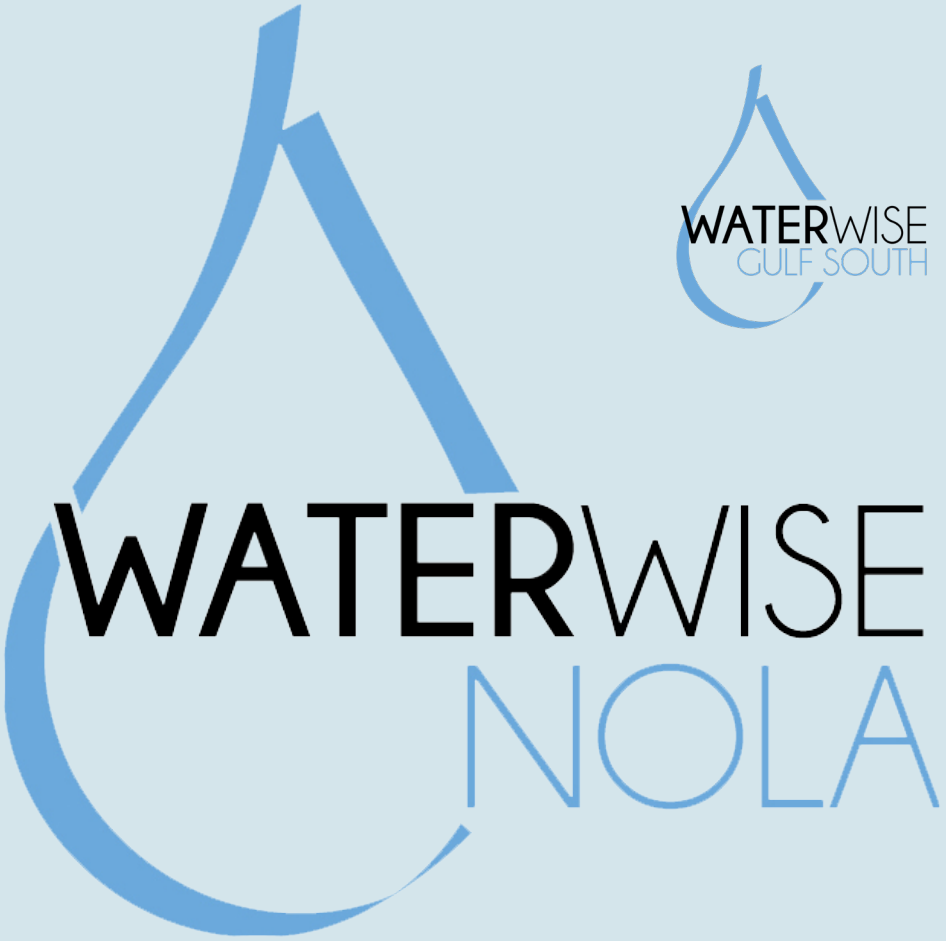
Water Wise Workbook



WATERWISE
GULF SOUTH

FUNDED BY:

GREATER NEW ORLEANS FOUNDATION

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Water Wise NOLA

Water Wise NOLA—Dana Brown & Associates Landscape Architects, Global Green, and Recharge NOLA—is an environmental outreach collaborative devoted to advancing and promoting green infrastructure and its associated benefits through education, events, tours, do-it-yourself workshops, demonstration projects and leadership training.

DANA BROWN & Associates

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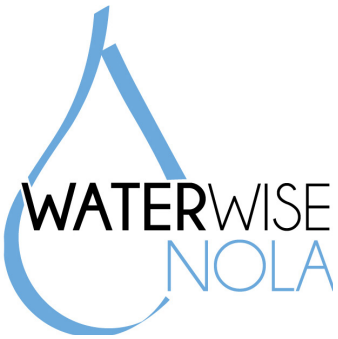
HEALTHY Community SERVICES

Building Healthier Communities by Going Green

Water Wise Workbook



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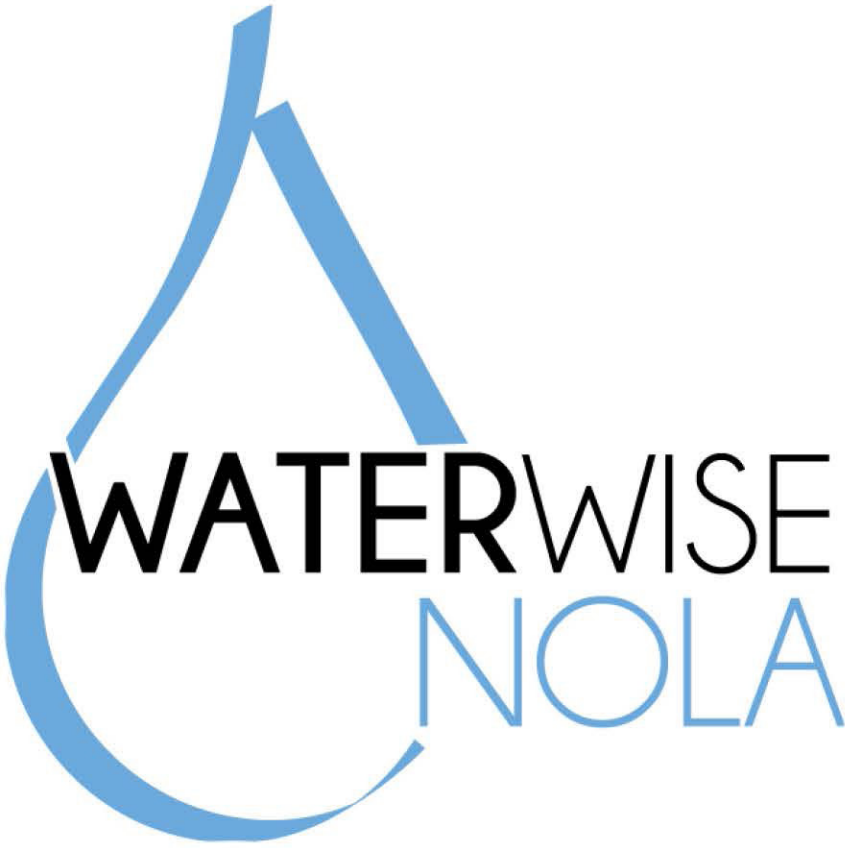


Section 1
Using this Workbook

1. Using This Workbook

The Water Wise Workbook provides information for managing stormwater on your property, including do-it-yourself guidance for implementing measures that better manage stormwater.

