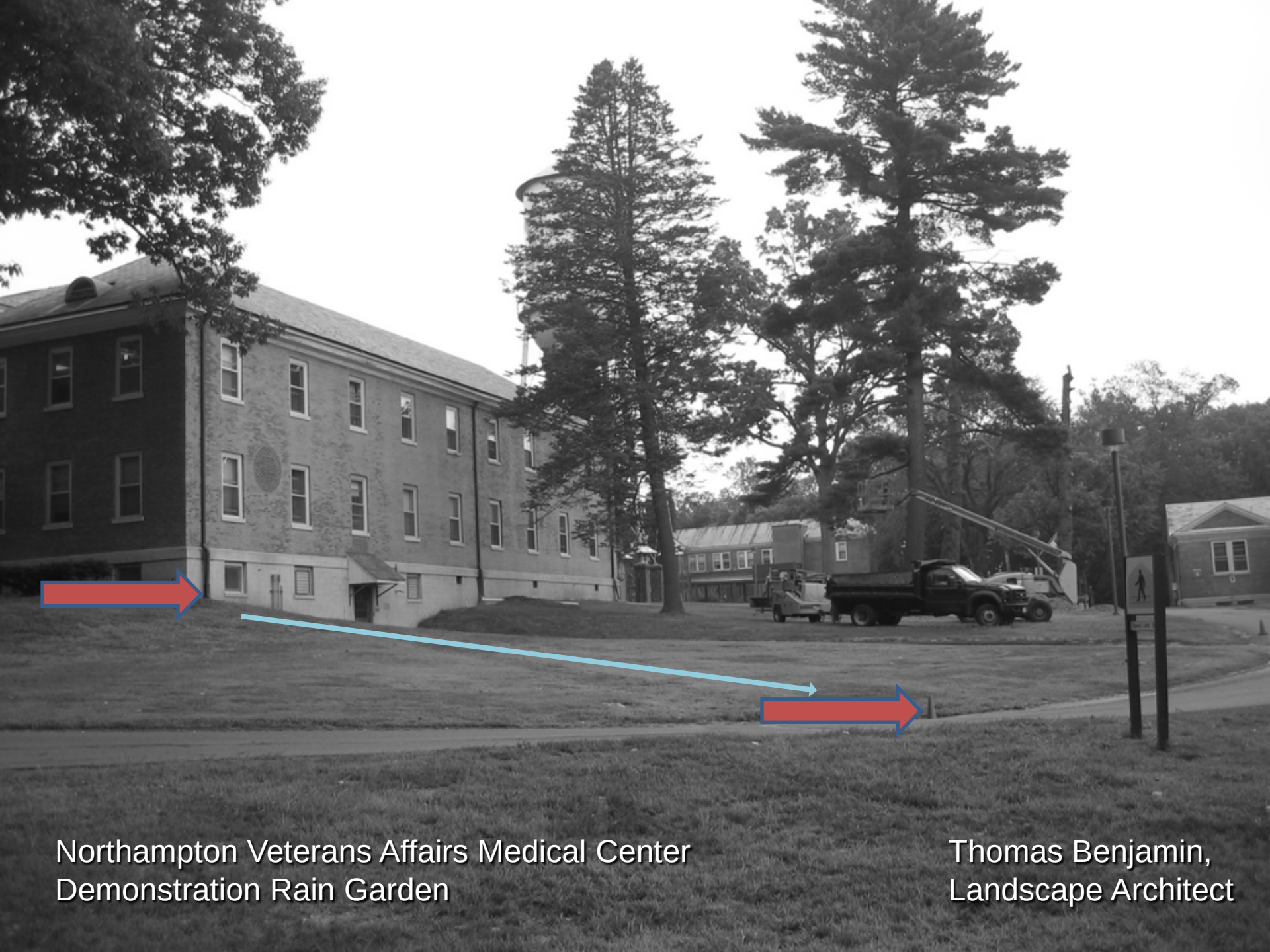
- Meadow Sweet (Spiraea alba)
- Steeplebush (Spiraea tomentosa)
- High Bush Cranberry (Viburnum trilobum)

