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Partners for the Southwestern Pennsylvania Guide

County of Allegheny

City of Pittsburgh

County of Westmoreland

PENNSTATE Cooperative Extension
College of Agricultural Sciences

Allegheny County Conservation District

Westmoreland Conservation District

Produced by:

Penn's Corner Conservancy and Charitable Trust, Inc.

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SOUTHWESTERN PENNSYLVANIA'S

Homeowner's Guide to STORMWATER

How to develop & implement a stormwater management plan for your property

Residential rain garden in Mount Pleasant, PA

Penn's Corner Conservancy Charitable Trust, Inc.

Our vision: Complete restoration and ongoing conservation of our natural resources, in harmony with strong, productive communities.
Our mission: To enhance the area's natural resources and build strong communities by fostering regional partnerships, securing resources, and delivering needed services and programs.
Our focus: Entire southwestern Pennsylvania region.

Contact your local County Conservation District for more information about stormwater

Allegheny	(412) 241-7645	www.accdpa.org
Armstrong	(724) 548-3425	www.armstrongcd.org
Beaver	(724) 378-1701	beavercountyconservationdistrict.org
Butler	(724) 284-5270	www.bccdonline.org
Fayette	(724) 438-4497	www.fayettecd.org
Greene	(724) 852-5278	www.co.greene.pa.us
Indiana	(724) 471-4751	www.iccdpa.org
Washington	(724) 705-7098	pawccd.org
Westmoreland	(724) 837-5271	www.wcdpa.com

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Kathryn Hamilton, RLA: inside front cover; page 2, stormdrain; page 3, driveway; pavers; page 5, surface ponding; stream erosion; downspouts; page 7, rain garden; page 16, maps; page 17, pavers; page 18, swale in rain; coneflower and bee

Stephen Simpson, page 2, stormwater on road

Margaret Kyler, page 6, rain guage

Matt Kofroth, LCCD, page 18, girl and rain barrel

Matt Royer, Penn State, page 8, planting

Dick Brown, page 8, vegetated swale

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Kristen Kyler, Penn State, page 19 measuring water

Mark Jackson, page 2, forest; page 7, riparian buffer; page 8 meadow; page 23, houses

Graphics

Matt Zambelli, page 4, property boundaries; buildings on property; page 5, natural features on property; page 21, BMP graphics, map of potential best management practices on property, Best Management Practices Treatment Potential for one inch rainfall.

Table of Contents

Purpose of this Guide

Are you concerned about water quality? Is flooding a problem in your neighborhood? Are you planning a home improvement project? If the answer is yes to any of these questions, then you need to know more about managing stormwater.* This guide will help you better understand:

- what stormwater is, why stormwater runoff can be a problem, and what you can do about it;
- how much stormwater runoff is generated by impervious areas on your property;
- how stormwater flows across and leaves your property; and
- how you can reduce the amount of stormwater runoff leaving your property.

This guide will help you create your own stormwater management plan and select simple stormwater solutions to be implemented on your property.

** Check with your local municipality to find out more about what permits may be required for any building projects.*

Acknowledgments

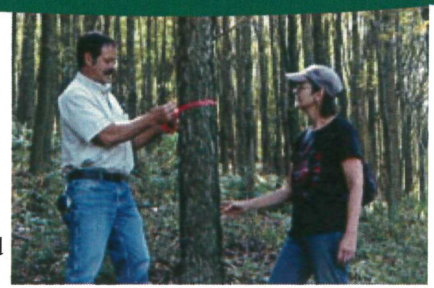
The Penn's Corner Conservancy Charitable Trust, Inc., extends its appreciation to the Little Conestoga Partnership and its funder, the National Fish and Wildlife Foundation, for allowing us to adapt their publication, The Homeowner's Guide to Stormwater, for our residents in southwestern Pennsylvania. Members of the Little Conestoga Partnership include: Alliance for the Chesapeake Bay, Brandywine Conservancy, Chesapeake Bay Foundation, Habitat MT, Lancaster County Clean Water Consortium, Lancaster County Conservancy, Lancaster County Conservation District, Lancaster County Planning Commission, Little Conestoga Watershed Alliance, PA Department of Environmental Protection, PA Department of Conservation and Natural Resources, PA Landscape & Nursery Association, and Penn State University.

Section 1: Introduction

What is Stormwater Runoff?

Stormwater runoff is precipitation (rain or snowmelt) that flows across the land. Stormwater may infiltrate into soil, discharge directly into streams, water bodies, or stormdrains, or evaporate back into the atmosphere.

In the natural environment, most precipitation is absorbed by trees and plants or permeates into the ground, which results in stable stream flows and good water quality.



Healthy forest

Things are different in the built environment. Rain that falls on a roof, driveway, patio, or lawn runs off the surface more rapidly, picking up pollutants as it goes. This stormwater runoff flows into streams or storm drains that empty into waterways like the Allegheny, Monongahela and Ohio rivers.

Storm drain

Polluted urban flooding

Why Can Stormwater Runoff Be a Problem?

Poorly managed stormwater runoff can cause many problems. These include:

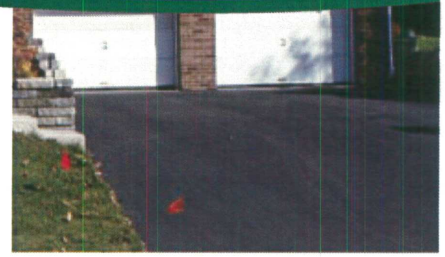
- **Flooding.** As stormwater runs off roofs, driveways, and lawns, large volumes quickly reach streams, causing them to rise and flood. When more impervious surfaces exist, flooding occurs rapidly and can be severe, resulting in damage to property and harm to people.
- **Pollution.** Stormwater running over roofs, driveways, roads, and lawns will pick up pollutants such as oil, fertilizers, pesticides, dirt/sediment, trash, and animal waste. These pollutants "hitch a ride" with the stormwater and flow untreated into local streams, polluting our waters.
- **Stream Bank Erosion.** When stormwater flows into streams at unnaturally high volumes and speeds, the power of these flows can cause severe stream bank erosion. Eroding banks can eat away at streamside property, create dangerous situations, and damage natural habitat for fish and other aquatic life. This erosion is another source of sediment pollution in streams.
- **Threats to Human Health.** Stormwater runoff can carry many pollutants, such as toxic metals, organic compounds, bacteria, and viruses. Polluted stormwater, especially coming from combined sewer overflows, can contaminate drinking water supplies and hamper recreational opportunities as well as threaten fish and other aquatic life.

