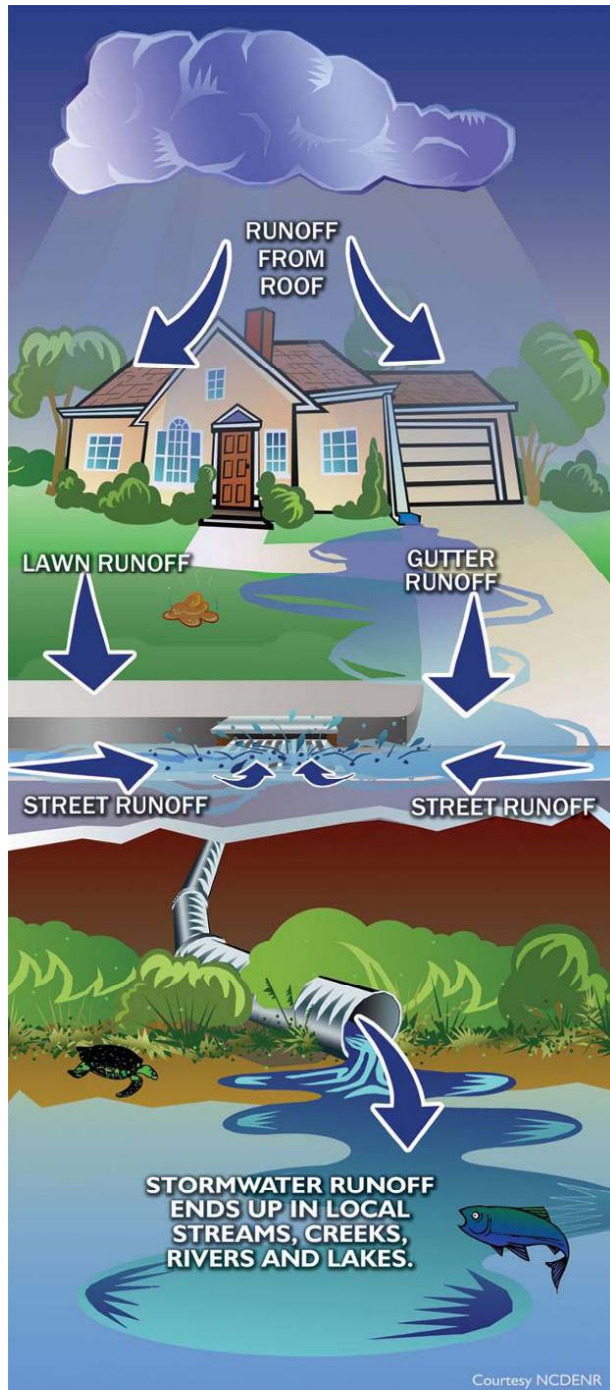


# Follow The Path To Cleaner Water



# What is Stormwater?



You're looking at stormwater --  
rainwater moving across the ground.

- Think about the last time it poured buckets of rain. Did you see sheets of water flowing down your driveway? Or streams of water gushing along the curb?
- That's stormwater.
- Stormwater is water flowing from yards, parking lots, roofs, and other places when rain falls or snow melts.

Photo: Mike Hirschi, University of Illinois

Source: [http://secretagentworms.org/vault\\_stormwater.html](http://secretagentworms.org/vault_stormwater.html)

# What are Storm Sewers?



Workers pose in huge storm sewer pipes below Chicago streets. Storm sewers transport stormwater and melting snow.

Photo: Chicago Public Library

Source: [secretagentworms.org/vault052](http://secretagentworms.org/vault052)

- Storm sewers are pipes found beneath our city streets. They handle stormwater, such as rain and melting snow.
- Rainwater flows into storm drains -- the openings that you often see along curbs. After water enters the storm sewers, it flows directly to rivers, lakes, or bays. Many times the water is not treated, or cleaned, before it goes to a waterway. That's why it's a big problem when ooze mixes with rain.
- Rainwater picks up all kinds of trash, dirt, and chemicals when it moves across the ground. Polluted stormwater moves into the sewers and flows straight to the closest body of water, such as a lake or canal, which usually flows into the Indian River Lagoon and eventually the ocean.

# What do storm sewers have to do with our lakes and rivers?



Heavy rain pours into the storm sewer drain (marked by yellow paint). Many storm sewers carry rainwater and pollution straight to our Indian River Lagoon.

