

River-Friendly Homes



**Smart Stormwater Management:
A How-To for Homeowners**



A Clean Bay Starts at Home

Although the Chesapeake Bay doesn't directly border Delaware, nearly one-third of the state's residents belong to its watershed (U.S. Census Bureau). Delaware acts as the headwaters to several key Delmarva rivers, so keeping the Bay clean starts in your backyard.

A watershed is all the land area that drains into a particular body of water. When it rains, gravity pulls water downhill into the lowest areas, usually streams, rivers, or ditches, which then flow into a larger body of water and eventually the ocean. This is how pollutants enter the ocean. Everyone lives in a watershed, and that's why it's important for us to remember that anything we do to the land will have an impact on local waterways.

The Nanticoke River is the largest tributary to the Bay in Lower Delaware and is also one of the cleanest rivers to flow into the Chesapeake Bay. The Nanticoke River has the most biologically diverse watershed on Delmarva and is home to many of this region's important family farms. The small ditches and streams that drain this land connect our homes and communities to the larger Nanticoke River. Any pollutants on our land will get picked up by stormwater runoff and pollute the Nanticoke River and then the Chesapeake Bay; that's the idea of a watershed.

The Chesapeake Bay is the nation's largest estuary. As an estuary, the Bay is a mix of fresh and saltwater which creates a special home for many creatures that can't live anywhere else. Along with the wildlife it supports, the Bay also provides an EPA-estimated \$33 billion a year in economic and recreational resources! With all the resources that the Bay provides for us, it's important that we respect it and do what we can to keep it healthy.

Composting and carpooling are great ways to start helping the environment, but this guide will provide you with ways to make your home and yard more "watershed-friendly." We need everyone's help to keep our watersheds clean.

Delaware is Doing Their Part

Did you know the Delaware Department of Natural Resources and Environmental Control (DNREC) has a Watershed Implementation Plan (WIP) to help clean up the Chesapeake Bay? The WIP aims to reduce pollution from sediment and excess nutrients (phosphorus and nitrogen). Phosphorus and nitrogen cause algae to grow. Algal blooms and sediment block sunlight, killing aquatic plants and reducing oxygen in the water. DNREC funds non-profit efforts and works with farmers and city planners to reduce stormwater pollution through on-the-ground projects. DNREC also educates homeowners and helps fund municipal projects that keep the environment healthy for everyone! Learn more about these projects at www.DNREC.delaware.gov.





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How Does Rainwater Get Polluted?

As rain or melting snow drains off of the land, it picks up pollutants such as trash, leaky engine fluids, pet waste, and lawn fertilizers. Even with just a little rain, these pollutants are carried into storm drains or directly into the waterways. This polluted water is called **stormwater runoff**.

Across our area, hard surfaces such as roads, buildings, and parking areas prevent rain from soaking into the ground. Many roofs have downspouts that funnel water directly into our sewer system, which can overwhelm the pipes. In a more natural setting, the rainwater would be able to soak into the ground, filtering out pollutants and replenishing ground water supplies. Runoff from your property may seem insignificant, but when you consider all the households, you can see why stormwater runoff is a major problem.

Pollutants Found in Stormwater Runoff:

- Dog Waste
- Engine Fluids
- Fertilizers
- Herbicides
- Loose Dirt
- Motor Oil
- Pesticides
- Road Grit
- Litter

There are some small changes we can make so these items don't end up in our waterways.



Trash accumulates and clogs a storm drain. Some of this trash will end up in our local waterways.

Why Is Stormwater Runoff a Problem?



1. Pollution

As rain or snow travels across rooftops, driveways, lawns, sidewalks, and streets, it picks up numerous contaminants. Eventually, this dirty water finds its way to local creeks and rivers, causing harm to fish and other wildlife.

2. Local Flooding

When the ground can't absorb water, storm drains and roadside ditches fill up too quickly with excess runoff and flash flooding can occur in streets and other places. This can cause damage to homes, businesses and natural spaces like creeks and river banks.



3. Threats to Human Health

Stormwater runoff can carry toxic metals, bacteria, viruses, and sometimes untreated sewage. This pollution drains directly to the Nanticoke River and Chesapeake Bay which makes it more costly for downstream communities to clean.

4. Harms Wildlife

As stormwater overflows and empties into our streams and rivers, unnaturally high volumes of rushing water can wear away the stream bottom and cause stream bank erosion. Combined with the impact of pollutants, this water damages natural wildlife habitats and degrades drinking water quality, making it more costly to treat.



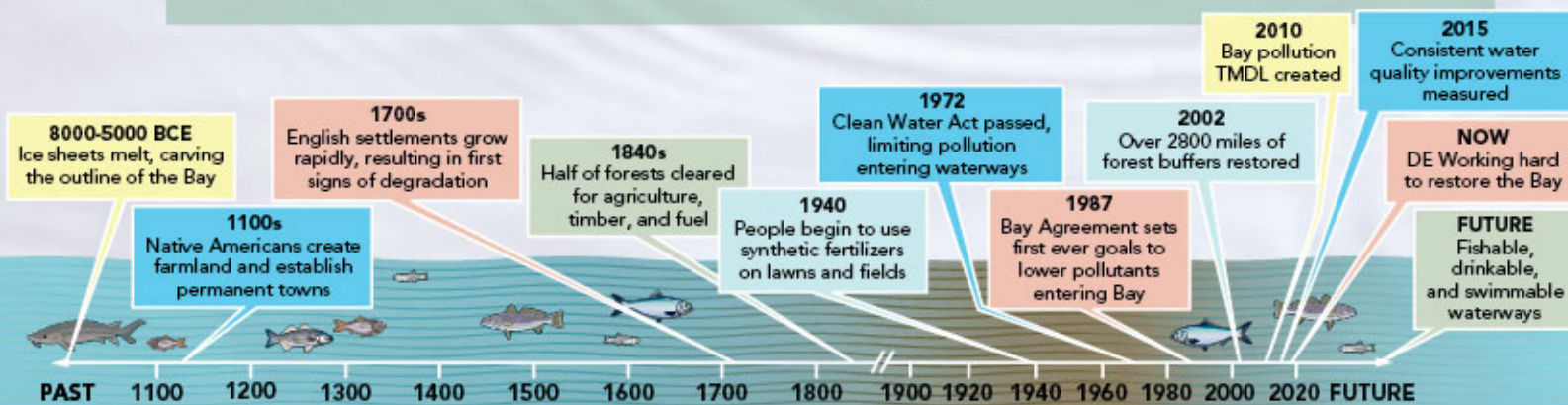
Delaware Is Working Hard to Save the Bay

In the 1970s, one of the first dead zones was found in the Chesapeake Bay. Because of polluted stormwater runoff from developed urban areas on the Western Shore and agricultural areas on the Eastern Shore, the Bay had toxic levels of nitrogen, phosphorus, and other contaminants. Very little life can live or travel through these dead zones, which impacts crabs, oysters, fish, and many other creatures. Many efforts began to help save the Bay, starting with regulating industrial waste.

By late 2010, Bay goals had not yet been met, so the U.S. Environmental Protection Agency established the Chesapeake Bay Total Maximum Daily Load (TMDL) for the waters in and draining to the Chesapeake Bay. A TMDL establishes the maximum amount of pollution allowed in a waterbody. With almost one-third of the State of Delaware draining to the Chesapeake Bay, Delaware has been working hard to meet the TMDL pollutant reduction goals. Pollution reductions have benefited both the Bay and local waterways in Southern Delaware.