GeoSyntec Consultants



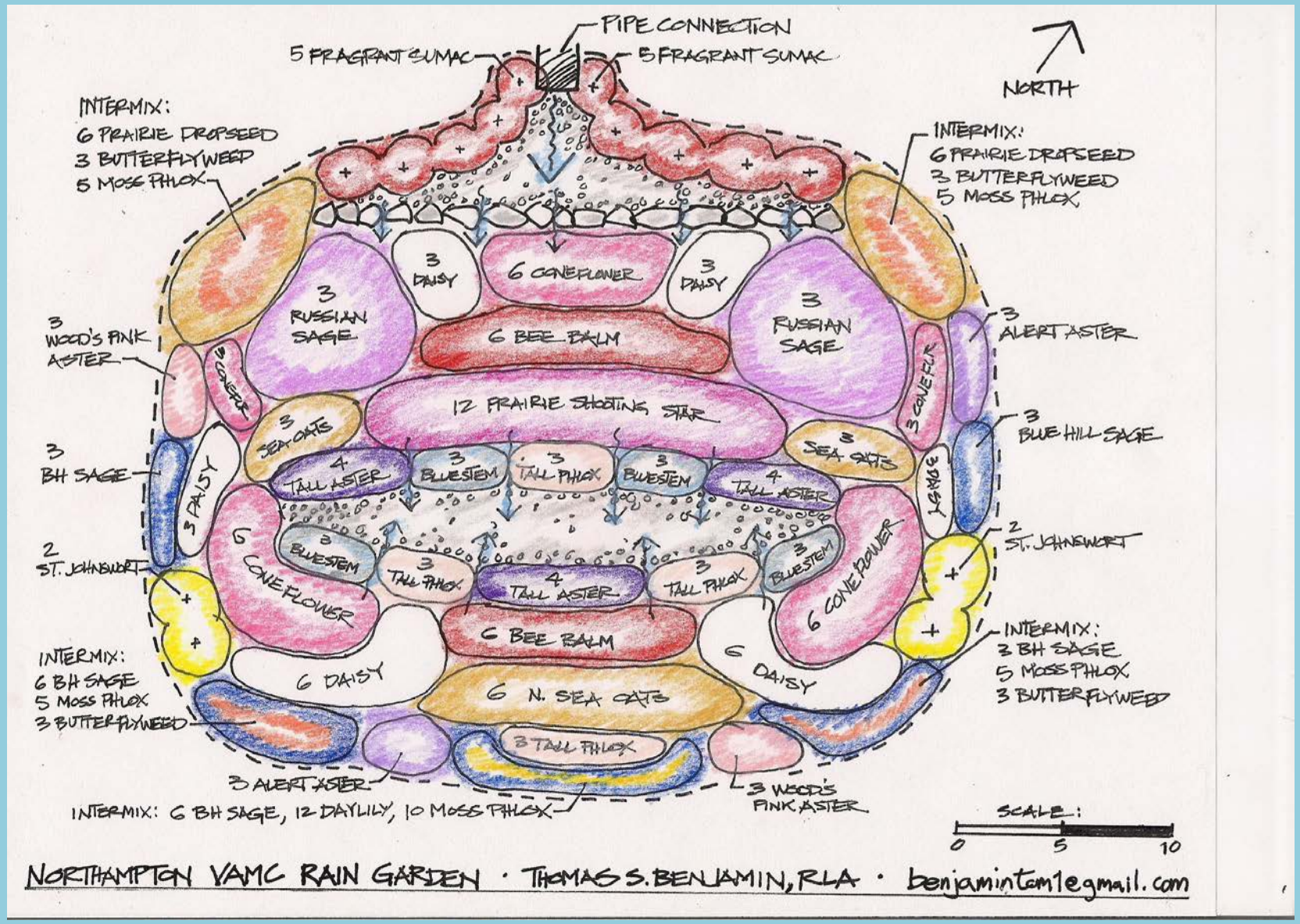


Source: http://www.mass.gov/eea/docs/eea/water/raingarden.pdf



Northampton Veterans Affairs Medical Center