Using the workbook, you will learn about drainage and managing stormwater: how they work, how they are different, and the benefits and problems with each.

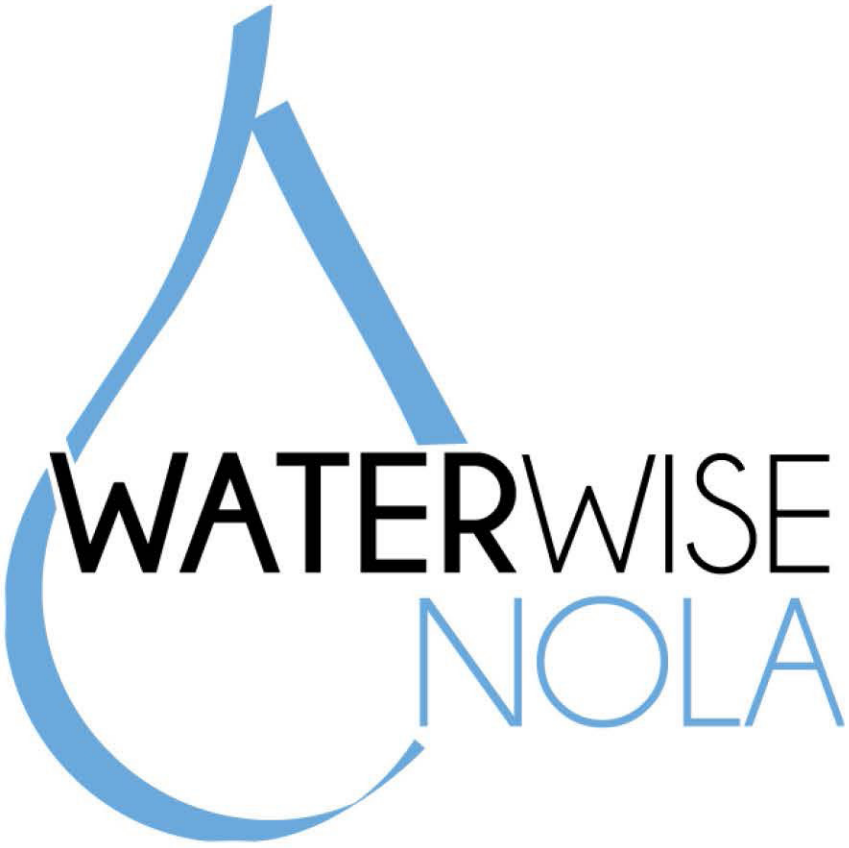
The workbook guides you in assessing your property for drainage issues and calculating how much stormwater runs off the hard surfaces. Your assessment sets the stage for identifying how to better manage your stormwater.

Green infrastructure, a way to manage stormwater more closely to nature's way, is described and different types are illustrated. To help you improve how stormwater is managed on your property, the workbook provides step-by-step descriptions and illustrations on how to build green infrastructure facilities yourself.

Suggestions are given about how to get involved managing stormwater in your neighborhood. Finally, the workbook includes a vocabulary section that lists and defines stormwater management terms, followed by a section on additional resources.

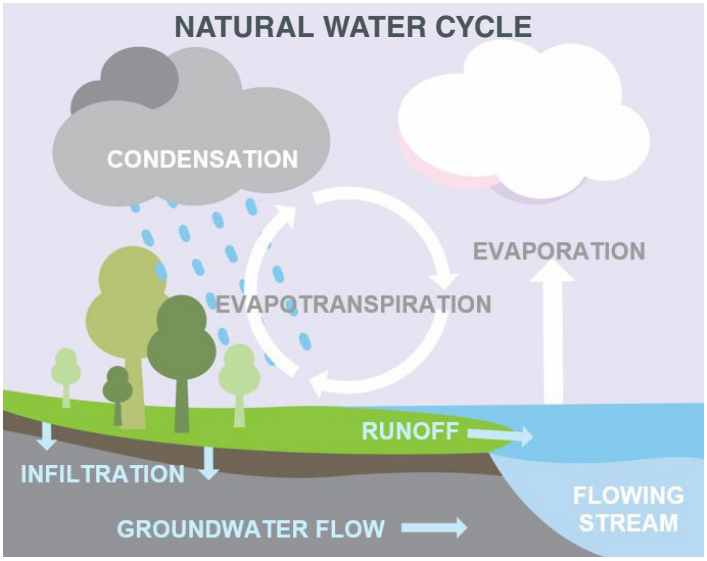
Note: This guide is not intended to suggest how to manage major hurricanes or storm surges, rather the strategies will help reduce flooding from rainfall events.

