Guidance Manual for Homeowners

Managing Stormwater Runoff Using Green Infrastructure

How To Disconnect a Downspout; Install a Rain Barrel; and Build A Rain Garden

This publication is a compilation of on-line information assembled by the Stormwater Coalition of Albany County. Much of the text is borrowed either in full, or conceptually, from special topic publications developed by the City of Portland, Oregon, Bureau of Environmental Services. Where possible, local information is provided. For a list of Sources, go to page 8.

THE STORMWATER RUNOFF PROBLEM AND GREEN INFRASTRUCTURE

Before development, forests and open space absorbed rainwater. Today, rain falls on buildings, streets, sidewalks, and other hard surfaces and runs off into rivers and streams. Stormwater runoff causes erosion, carries pollution and sediment to rivers, decreases groundwater recharge, and increases stream temperatures. Using green infrastructure strategies to manage stormwater is an alternative to the traditional piped approach. These strategies include the onsite collection and conveyance of stormwater runoff from roofs, parking lots, streets, and other surfaces so that rain infiltrates into the ground or collects for re-use, often reducing the need for costly underground structures. The approach also relies on vegetated natural systems which slow down and filter the water. These systems enhance both the interception and evaporation of rainfall through leaves, helping to reduce the volume of runoff and amount and type of pollutants entering our waterways.

In the Albany area, the annual average rainfall is 39". This translates into significant runoff events throughout the year. By examining your own property, green infrastructure opportunities can be identified. This handout serves as a starting point for understanding what you can do, where and how.

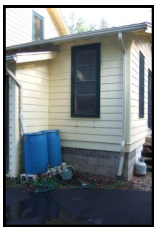
Getting Started

Step 1
Study how and where stormwater runs off your property

Step 2
Consider your options

Step 3
Sketch some ideas and take action

Image from portlandonline



Become A Solution to Water Pollution

Look at the diagram below. As development increases, there are fewer trees available to pull water up and out into the atmosphere and block rainfall. Surface runoff increases. When it rains, pollutants associated with daily life (bacteria from pet waste, fertilizers, oil drips for cars, metal from brake linings, sediment…) are transported to neighborhood streams. As runoff increases, more pollutants are carried to waterways. By installing a rain barrel or building a rain garden, runoff is contained on site and if directed to a rain garden, pollutants are treated naturally. Rain barrels also conserve water and rain gardens add green space to urban environments. Both are low-tech, multi-purpose strategies which add value to our communities. They are an easy way to become a solution to stormwater pollution! Learn how...

Runoff, Vegetation, & Development

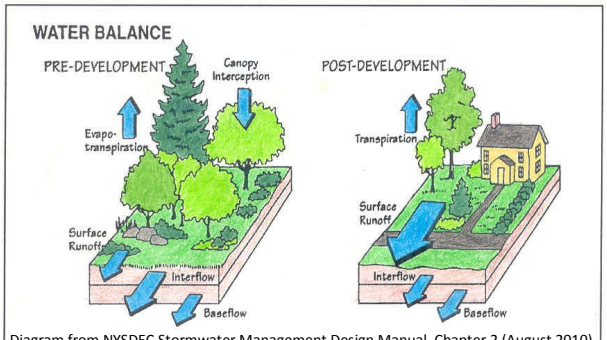


Diagram from NYSDEC Stormwater Management Design Manual, Chapter 2 (August 2010)

A Green Infrastructure Future

1) **Let vegetation do the work of**
-trapping sediment (roots)
-trapping pollutants (roots)
-blocking rainfall (leaves)
-pulling water up and out of the soil (stems and leaves)

2) Contain rainfall on site
-let it percolate into the soil
-store for reuse (ex. rain barrels)

MORE GREEN INFRASTRUCTURE
↓
LESS STORMWATER RUNOFF
↓
LESS WATER POLLUTION
↓
CLEAN WATER FOR EVERYONE!

Stormwater Coalition of Albany County

Members: City of Albany; Town of Bethlehem; City of Cohoes; Town of Colonie; Village of Colonie; Village of Green Island; Town of Guilderland; Village of Voorheesville, Village of Menands; Town of New Scotland; City of Watervliet; Albany County; SUNY Albany-Uptown Campus

Supporters: Capital District Regional Planning Commission and Albany County Soil and Water Conservation District