- Storm sewers carry rainwater directly to lakes and canals. Usually, the water is not cleaned up before it winds up in our Indian River Lagoon and this is a big problem.
- Rainwater moving into storm sewers can pick up all kinds of gunk on the ground -- soil, oil, pesticide, fertilizer, litter, pet waste, and more. Then the sewer will carry all of this gunked-up water straight to our Indian River Lagoon.
- See the problem?

# What are sanitary sewers?



Two types of sewers run underneath our city streets. **Storm sewers** handle rainwater (stormwater), while **sanitary sewers** take care of used water from our homes and buildings.

Photo: Chicago Public Library

- Don't confuse sanitary sewers with storm sewers.
- **Storm sewers carry excess rainwater** from our streets, rooftops, and yards. **Sanitary sewers carry wastewater** coming from our houses and other buildings -- from bathrooms, kitchens, and floor drains.
- When you flush a toilet or take a shower, everything heads for the sanitary sewers found beneath our city streets. Then it goes to a place where the water is treated, or cleaned.
- Once the wastewater from sanitary sewers has been cleaned, it is usually used for irrigation.

# What is a storm drain?



When it pours, rainwater moves into this storm drain along a curb.

- A storm drain is a portal into the storm sewers. It's also where pollution can enter the sewers.
- You probably see storm drains every day. They're those openings along the curbs where your baseballs may have rolled into and disappeared forever.

# What do pavement, spies, and stormwater have to do with each other?



Cities are loaded with pavement. When there is a lot of pavement, water cannot infiltrate, or move down into the ground.

- The word “infiltration” has to do with spies. But it also has to do with stormwater.
- When spies infiltrate a dangerous place that means they sneak into it. When rainwater infiltrates the ground, it moves down through the soil. It “sneaks” into the ground.
- In a city, water cannot infiltrate, or move down into, the ground when there is a lot of pavement. This can cause problems. The water has to go somewhere. So it flows off of the pavement and into the storm sewers. Unfortunately, rainwater picks up pollutants along the way, carrying them into the waterbodies.

# How big are storm sewer pipes?



Some storm sewer pipes can be as small as 12 inches in diameter. However, sewer pipes can also be larger than a man, as you see here.

Photo: Chicago Public Library

- Storm sewer pipes can be as small as 10 or 12 inches in diameter. But the pipes can also be bigger than 8 feet from top to bottom.
- The pipe size depends on how much water is expected to move through the storm sewer. If the storm sewer catches rainwater coming from a large chunk of land, the pipe needs to be big.
- The biggest storm sewer pipes are shaped like rectangular tubes. They're called "box culverts." Some of the biggest pipes are placed side-by-side to carry even more water.

# How does rainwater move through storm sewers?



Rainwater flows downhill along the curb, pulled by gravity. It flows toward the storm drain which is located at the low point.

- Gravity does the job. Storm sewer drains are put in low spots along curbs. That way, gravity moves water toward the drain and into the storm sewers.
- Once the water is in the storm sewer, it moves downhill through the pipes. Once again, gravity does the job.
- In some storm sewers however, pumps are also used to move the water.

# Storm Sewers are dangerous places



Sewers are not safe places.

Photo: Chicago Public Library

- Storm sewers are dangerous places for many reasons and should never be entered, except by workers with special training.
- Sewers can contain invisible poisonous gases, dangerous wildlife, sharp objects, and slippery surfaces. They can also flood during even small rain storms.
- So never go in a manhole or sewer pipe.

# How much rainwater moves through storm sewers?



A lot of stormwater is carried underground by storm sewers. But some stormwater is carried aboveground in channels like you see here. In Indian River County we refer to these as canals that were designed to drain the land back in the 1920's. These canals convey the water to the Indian River Lagoon and the St. Sebastian River which empties into the Indian River Lagoon.

Photo: USDA NRCS

- Lots and lots.
- Let's say that 2 inches of rain falls on an average neighborhood block in one hour. During that storm, about 130,000 gallons of rainwater may wind up in the storm sewers. km1
- To picture this, imagine a line of 130,000 milk jugs filled with water. **THAT'S OVER 12 MILES WORTH OF MILK JUGS!** And that's how much rain may go through the sewers after a 2-inch rain on one block.

By the way, if 2 inches of rain fell in one hour, it would be a really heavy rainfall

## Slide 11

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km1

Actually, you won't get runoff until all of the soil voids are filled or until the rainfall is coming faster than the voids can be filled.. So, in real life, you won't have 2" of runoff from a 2" rainfall unless the land is 100% impervious.