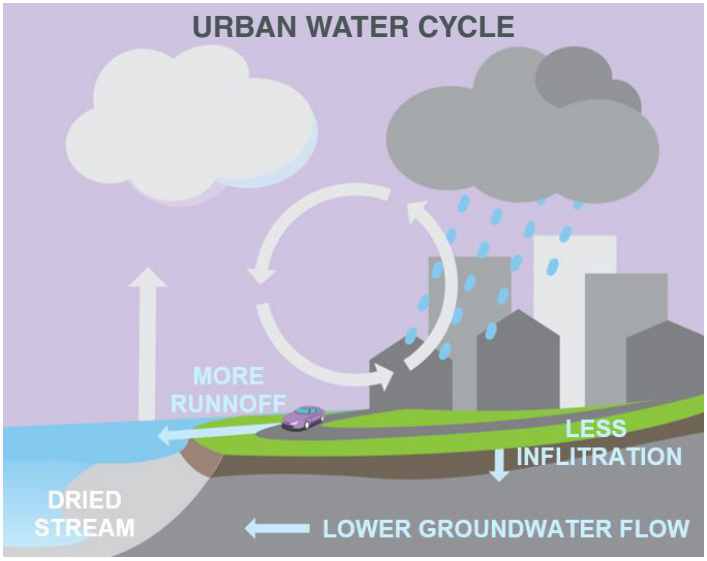
Water Wise Workbook



Section 2
Understanding Our Drainage System

2. UNDERSTANDING OUR DRAINAGE SYSTEM





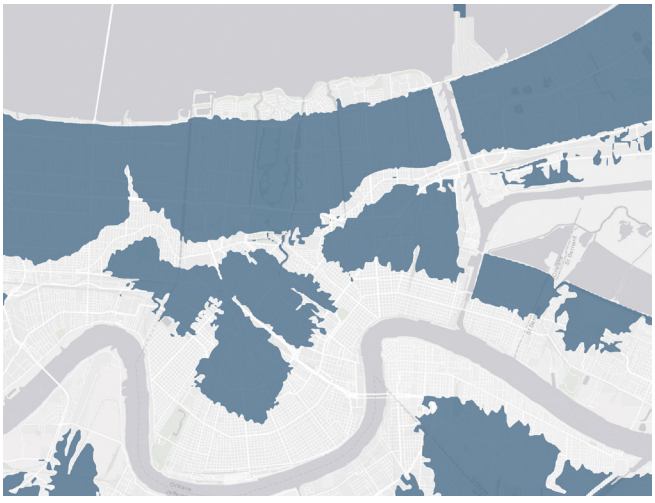
THE EARTH'S WATER CYCLE

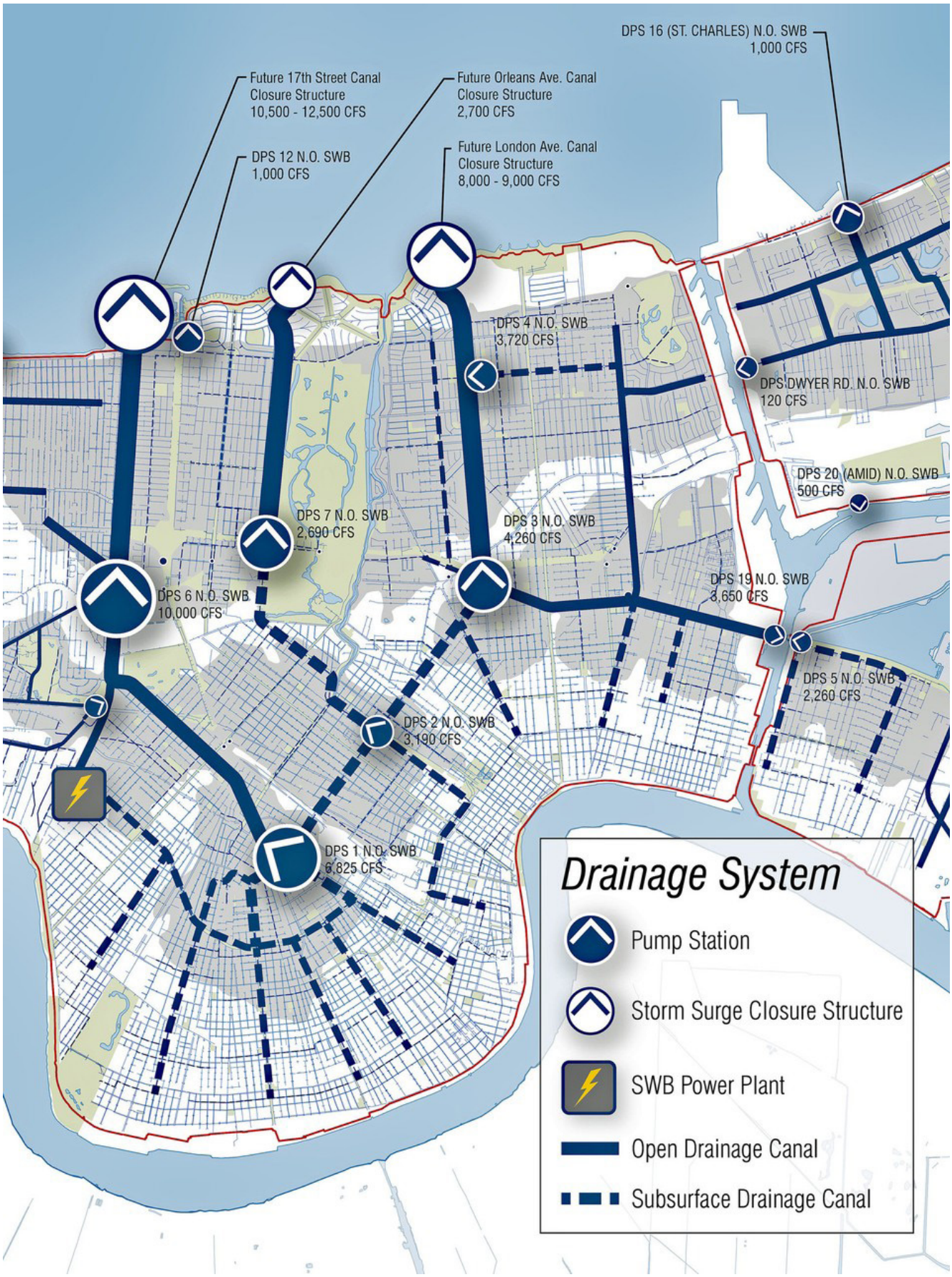
The Earth's natural water cycle transforms and moves water from the atmosphere to the Earth's surface, becoming runoff, transpiring into the atmosphere, infiltrating into the subsurface (forming groundwater), entering water bodies, evaporating into the atmosphere, and cycling again.

Every drop of water that is currently on our planet is the only water that will ever be here. New water is not created. Only 2.5% is freshwater, the rest being salt water. Of the freshwater, almost 70% is found in glaciers which cannot be captured and used by humans. The remaining 30% is primarily groundwater, of which about 1% is in surface water bodies.