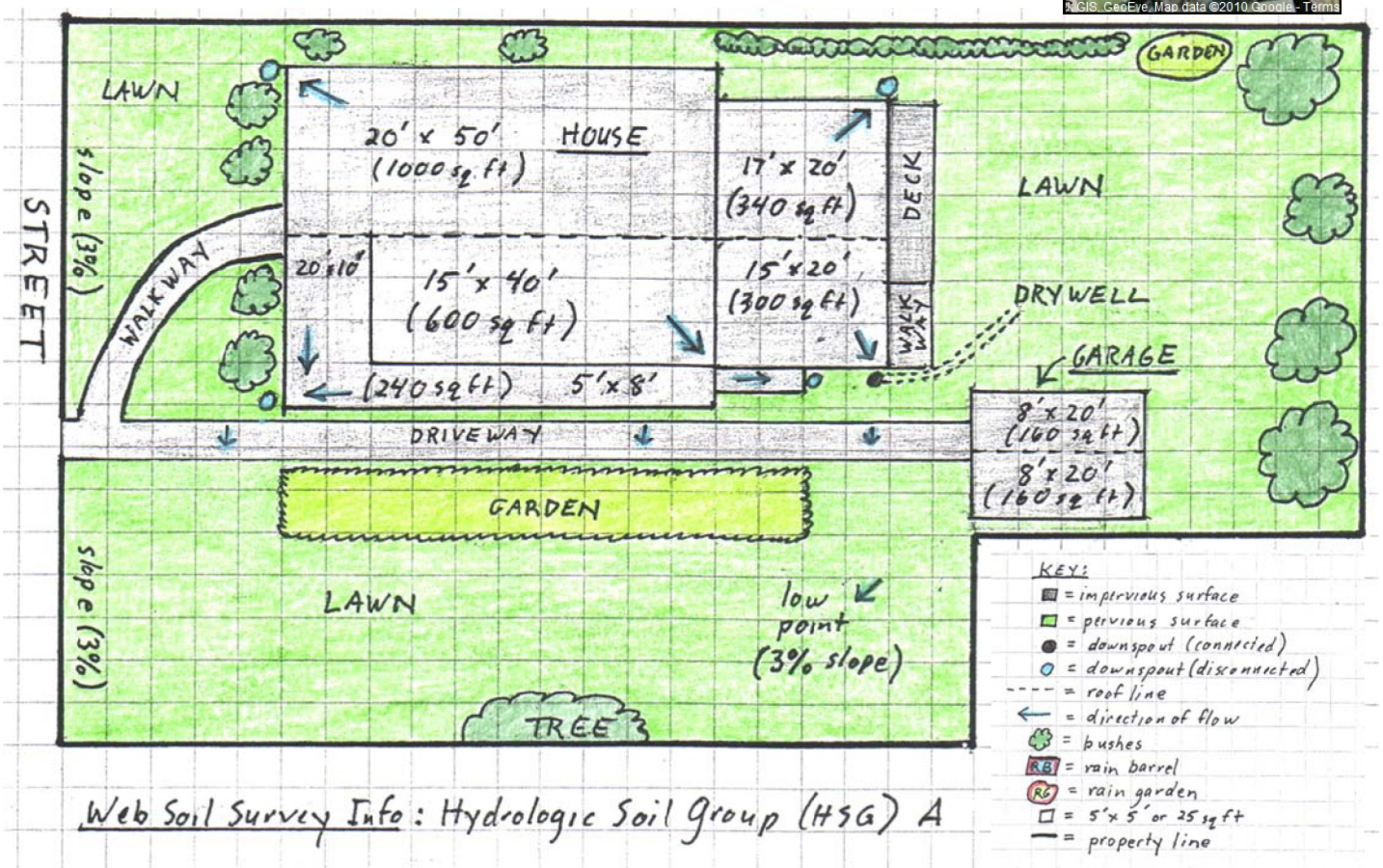
Step 1 Study How and Where Stormwater Runs Off Your Property

THE SITE ASSESSMENT

1) Draw the general layout of buildings on your site (graph paper helps, so do aerial images from Google maps).
2) Add impervious areas like the driveway, sidewalks, or parking areas.
3) Use a tape measure to measure the length and width, then multiply the two together to get the area. Estimate hard, or impervious areas where water runs off.
4) Note the measurements on the map.
5) Locate the downspouts that drain water from your roof and mark them on your map. Note the rooflines and area draining to the downspout.
6) If you don't see downspouts, the building may have an internal drainage system. If so, contact a professional for help.
7) Look at other impervious surfaces on your site. Try to figure out where runoff from these areas goes. If it isn't raining, use a hose. Use arrows to note on your map the direction the water flows.
8) Look at other surfaces of your property and mark any noticeable hills and dips. Note areas that stay wet and muddy. Note areas where water soaks in or are soft (lawns, planting beds, trees).
9) Soil type has a lot to do with how well rainwater soaks into the ground. Sandy, loamy soil soaks up water very quickly. Heavier soils with clay don't soak up water as well. Soil information is available at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Look up the Hydrologic Soil Group of your site. Soils in groups A and B drain well, while soils in Groups C and D have slower infiltration rates. If you are unsure, dig a hole at least 12 inches deep in one of your green spaces, fill it with a hose, let it drain and fill it a second time. If the water on the second run does not drop at least two inches in an hour, your soils may not drain well enough to consider an infiltration practice.
10) Locate your property lines to determine how much space you have for a stormwater practice. Your practice must meet general building code safety rules.