Keith McCully, 9/16/2010

# Why are manhole covers round?



Workers can enter sewers through manholes. Some storm sewer manhole covers have openings for rainwater like you see here. Other manhole covers are solid.

- Manholes are sealed with those flat, round, heavy metal covers you often see smack in the middle of the street. Workers enter manholes when they need to work on the sewers.
- But why are they round?
- If you tip a round cover on its side, it cannot fall through the hole. But if you tip a square cover on its side and turn it diagonal to the opening, it could fall through, clunking someone on the head. So it's a safety thing.

# What kinds of pollution can get into our storm sewers?



Dogs may be cute, but they leave messes that can get into our sewers. Pick up after your dog.

- When rainwater washes into the sewers, it can carry all kinds of gunk with it. The storm sewer can carry this gunk to a lake or the lagoon many miles away:
- **Pesticide and fertilizer from yards.** Pesticides are used to kill insects and weeds. Fertilizer is plant food.
- **Leaves and other plant material.** When plant material in lakes and rivers rots, it can take oxygen out of the water. It steals oxygen from fish.
- **Soil.** Even something as valuable as soil can cause pollution when it gets in our lakes and rivers.
- **Paint and household chemicals**
- **Dog poop.** One dog may not leave much on the ground. But how about over 10,000 dogs in our County?
- **Oil and antifreeze** from cars

# What are the "litter bug blues"?



Litter and leaves collect on a storm drain. If they move into the storm sewer, they could be carried to nearby canals, lakes, and the lagoon.

- If you throw a gum wrapper on the street, it could wind up in a river miles away.
- Rainwater can wash the wrapper into the storm sewer. Then water in the storm sewer carries the wrapper through the underground world of pipes. Stormwater (and the gum wrapper) flow into a river miles away. The fish that live there and the people who swim and boat there aren't too thrilled by the litter.
- Any litter can end up in a river - - even the "litter" your dog leaves on the ground. Pet poop pollutes.

# What does it mean to ‘drain the rain’ and ‘lose the ooze?’



Storm sewers are made to “drain the rain.” If it rains too fast for the sewers to handle all of the water, flooding can result.

Photo: USDA NRCS

- Storm sewers are made to “drain the rain.” Their job is to carry rainwater to nearby lakes and rivers. They’re not made to carry litter, oil, pesticides, and other gunk to lakes and rivers.
- The best way to prevent ooze and gunk from getting into our storm sewers is to avoid dumping them on the ground in the first place. Don’t spill oil or chemicals on the ground. Don’t overuse pesticides and fertilizers. Pick up after your dogs. And don’t litter.
- In other words...“Lose the ooze.”

# How do people get rid of dangerous gunk around the house?



These are not spacemen. Workers are just getting rid of toxic materials at a hazardous waste collection site.

- Most families keep some pretty toxic (poisonous) stuff around the house -- and we're not talking about month-old pizza crust.
- Families keep stuff like bug killers and paint thinner. It's too dangerous to put this stuff in the garbage because it might pollute the ground and water. So, take the really toxic stuff to a hazardous waste collection site.
- Mom or Dad should check with your city or town to find out where the closest collection site is located. Lose the ooze.

# What are detention ponds and do they have anything to do with detention hall?



This pond, called a “detention pond,” catches water flowing from a cluster of homes.

Photo: USDA NRCS

- Have you ever seen a small pond just in front of a huge parking lot at the local mall?
- The pond isn't there for swimming or sailing. It's a “detention pond.” It stores rainwater that comes from the parking lot pavement. This water moves into the storm sewers.
- A detention pond is a great way to drain the rain. It has nothing to do with detention hall, but there is one similarity. In detention hall, students just sit around waiting for it to end. In detention ponds, water just sits around waiting to be drained away.

# Can grass blades guard our water?



Lush grass on either side of a stream helps keep pollutants out of the water. This is called a “buffer strip.”

A single grass blade can't do much, but an army of them can do a lot!

A grass blade army can catch pollution before it gets into the water. Like any good army, they capture the enemy (pollution) and prevent it from doing its dirty work. Here's how...

Water flowing from pavement and roofs carries pollution with it. To capture the pollution, some cities plant grass “buffer strips” along the edge of shopping centers or other built-up areas. These strips of grass are often 50 to 100 feet or more wide.