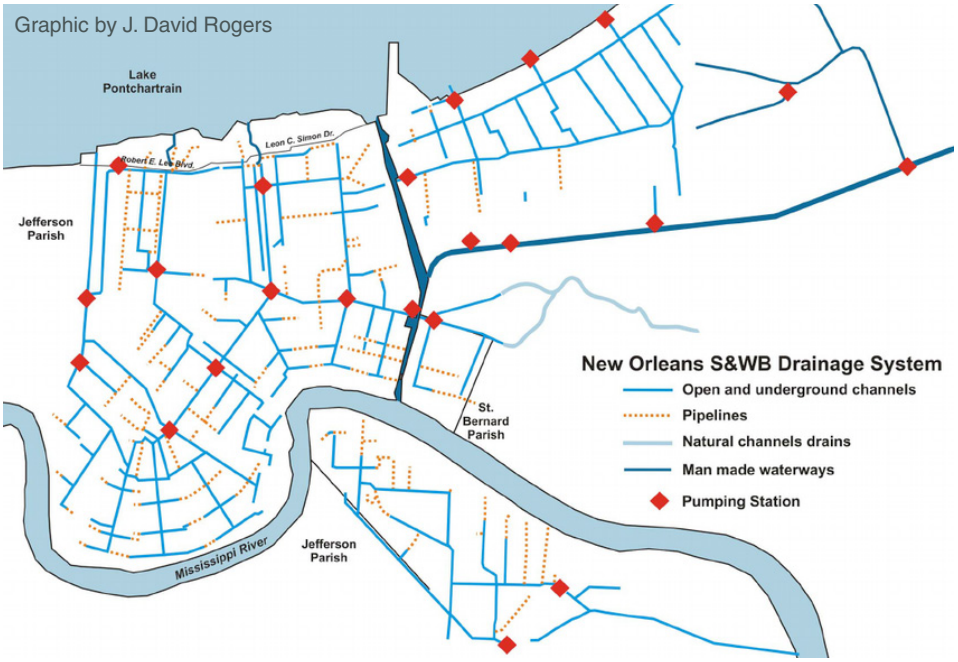
The development of cities, which includes massive areas of rooftops, asphalt, and concrete, has changed the natural water cycle. Impervious urban surfaces result in more stormwater runoff and less infiltration into soils to recharge groundwater. Fewer trees, plants, and open green spaces have reduced transpiration and increased air temperatures. Cities have long sought to drain large amounts of runoff using a traditional drainage system, such as the one we have here in New Orleans.

In the Greater New Orleans area our approach to dealing with rainfall has been to drain it away as quickly as possible. Much of our system of catch basins, pipes, canals, and drainage pumps, called grey infrastructure, was designed and built generations ago, when less of the land was developed. Drainage systems like ours were sized and designed based on the amount of rain from a specific storm event, so events that are more intense or longer in duration cannot be handled by the system.



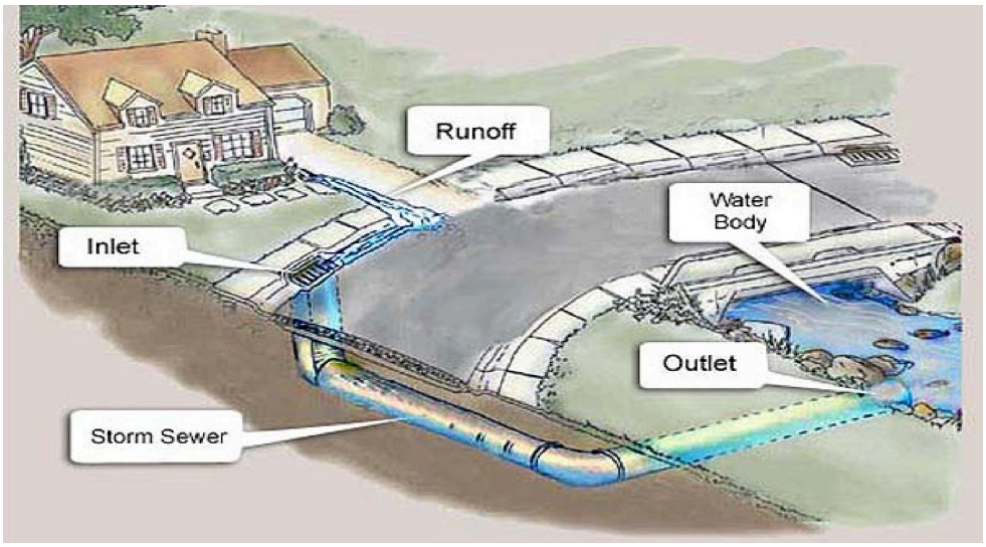


Courtesy Times-Picayune, Photo by Mark Schleifstein



The City of New Orleans drainage infrastructure includes 19,460 drain inlets and catch basins, 1,288 miles of drainage pipe, and 235 miles of canals and drainage pipe over 36” in diameter. It is an elaborate system of collecting, conducting, and disposing of water. Grey infrastructure is visually unappealing, so it does not add to the livability or value of a neighborhood except insomuch as it may keep it from flooding

Rain that falls on your property hits different surfaces and materials. The roof on your house is impervious, meaning water cannot penetrate the roof system to enter the house, so rain instead runs off of your roof. Similarly, rain that falls on your patio, driveway, or sidewalk runs off those surfaces. This is called stormwater runoff.



IMPACTS OF GREY INFRASTRUCTURE SYSTEMS

Localized Flooding

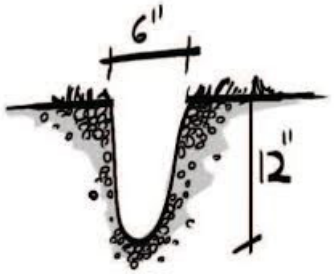
When our drainage system of pipes, canals, and pumps is overwhelmed by excessive stormwater runoff, water can backflow and cause flooding. Backflooding occurs when an area has drained and has no standing water, but the grey infrastructure system in lower areas, down pipe, is overwhelmed and backs up, coming out of catch basins and manholes. Grey infrastructure is mostly a closed system and therefore has limited capacity, so the excess water has nowhere else to go except back from where it drained. This backflooding causes what is called localized flooding because it occurs in isolated areas, such as your street or your neighborhood block.

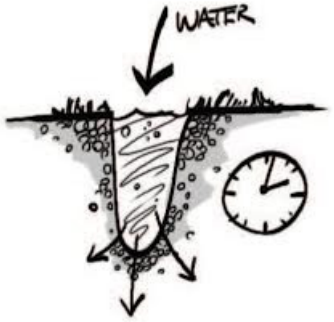
Due to the topography of our land, stormwater must be pumped into our surrounding water bodies. On the east banks of Orleans and Jefferson parishes, stormwater is collected, conveyed, and pumped into Lake Pontchartrain. This means water from areas closer to the Mississippi River, which is generally higher ground, flows to areas closer to the lake to be pumped. This collection of water from other areas combined with rainwater that falls on lakefront areas often fills the pipes and canals and subsequently backs up, causing localized flooding in Lakeview, Gentilly, and low-lying areas such as Broadmoor. Flooding causes damage to property, buildings, streets, and vehicles.