What Can I Do to Help?

As a homeowner, you can help avoid the problems associated with stormwater runoff by:

- reducing impervious areas (hard surfaces like roofs, paved areas) so that rain soaks into the ground
- planting native trees and plants which help infiltrate stormwater and increase evaporation and transpiration
- managing stormwater on-site with rain gardens, rain barrels, and similar practices
- following the lawn care practices described in this guide

By doing many small things on your property, you can have a big impact on improving stormwater management and water quality in our region.



Impervious surface

Permeable pavers

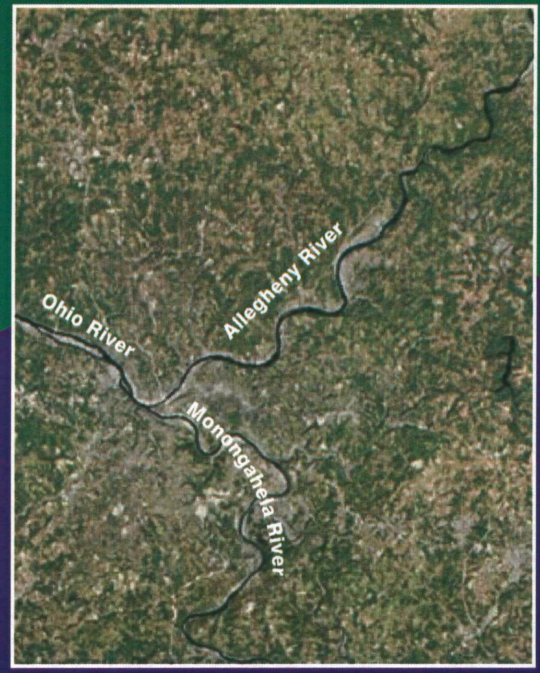


Photo by ESRI

In Pennsylvania, the drainage area of the Allegheny, Monongahela, and Ohio rivers covers more than a third of the state and is home to more than three million people. (www.orsanco.org)

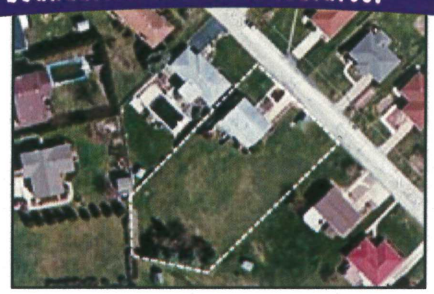
Managing stormwater on your property will not only help protect local streams, but will also help clean up downstream waterways like these rivers.

Section 2: Assessing Stormwater on Your Property

In order to better manage stormwater on your property you should first understand how stormwater affects it. Follow these simple steps to figure out where stormwater is generated, how it flows, and approximately how much stormwater comes from your property. You may draw your map on paper using Appendix A, or use the additional instructions in Appendix B to create an aerial photo map.

1. Walk your property and map your boundaries and basic features.

Step 1: Draw your property boundaries.
Draw the boundaries of your lot. If you are not sure of your boundaries, you may be able to look this up on your property tax assessment, deed to your house, or at your county's tax office.



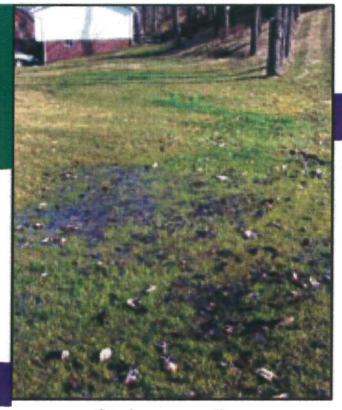
Typical property boundary mapped via www.stormwaterguide.org

Step 2: Draw buildings and other features of your property.
Draw and label the buildings and other features of your property. These include:

Impervious surfaces mapped via www.stormwaterguide.org

- **Impervious areas.** These are hard surfaces on your property that prevent stormwater from soaking into the ground. They include rooftops, driveways, parking areas, walkways, decks, patios, or other hard surfaces.
- **Lawn and landscaped areas.** These include any areas with grass or landscaping that you regularly maintain.
- **Natural vegetation.** These are areas of woods, meadow, or other naturally vegetated areas that are allowed to grow on your property.
- **Water features.** These could be streams, wetlands, ponds, or swimming pools.

You can determine the approximate size of each area by using a tape measure and calculating the square footage of each. Depending on the overall size of your property, you may want to calculate these areas in square feet or convert to acres (1 acre = 43,560 square feet). If your property has no natural vegetation, such as woods or meadows, or water features on it, you can simply subtract the impervious areas from your total lot size to get your total lawn and landscaped area.



Surface ponding

2. Assess and map your stormwater flow.

The next step is to show how and where runoff flows on your property and identify any problems it may be causing. Common stormwater problems may include large puddles ("ponding"), damp basements, soil erosion, and collapsing stream banks. The ideal time to assess stormwater flow is during or immediately after a rain storm. Look for and map the following:

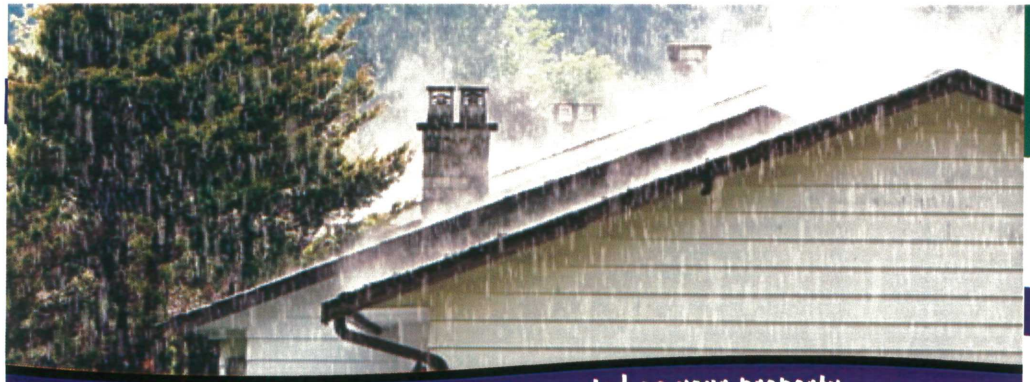
- **Roof downspouts.** Indicate the location of roof downspouts and the direction stormwater flows from the downspouts.
- **Stormwater flow paths.** Using arrows, show the direction of stormwater flow off impervious surfaces. If you have any areas where stormwater collects, such as drainage swales or ditches, show this and label them as such.
- **Areas of ponding.** Indicate locations of standing water or ponding on the map.
- **Gullies or ditches from soil erosion.** Indicate any areas of soil erosion which have resulted in gullies or ditches. This may appear within existing drainage swales or channels and would be good to note on your assessment.
- **Slope of the land.** Water always flows downhill. Which areas of your property are high and which are low? What is above or below your home?