Delaware has initiated a wide variety of programs to meet pollution reduction goals, including:

- Providing farmers with the tools and resources to plant cover crops, which reduce soil and fertilizer runoff.
- Certifying commercial lawn care providers who use environmentally-friendly practices.
- Ensuring municipalities' wastewater treatment plants are in compliance with new regulations.
- Assisting new poultry farmers with incorporating the best methods of capturing and beneficially reusing chicken manure.
- Working with towns to identify ways to reduce stormwater runoff pollution coming from urban areas.
- Educating homeowners on the need to reduce the use of lawn chemicals through the Livable Lawns program. Visit www.DelawareLivableLawns.org for more information.



How You Can Help at Home

The Nanticoke Watershed Alliance wants to help you make **your yard an ecological paradise**. Please contact us if you are interested in any of these projects for your yard, and we can get you started in the right direction. We also have volunteer opportunities and host several homeowner workshops a year. Join our email list to make sure you hear about all our events and programs.

Visit NanticokeRiver.org to sign up.

If a designer ditch or a rain garden project captures your interest, please contact us at (410) 443-8878 or info@NanticokeRiver.org. A brand new designer ditch or buffer can be a fun and exciting project, but if you're just looking to plant some more trees in your yard, we can provide most Delaware residents with free trees (while supplies last).

There is a magnitude of other resources on our website, and while you're there, don't forget to check out our quarterly newsletter, *Nanticoke Currents*.

As a homeowner or resident, you can help keep our water clean and reduce stormwater pollution by:

- Using fewer chemicals outside. There are lots of natural solutions for your lawn, car, and sidewalk that will be healthier for you, your family, and the environment.
- Reducing impervious surfaces (hard surfaces, such as concrete, that don't absorb water) so stormwater can soak into soil naturally and replenish our groundwater.
- Planting native trees and plants that soak up stormwater before it enters storm drains and roadside ditches.
- Following the practices listed in this guide. By doing many small things, you can have a big impact on our local waterways and the Chesapeake Bay.
- Encouraging others to properly dispose of trash and waste so our streets and storm drains stay clean. **Remember: only rain goes down the storm drain!**



Find out what funding and supplies we have available for planting in your yard, school campus, business property, church ground, or anywhere else! Please contact us at (410) 443-8878 or info@NanticokeRiver.org

Homeowner Maintenance

Washing Your Vehicle

Where you wash your car matters. The best option for our rivers is to take your vehicle to a commercial car wash, especially if you plan to clean the engine or the bottom of the car. Most car washes reuse water several times before sending it to a sewage treatment plant.

Vehicles washed in driveways and parking lots allow dirty wash water to find its way to the nearest storm drain. That water often contains oils and grease, phosphates (from the soap) and heavy metals—all substances that are unhealthy for people, fish, and other living things. If you would rather wash your car at home, protect our local streams with these tips:

Home Car Wash Tips:

- Wash your vehicle on gravel, grass, or another permeable surface so the ground can filter the water naturally.
- Use soap sparingly and try to use non-phosphate detergents. Phosphates are pollutants that can be harmful to nearby waterways and promote excess growth of algae.
- Use a hose that is high pressure and low volume. Fit your hose with a nozzle that automatically turns off, or has a pistol grip or trigger nozzle to save water. Wash one section at a time and rinse quickly.
- When you are done, empty the bucket of soapy water down the sink—not into the street.
- If you are hosting a car wash fundraiser, consider selling coupon books. Many car wash companies offer fundraiser savings books to nonprofit organizations and sports teams at reduced prices. The coupons can then be used anytime by the supporter.

Most car washes clean and recycle the water several times before it goes to the sewage treatment plant. The plant then cleans it even more before it is returned to the Chesapeake Bay.



Vehicle Maintenance

Own a vehicle? You can do your part to reduce the chances of oil and other hazardous chemicals entering our drinking water supply. Oil, heavy metals and other toxic materials that leak out of your car are washed by rain into the nearest storm drains or ditches, which lead to our rivers. Whether you do vehicle maintenance at home or take it to a local car care center, you can prevent leaks by servicing your car regularly and ensuring oil and other fluids are disposed of correctly.



Vehicle Maintenance Tips:

- Check your vehicle for drips and oil leaks regularly and fix them promptly.
- If you're doing maintenance and spot a leak, use ground cloths or drip pans to collect the fluid.
- Collect used oil in a leak-proof container with a tight-fitting lid. You can recycle it for free at the Jones Crossroad Landfill near Georgetown or many auto supply stores, car care centers, and some gas stations.
- Never dump motor oil, antifreeze, transmission fluid or other engine fluids into road gutters, storm drains, ditches, soil, or inside your home sinks or drains.
- Safely store used vehicle fluids for a hazardous waste collection day. You can find a schedule of these events at: www.dswa.com.



Little leaks add up!

There are over 445,000 cars in Delaware, if each one leaked 10 drops of oil a day that would be over 17,800 gallons of oil a year.

Each year, 200 million gallons of used oil are disposed of improperly. Recycled properly, that oil could generate enough electricity to power 100 million homes for an entire day!*



*Source: EPA, 2013 Source: <http://www.epa.gov/osw/conserve/materials/usedoil/oil.htm>

Winter Deicing

As snow piles up in the winter, we often turn to salt or other solutions to melt snow and ice. All deicers can be harmful to our drinking water supply and the environment when overused, so the best strategy is to read the labels and use as directed only when needed. High concentrations of salt can damage and kill plants and harm our local waterways, creatures and fish.

You can effectively control ice and keep surfaces safe by using less road salt. In addition, many safer alternatives can be found at local hardware stores. Check the labels for products containing potassium chloride, calcium chloride and magnesium chloride, corn processing byproducts, and calcium magnesium acetate (CMA). These alternatives can be spread in a dry form or sprayed as a liquid and work best when used with salt. Together, they work more efficiently so you can use less.

If you have pets, you should consider using reduced amounts of traditional road salts or alternatives that are less harmful to paws. Keep these products out of reach of pets and children.



Winter Deicing Tips:

- The first line of defense should always be shoveling sidewalks and pathways to keep them clear and prevent ice from forming. **Salt and deicers are not effective when more than 3 inches of snow have accumulated.**
- Consider the temperature. Salt and calcium magnesium acetate (CMA) are much more effective at melting snow and ice at temperatures above 25 degrees.
- Reduce salt and other chemicals by adding sand for traction.
- Focus your use of deicing products on high use areas and slopes where traction is critical. By using the least amount necessary to get the job done, you save money and will minimize property damage to paved surfaces, vehicles and plants.



Shorty says too much salt hurts his paws.
Find an eco-friendly and pet-friendly deicer.

Lawn & Garden Care

Get a free soil test kit!
Visit www.delawarelivablelawns.org

When fertilizing lawns and/or using pesticides and herbicides, you're not just spraying the lawn. When it rains, the fertilizers, pesticides and herbicides wash off your property and into storm drains. This not only contaminates the water in our streams, but these chemicals can harm wildlife.