Groundwater Depletion & Subsidence

Our traditional grey infrastructure system drains water away as quickly as possible and uses large pumps to convey stormwater runoff over levees and floodwalls into the lake. When pumps are engaged, they not only pump out stormwater runoff, but also draw groundwater out of the soils. Large areas of impervious surfaces prevent rain from percolating back into the soils, thereby compounding the problem of depleted groundwater.

Our region is comprised of three general soil types: clay, sand, and organic. Clay soils are the most prevalent and vary in characteristics from one neighborhood to another, or even one lot to another. Clay soils are thought to be impermeable, but that is not factual. The rate at which water can percolate into and through clay soils is slower than that of sand, but water does percolate clay soils. Sandy soils are generally found along areas that were once barrier islands along the coast. The Pine Island Trend is a linear configuration of subsurface sandy soil through New Orleans East, Gentilly, Lakeview, and into Jefferson Parish. The New Orleans region is also known for its organic soils, which are made of once living plant materials that have become buried and inundated by groundwater. When groundwater is pumped out of organic soils, their exposure to oxygen makes them decompose and, therefore shrink or subside.



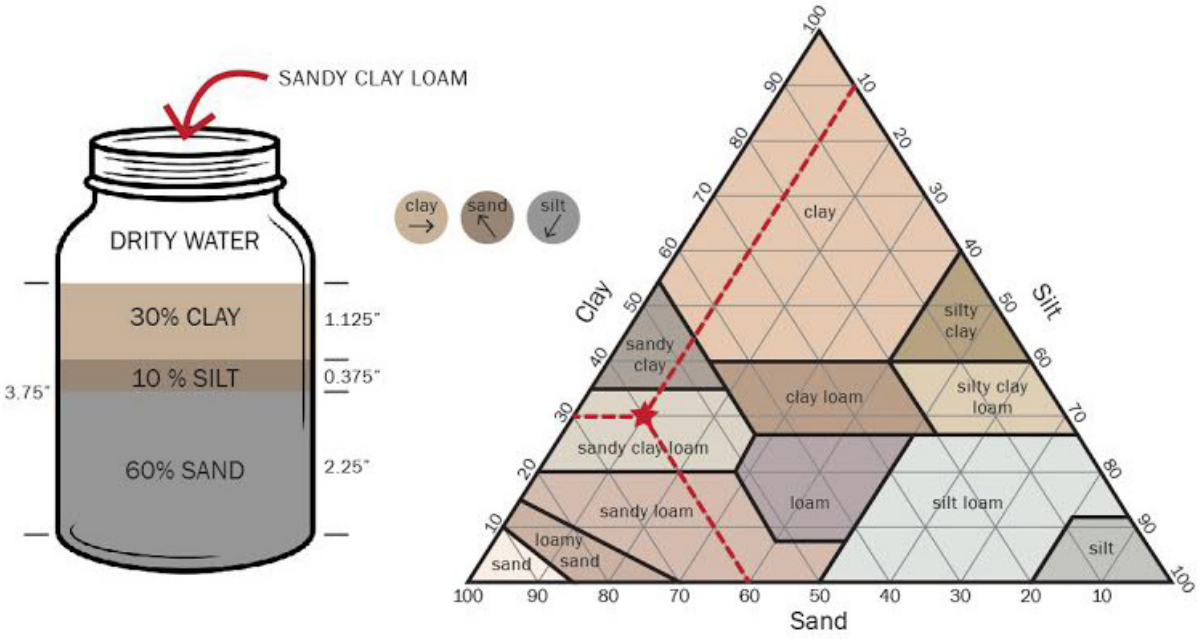


You can conduct simple tests to identify what kind of soils are in your yard and the infiltration rate of the soils. Testing the infiltration rate of soils on your property where you think you might build green infrastructure requires a few tools, digging a hole, filling it with water, and timing the length of time it takes for the water to soak into the ground.

TOOLS: Shovel, Water, Timer, Pen, Paper

1. Dig a minimum 6-inch diameter hole at least 12 inches deep at your proposed location for a rain garden or other green infrastructure feature that will need to have stormwater soak into the ground.
2. Fill the hole with water from a bucket or hose, record the time, and see how long it takes to drain completely.
3. Fill the hole with water again and start keeping time. The rate of infiltration is measured in inches per hour, so the formula to calculate the rate is 12 inches (depth of hole) divided by time to drain in hours (which will likely be include a fraction).
4. If the water on the second fill does not drop at least two inches in one hour, your soils may not drain well.

If you have a large yard, you may wish to perform the test on several areas. If testing a lawn area, remove grass and dig a small hole about 8 inches deep and collect the soil. Using a glass jar, such as a Mason jar, add your soil to about ½ full, then add a teaspoon of liquid dish detergent, and fill the rest of the jar with water. Close and shake the jar vigorously for 3-5 minutes. Wait 24 to 48 hours to observe the layers of soil that formed, which are discernible in the jar by texture and color. Measure the height of each layer and the height of the entire amount of soil. Using the formula height of each soil (inches) divided by total height of soil (inches) tells you the percent of each type of soil you have. The soil triangle chart lets you plot your percentages to identify the name of your soils. The more your soils fall toward the clay part of the triangle, the slower water will percolate into the soil. You may want to consider this if you are sizing green infrastructure to manage all the runoff from an area. It is not a problem if the green infrastructure fills up before water can infiltrate. It will just overflow and runoff just as it did before you built green infrastructure, but not as quickly.



Soils subsidence alters the elevation of land which can damage building foundations, break streets and sidewalks, and damage subsurface infrastructure. Maintaining groundwater balance by not depleting groundwater is critical to minimizing subsidence and the damage it causes.

Water Quality

Stormwater runoff carries pollution that is pumped into Lake Pontchartrain without any treatment, degrading the water quality of the lake. Pollution is in the air and on rooftops, streets, parking lots, construction and industrial sites, and from excessively fertilized lawns, golf courses, and sports fields.