Google maps aerial image

SITE MAP EXAMPLE



THE SITE ASSESSMENT (Cont'd)

After mapping, study your downspouts (home, garage, and other covered structures). Are your downspouts draining to your lawn or are they connected to the sewer system or to drywells? Downspouts that drain into standpipes (pipes) may drain into a public sewer system, a curb cut (hole in the curb at the sidewalk), soakage trench, a drywell, or other stormwater drainage systems. If your downspouts drain into soakage trenches or drywells and are in good working order, you don't need to change how that stormwater is managed, but you may want to in order to avoid future maintenance or replacement costs.

Step 2 Consider Your Options

THE GOAL:

The goal is to mimic nature so that stormwater is directed towards those surfaces which soak up rain. Depending on the site, if draining to a sanitary or stormwater line, a downspout may need to be disconnected so that it can instead drain to a vegetated surface, such as a rain garden, or if the space is too small, a rain harvesting practice, such as a rain barrel. You may need to re-route drainage systems to get water to where there is enough space to install a particular practice. What is possible depends on site conditions, set back requirements, sizing, and soil constraints.

Practices presented here, in some detail, include disconnecting a downspout, diverting runoff to rain barrels and building a rain garden. There are many other stormwater management practices suitable for homeowners. Some to consider include: cisterns, ecoroofs, roof gardens, trees, contained planters, vegetated swales, vegetated infiltration basins, flow-through planters, infiltration planters, pervious pavers, pervious pavement, turf block, drywells, and soakage trenches. All of which reduce the amount of runoff entering a piped system, with many providing the added benefit of filtering runoff and removing pollutants.

1) Disconnect a Downspout 2) Install a Rain Barrel 3) Build a Rain Garden

1) DOWNSPOUT DISCONNECTION (for downspouts connected to standpipes)

Description

- Low maintenance option to move water away from building foundations and let it soak into the ground.
- Includes cutting the downspout, attaching elbows, extensions, and splashblocks to direct water to flow away from the house, plugging the standpipe, and securing materials to structures.