Demonstration Rain Garden

Thomas Benjamin,
Landscape Architect



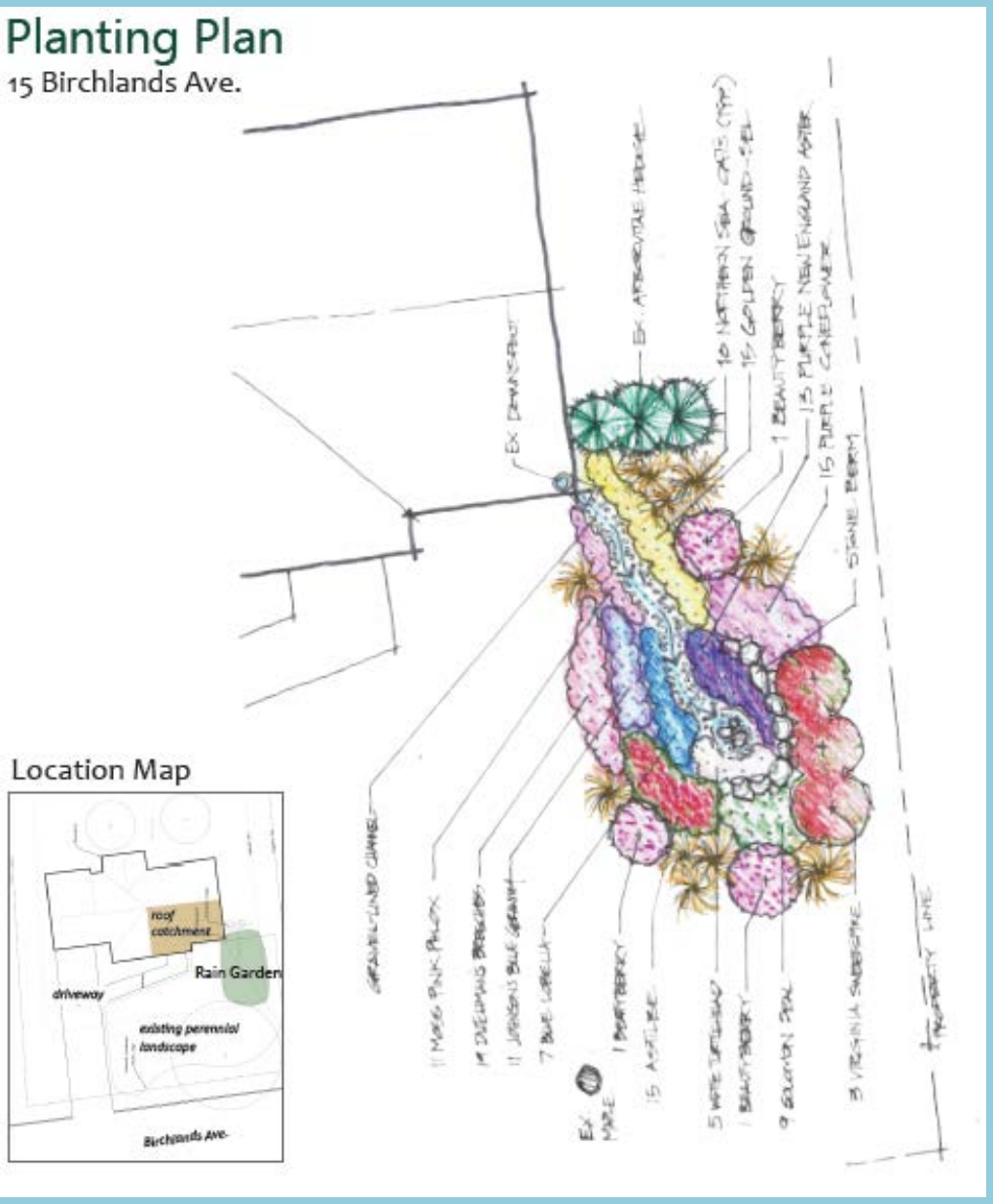
Notice slowing and spreading of flow for infiltration.