Oil, gasoline, brake fluids, and small particles from worn materials, such as tires, brake pads, and engine blocks, are deposited on streets and parking lots by every vehicle. Though the amount from one vehicle is insignificant, together many vehicles deposit substantial amounts of pollutants that remain on hard surfaces until the next rain. Stormwater runoff collects and concentrates the pollutants, particularly during the first inch of rainfall. You can see how much cleaner your car, driveway, and the atmosphere appear after a rainstorm.

Costly to Build, Maintain, Repair

Think about the grey infrastructure that you have seen installed in neutral grounds and streets. That work requires a long period of construction, large equipment, highly skilled workers, and expensive materials such as reinforced concrete pipes and steel sheet pilings, all of which make the construction of grey infrastructure very costly. Furthermore, grey infrastructure serves only one function: drainage. And because it is comprised primarily of closed pipes and underground culverts, it is a closed system with fixed capacity.

Now think about when an area of a block remains flooded long after the rain has stopped. What could be the problem? Starting with the easiest problems to solve, we will look at a step-by-step approach to determining the answer and the solution.

1. Maybe the drain inlet is clogged. You might clean out the drain inlet along the curb. If in the next rainfall it floods still holds water, that solution did not correct the whole problem.
2. Maybe the outlet pipe connected to the inlet is clogged. You call the City or the Sewerage & Water Board to bring a truck that can pump out. They do so, but the block still holds water after the next rainfall.
3. Maybe a pipe is broken. This requires that a trained inspector to use a camera scope that can peer inside and along some distance of the outfall pipe to look for damage. If they find that the pipe is broken, replacing it requires that the street be partially demolished, old pipe removed, new pipe installed, and the road rebuilt. If not, other issues along the same pipe or the outfall pipe in the next catch basin to which it connects may be the one with the problem.
4. The cleaning, inspecting, pumping, demolishing, and rebuilding is very costly and may not have corrected the problem. Because the system is hidden underground, clogging, damage, and other problems cannot be seen.

In summary, grey infrastructure is very costly to maintain and repair. Yet it serves only one function and does not have the capacity to always fulfill its purpose, which is to prevent our properties from flooding.

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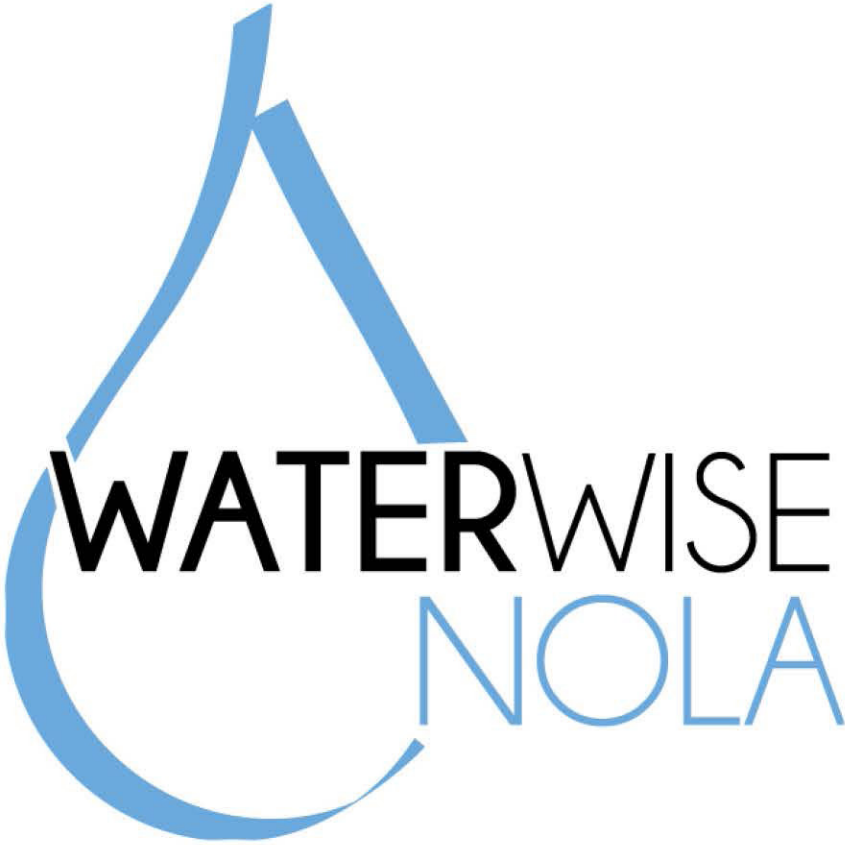

Section 3
Thinking Outside the Pipe: Stormwater Management

3. THINKING OUTSIDE THE PIPE: STORMWATER MANAGEMENT

Green Infrastructure is the use of plants, soils, and pervious surfaces to manage stormwater and reduce flooding by mimicking natural hydrologic processes. By including plants and making stormwater runoff flow to them, the negative effects of concrete and other impervious surfaces are reduced.

FUNCTIONS OF GREEN INFRASTRUCTURE

Measures which slow runoff, hold it, and allow it to soak into the ground help protect against localized flooding when rainfall overwhelms our drainage infrastructure. While these measures may not be able to keep up with the intense rainfall events in Southeast Louisiana, they can help ease the burden on our system of pipes, canals, and pumps when used widely throughout our neighborhoods. Green Infrastructure reduces flooding and helps filter out pollutants through detention, infiltration, and filtration.

Detention

Large planted areas can be used to detain or temporarily store rainwater, allowing water to be absorbed by plants and the soils rather than run directly into the storm drains. This decreases flooding by preventing the drainage system from being overloaded with stormwater runoff.

Infiltration

By allowing water to infiltrate or flow back into the soil, recharging groundwater. A balanced water table reduces the constant expanding and shrinking of our clay soils and shrinking of our rich organic soil, which in turn helps to stop the ground in urban areas from sinking, a process called subsidence.

Filtration

Plants are a key aspect of green infrastructure because as rainwater flows through the plants, the roots absorb the dirty water and filter pollutants before they can reach pipes and drains. Soil microbes also filter out pollutants. This means cleaner water flows into our lakes and bayous, benefitting recreation and fishing.