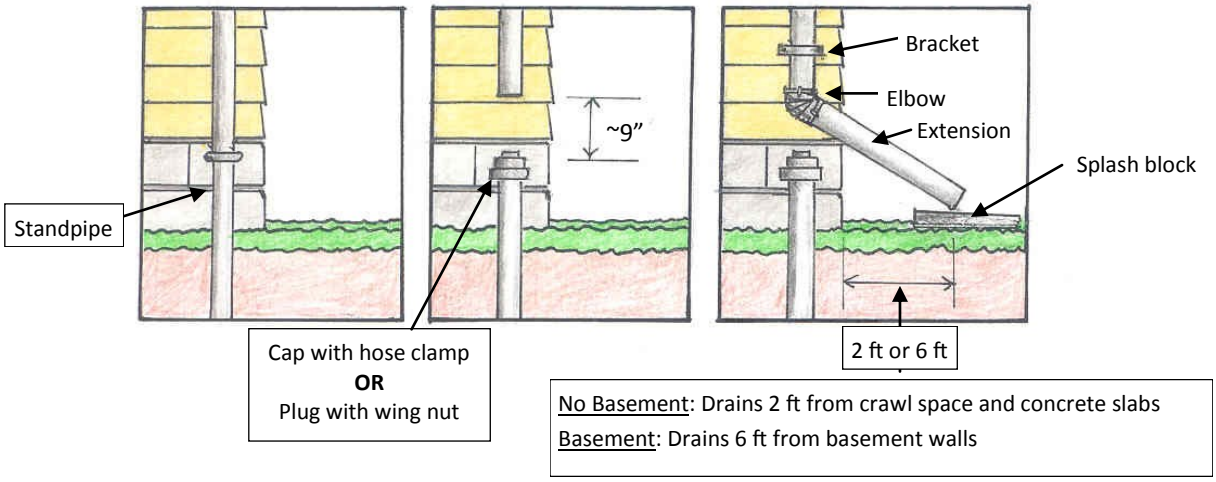
Safety Considerations

1) Add or remove soil to make sure that the slope of the ground allows water to flow away from structures. Do not disconnect downspouts on slopes greater than 10%.
2) Avoid disconnecting downspouts in an area too small for good drainage.
3) Disconnected downspouts must be extended to discharge water at least 6 feet from a structure basement and 2 feet from a crawl space or slab foundation.
4) Downspout extensions must drain away from any structure.
5) End of downspout must be at least 5 ft from neighbor's property line and 5 ft from the public sidewalk. May need more room if your yard slopes towards your neighbor or the sidewalk.
6) Avoid disconnecting downspouts or adding extensions across a walkway, patio, driveway, or in front gate because of possible tripping hazards.
7) Do not extend downspout directly over a septic system, drain field, or an underground storage tank, unless they have been decommissioned. Do not disconnect within ten feet of a retaining wall.
8) Make sure you have enough landscaped area for rain to safely soak into the ground. Ground area must be at least 10% of the roof area that drains to the disconnected downspout. If roof area is 500 sq ft, landscaped area should be 50 sq ft (10% of 500)

1) DOWNSPOUT DISCONNECTON (Cont'd)

How To Disconnect **Note: ALL DISCONNECTIONS SHOULD MEET THE ABOVE SAFETY CONSIDERATIONS**

1) Measure existing downspout from the top of standpipe and mark it 9 inches above standpipe. May need to cut downspout higher depending on length of your extension.
2) Cut the existing downspout with a hacksaw at the mark. Remove the cut piece.
3) Plug or cap the standpipe using an in-pipe test plug or an over-the-pipe cap secured by a hose clamp. Do NOT use concrete to seal your standpipe.
4) Attach the elbow. Be sure to attach the elbow OVER the downspout. Do NOT insert the elbow up inside the downspout or it will leak. If the elbow does not fit over the downspout, use crimpers or needle-nose pliers to crimp the end of the cut downspout so it slides INSIDE the elbow.
5) Measure and cut the downspout extension to the desired length. Attach the extension to the elbow by slipping the extension OVER the end of the elbow. Do NOT install the elbow over the extension or it will leak. The length of the extension will depend on site conditions and where you want the downspout to drain.
   - Downspouts must drain at least 6 feet from basement walls and at least 2 feet from crawl spaces and concrete slabs.
   - The end of the downspout must be at least 5 feet from your property line, possibly more if the yard slopes to the neighbor's house.
6) Secure the pieces with sheet metal screws at each joint where the downspout, elbow, and extension connect. It helps to pre-drill holes for screws.
7) Using a splash block at the end of the extension is optional, but it will help prevent soil erosion.



2) RAIN BARRELS

Description

– a simple rain water collector that captures and stores a portion of runoff from a roof downspout for non-potable, exterior uses, such as irrigation

Plan Your Rain Barrel

1. Install barrels based on where you will use the water in your yard. Must be located at base of a downspout. May be possible to re-hang gutter and move downspout to a more desirable location. Consider multiple rain barrels.
2. Rain water collection system must have an overflow to a safe disposal location. Diverters possible.
3. In general, for every inch of rain, a 1000 sq ft area of roof generates ~625 gallons of runoff. Ex. If 1" rain event, an 800 sq ft roof would generate 500 gallons of runoff. Ten 50 gallon rain barrels would be needed to capture ALL of the rain.
4. Elevate the rain barrel about 12" to provide pressure.