The grass in a buffer strip slows down runoff water and gives it time to “infiltrate,” or move down into the soil. The grass also traps some of the pollution before it gets into our water. It's the last line of defense to keep pollution out of nearby water.

Of course, this doesn't mean it's OK to get rid of pollutants by dumping them on your lawn. First of all, the grass used in buffer strips usually has deeper roots and taller blades than most lawn grasses. Secondly, even though grass can stop some pollutants, it can't catch everything.

# What do street sweepers do?



A street sweeper machine cleans up in Preston, England. Blimey! That's why the sweeper is going down the left side of the road. Street sweepers help keep gunk out of storm sewers.

Photo: [Preston City Council](#), England

- Street sweepers are monster machines that run along the curbs of city streets.
- Some machines use steel brushes to sweep leaves, litter, twigs, and other stuff into a “hopper.” Other street sweepers use vacuums, instead of brushes, to suck up the stuff.
- Once the gunk is collected, it is properly thrown away. Street-sweeper machines are a good way for cities to “lose the ooze.” But remember, small litter items such as cigarette butts wedge into small crevices that the street sweeper can't reach.

# How are erosion and stormwater pollution kind of like Austin Powers?



Soil washes dirt from many different spots on a field. That's why it is called "nonpoint source pollution." The pollution doesn't come from just one point.

Photo: USDA NRCS

- Some pollution comes from an obvious place, such as a pipe at a factory --yeah, baby! This is called "point source pollution." The pollution comes from one point, such as a pipe spewing dirty water.
- Other pollution, such as eroding soil or stormwater pollution, is much sneakier. In fact, it's as sneaky as a secret agent like Austin Powers -- without the wild clothes.
- Eroding soil and stormwater pollution usually come from many, many spots on the land -- not just one point. All of these little bits of pollution are hard to spot. But they add up to a BIG problem.
- Because this type of pollution comes from many points on the land, it's called "nonpoint source pollution." Oh behave!

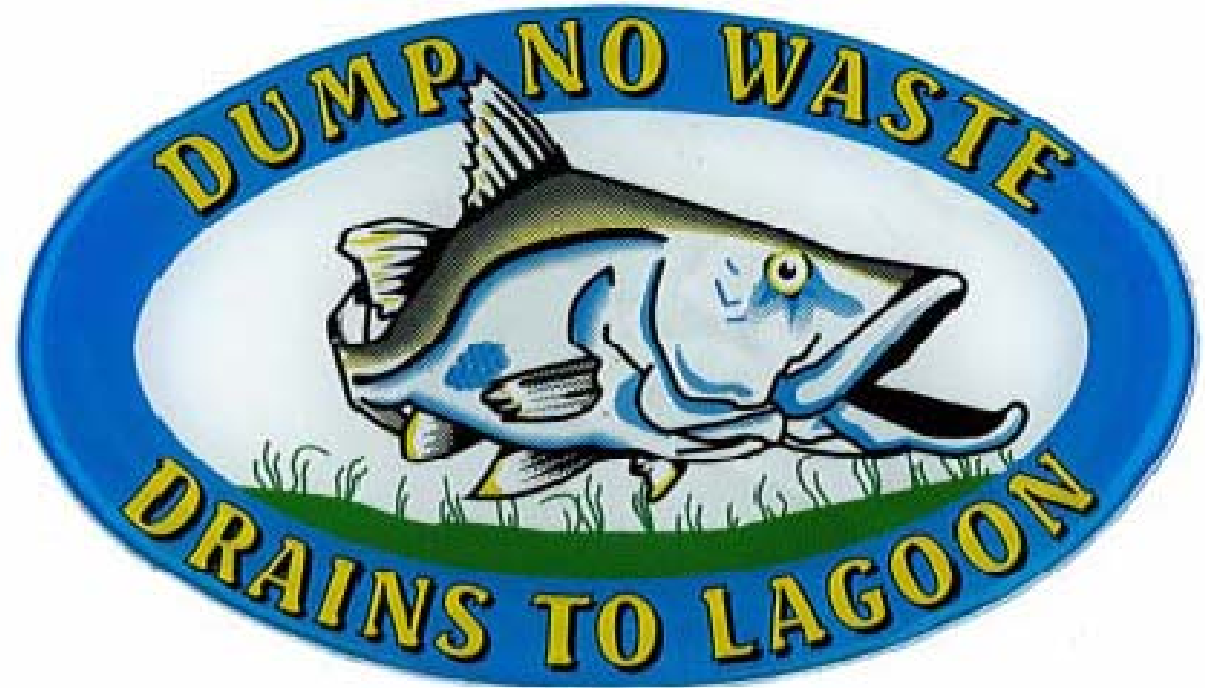
# Do sewers contain secret messages?