The most effective way of keeping your lawn green and healthy is not only good for the environment, but it will also save you money. Before you fertilize, get a soil testing kit from the University of Delaware Cooperative Extension near Georgetown or your local garden center. The soil test will help you determine what type and how much fertilizer your property requires. For best results, you do not need to fertilize all year round. **Fertilizing in the spring just makes the grass grow taller and quicker so that it needs to be mowed more. Instead, concentrate your efforts on the fall. Fertilizing in the fall helps the roots grow deeply enough to last through the winter and thrive during the spring and summer.**

You may also consider adding native plants in place of some of your grass. Native plants often require less water and can capture and filter more pollutants than grass alone. They also won't require as much fertilizer, saving you money in the long run while making your yard cleaner and healthier.

Keep your lawn healthy and your family safe. Test your soil so you can find out exactly what nutrients your lawn needs, if any, before fertilizing.



Lawn Care Tips

- Use fertilizers sparingly. Testing your soil will save you time and money.
- Do not fertilize or treat your lawn before a rain storm. It won't help your lawn, and those pollutants will be washed into our local waterways.
- Fertilize only in the fall. Fertilizing in the spring just makes your grass grow taller and need to be mowed more. The fall is when the grass puts its energy into growing thick roots, which will mean a plush lawn next spring.
- Let grass clippings lay! They can act as free, natural fertilizer for your lawn. Use a mulching lawnmower to cut one-third of the blade height each week and leave the clippings.
- Fertilizers don't help your sidewalk or driveway. If fertilizer gets onto paved surfaces, sweep it back on the lawn or collect it for later use.
- Consider using organic fertilizers that release nutrients more slowly.
- Never use fertilizer near a stream, as it can kill fish and other wildlife.



**Leave grass clippings
on your lawn for
free natural fertilizer.**

Pet Waste

When animal waste is left on the ground, rainwater or melting snow breaks it down and washes it into storm drains, ditches or directly into our creeks. This contaminated water contains disease-causing bacteria, which is unsafe for everyone, and causes larger environmental issues. Pet waste increases algae blooms and excessive aquatic plant growth, which can rob the water of vital oxygen needed for fish and other animals to live.



Scoop the Poop Tips:

- **Bag it!** When going for dog walks reuse a plastic bag or take a compostable baggie. After your dog does its business, turn the baggie inside out over your hand and use it as a glove to pick up the waste.
- Treat pet waste like human waste—flush it down the toilet so it can be treated appropriately. Be sure not to flush the baggie!
- If you can't flush your pet's waste, throwing the filled baggie in the trash is an alternative. **Never put waste into storm drains!**
- Check to see if your neighborhood and local parks have baggies available. If not, talk to your local civic association about installing a pet waste station to reduce "poo-lution" in your area.



Dog waste carries disease-causing bacteria and worms. Pick it up!

Examples for Greening Your Home

Rain Gardens
(see page 14)

Vertical Gardens
(see page 20)

Rain Barrels
(see page 12)

Trees
(see page 16)

Designer Ditches
(see page 24)

Permeable Pavers
(see page 15)

Downspout Planters
(see page 13)

Rain Barrels

A rain barrel collects and stores rainwater that runs off of your rooftop. It temporarily holds water during and after a storm. This prevents water from running across surfaces, picking up pollutants and washing them into creeks and rivers.

You can use this freshly-collected rain to water your plants or clean your outdoor spaces. Using this stored water can also help you save on your water bill.

Rain Barrel Tips

- Interested in having a rain barrel in your yard and live in western Sussex County? Call (410) 443-8878 or email info@NanticokeRiver.org to find out if any are available for free or at reduced prices.
- Rain barrels are generally low maintenance, but do require being emptied before each rainstorm.
- In the winter, you should completely drain your barrel and detach it from the downspout.



Although one rain barrel is not going to capture all the water collected from your rooftop every time it rains, every gallon stored helps. If every house installed a rain barrel, imagine how much water we could save.

Examples of native plants to use in your downspout planter!



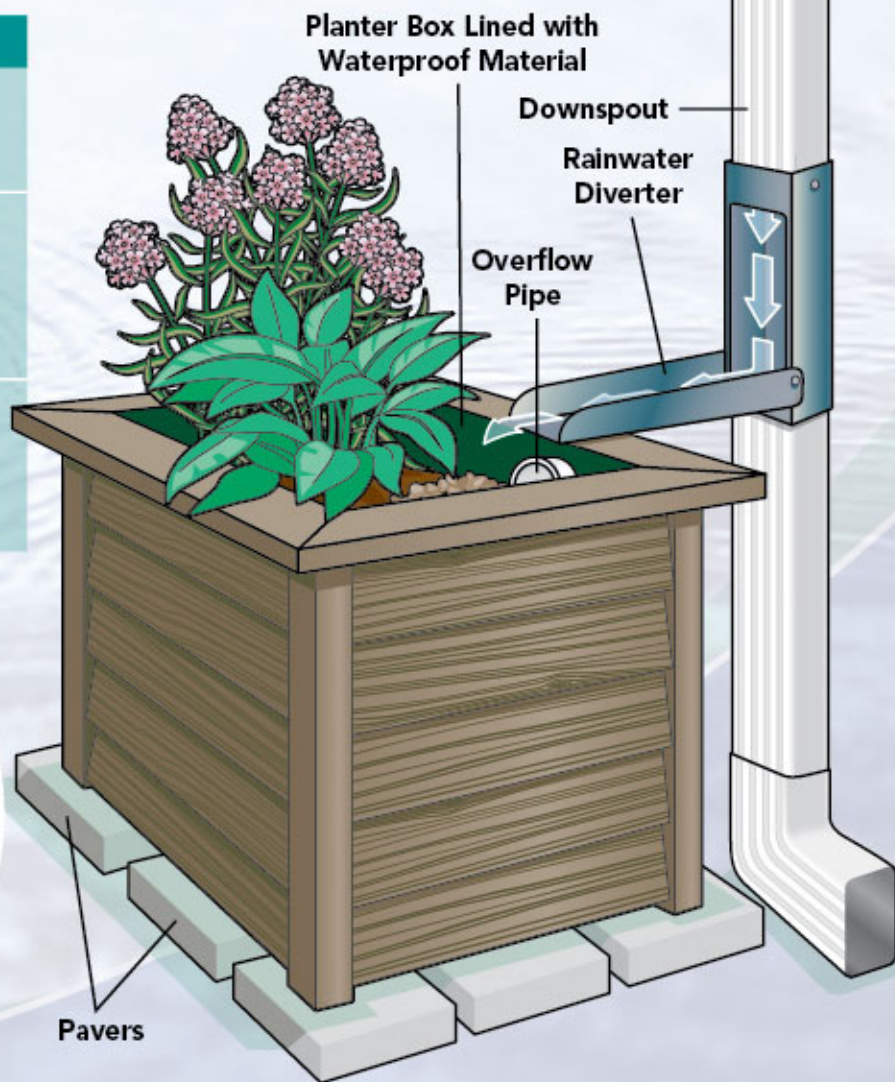
Downspout Planters

Even if you don't have space to plant flowers, trees or shrubs, you can create your own garden in a planter. Planters come in all shapes and sizes, ranging from large concrete containers to potted plants arranged along a building or in a yard. They'll look beautiful while helping to capture stormwater that would otherwise wash into nearby storm drains. Container gardens are the perfect way to green your property and can be made or purchased to fit any yard or patio.