Stream erosion

If you have multiple downspouts, drainage channels, ponding areas, etc., organize your map and assessment plan by numbering them.

Natural features mapped via www.stormwaterguide.org

Downspouts for roof runoff



3. Estimate how much stormwater is generated on your property.

The amount of stormwater runoff generated from your property depends on how long and how hard it rains, the slope of your property, the type and quality of the soils, the amount of impervious surface on your property, and other factors. Nevertheless, there is a simple calculation you can use to estimate how much stormwater runoff your property generates during a typical rainstorm.

The majority of annual rainfall in southwestern Pennsylvania comes in the form of small storms of one inch or less. These small storms carry most of the pollutants that impact water quality, and thus the stormwater generated by your property for the one inch storm is a good measure of typical stormwater runoff. Use the following chart to determine how much stormwater is generated by the impervious area on your property:

Rain gauge

Square Feet of Impervious Area	Gallons of Runoff to be Managed
500 or less	less than 312
501 – 1,000	312 – 624
1,001 – 2,000	624 – 1,246
2,001 – 3,000	1,246 – 1,869
3,001 – 4,000	1,869 – 2,492
4,001 – 5,000	2,492 – 3,115
5,001 – 10,000	3,115 – 6,231
10,001 – 20,000	6,231 – 12,462
20,001 – 43,000	12,462 – 26,793

The above numbers were calculated using the following formula:
(Total square feet of impervious area) x 0.0833 x 7.48 = _____ gallons of runoff

Use this formula if you want a more accurate calculation of the runoff generated from your impervious area.

0.0833 is to convert feet to inches • 7.48 = number of gallons per cubic foot

Section 3: Developing Your Stormwater Management Plan

Now that you know what areas of your property generate stormwater when it rains, how the runoff flows, and what areas generate the most amount of runoff, you can start thinking about adding stormwater management practices to your property.

1. Types of stormwater best management practices.

Many management practices exist for handling stormwater runoff. This guide suggests six of the simpler, easier to implement practices. Each practice is introduced briefly in this section so you can consider which ones are right for you. (related cost value scale: $ $$ $$$)

RAIN GARDEN

A depressed landscape bed that uses mulch, soil mix, and deep-rooted native plants to capture, absorb, and infiltrate stormwater.

Benefits
- Manages stormwater and filters pollutants
- Provides wildlife habitat
- Minimal maintenance
- Adds beauty

Negatives
- Plants can take 2-3 years to establish
- More maintenance required in first few years

Cost
$ – $$$
- Varies depending on size and depth

Maintenance
- Low once plants are established
- Weeding and watering in first two years
- Some thinning in later years

Aesthetic Appeal
- Ranges from medium to high
- Can customize based on plant selection

Implementation Considerations
- Construct downslope of runoff to be captured
- Locate at least 10 feet from buildings & utilities
- Soils may require underdrain

RIPARIAN BUFFER

Planting native trees or shrubs along streams to restore the streamside area to forested conditions. These "riparian buffers" filter runoff and have numerous water quality benefits.

Benefits
- Increases infiltration and groundwater recharge
- Improves water quality
- Controls erosion & sedimentation
- Provides wildlife habitat

Negatives
- Not as effective on steep slopes
- Flooding may damage planting

Cost
$
- Supplement existing native vegetation

Maintenance
- Low, once native plants are established
- Weeding and watering in first two years
- Some plant thinning in later years
- Regularly remove debris

Aesthetic Appeal
- Ranges from medium to high
- Higher aesthetic appeal than conventional stormwater conveyances

Implementation Considerations
- Plant in spring or fall
- Contact your municipality or conservation district for possible permit information

TREE PLANTING

Planting native trees and shrubs to restore a portion of your property to forested conditions.

Benefits

- Increases infiltration and evapotranspiration of stormwater
- Filters pollutants
- Requires minimal maintenance
- Provides wildlife habitat
- Large numbers of native trees maximizes benefits

Negatives

- Takes many years before trees grow to provide maximum benefit
- Regular maintenance is required where invasive plant species exist
- Must guard against deer browsing and rodent damage

Cost

$-$$

- Varies, depending on species, size, and type of tree planted

Maintenance

- Maintain tree tube/stakes or cages, remove after 5 years
- Mow between trees at least twice a year during first 4 to 5 years

Aesthetic Appeal

- High asethetic appeal, as trees add interest, structure, color, and wildlife to property

Implementation Considerations

- Plant in spring or fall
- Watering may be necessary after planting during dry weather (25 gallons/week)

"Trees can lower energy costs, remove pollution from the air, increase property values, capture stormwater and provide wildlife habitat."

(Pittsburgh Office of Sustainability)

VEGETATED SWALE OR NATIVE MEADOW

An area planted with native grasses and wildflowers and maintained as a natural area. "No mow" areas can also develop into meadow areas.

Benefits

- Increases infiltration and evapotranspiration of stormwater
- Filters pollutants
- Requires little maintenance
- Provides wildlife habitat

Negatives

- Site preparation (including turf grass removal) is required before planting
- Meadows may conflict with local weed ordinances

Cost

$

- Native seed mixes vary depending on type of species and amount of variety desired

Maintenance

- Mow twice a year for first two years, then annually
- Control invasive plant species

Aesthetic appeal

- High aesthetic appeal, as tall grasses and wildflowers add interest, structure, color, and wildlife to property

Implementation Considerations

- Plant in spring
- Monitor and control invasive species

Appendix A: Stormwater Management Plan Template

You may use this template to create your stormwater management plan.

1. Map

Use the grid paper provided to hand draw your stormwater management plan map. (See sample map on page 16.) Or, follow the tutorial provided in Appendix B to create a computer generated aerial map. If you hand draw your map, it is suggested you use one ink color to draw existing conditions and a different color to draw your proposed stormwater management practices.