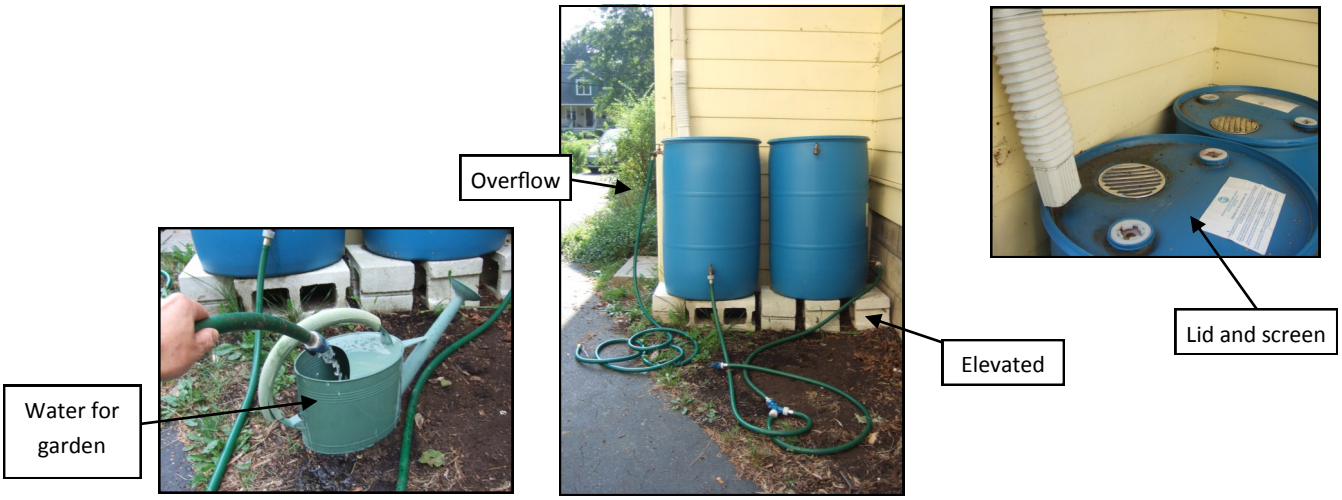
Safety Considerations

1. Rain barrel must be secured on a firm, level surface. A full 55-gallon rain barrel weighs over 400 lbs. Tipping is a risk.
2. Barrel must be structurally sound. If making your own, it must be strong enough to hold water. Containers such as trash cans are not designed to withstand pressure of water. There are many different types of rain barrels to buy.
3. Barrel must have a lid and sturdy fine mesh covering over all openings to prevent mosquitoes and debris from getting inside.
4. Water from rain barrel should NEVER be used for drinking, cooking, or other potable uses.
5. Larger and more complex rainwater collections system (cisterns) have a larger storage area, and/or use pumps. Consult a professional to review design, construction, and safety considerations.

2) RAIN BARRELS (Cont'd)

Maintenance

1. Clean out gutters twice a year and make sure gutters are tilted to direct water to downspouts. Fix low spots or sagging areas. Make sure roof flashing directs water into gutter.
2. If overflow is to a surface infiltration area, monitor the flowing area and regrade soil to make sure water flows away from structures and does not flow into pavement, sidewalks, or neighboring properties.
3. During the winter, remove water and store rain barrel.



3) RAIN GARDEN

Description

- a shallow depression between 100 to 300 sq ft, which collects rain water and is often planted with native plants
- a rain garden is a great place to direct water from downspouts or paved areas, or capture the overflow from a rainwater harvesting system

Draw what you see

1) Mark locations of downspouts and paved areas on site map.
2) Estimate the square footage of your roof area and pavement that will drain to the rain garden.
3) Map out where you might construct a rain garden. Choose spots that are down slope of the downspouts or paved areas that will drain to your rain garden. Construct another rain garden, if necessary.

Safety Considerations

1) To prevent damage to utilities, before digging call DIG SAFELY NY (1-800-962-7962). The service is free and fast. Within 2 working days, if present, utility lines are marked (water, sewer, cable, phone, electric, gas, fiber optic).
2) You may need to add or remove soil to make sure that the slope of the ground allows water to flow away from buildings, including your house and garage.
3) Downspouts must discharge water at least six feet from a building's crawl space and two feet from a building's concrete slab foundation. Rain garden should be at least 10 ft from the foundation of a house with a basement.
4) Do not locate the rain garden over a septic system, drain field or underground oil tank, unless decommissioned.
5) Avoid building a rain garden in an area that is too small for good drainage or too close to a retaining wall.
6) Make sure overflow is directed to an appropriate place, away from buildings and neighboring properties.

Other Factors To Consider

1) It's easier to build a rain garden in a flat area.
2) A naturally low spot with good drainage is ideal for a rain garden because water already ends up there.
3) Avoid building a rain garden where water ponds, because that indicates soils don't drain well.
4) Consider removing paved surfaces to create space for a rain garden.
5) Avoid placing rain gardens underneath the canopy of trees.
6) A rain garden larger than 300 sq ft creates a small pond.

3) RAIN GARDEN (Cont'd)

Design

1) Make sure garden is large enough to drain water directed to it in 36 hours. This keeps water from stagnating and mosquitoes from breeding.
2) Size your garden to be at least 10% of the area that drains to it. Ex. Roof area (500 sq ft) x Sizing Factor (10%)=50 sq ft or a 5 ft x 10 ft garden.
3) Test your soils. Dig a hole two feet deep and two feet wide where the deepest part of the garden will be. Fill the hole with water and let it drain completely. Fill it again and monitor how fast the water drains. If it drains within 24 hours, this is a good spot to locate a rain garden. It's a good idea to dig a couple of holes to see if your garden is uniform.
4) Sand, gravel, or compost can improve drainage. Till in a mix of two thirds sandy loam topsoil and one third compost to improve conditions for plant growth. Blend it well to a depth of 18 inches to loosen compacted soil and allow plant roots to establish more quickly.
5) An above ground pipe is the easiest way to convey water from your downspout to the rain garden.
6) Water can also be conveyed by directing water to a shallow conveyance swale; building a rock-lined swale that looks like a dry creek bed; carving a channel in a piece of flagstone; sending water through a piece of bamboo into a container and letting it splash onto a rock; or using a plastic splash block.