In addition to regular containers a unique downspout planter can be built and installed. A downspout planter is a specially designed container garden that collects rain directly from your roof's downspout. You can find schematics and instructions at: http://www.phillywatersheds.org/whats_in_it_for_you/residents/downspout-planters

Planter Tips

- Choose hardy, self-sustaining, native plants. These require less care and will retain more rainwater.
- If you would rather build or purchase your own planter, you can find materials at your local hardware or landscaping store. Drill holes in the bottom of the container if they are not already there.
- Fill the planter with soil, leaving a few inches from the top of the soil to the top of the planter. Occasionally turning or tilling the soil can improve water absorption.



Downspout planters look beautiful and manage stormwater.



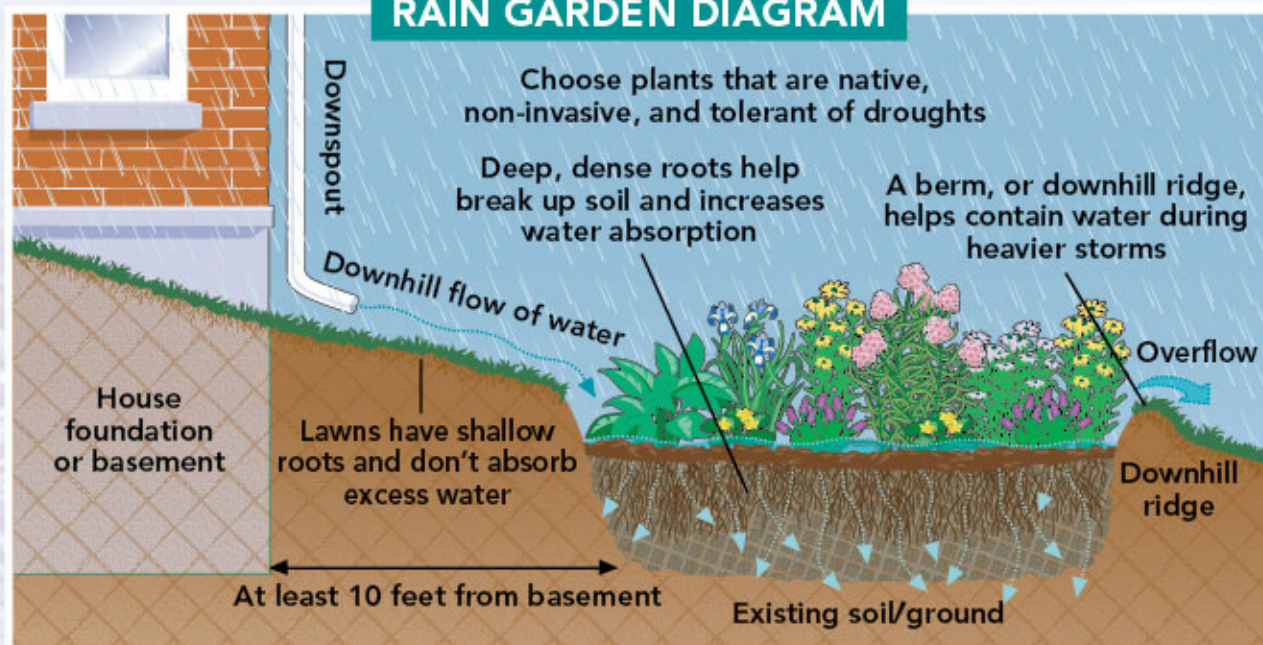
Rain Gardens

Rain gardens are shallow, planted depressions that are designed to absorb water from your roof, allowing it to drain directly into the soil. Typically, a downspout from your home is diverted into the rain garden, which can prevent hundreds of gallons per year from entering the sewer system. Rain gardens are one of the most cost effective ways to manage stormwater runoff and can be a beautiful addition to your existing landscape design.

Sometimes funding is available for projects like these. If you are interested in having a rain garden on your property call (410)443-8878 or email info@NanticokeRiver.org for technical assistance and more information on resources available. Also visit www.NanticokeRiver.org.



RAIN GARDEN DIAGRAM



Rain Garden Tips

- Check your soil first! Rain gardens require well-draining soil.
- Rain gardens must be planted at least 10 feet from any below-ground basement.
- Rain gardens can be designed to suit your landscaping preferences by using a variety of native, perennial plant species.
- This is not a vegetable or herb garden. Rain gardens are designed to absorb stormwater and filter out pollutants—not for growing food.

Rain gardens are beautiful and help our sewers from being overburdened during rainy days.



Permeable surfaces allow rainwater to soak back into the ground, like it would naturally, replenishing our ground water.

Permeable Pavers

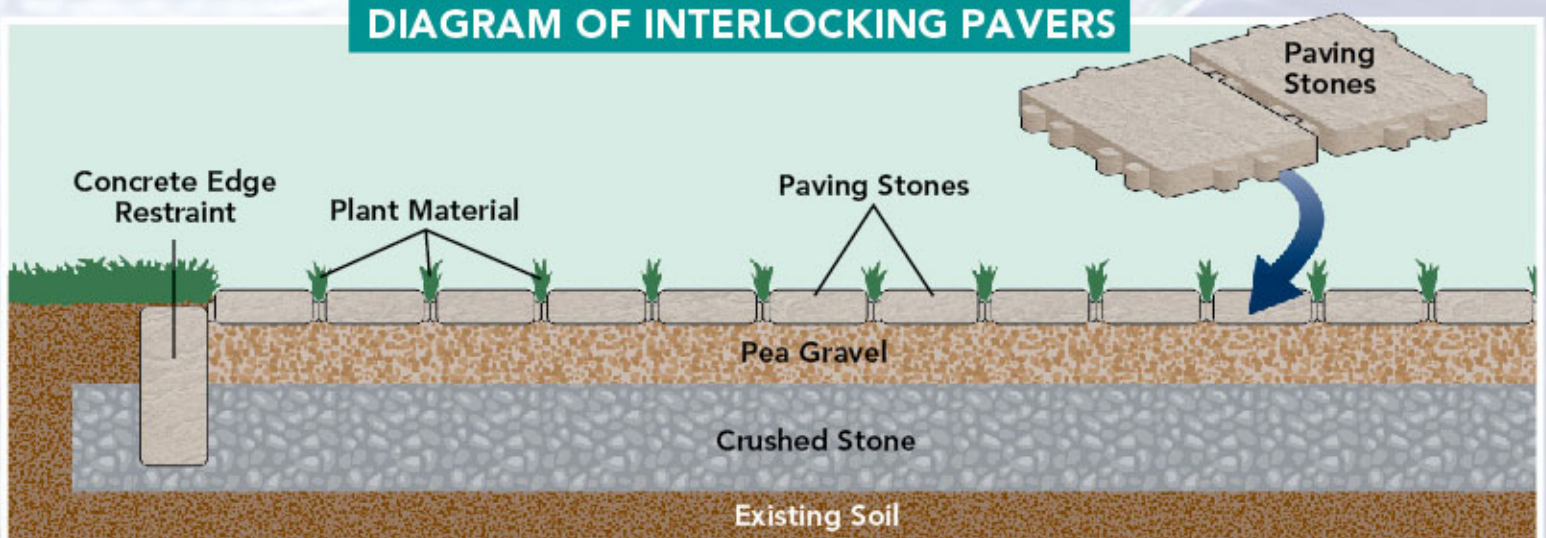
Removing impervious (hard) surfaces like concrete or asphalt allows stormwater to soak back into the ground naturally. There are many permeable surfaces available, including paving stones, bricks, pavers, or a special mix of concrete and asphalt that has pores for water to soak through. The specially-designed stone bed under the permeable paving provides somewhere for water to go and may even reduce the amount of soggy areas you have in the rest of your yard. De-paving or installing permeable pavers will prevent stormwater from running off your property while making your driveway or pathway customized, unique and beautiful.