Girl Scouts help to put warnings on a storm drain. The warning says NOT to dump pollution in the storm drain. This drain carries rainwater to the Chesapeake Bay.

•Photo: U.S. EPA

- Some sewers do contain messages -- but not secret messages.
- Groups of parents and kids use stencils to paint warning messages where water enters storm sewers. (They get permission from the city first.) These messages say things like "Dump No Waste--Drains to River."
- They warn that if you dump gunk on the ground, it might end up in storm sewers, where it can travel to the river.



**In Indian River County, volunteer groups are encouraged to use the art on the right when doing stormdrain marking as a community service project. The message reminds those passing by that the storm drains connect to local waterbodies and that dumping will pollute the Indian River Lagoon. It correlates with the County's signs placed along the roads also.**

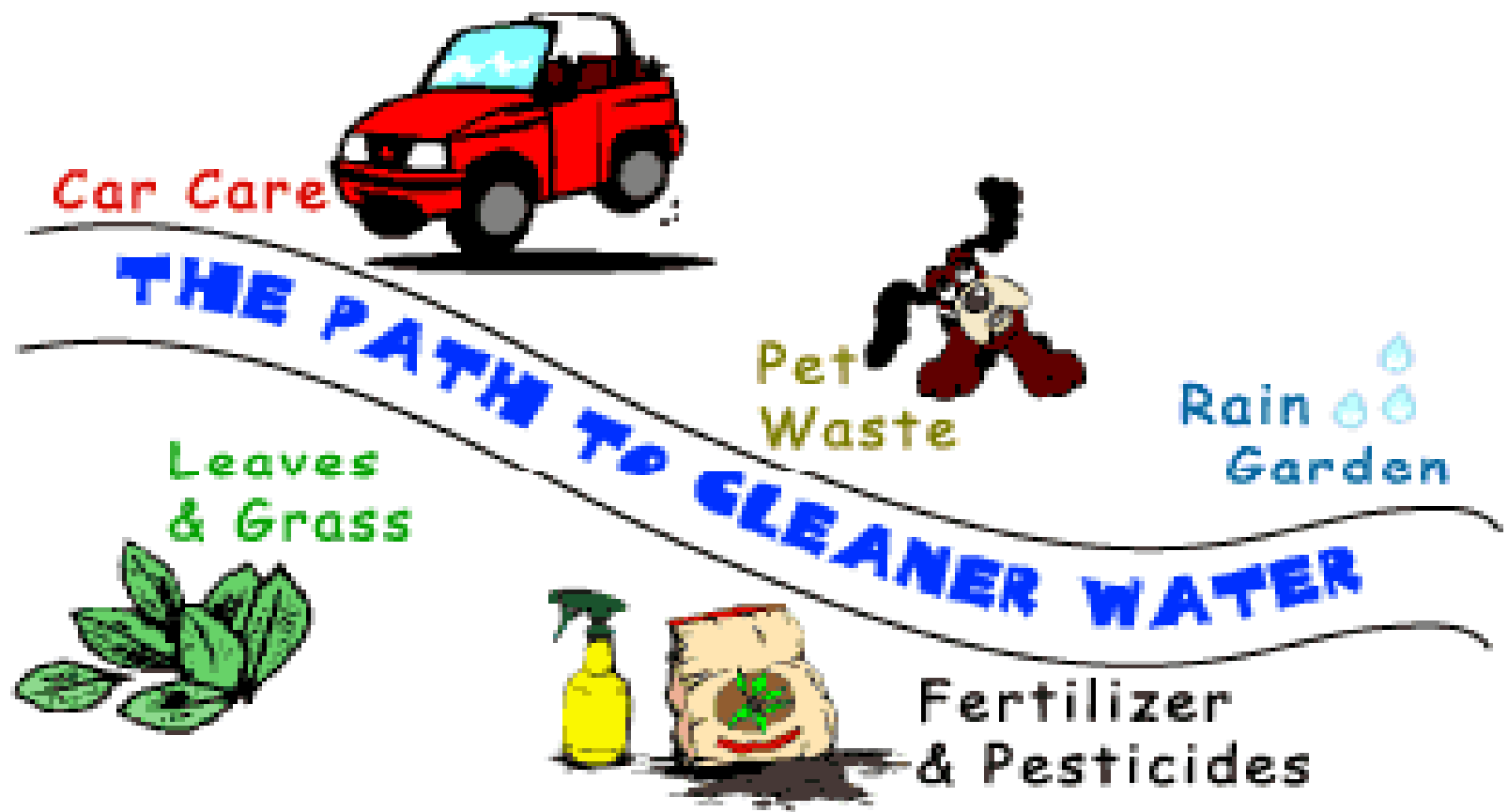
# You can help keep our lakes, canals and Indian River Lagoon Clean