2. Plan Details

Fill in the template to create the details of your plan. For both existing conditions and proposed stormwater management practices, be sure to label all features on your map with numbers that correspond to the plan template.

Stormwater Management Plan

Property Owner's Name: _____

Property Address: _____

Municipality: _____ County: _____

Watershed: _____ (example: Youghiogheny River)

Name of stream into which stormwater flows: _____ (example: Sewickley Creek)

EXISTING CONDITIONS

IMPERVIOUS AREAS

Buildings

Number	Description (house, shed, etc.)	Square Feet

Driveways and Walkways

Number	Description (driveway, back walkway, front walkway, etc.)	Square Feet

Other Hard Surfaces

Number	Description (patio, deck, etc.)	Square Feet
Total Impervious Area:		

LAWN AND LANDSCAPED AREAS

Number	Description (front yard, back yard, flowerbed, etc.)	Square Feet
Total Lawn and Landscape Area:		

NATURAL AREAS

Woods

Number	Description (back woodlot, side woods, etc.)	Square Feet

Meadow

Number	Description (back meadow, front meadow, etc.)	Square Feet
Total Natural Area:		

Note any water features (streams, wetlands, ponds, etc) on your property:

Total Stormwater Generated in a 1 inch rainstorm:
(Total Impervious Areas x 0.0833 x 7.48)

_____ ft^2 x 0.0833 ft x 7.48gal./ft^3 = _____ gallons

STORMWATER FLOW

Downspouts

Number	Description (front house, back house, shed, etc.)

Drainage Swales

Number	Description (side yard swale, back yard swale, etc.)

Areas of Ponding

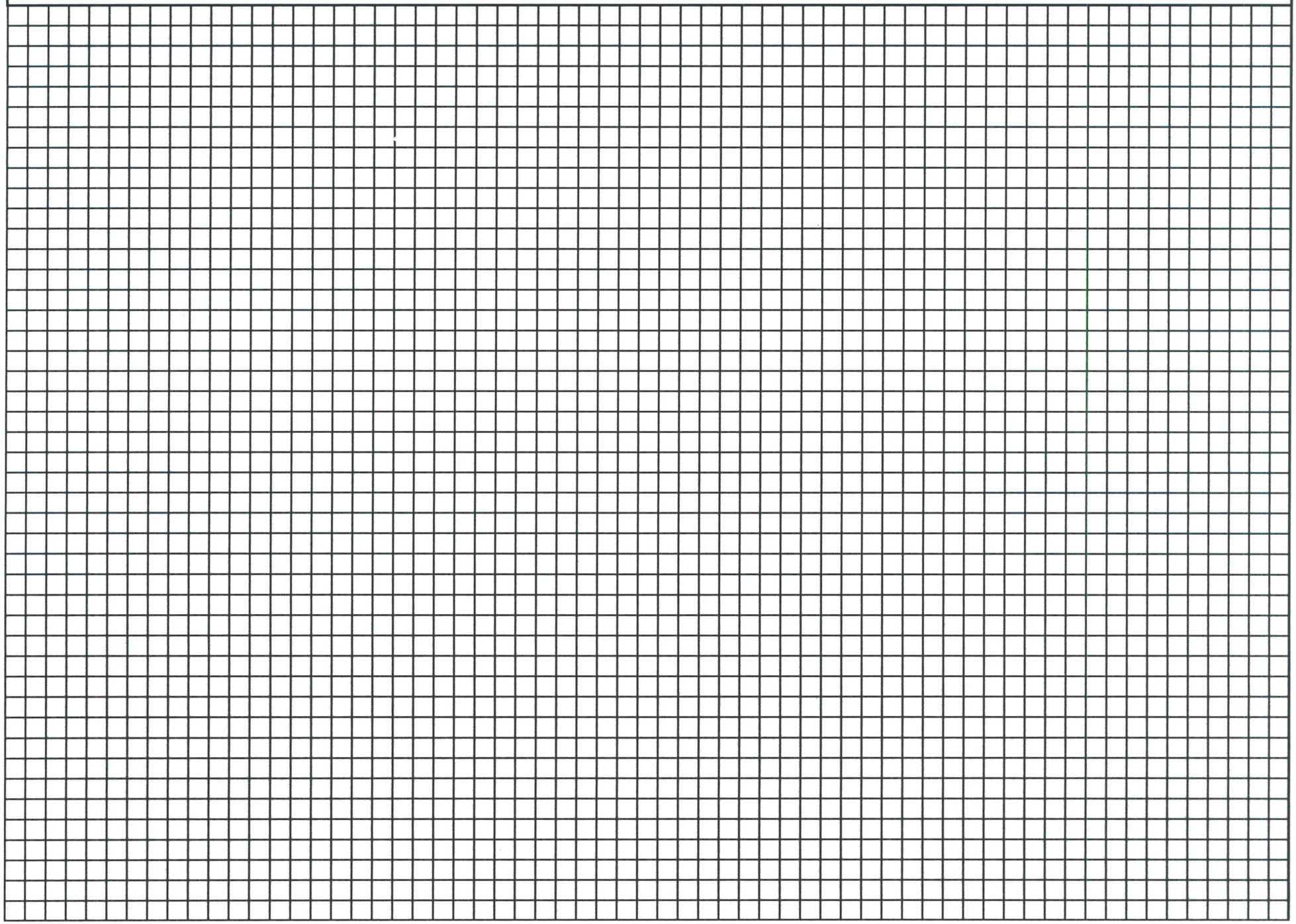
Number	Description (side yard ponding, back yard ponding, etc.)

Note any areas of gullying or erosion or any other areas of concern:

UTILITIES

	Location (Front, Side, etc.)
GAS	
WATER	
SEWER	
ELECTRIC	
PHONE/CABLE	

Stormwater Management Plan Map



Proposed Stormwater Best Management Practices

Rain Garden		
Number	Description (front yard, back yard, etc.)	Square Feet
Riparian Buffer		
Number	Description (tributary, main stem of creek, etc.)	Square Feet
Tree Planting		
Number	Description (backyard woods, side woods, etc.)	Square Feet
Vegetated Swale or Native Meadow		
Number	Description (side yard swale, back yard meadow, etc.)	Square Feet
Pervious Paving		
Number	Description (front walkway; back patio etc.)	Square Feet
Rain Barrel		
Number	Description (side house barrel, shed barrel, etc.)	Gallons

Appendix B: Interactive Computer Resources

COMPUTER MAPPING TUTORIAL

1. Open Web Browser.

Go to Google maps (www.google.com/maps) or Bing maps (www.bing.com/maps), or your local county's tax maps to access an aerial map of your property. Or use **www.stormwaterguide.org** and follow the prompts.