Permeable Paving Tips

- There are lots of options after de-paving your property, including landscaping, a rain garden, a lawn, permeable pavers, and more.
- Anytime you plan to dig make sure to call Miss Utility. Dial 811 at least two days in advance so they will mark where any below ground utilities exist.
- Worried about water in your basement? A liner can be installed against your exterior foundation wall to prevent potential water seepage, especially if there are existing signs of moisture.



DIAGRAM OF INTERLOCKING PAVERS



Trees

Trees are beautiful additions to your yard or sidewalk and provide many benefits to neighborhoods and properties. They cool and shade homes during the hot summer months, which can help fight the urban heat island effect and decrease your energy bill. They also can increase your property value and act as a neighborhood noise buffer. Trees are great for both our health and the environment. They remove pollutants from the air we breathe and they help reduce the amount of polluted stormwater that goes into storm drains and roadside ditches. **DNREC is planting thousands of trees over the next few years to help improve the Chesapeake Bay. Pitch in and find out how you can get trees for your property. Visit www.NanticokeRiver.org.**

**In one day,
one large tree can
lift up to 100 gallons
of water out of the
ground and discharge
it into the air.***

*Source: <http://www.ncsu.edu/project/treesofstrength/treefact.htm>

Tree Planting Tips:

- **PICK THE RIGHT TREE:** Plant only native trees that will not get too large for the space you have chosen for them! These trees will thrive in our environment.
- **GIVE YOUR TREES A GOOD START:** Be sure to water young trees regularly to help establish a good root system.
- **HELP ENHANCE DIVERSITY:** Select several different types of trees to create a better habitat to attract a variety of birds. A variety of trees will also mean a beautiful array of fall colors, blooming times, and fruits!
- **GET MORE PRIVACY:** Instead of a fence, plant a row of smaller trees. These trees will offer privacy while reducing wind, noise, and pollution, as well as providing shade in the summer.
- **MAKE SURE TO PLAN:** A carefully planned landscape can reduce heat and heavy winds. Follow "The Right Tree in the Right Place" guidelines to ensure you get the most benefits from your trees.

Recommended Trees for the Delmarva Peninsula:

* flowers ° fall colors

SMALL TREES – Under 30'

American Hornbeam – *Carpinus caroliniana* °
Fringetree – *Chionanthus virginicus* **
Dogwood – *Cornus florida* **
Redbud – *Cercis canadensis* **
Serviceberry – *Amelanchier arborea* **

MEDIUM TREES – 31-60'

Black Birch – *Betula lenta*
Blackgum – *Nyssa sylvatica* °
Catalpa – *Catalpa speciosa* **
Honeylocust (thornless) – *Gleditsia triacanthos*
Persimmon – *Diospyros virginiana* *
Post Oak – *Quercus stellata*
Sassafras – *Sassafras albidum* **
Sweetbay Magnolia – *Magnolia virginiana* **
Willow Oak – *Quercus phellos* °

LARGE TREES – Over 61'

Basswood – *Tilia americana* °
Beech – *Fagus grandifolia* **
Buckeye – *Aesculus glabra*
Chestnut Oak – *Quercus prinus* °
Hackberry – *Celtis occidentalis* °
Shagbark Hickory – *Carya ovata* °
Kentucky Coffeetree – *Gymnocladus dioica* °
Pecan – *Carya illinoensis*
Red Maple – *Acer rubrum* °
River Birch – *Betula nigra* °
Silver Maple – *Acer saccharinum* °
Sugar Maple – *Acer saccharum* °
Tulip Poplar – *Liriodendron tulipifera*
White Oak – *Quercus alba* °

EVERGREENS – 15-60'

American Holly – *Ilex opaca*
Eastern Red Cedar – *Juniperus virginiana*
White Pine – *Pinus strobus*
Loblolly Pine – *Pinus taeda*
Yew – *Taxus canadensis*

Source: <https://delawaretrees.com/publications/recommended-trees/>

Using Native Plants

Monarch butterflies are beautiful, but they cannot survive without native plants. Their larvae can only eat one type of plant: milkweed. Fortunately, several types of milkweed are native to this area. This phenomenon is true for many types of insects, so a wide variety of native plants is the best way to help the environment.



Plants are a vital part of the ecosystem.

They are the only organisms on earth that can absorb the sun's energy and turn it into food, making them critical parts of the food chain. Humans love the beauty of plants, especially those that flower, but a crepe myrtle is originally from the other side of the world, not Delmarva. These plants are unique, but they cannot support the same type of ecosystem that native plants can.

Native plants provide a rich habitat for important local wildlife like pollinators and birds.

Pollinators, like butterflies and bees, help humans grow our food. In our area, pollinators are important to many family farms and they keep our beautiful home gardens alive and well. Birds are great to watch in your yard; they provide a wonderful soundtrack to any lazy day, and they may even reduce the number of mosquitoes you run into.

Native plants offer benefits that non-native plants do not. They reduce erosion, provide habitat and food for local organisms, conserve water, require less chemicals, and can even reduce the amount of lawn mowing! There are many native plants that you could use to replace non-natives or annuals in your yard. Next time you visit your local nursery, ask them to show you their native plant selection.



Native Plant Tips

- **PLANT A MEADOW:** Use native plants when trying to create a meadow because local herbivores will know these plants as food.
- **SUPPORT INCREDIBLE JOURNEYS:** Nearly 90 million birds migrate over this area each year. Support their journey by providing food and shelter with native plants.
- **DON'T FORGET THE CANOPY:** Native plants don't just include flowers; you can find native trees and shrubs at a nursery near you.
- **ADD VALUE:** A beautiful native garden or a patch of native trees could increase your property value.
- **REDUCE YOUR FOOTPRINT:** Large, native trees can absorb a lot of carbon from the atmosphere, helping to reduce your carbon footprint.



Fifteen feet of marsh in a Living Shoreline can absorb up to 50% of incoming wave energy. Living Shorelines are more resilient than bulkhead against storms and they trap sediments caught in the water, which means they can grow in elevation as sea level rises.

Source: NOAA

Living Shorelines

Erosion is a real problem if you own land with shoreline. Boat wakes and storms can cause your shoreline to begin to wash away. Bulkhead or rip-rap might work for a time, but what happens if erosion begins behind it? Traditional methods to stabilize a shoreline can reduce erosion, but they sever an important connection between land and water and cannot adapt to an evolving environment.