DETENTION: Temporarily store each drop of rain as close as possible to where it falls

INFILTRATION: Store runoff to increase re-charge of groundwater

FILTRATION: Store and convey runoff to facilitate pollutant removal by plants and soil

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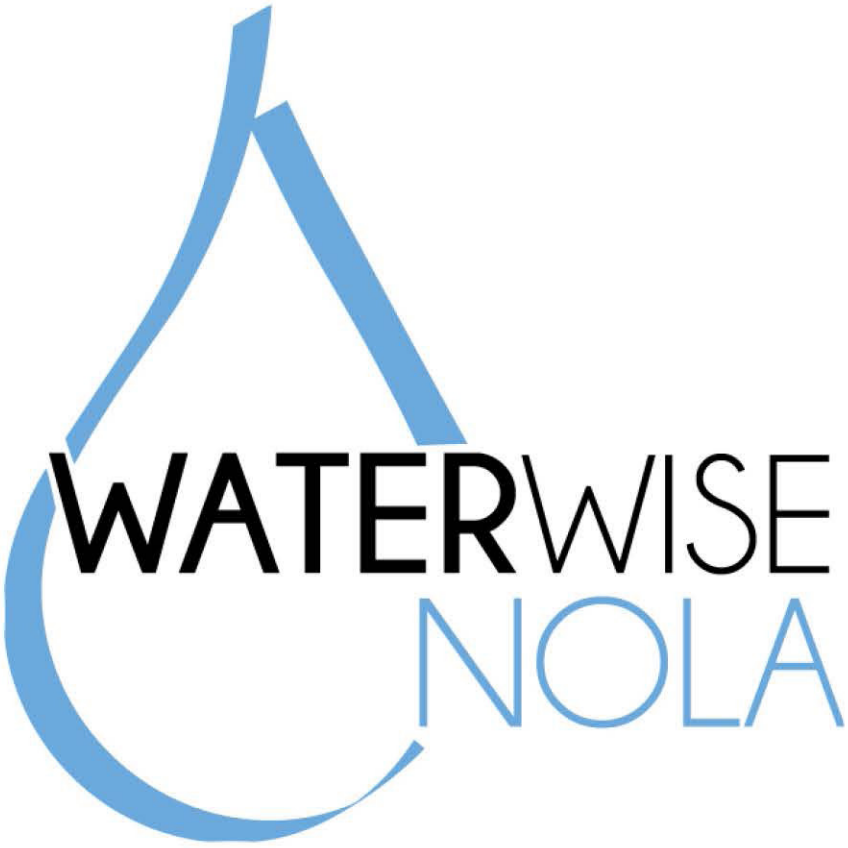


Section 4
Types & Benefits of Green Infrastructure

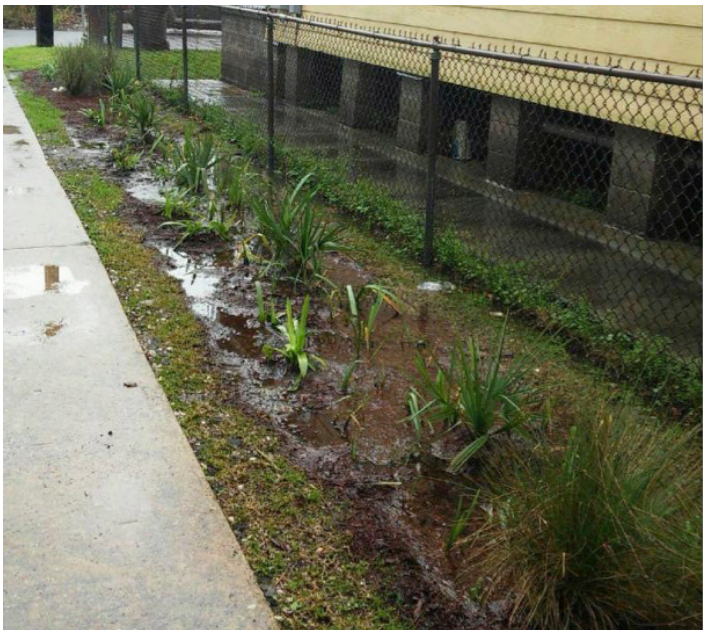
4. TYPES AND BENEFITS OF GREEN INFRASTRUCTURE

TYPES OF GREEN INFRASTRUCTURE

Green infrastructure is a term that includes different features and facilities that manage stormwater, whether they involve plants or not. Typical green infrastructure that utilizes plants and soil to slow, detain, and filter stormwater are raingardens, bioswales, stormwater planters, and trees. French drains, infiltration columns, and infiltration pits are filled with coarse gravel and, although not planted, can be covered with lawn grass and still function. Pervious or permeable paving includes several different types of surfacing for patios, driveways, and sidewalks that allows water to enter the subsurface soil through the paving. Rain barrels are also a type of green infrastructure, one which collects stormwater runoff from roofs for reuse in irrigating vegetable and flower gardens, trees, and shrubs.

Raingarden

Raingarden



Bioswale

Bioswale



Different Types of Stormwater Planter Boxes

French Drain



Different Types of Pervious/Permeable Paving

Rain Barrel

Trees

Trees

BENEFITS OF GREEN INFRASTRUCTURE

On an individual property, the impact of small scale measures on water quality and quantity may be small, but the impacts can be significant when many people take these measures across their neighborhoods. All individual water management measures play a role in reducing stormwater runoff and pollution. Some of the major benefits of Green infrastructure include:

- *Can be implemented a little at a time,*
- *Less stormwater runoff leaves the property,*
- *Less stormwater enters the pipe drainage system,*
- *Stormwater can be captured, stored, and reused for irrigating gardens,*
- *More rainwater is absorbed into the soil to recharge groundwater and reduce subsidence,*
- *Less pollutants are pumped into our bayous and lakes,*
- *More trees and plants to improve neighborhood livability and provide urban wildlife habitat,*
- *Reduced air pollution,*
- *Reduced urban heat island effect, and*
- *Beautification.*

Note:
In Southeast Louisiana, we also face tropical storms and hurricanes. Green infrastructure consists of small-scale measures that are not intended to reduce our risk of flooding and pollution from very large storm events. The flood reduction benefits of green infrastructure come in dealing with the average rainfall we get throughout the year.