Building it

1) Mark the area for digging (use stakes and string, marking paint, or garden hose).
2) Moisten hard soils with a garden hose to make digging easier. Dig up existing grass and plants.
3) Dig the entire garden about 18 inches deep to loosen soil, then add a few inches of soil, sloping the sides at about 20% (or a slope ratio of 5:1). This reduces the risk of erosion and soil falling back into the garden.
4) Plant your garden. Use a variety of species and plant densely to make it harder for weeds to grow. After planting, add some compost to prevent erosion and provide nutrients for plants. Consider using weed-free straw for soil cover during first year.
5) Make the main basin of the garden as level as possible, so that water spreads evenly.
6) If the garden is on a slight slope, add a berm on the downhill slope to hold rainwater. The steeper the slope, the higher the berm.
7) Use plastic or concrete splash blocks, rocks, or boulders at end of the downspout to control erosion and add interest.

Planting Suggestions and Chart

1) Plants must be able to survive periods of wet and dry soil, as well as occasional flooding. Many attractive native plants handle these conditions. Need sun or partial sun.
2) Natives often require less maintenance; generally do not require fertilizer or pesticide applications; some are deer resistant.
3) A mixture of species with varying forms, heights, and bloom times adds diversity and interest.
4) As in a traditional perennial garden, repeating blocks or drifts of plants (mostly in odd number groups) will have a pleasing effect.

PERENNIALS			
Latin name	**Common Name**	**Height**	**Bloom Time**
Aquilegia canadensis	Columbine	2'	Spring
Amsonia spp.	Blue star	2-3'	E. Summer
Asclepias incarnata	Swamp Milkweed	2-4'	L. Spring
Aster novae angliae	New England Aster	1-6'	Summer-Fall
Chelone spp.	Turtlehead	1-4'	L. Summer-E. Fall
Cimicifuga spp.	Black Snakeroot, Fairy Candles	4-7'	Summer-Fall
Eupatorium spp.	Joe Pye Weed, Mist Flower	4-6'	L. Summer
Filipendula rubra	Meadowsweet	4-6'	L. Summer
Geranium maculatum	Cranesbill	8-15"	L. Summer
Iris versicolor	Blue Flag	2-4'	L. Spring
Liatris spicata	Blazing Star, Gayfeather	1-3'	Summer
Lobelia cardinalis	Cardinal Flower	2-4'	Summer
Monarda didyma	Bee Balm	1-4'	Summer
Oneothera spp.	Evening Primrose, Sundrop	1-2'	Summer
Physostegia virginiana	Obedient Plant	2-4'	L. Summer-Fall
Solidago spp.	Goldenrod	1-6'	L. Summer-Fall
Vernonia noveboracensis	New York Ironweed	4-8'	L. Summer-Fall

FERNS			
Latin name	**Common Name**	**Height**	**Bloom Time**
Onoclea sensibilis	Sensitive Fern	1-2'	
Osmunda cinnamomea	Cinnamon Fern	2-3'	
Osmunda regalis	Royal Fern	2-3'	

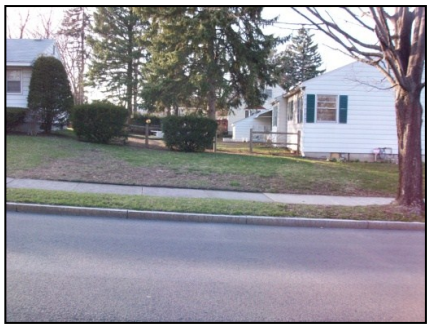
GRASSES			
Latin name	**Common Name**	**Height**	**Bloom Time**
Andropogon gerardii	Big Bluestem	3-7'	L. Summer-Fall
Calamagrostis acutiflora	Feather Reed Grass	4-6'	Summer-Fall
Carex spp.	Sedge	6-36"	L. Spring-E. Summer
Chasmanthium latifolium	Northern Sea Oats	2-4'	L. Summer
Panicum virgatum	Switch Grass	3-8'	Summer-L. Summer