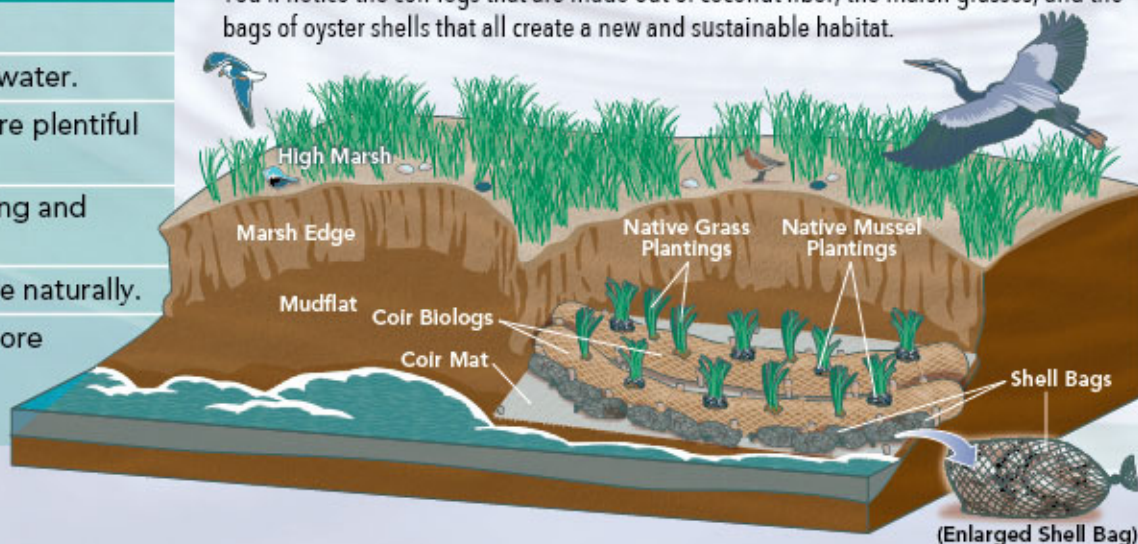
Try a Living Shoreline that features marsh grasses, shellfish or both! A Living Shoreline is a method of shoreline stabilization that reduces erosion while preserving or enhancing the habitat. Marsh grasses and oysters or mussels are planted among natural fibers that trap mud and soil. As these grasses and oysters mature, they form dense barriers that dampen wave action and can grow and move with sea level rise. Oysters and mussels are also filter feeders, meaning that as they eat and grow they also filter and clean polluted water.

Preserving shoreline is vital to protecting our wetlands. Wetlands protect our shores and inland wetlands from wave energy, reduce the impacts of floods, and improve water quality by absorbing pollutants. More importantly, they provide habitat for some plants and animals that can't be found anywhere else. A gently-sloping Living Shoreline gives animals easy access to the water and will support a more productive shoreline ecosystem.

Living Shoreline Benefits

- Reduce shoreline erosion.
- Filter pollutants out of the water.
- Promote the growth of more plentiful and diverse organisms.
- Maintain important spawning and feeding areas for animals.
- Allow sand and soil to move naturally.
- Reduce the potential for more erosion and flooding downstream.

This image shows two different shorelines. The scene to the right is the Living Shoreline. You'll notice the coir logs that are made out of coconut fiber, the marsh grasses, and the bags of oyster shells that all create a new and sustainable habitat.



Vegetative Buffers

Erosion can happen fast! Earth is about 4.5 billion years old, but it only took 6 million years for water to carve out the Grand Canyon. A stream or river on or near your yard might not become the next Grand Canyon, but erosion along the shoreline could change the topography of your lawn more than you'd like. Native trees and shrubs along the water's edge otherwise known as buffers can help.

A buffer captures, slows down, filters and helps soak in stormwater. Roots from the native plants that you choose to line your shoreline will help anchor soil into place while the stem, trunk, and branches absorb water and excess fertilizers that could pollute local waterways.

Buffers create vital habitat and reduce extreme temperatures. Many organisms rely on the zone between the water's edge and dry land. By creating a buffer you're not only reducing pollution and erosion, but also restoring habitats that cannot be found anywhere else. Not only that, but trees along the water's edge can also reduce the temperature of the water, thereby reducing bacteria growth and algal blooms in hot summer months.

Heat energy can be pollution too! Aquatic organisms have a specific temperature range in which they can live. Warmer water also holds less dissolved oxygen than cooler water. Buffers can help shade water before it overheats, killing fish and dramatically dropping oxygen levels.

Source: Conservation Institute

Buffer Tips:

- If you have a pond on your property a buffer could reduce the need for future dredging by blocking the inflow of sediment.
- Be sure to choose native plants when creating your buffer.
- Don't fertilize or use chemicals on your buffer; native plants shouldn't need this anyway.
- Don't plant trees too close together; think about how big they will be once fully grown.
- Grasses and shrubs along the water's edge are a great habitat for dragonflies and other insect predators that eat mosquitoes and their larvae.



This shoreline has been planted with a vegetative buffer. Notice that the farmed fields do not go up to the edge of the water here.



Vertical Gardens

Looking to add some green to your property and capture stormwater, but don't have much space? A vertical garden might be the perfect DIY project for you. You can create one with potted plants placed on A-frame shelves, grow vines or climbing plants, or go totally vertical by creating or purchasing a wall planter. In addition to beautifying your space, vertical gardens can capture some rainwater, reduce noise and air pollution and even help reduce heating and cooling costs if placed against a building. The options are endless and allow for your creative style to show through.

Vertical Garden Tips:

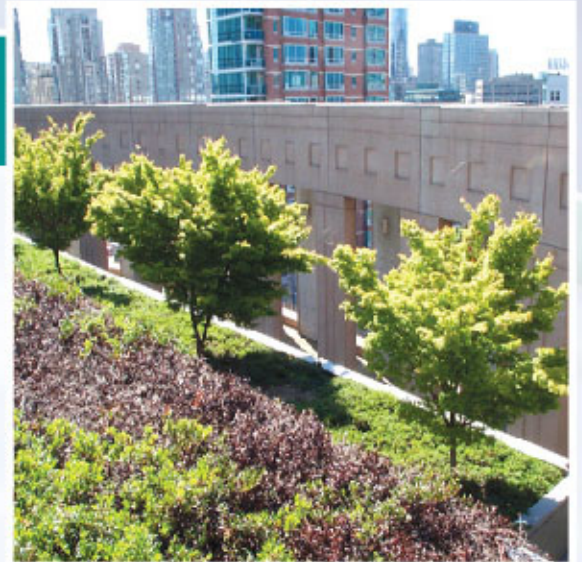
- There are lots of DIY resources available online to create your own green living wall or vertical garden. Search "green living wall DIY" and "vertical gardens DIY" to find easy, fun ways to get started.
- If you don't want to start completely from scratch, purchase inexpensive pots and planters at a hardware store and incorporate them into your design.
- When possible, use recycled materials. Simple planters can be created by reusing wooden shipping crates or pallets. (Search "pallet vertical garden" for some great step-by-step guides.)
- Choose hardy, native flowers and plants. These will look great, last longer and can retain more rainwater than their dainty counterparts.



Green walls, also called living walls, clean our air and water and they look amazing!