Photo courtesy Tom Benjamin

Photo courtesy Tom Benjamin

Planting Plan

15 Birchlands Ave.



Residential demontration project

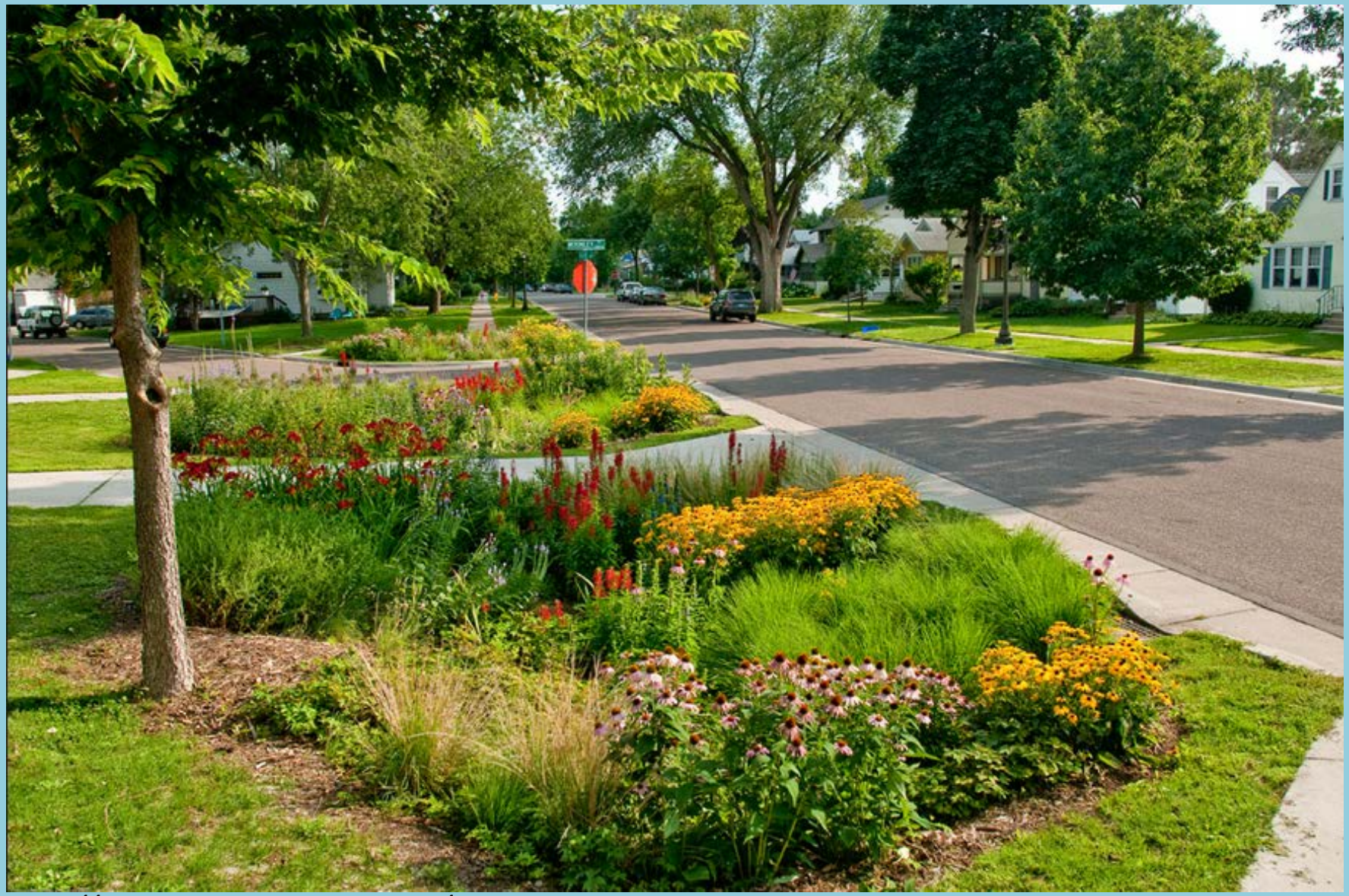
- 370 square feet
- 1,384 gallon capacity