2. Type in your property address, if using Google or Bing Maps.

Use the zoom functions to zoom in as close as you can to your property, making sure your entire lot is shown on the map. Make sure the "Satellite" or "Aerial" function is turned on so that the map is shown in aerial photography format.

3. Press "Print Screen"; Paste.

Use print screen option on your computer to paste the screen shot in the program of your choice to crop and edit. We recommend Power Point, Microsoft Word, or Paint.

4. Use drawing tools to add your different elements.

Using the "shapes" or other drawing tools available you can add your areas affected by stormwater and your new best management practices. The arrows and freeform tools are particularly useful. Be sure to use different colors for different elements of your map. Text boxes can be used to add labels or a legend.

5. Save and print your map.

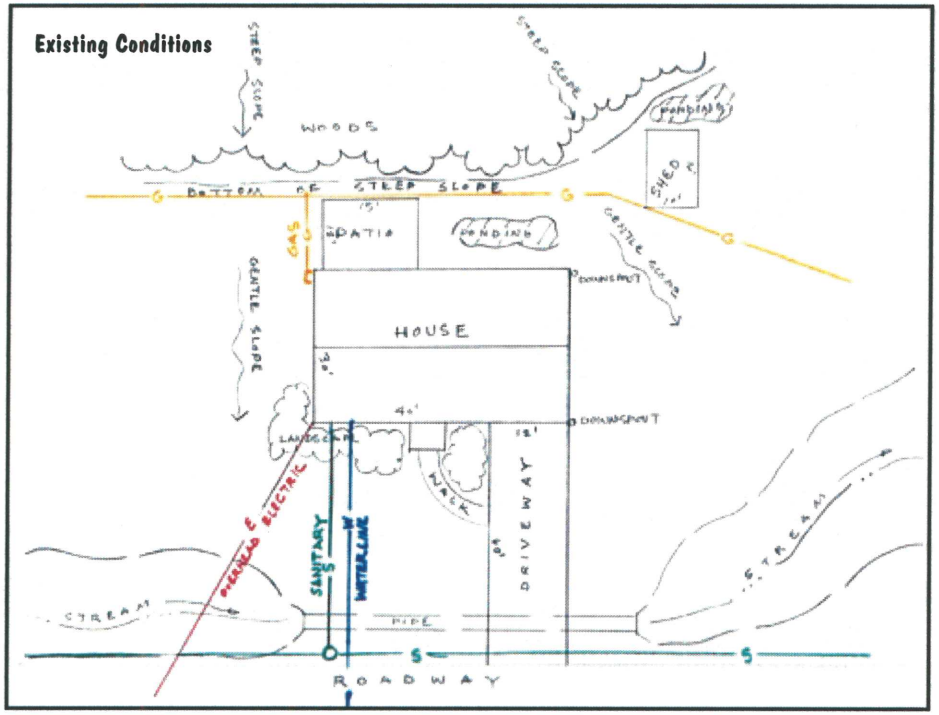
When you are done, you can save your map as a .pdf or print it to go with your written stormwater management plan.

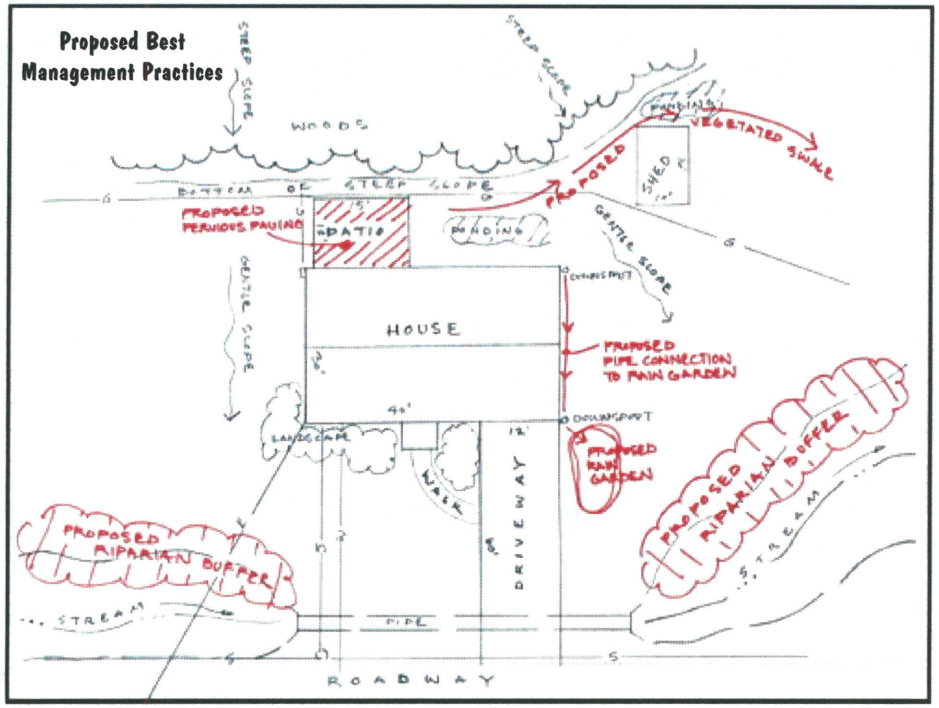
STORMWATER CALCULATOR

EPA's National Stormwater Calculator is a computer desktop application that estimates the annual amount of rainwater and frequency of runoff from a specific site anywhere in the United States. Estimates are based on local soil conditions, land cover, and historic rainfall records. All you need to do is supply information on your property's cover and what best management practices you would like to use. Just follow these instructions to download the National Stormwater Calculator to your computer.

1. Go to www.2.epa.gov/water-research/national-stormwater-calculator
2. Download the National Stormwater Calculator Exe (13MB) version 1.1
3. If your browser offers the option to run the setup program then do so.
4. Otherwise, have your browser display its list of recent downloads and select the setup file to run it.
5. If you have problems installing the calculator, contact your system administrator or try to download a 7MB zip file version.

SAMPLES - MAPS & PLANNING





PERVIOUS PAVING

Pervious concrete or asphalt can be poured in place for use in driveways, parking areas, or walkways. Impervious building materials, such as stone, concrete, or brick, can be laid with space in between to allow for pervious areas (gravel, sand, or vegetation).