SHRUBS			
Latin name	**Common Name**	**Height**	**Bloom Time**
Aronia spp.	Chokecherry	3-12'	Spring
Callicarpa americana	Beautyberry	4-8'	Summer
Cephalanthus occidentalis	Buttonbush	3-10'	L. Summer
Clethra alnifolia	Summersweet	6-10'	L. Summer
Cornus stolonifera	Red Twig Dogwood	7-9'	L. Spring-E. Summer
Ilex glabra, I. verticillata	Inkberry, Winterberry	3-12'	L. Spring-E. Summer
Itea virginioca	Virginia Sweet Spire	3-9'	L. Spring
Lindera benzoin	Spicebush	6-12'	Spring
Sambucus canadensis	Elderberry	6-12'	L. Spring
Vaccinum spp.	Blueberry	2-12'	L. Spring
Viburnum spp.	Viburnum	2-18'	Spring

Plant selection chart from Cornell University Cooperative Extension Albany County Handout-Installing a Rain Garden

RESIDENTIAL RAIN GARDEN
144 Melrose Ave, City of Albany, Albany County, New York

Purpose: collect stormwater from adjacent property and eliminate large puddle in backyard. **Garden size:** ~150 sq ft. **Site:** ~18% slope, sandy, well drained soils (hydrological soil group A). **Construction:** winter planning (research, layout, and plant selection); dug and planted garden in two days (May, 2010); added soil amendments (eight 40-lb bags of humus/composted manure and some peat moss); surfaces mulched at completion (reduce weeds); neighbor installed gutters/downspout. **Plant list:** cone flowers, columbine, blue flag, bee balm, evening primrose, dwarf goldenrod, sedge, feather reed grass. **Cost:** plants ($200); compost/mulch ($60). **Time:** research/planning (5 hours); digging/planting (15 hours/2 people); maintenance (10 hours/spring, summer, fall). **Other:** to get plants established, need to keep plants watered the first year; if there is not much rain, need an inch of water a week…given success of first rain garden, built second rain garden to address other drainage issues. **Maintenance:** weed; renew mulch; prune/thin woody plants; cut herbaceous perennials and grasses back 4 to 6 inches each spring before new growth emerges; may need to remove silt or sediment that accumulates in depression; check water inflow/outflow, clear out as needed; remove dead stems/leaves from depression; fill gaps with new plants.



Runoff from property on left (grey house) creates large puddle in backyard of white house (right). Rain garden site is between the two houses, on the slope.

Owner of white house builds rain garden. First, garden area is scraped of grass and weeds.

Area measured to get sense of natural slope and needed height of berm.

Spading fork to break up soil, also used rototiller

All spaded and ready for soil amendment.

Soil amendment.

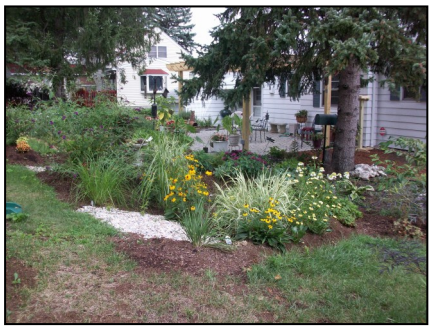
Rototiller to mix in organic humus and manure. 9" berm.

Planting.

Stone used where water flows in from neighbor.

Planted and waiting for rain.