**The Clean Water Act did a good job of reducing pollution from "point" sources, like a factory wastewater discharge pipe.**

**Now, we need to control pollution from what is called "nonpoint sources." A nonpoint source of pollution is one that doesn't come from a single place, but washes off the landscape or blows in the wind and gets into lakes and rivers when it rains or the snow melts.**

**A nonpoint source of pollution might be fertilizer from someone's lawn that has washed off the grass after a rainfall and heads down the curb to the storm drains.**

# Follow the Path to Cleaner Water





# Fertilizer

- When the nitrogen and phosphorus from fertilizer washes into lakes and streams they create harmful algae blooms and aquatic weed growth. The algae blooms lower the dissolved oxygen levels in the water and they may release ammonia, which is toxic to fish. What can you do?
- Test the soil. Before planting a garden or fertilizing your lawn, have your parents get the soil tested. That way you're not guessing and you won't add too much fertilizer.
- Fertilize in the fall. Fall is the best time to fertilize your lawn. It promotes healthy lawns with deep roots.
- Sweep up any extra fertilizer that lands on your sidewalk or driveway. You should also sweep up soil, grass clippings and leaves which also contain nitrogen and phosphorus. This will keep them from washing down the storm sewers into nearby waterways.



# Pesticides

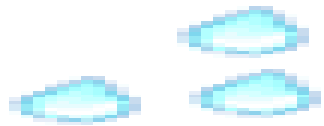
- Pesticides kill pests. That seems simple, doesn't it. But, pesticides can also hurt pets and other animals and plants that you don't want to kill. Pesticides can be herbicides (which kill plants), insecticides (which kill insects) and fungicides (which kill fungi).
- How can you cut down or eliminate the use of pesticides?
- Plant disease resistant varieties of plants.
- Clean up pest infested plant waste in the fall. This keeps diseases from overwintering in your garden or lawn.
- Pick weeds by hand! (Wow, you mean people still do that?)
- Do your best to keep birds and other natural pest predators visiting your yard.
- Use mulches to hold down weeds, conserve moisture, and prevent soil from washing away.



# Pet Waste

Do you own a dog or a cat? What's your favorite pet chore? It's probably not picking up dog poop or cleaning the litter box. But, it's important that you take care when disposing of pet waste.

- When pet waste is washed into lakes or streams the waste decays, using up oxygen. It also contains nutrients that cause weeds and algae to grow. Overly fertile water becomes cloudy and green and is not someplace you'd want to swim. And, pet waste can carry diseases which makes water unsafe for swimming and drinking.
- Be sure to dispose of your pet's waste properly. Do not flush it down the toilet. Bury pet waste 5" deep and keep it away from vegetable gardens and any lake, stream, or well. Or you can dispose of it in the trash, preferably in a biodegradable bag.



# Plant a Rain Garden

Gather your family together and start gardening -  
- rain gardening that is.

A rain garden soaks up rain that normally would run off your land from your roof and lawn.

By planting wildflowers and other native vegetation, your rain garden will be able to hold water and release it slowly, instead of having it rush over your roof, down your gutters, into the street, into the storm sewer and eventually into a lake or stream.



# Yard Care

- **Mowing, raking, gardening...** these tips will keep your lawn and garden growing and keep pollutants out of lakes and streams.
- **Grass clippings.** Leave it be. After you mow, you can leave the grass clippings on the lawn where they will act as a natural fertilizer. It's good for the lawn and much less work than bagging them up and hauling them away. If you just love to rake and bag up your grass clippings, you can use grass clippings as mulch in your vegetable garden. It will help hold moisture in and keep the weeds down.