Benefits
- Increases infiltration and groundwater recharge
- Reduces volume and rate of runoff

Negatives
- More labor intensive to install than other practices
- Extra maintenance needed

Cost
$$$
- Can save by installing permeable pavers
- May need to excavate and install stone base

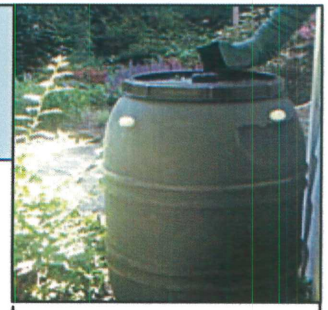
Maintenance
- Moderate to high maintenance
- Grass between pavers may have to be mowed
- Inspect for signs of clogging
- Pressure wash and replace pea stone as needed
- Snow plow using higher blade

Aesthetic appeal
- Ranges from low to medium
- Artistic designs with layout can increase aesthetic appeal
- Creeping plants can be used as infill

Implementation Considerations
- Need to install permeable stone base layer 10"-12" thick
- May require underdrain
- Pavement subgrade should slope away from building foundation

RAIN BARREL/CISTERN

A barrel that captures rainwater from a roof and stores it for later use, such as watering plants or gardens. A cistern is a larger container that does the same thing.



Benefits
- Conserves water
- Captures and reuses stormwater

Negatives
- Minimal volume captured
- Poor construction or maintenance can result in mosquitoes
- Freezing/splitting if not put away in the winter

Cost
$
- Minimal cost as DIY project
- Can save dollars because of reduced potable water usage

Maintenance
- Clean screen/filter regularly
- Clean gutters twice annually
- Monitor during severe storms to avoid overflow
- Empty before winter months

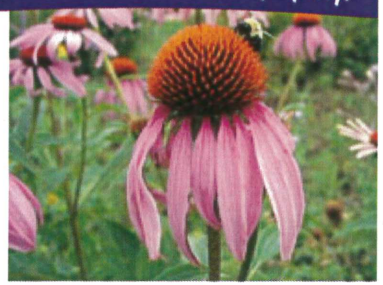
Aesthetic appeal
- Ranges from low to medium depending on type of barrel used

Implementation Considerations
- Place on level surface
- Full rain barrel weighs 400 lbs
- Can be used in series for more storage capacity
- Water should be used between rain events

2. Factors to consider when choosing stormwater best management practices for your property.

Here are some considerations that might help you decide which practices you would like to install on your property.

- If you would like to enhance your landscaping with flowers and other attractive plants consider a rain garden or a native meadow/swale.
- If you want to reduce the amount of time it takes to mow the lawn, a rain garden or native meadow/swale would help accomplish this goal.



Native Purple Coneflower

Rain barrel use

- If you would like to see more butterflies, a rain garden or native meadow/swale can provide excellent butterfly habitat.
- If you have outdoor water needs (water for a garden, to water your lawn, or to wash your car) consider a rain barrel.
- If you don't have much yard to work with, a rain barrel takes up minimal space.
- If your driveway needs to be repaved, consider using pervious paving instead of traditional pavement.
- If you would like to give your patio a new look, consider pervious paving.
- If you would like to restore forested conditions on a portion of your property, consider tree planting.
- If a stream is running through your property installing a forested riparian buffer would be beneficial.
- If you want to cut down on air conditioning costs during the summer, consider planting some trees on your property.

Tree planting

3. Choose where to locate the stormwater best management practices on your property.

Now that you know about your property and the type of practices you would like to install, it's time to choose the right locations for the practices. Some considerations in your planning are:

- **Ponding Water.** Many stormwater practices encourage water to infiltrate into the soil (such as rain gardens and pervious paving). Where water ponds on your property, water is unable to infiltrate and it may be inappropriate to use these practices. *(Note- if you have an on-lot sanitary septic disposal system and an area is permanently wet near this system, the septic system may be failing. The disposal system should be evaluated and fixed before any other practices are installed.)*
- **Depth to bedrock.** You do not want to construct infiltration practices where rock layers are visible or are close to the surface.
- **Proximity to foundations.** You should also avoid constructing infiltration practices within 10 feet of building foundations.
- **Location of underground utilities.** Do not construct infiltration practices near septic systems or drinking water wells. Also avoid any underground utilities such as electric, cable, water, sewer, and gas lines (make sure to use the PA ONE-CALL system to locate underground utilities and contact your municipality).
- **Slope.** Depending on the practice, a steeper slope may prohibit siting, or it may be something that needs to be taken into account during the design stage. Consult the chart on the next page for guidance.
- **Soil percolation.** Since rain gardens and pervious paving are designed to infiltrate stormwater into the ground, the soil in the location of the rain garden or pervious paving must be able to drain. When considering these practices, you should conduct a simple percolation test where you would like to locate them:

Infiltration test

- Dig a 1 foot deep hole and fill with water.
- Allow the water to moisten soil and drain completely. If water is still in the hole after 24 hours, choose a different location.
- Fill the hole with water a second time and place a ruler in the hole. Note the water level and time.
- After 15 minutes, re-measure the water level. Multiply the change in water level by 4 to get the number of inches of infiltration per hour.
- A perforated underdrain may be necessary to drain excess water from a rain garden or permeable pavement if the infiltration rate is less than 1/2 inch per hour.

Use this summary chart to help you select one or more stormwater practices that are right for your property.