Institutional demonstration project

- 2,900 square feet
- 11,800 gallon capacity

Community demonstration project

- 1,000 square feet
- 3,740 gallon capacity



http://www.capitolregionwd.org/

Community Field, Holyoke

Massachusetts Green High Performance Computing Center, Holyoke

Maintenance

- Check for erosion/dissipate energy if erosion
- Water plants 1” per week
- Remove weeds

Many benefits

- Stormwater runoff reduction
- Less pollution into waterways
- Groundwater recharge
- Water supply protection
- Less streambank erosion
- Flooding reduction/public safety improvements
- Wildlife habitat
- Added green spaces, improved quality of life
- Outreach and education
- Property values
- Cost savings

Image source: Buster Simpson, Growing Vine Street project in Seattle

Be playful, get inspired


STOP

Resources

soakuptherain.pvpc.org

www.ConnecticutRiver.us

ConnecticutRiver.us

Home | Swimming/Boating | Fishing | Hiking/Biking | About the river | About Us | Is it Clean?

Return to all sites | Nearby Sites | Return to search

Mill River, Northampton at Rope Swing off Smith College Path

Off Ward Ave
Northampton, MA
Longitude/Latitude: -72.650227 / 42.317161

Mill River in Northampton. There is a rope swing that is commonly used as a swimming hole and dog swimming area. Located along the path that goes between Smith College and Federal Street. Area can also be accessed from the "dog park" on the former state hospital grounds on other side of the river.

Is It Clean?

The Mill River in Northampton is sampled Thursdays between June and October by volunteers coordinated by the Connecticut River Watershed Council.

Sample Date	Status	CFU/100ml	Wet
2013-10-03	Clean for Boating	285.1	N
2013-09-26	Clean for Boating and Swimming	101.7	N
2013-09-19	Clean for Boating and Swimming	90.8	N
2013-09-12	Not Clean for Boating or Swimming	686.7	Y
2013-09-05	Clean for Boating	387.3	N

Get more data | What do these numbers mean?

How Do I Get There?

Park at intersection of Ward, James, and Washington Avenues. Walk downhill about 50 yards on the path down to Mill River trail along the north bank of the Mill River. Turn right (upstream) and walk about 100 yards to the site. A large fallen tree along the edge of the bank marks the downstream end of the site. There is a beach like bend just above, with the rope swing directly across the river on the former state hospital grounds. You can also get there by parking at Federal Street and walking downstream along the path.

This Site Is Monitored By:

Connecticut River Watershed Council
View Website

Bacteria levels can increase due to rainfall and runoff, which can be reflected in river flow levels. This graph shows river flow levels for the past 21 days at the nearest U.S. Geological Survey stream gage. The gage is located on the Mill River in Northampton near the Clement Street bridge, approximately 1.4 miles upstream of this monitoring site.

Rain Gardens

A Design Guide for Connecticut & New England Homeowners

Home | Frequently Asked Questions | More Resources | Contact Us | UConn's NEMO Website | Save the Sounds's Reduce Runoff Website

- Rain Gardens Home
- Rain Gardens 101
- Siting & Sizing
- Design & Installation
- Plants
- Maintenance
- Cost Calculator

What is a Rain Garden?

A rain garden is a depression (about 6 inches deep) that collects stormwater runoff from a roof, driveway or yard and allows it to infiltrate into the ground. Rain gardens are typically planted with shrubs and perennials (natives are ideal), and can be colorful, landscaped areas in your yard. {learn more}

Why a Rain Garden?

Every time it rains, water runs off impervious surfaces such as roofs, driveways, roads and parking lots, collecting pollutants along the way. This runoff has been cited by the United States Environmental Protection Agency as a major source of pollution to our nation's waterways. By building a rain garden at your home, you can reduce the amount of pollutants that leave your yard and enter nearby lakes, streams and ponds. {read more}

- Can I Build a Rain Garden?
- Environmental Benefits
- They are Easy to Create
- They are Attractive

You Can Make A Difference!

http://nemo.uconn.edu/raingardens/

Questions?