Green Roofs

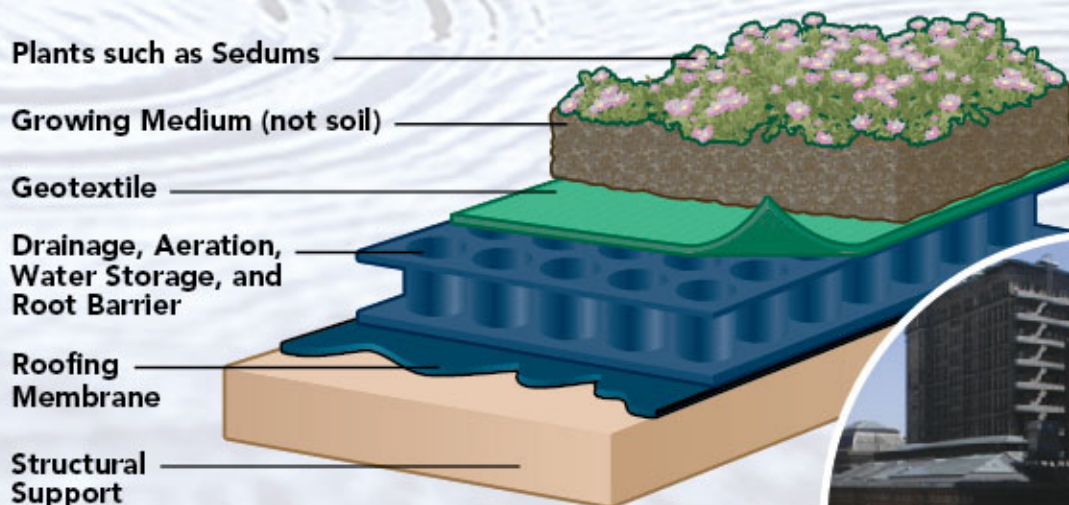
A green roof is a roof of a building that is partially or completely covered with plants. Green roofs are an excellent way to manage stormwater, as they can absorb and retain up to 50 percent of the rainfall they receive. Rain that doesn't get absorbed is slowed down and filtered by plant roots and soil. Green roofs also provide a lush oasis in the city, produce fresh oxygen, serve as natural habitats and significantly reduce heating and cooling costs by acting as an additional layer of insulation. Green roofs look great, require very little maintenance and can help extend the lifetime of your roof!



Green Roof Tips:

- For most people, the best option is to hire a contractor who can help you design a green roof to meet your needs and budget, and also help you through the permitting process. Green roofs typically range in cost from \$10-\$25 per square foot. The most cost-effective time to construct a green roof is when your roof already needs repairs or when a building is being constructed.
- Like the idea of a green roof but don't like the price tag? Try a rooftop garden as a simple and low-maintenance alternative. Drought-resistant potted plants can also help absorb stormwater on your roof, as long as you have easy roof access and consider the weight your roof can hold.

DIAGRAM OF GREEN ROOF LAYERS



Green roofs absorb water, produce fresh oxygen, reduce HVAC costs and create a lush oasis.



Farmettes

A small farm on your property can be very rewarding, but if you're not careful you could be polluting waterways that are vital to the production of healthy and abundant food. Many homeowners on Delmarva choose to have small farms, or farmettes, on their land to raise livestock or grow their own food. Farms, even farmettes, rely on healthy topsoil and fertilizer to support livestock or crops. Choosing to protect these assets can not only save you money but can also create a healthier environment for those downstream.

During heavy rain events anything that is on this farmland, including animal waste, pesticides, fertilizers, and loose soil, can wash away and pollute streams and ditches. Since the Clean Water Act was passed, Americans have done a great job cleaning up streams and rivers. Now the biggest challenge is the pollution that comes from our homes, schools, businesses, farms, parking lots, and other developed land. As a farmette owner, you can help clean up our waterways by reducing erosion, managing pesticide and fertilizer use, and containing manure that would otherwise wash away with stormwater.

There are many simple projects that can protect your topsoil and keep our waterways healthy. Many of these techniques can even make your farmette more productive and save you money. Developing a nutrient management plan can save you money on fertilizer and reduce the chance of excess fertilizer being washed away. By properly storing manure you can save it to use as a free fertilizer while stopping it from being washed away and polluting drinking water. Switching to no-till or less-till techniques will save on labor and fuel costs while keeping soil in place and out of our waterways. Cover crops can also be a great way to prevent erosion and make your soil more productive. Capturing rainwater can allow you to reuse it later to water crops or clean equipment; try using a rain barrel or cistern. This will reduce your water bill as well as the chance of floods happening on your property. Buffers along waterways are also a great way to trap pollutants, reduce erosion, and keep livestock from degrading water quality.

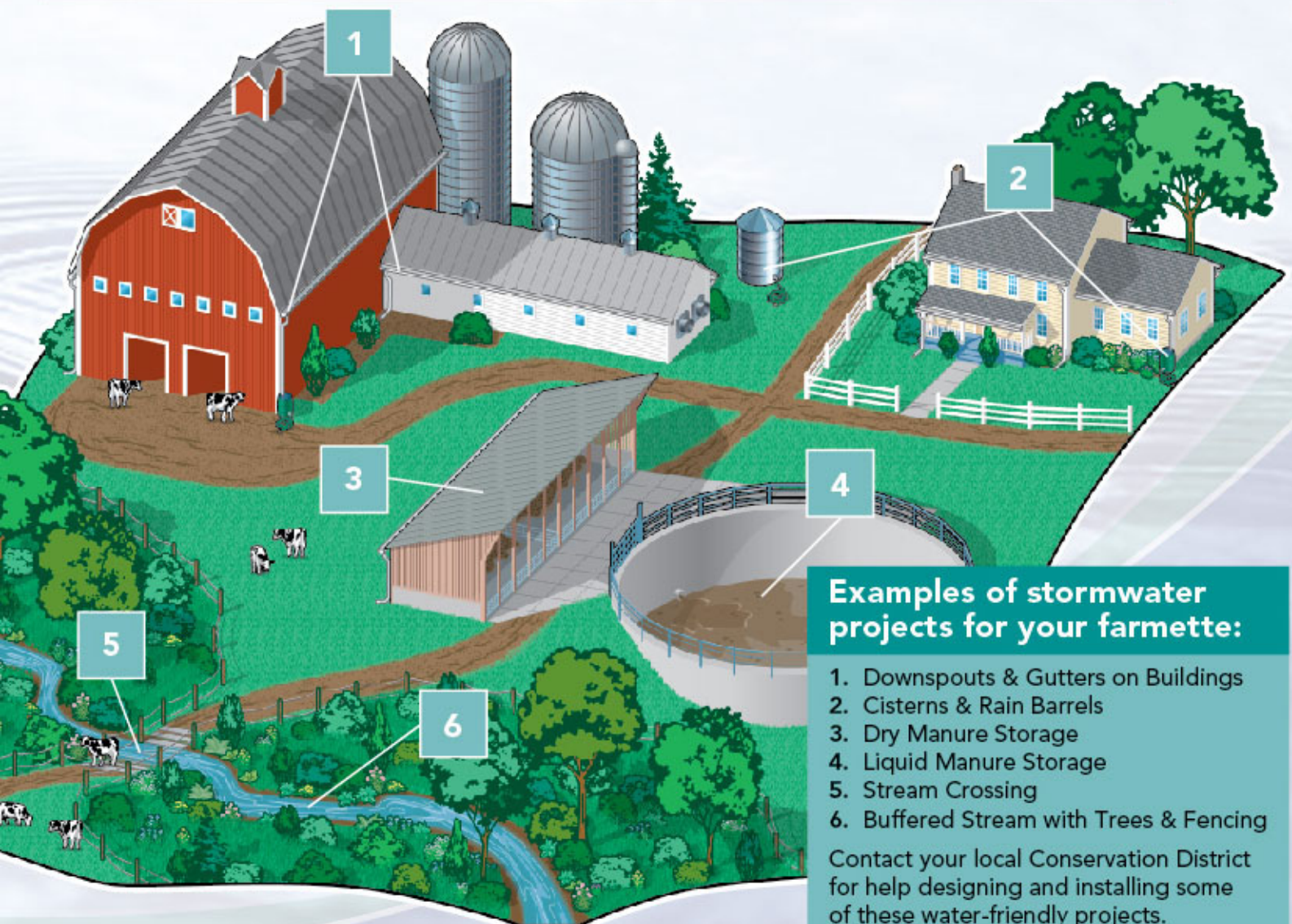
More than 40 diseases can be transferred to humans by manure-polluted water according to the NRDC!