	Rain Garden	Riparian Buffer	Tree Planting	Native Swale/Meadow	Pervious Paving	Rain Barrel/ Cistern
Space Required	Minimum Size: 50 – 200 ft² 5 – 10 ft wide 10 – 20 ft long 6 – 12 inches ponding depth	The wider the better for water quality benefits based on lot size and configuration	Consider space needed for canopy spread	Not a factor	As needed to accommodate walkway, patio, or driveway	Not a factor
Slopes	Locate down slope of building foundations and drainage	Not usually a limitation, but a design consideration	Not usually a limitation, but a design consideration	5% or less along length of swale	2% or less	Barrel must be on level surface
Depth to Water Table	1 – 4 ft clearance	Not a factor if correct species are planted			1 – 4 ft clearance	Not a factor
Depth to Bedrock	1 – 4 ft clearance	1 – 4 ft clearance	1 – 4 ft clearance	Not a factor	1 – 4 ft clearance	Not a factor
Building Foundations	Minimum 10 ft down slope from building foundations	Usually not a factor				
Maintenance All practices should be inspected seasonally and after major storm events.	Low to Moderate: Weeding and watering in first 2 years. Some thinning in later years. Replace mulch.	Low to Moderate: Maintain tree tubes or cages. Mow between trees for first 4-5 years. Control invasives. Water as needed.	Low to Moderate: Maintain tree tubes or cages. Mow between trees for first 4-5 years. Control invasives. Water as needed.	Low to Moderate: Mow twice annually for first two years. Control invasive plants	Moderate to High: Trim vegetation. Inspect for signs of clogging and vaccuum 2 times per year. Replace stone fill as needed.	Low: Clean screen/ filter regularly. Clean gutters twice annually. Monitor for overflows. Empty and store before winter months.
Treatment Potential	1500 gallons treatment capacity per 200 ft²*	200 gallons captured and treated per 1000 ft²	45 gallons of water captured and treated per 2 inch caliper deciduous tree. 75 gallons of water captured and treated per 6 ft evergreeen tree	200 gallons captured and treated per 1000 ft²	30 gallons water captured and treated for a 1/2 inch rain fall per 100 ft²	A 55 gallon drum will be filled from a one inch storm on a 100 ft² roof

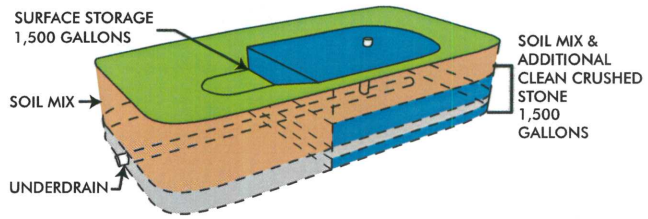
*the subsurface storage of a rain garden should be equal to the surface ponding volume.

Chart adapted from the New Hampshire Homeowner's Guide to Stormwater Management Do-It-Yourself Stormwater Solutions. NH Department of Environmental Services (March 2011, revised February 2012).

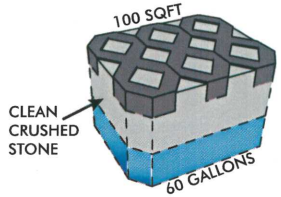
Please remember that by law and for safety you must call PA One Call before digging underground so you know where your underground utilities are located (ie electrical, sanitary sewer, water, etc.).

Best Management Practices: Stormwater Captured During a 1" Rainfall

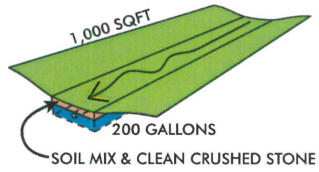
Rain Garden



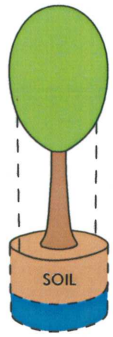
Permeable Pavement



Vegetated Swale

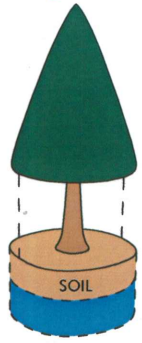


2" Caliper Deciduous Tree



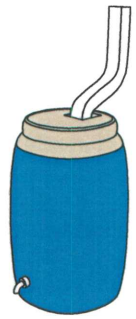
45 GALLONS

6' Tall Evergeen Tree



75 GALLONS

Rain Barrel 100 sq ft of Roof



55 GALLONS

4. List and map your chosen stormwater best management practices.

Now that you've chosen stormwater management practices for your property, list them on the stormwater management plan template provided in Appendix A. Draw them on your property map. Again, you can either hand draw them on the graph paper provided in Appendix A, or continue to follow the Computer Mapping Tutorial in Appendix B to map your chosen stormwater practices on your computer generated property map.

Map of potential best management practices via www.stormwaterguide.org

Section 4: Implementing Your Stormwater Management Plan

Congratulations! Your stormwater management plan is complete! You have taken an important step in managing stormwater on your property to help clean your local stream and river. Now you are ready to start implementing your plan. If you are a do-it-yourselfer, there are several online resources that provide detailed design and implementation guidance for the six practices discussed in this guide. Note: Please refer to the disclaimer at the end of this guide.

In the meantime, here are some other online guides you can reference:

RAIN GARDENS

Rain Gardens: A How-To Manual for Homeowners (University of Wisconsin Extension)
http://learningstore.uwex.edu/assets/pdfs/GWQ037.pdf
Rain Gardens in Connecticut: A Design Guide for Homeowners (UConn Cooperative Extension System) http://nemo.uconn.edu/publications/rain_garden_broch.pdf
Primer - Bioretention in Clay Soils http://wcdpa.com/tech-services/stormwater-management/stormwater-primer-entry-page/
Three Rivers Rain Garden Alliance
http://www.raingardenalliance.org

RIPARIAN BUFFERS

Riparian Forest Buffer Guidance (PA Department of Environmental Protection)
http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-82308/394-5600-001.pdf

TREE PLANTING

Planting and After Care of Community Trees (Penn State Extension)
http://pubs.cas.psu.edu/freepubs/pdfs/uh143.pdf
PATrees.org: The Free Resource Guide
http://www.patrees.org

NATIVE MEADOWS

Meadows and Prairies: Wildlife-Friendly Alternatives to Lawn (Penn State Extension)
http://pubs.cas.psu.edu/FreePubs/pdfs/uh117.pdf

PERVIOUS PAVING

New Hampshire Homeowner's Guide to Stormwater Management Do-It-Yourself
Stormwater Solutions: Pervious Walkways & Patios (NH Dept. of Environmental Sciences)
http://des.nh.gov/organization/divisions/water/stormwater/documents/perv-walkw-patios-fs.pdf
Westmoreland Conservation District Fact Sheets
http://www.wcdpa.com

RAIN BARRELS AND CISTERNS

Build Your Own Rain Barrel (Chesapeake Bay Foundation) http://www.cbf.org/Document.Doc?id=30
Rainwater Harvesting: Guidance for Homeowners (North Carolina Cooperative Extension)
http://www.ces.ncsu.edu/depts/agecon/WECO/documents/WaterHarvestHome2008.pdf

STORMWATER MANAGEMENT

3 Rivers Wet Weather
http://www.3riverswetweather.org
StormwaterPA
http://stormwaterpa.org/
Pennsylvania Stormwater Best Management Practices Manual
http://wcdpa.com/publications/technical-reference-manuals/pa-stormwater-bmp-guide-2006-cover-id/

WATERSHEDS

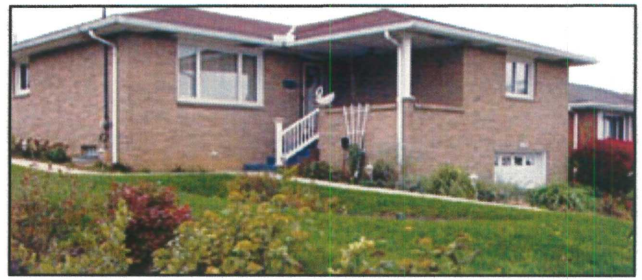
EPA Surf Your Watershed
http://cfpublepa.gov/index.cfm

If installing these stormwater practices is not something you want to tackle, you can take your plan to a landscape professional with experience in designing and implementing these types of stormwater practices. You may want to do some of the work yourself and enlist the help of a professional to do the other part. The choice is up to you.