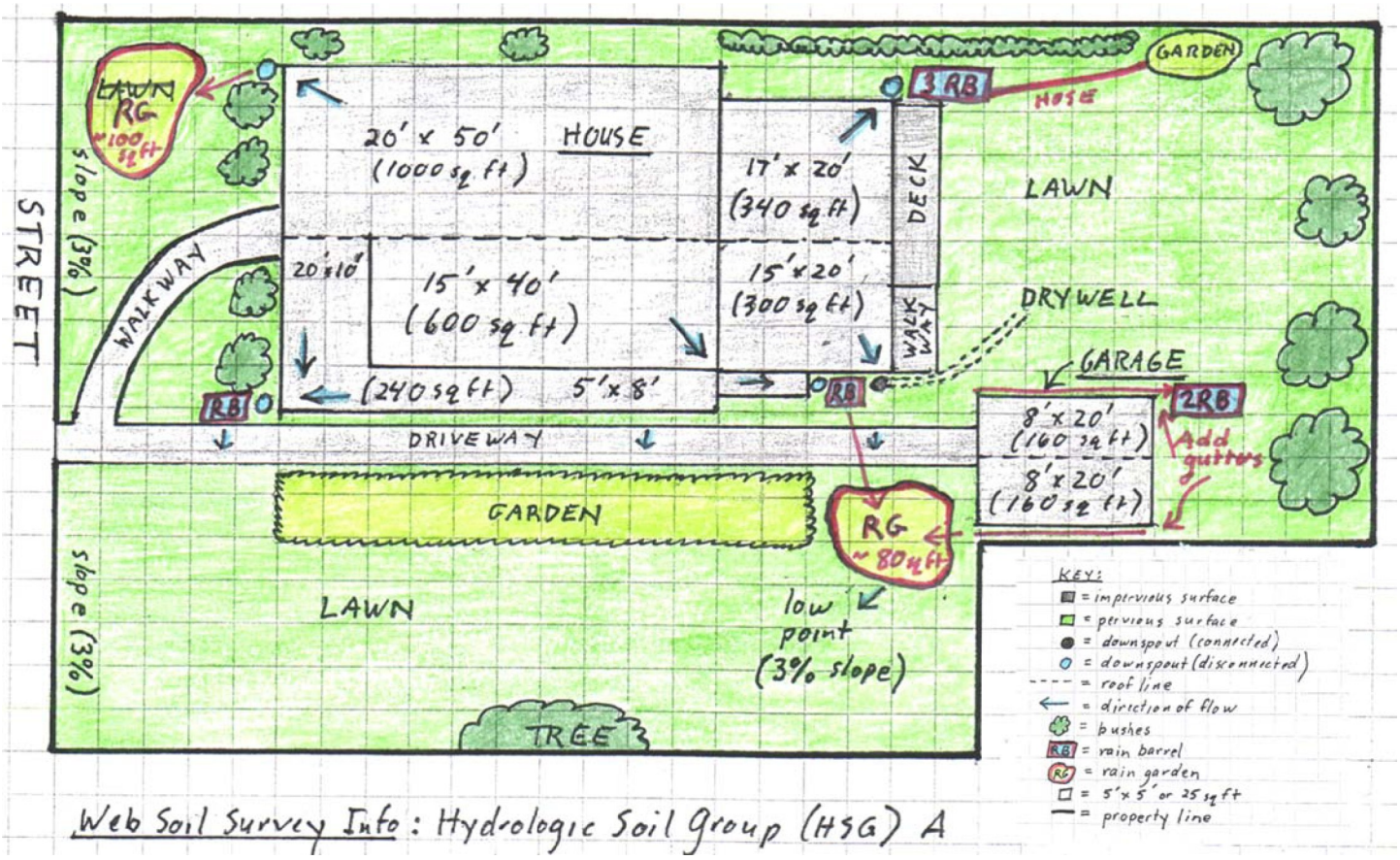
Neighbor (grey house) installs new gutter, downspout, and splash block. First rain.



Planted in May, blooming in August.

STEP 3 Sketch Some Ideas and Take Action

Example of Plan: Install rain barrels at 3 downspouts and rain garden at fourth (house). Direct rain barrel overflow across driveway into second rain garden. Install soaker hose. For garage, install gutters and 2 downspouts; 1 drains to rain barrel; 1 to rain garden.



SOURCES

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Chapter 2 Impacts of New Development. NYSDEC Stormwater Management Design Manual (August, 2010)

Rainfall Data: http://www.erh.noaa.gov/aly/climatef/annualwx.htm

Stormwater Solutions Handbook. City of Portland, Oregon. Bureau of Environmental Services, Portland, Oregon.

See http://www.portlandonline.com/bes/index.cfm?c=1870 for all Portland, Oregon publications

Site Assessments

Stormwater Management Facilities. Site Assessment Guide. City of Portland, Oregon. 2006. Bureau of Environmental Services.

Downspout Disconnect

How to manage stormwater-Downspout Disconnection. City of Portland, Oregon, Bureau of Environmental Services.

Rain Barrels

How to manage stormwater-Rain Barrels. City of Portland, Oregon. Bureau of Environmental Services.

Rain Barrels-Tip Sheet #6. Philadelphia Water Department (Office of Watersheds). Living Streamside-Guide to Designing your Property and Protecting our Watershed-Backyard Buffer Program.

*This Old House Rain Barrel Installation Video: http://*www.thisoldhouse.com/toh/video/0,,20045365,00.html

Rain Gardens

How to manage stormwater-Rain Gardens, City of Portland, Oregon, Bureau of Environmental Services.

installing a Rain Garden. Handout from Cornell University Cooperative Extension Albany County.

Rain Gardens in Connecticut-A Design Guide for Homeowners. University of Connecticut Cooperative Extension System.

The Stormwater Coalition of Albany County was formed in 2008 via an inter-municipal agreement. **The purpose of the Coalition** is to foster cooperation and to provide for the provision of joint services related to compliance with NYSDEC SPDES MS4 Permit program requirements. **For more information about the Stormwater Coalition,** call 518-447-5645; e-mail swcoalition@albanycounty.com; or go to www.albanycounty.com/stormwatercoalition. For information about individual stormwater management programs, contact Coalition members directly. Special thanks to the City of Portland, Oregon for use of their publication text and Cornell Cooperative Extension of Albany County for rain garden photos. Guidance Manual publication date: October, 2010