A farmer enjoying the fruits of his labor!

Tips for a Bay-Friendly Farmette

- **Manure:** Install a covered storage structure, which should be able to hold at least six months of manure to ensure that it can get spread on fields at the proper time. This size will depend on the number and type of animals you have.
- **Fertilizer and Pesticides:** Test your soil to find out what nutrients it needs before you fertilize. Over-fertilizing can lead to excess nutrients (phosphorus and nitrogen) washing into waterways and causing algal blooms. Make sure there is no rain in the forecast before you apply pesticides or fertilizers; the rain could wash away the nutrients you just applied, wasting your money and polluting our water.
- **Cover Crops:** Plant these crops to reduce weeds, add nutrients to the soil, and reduce erosion, which strips topsoil. Find out what crop would be best for you based on your needs and those of the land.
- **Protect your Waterways:** Plant grasses or trees along the edge of a waterway to act as a buffer, which trap pollutants and reduce erosion. Put up a fence to protect the buffer from livestock. Consider a designated stream crossing site to reduce the impact animals have on the water. By installing a cattle crossing structure, you can reduce erosion caused by hooves, prevent livestock from getting stuck, and improve drinking water for your animals.
- **Downspouts:** Install downspouts that direct rain to the downhill side of a concentrated animal area, so that the rainwater doesn't wash across the pad carrying animal waste into local waterways.



Examples of stormwater projects for your farmette:

1. Downspouts & Gutters on Buildings
2. Cisterns & Rain Barrels
3. Dry Manure Storage
4. Liquid Manure Storage
5. Stream Crossing
6. Buffered Stream with Trees & Fencing

Contact your local Conservation District for help designing and installing some of these water-friendly projects.

Designer Ditches

Check out our in-depth design guide online at NanticokeRiver.org/restoration/designer-ditches/

Have a ditch on your property? Most of us do. They drain wet areas to make them available for development and are especially important in preventing flooding. Designer Ditches are a new take on the traditional ditch. Native plants are used to line the ditch so they can help reduce erosion and trap pollution and even make your yard more beautiful.

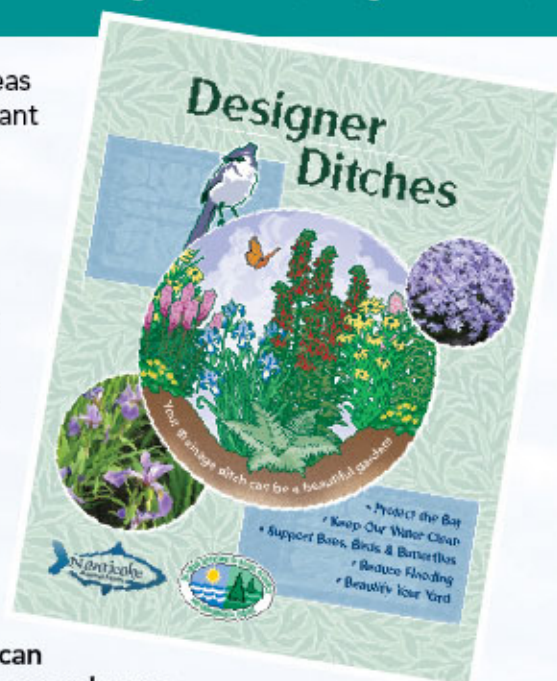
Turf grass just doesn't cut it. Not only do the roots not go deep enough to hold soil in place but these shallow roots won't break up compacted soil, meaning more water will flood over your yard than be absorbed. Ditches lined with just grass can begin to erode and pollute waterways with soil. For fish, soil in the water is like smoke in the air for humans. These same ditches do not absorb much water, meaning more flooding downstream and more pollutants making their way to the Bay.



This ditch is now the home of many native plants. These plants create a beautiful habitat and filter out stormwater pollution.

Native plants in your Designer Ditch can help reduce run off and pollution in several ways.

Native plants have root systems that are much more extensive than the typical grass. These roots hold soil in place and help it absorb water, but they can also trap and use excess nutrients, like phosphorus and nitrogen, that cause algal blooms and other issues in local waterbodies. The best part about a designer ditch is that native plants support our pollinators and other wildlife.



There are over 2,820 miles of public ditches in Delaware and the Lower Eastern Shore of Maryland. That's nearly 30 times longer than the state of Delaware! Ditches connect our homes to local waterways; remember that when you think that you're too far from water to pollute it.

Source: MDA and DNREC

Designer Ditch Tips:

- SET UP:** Spray with an aquatic-approved herbicide a few weeks before planting. Do not clean up the dead grass; the new plants will be planted within the dead turf grass to prevent erosion.
- USE NATIVE PLANTS:** These plants evolved on Delmarva. They require less upkeep once established and provide food for native critters.
- CHOOSING PLANTS:** You'll need to select an assortment of plants due to the varying levels of moisture found in different areas of the ditch.
- PLANTING:** Do not plant any shrubs or woody plants in the bottom or along the side to avoid possible blockages and flooding. Push plants firmly into the soil at the bottom of the ditch to reduce the chance of them being washed away.
- MAINTENANCE:** Weed every two weeks and avoid using mulch. Only use triple-shredded mulch. Water the plants frequently first two years. Since ditches play an important role in flood control take care to trim and remove any woody material from the ditch in the fall. You can retain this material in a safe spot in your yard to provide habitat for critters or compost.



Paddle the Nanticoke

Taking care of your property means clean waterways for our wildlife and fellow community members. In this region especially clean water means a better economy through tourism, farming and fisheries. Get outside and enjoy the fruits of your labor.

Did you know that the Nanticoke River is home to the largest Bald Eagle population in the northeastern United States? They are right outside your door! Learn about all the wildlife around the river and more at ***PaddleTheNanticoke.com***.

At PaddleTheNanticoke.com, you can check what launches and ramps are closest to you for easy access. There are also sample trip plans that will make choosing an adventure stress-free. You'll find the largest variety of creatures on Delmarva along the Nanticoke River, and there are plenty of historic sites to visit or other recreational activities to check out. PaddleTheNanticoke.com can help you find fun things to do along your trip, and even suggest restaurants and hotels if you want to stay a little longer.

Find sample trip plans at ***PaddleTheNanticoke.com***



You might meet some river otters on your trip down the Nanticoke.

Otter photo by Heather Paul,
flickr.com

The bald cypress you will find in the Nanticoke region can grow to be 150 feet tall and up to 600 years old!



**Interested in having
a rain garden, more trees,
or some other type of
addition to your property?**

**Contact 410-443-8878 or
info@NanticokeRiver.org
to find out if funding and
supplies are available.**



**Special Thanks to the
Partnership for the Delaware Estuary and the Philadelphia Water Department
for content, photographs, and permission to reuse and adapt the information
contained in "Homeowner's Stormwater Handbook".
All illustrations throughout the book © Frank McShane.**