Please note that this guide focuses on six practices that are fairly simple to plan and construct. There are many other, more complex stormwater best management practices that may be applicable to your property and that you may want to consider. These include bioswales, underground cisterns, drywells, infiltration trenches, and many more. If you are interested in seeing if any of these types of practices are a good fit for your property, you should consult an experienced professional to plan, design, and implement them.

Section 5: Healthy Lawn Care Practices

The practices described in this guide are alternatives to maintaining a lawn and go a long way to protecting our streams. Yet lawns remain a significant component of the residential landscape and are important to homeowners for many uses. A special EPA Expert Panel looking at the issue of lawns and water quality concluded that maintaining a dense, vegetative cover of turf grass reduces runoff, prevents erosion, and retains nutrients in the turf grass.



EPA'S TIPS FOR GROWING AND MAINTAINING A HEALTHY LAWN:

Consult with your local Penn State extension office or lawn care professional for technical assistance to develop an effective nutrient management plan for your lawn based on a soil test analysis.

The precise lawn care prescription should be based on site-specific recommendations that take into account soil properties, the type of grass species, the age of the lawn, and other factors. Look

for professionals who are Pennsylvania Certified Horticulturists or Landscape Industry Certified.

Per the recommendations of your local extension educator or your lawn care professional, follow one of four fertilizer application strategies: (1) choose not to fertilize; (2) fertilize with organic materials; (3)reduce rate and monitor; or (4) apply less than a pound of nitrogen per 1,000 square feet per each individual application.

First, elect not to fertilize at all. Some lawns, due to their age or natural soil fertility may be able to maintain a healthy, dense cover without additional fertilization. (However, if your lawn is thin, is weed infested, or has bare spots, you should consider fertilizing to restore a thick turf grass cover, using one of the other three strategies.)

Second, apply organic fertilizer such as compost, composted manure, or Milorganite™

Third, take a "reduced rate and monitor" approach. For this approach, follow the nitrogen application rates on the fertilizer bag label and reduce them by one-third to a half, and monitor the results. If lawn quality starts to fall below acceptable levels, re-apply at the reduced rates.

Fourth, fertilize at the Penn State Extension recommended rate (3.0 to 3.5 pounds of nitrogen per 1,000 square feet of lawn per season), but split into 3 or 4 small doses during the growing season (for example, early spring, late spring, late summer and mid-fall). This will get you to an accepted application rate of less than a pound of nitrogen per 1,000 square feet for each individual application.

Most bagged fertilizers in Pennsylvania have already removed phosphorus from their products, except for "starter fertilizers" used to establish grass seed in new lawns. If your soil tests show a phosphorus deficiency, ask your lawn care professional for recommendations on how to provide the phosphorus your lawn needs.

Use a mulching mower to retain clippings and mulched leaves on the lawn and keep them out of streets and storm drains.

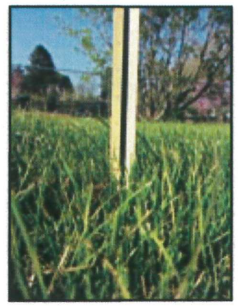
Lawn clippings are high in nutrients and should be treated as if they are a fertilizer. Nitrogen fertilization can be reduced without decreasing turf grass quality when clippings are left to decompose and return to the lawn.

Do not apply fertilizers before spring green up or after the grass becomes dormant.

The risk of pollution by leaching or surface runoff is greatest during the seasons of the year when grass is dormant. Avoid applying fertilizer in the late fall or winter. In spring, wait until the grass begins to green.

Maximize use of slow release nitrogen fertilizer.

Less nutrient loss occurs when slow release fertilizer products are used during the growing season, compared to water soluble formulations. Slow release fertilizer is typically shown on fertilizer products as water insoluble nitrogen (WIN), and can range from 20 to 50% of the total nitrogen product. You can shop for the fertilizer product with the greatest percentage of WIN. Avoid using in late fall as they may release nitrogen when the grass is dormant or frozen.



Apply lime.

Lime will improve vegetation health and soil porosity. Many southwestern PA soils are clay-based and have a low pH - an indication of an acid soil. Lime applied according to Penn State Extension recommendations will ensure good turf grass growth and stormwater retention.

Immediately sweep off any fertilizer that lands on a paved surface.

Rotary spreaders are the most common method to apply fertilizers and can broadcast fertilizer granules near the edge of a lawn, street, or driveway, where they can be subsequently washed off in a rain storm. Sweep up wayward granules before they have a chance to get into gutters and storm sewers. If you use a rotary spreader, purchase one with a deflector shield to prevent spraying fertilizer on the street, driveway, or sidewalks.

Do not apply fertilizer within 15 to 20 feet of a stream, pond, or other water body and consider managing this zone as a perennial planting, native meadow, native grass buffer, or forest buffer.

The risk of runoff is greatest from lawn areas adjacent to water features such as streams, shorelines, sinkholes and drainage ditches. Consider establishing a riparian buffer of shrubs, trees, or perennials along streams and other water courses.

Set mower height at 3 inches or taller.

Maintaining taller grass produces a deeper and more extensive root system, increasing nutrient uptake, and reducing runoff. The deeper roots also capture moisture during times of drought, suppress weeds, and increase turf density.

A well maintained lawn, with a dense healthy cover of turf grass significantly slows and absorbs stormwater runoff. However, you should consider installing stormwater best management practices where runoff is causing problems. Rain gardens, trees, and vegetated swales help lawns infiltrate excess stormwater.

Disclaimer