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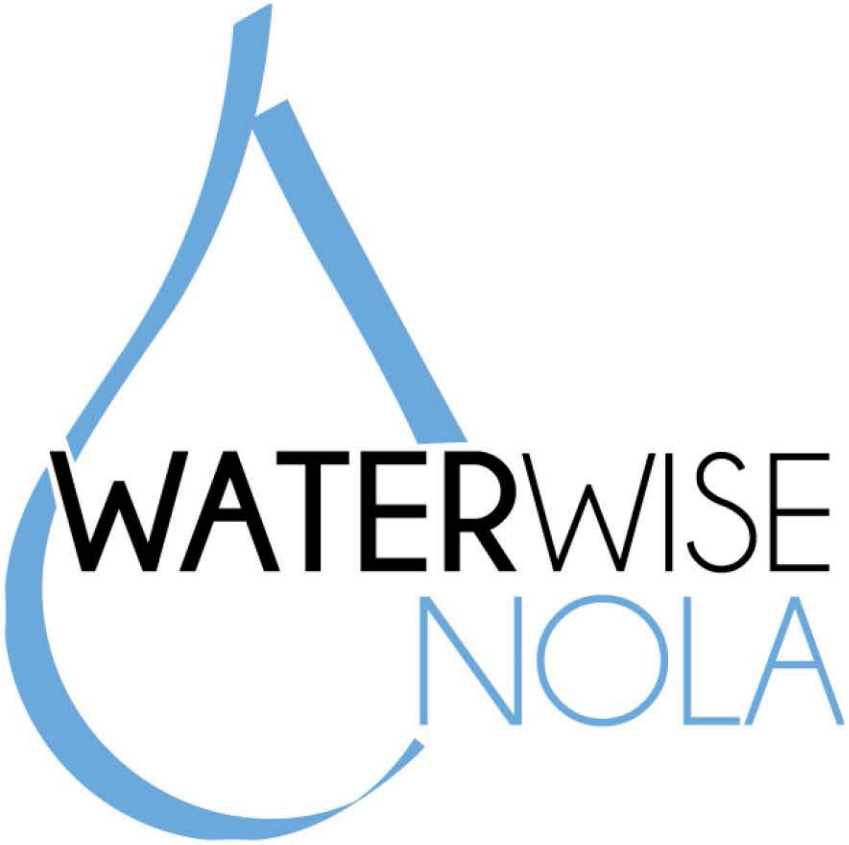


Section 5
Assessing Your Property

5. ASSESSING YOUR PROPERTY

Understanding your property from a different point of view than you may be used to is important in planning how to manage stormwater. Assessing your property includes drawing a plan of the property line and built features, identifying how water flows on the surface, identifying where standing water sometimes occurs, identifying your soil types, determining the best locations for green infrastructure, and calculating your runoff.

MAKING A MAP OF YOUR PROPERTY

You will need to measure and create a map of your property. If you have a copy of the plat plan that came with the house when you purchased it, that would make a good starting point. If not, you will need to conduct rough measurements.

Determine the Length of Your Pace

You can measure the size and location of features on your property using a tape measure, but that level of accuracy is not required. Knowing the length of your steps is adequate and very helpful to know, but you will need a tape measure to determine it the first time. From a spot you mark or can identify, walk naturally in a straight line for at least 10 steps and measure in inches the distance you walked. Divide the distance by the number of steps to calculate the length of your pace. The average length of paces is 30 inches but varies substantially.

Measure and Map Your Property

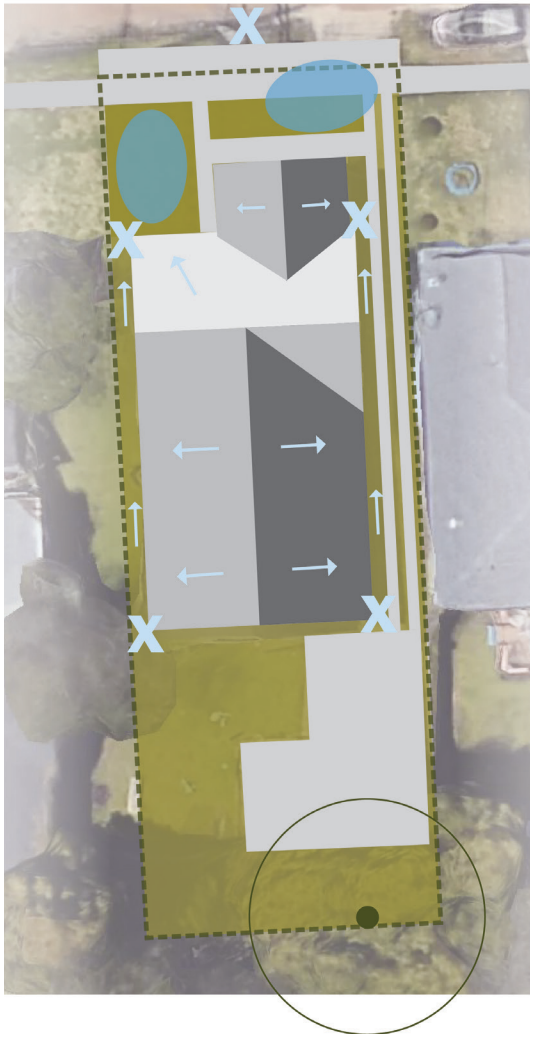
Pace off the width and depth of your property. If the shape of your lot is not rectangular, pace off the other sides as well. The number of paces multiplied by the length of your pace is the length in inches. Divide by 12 to convert the length to feet. Using the grid paper included in the back of this workbook, draw your property boundaries. Next, pace off the location of major features, such as the house, driveway, patio, fencing, carport, and garden shed, measuring from a property boundary perpendicular to the feature. Once you have drawn the location of two adjacent sides, pace off the size of the feature to complete it on your map.

If your roof has complex geometry, use online aerials photos, such as Google maps, to draw the hips and slopes of your roof. You will need to know where the roof slopes are to calculate roof runoff. The location and size of other features, such as planted areas, trees, vegetable gardens, and downspouts, can be estimated by eye and marked on the map. Also note whether your downspouts connect directly to underground pipes as in some New Orleans' neighborhoods. If you have access to a copier, make a few copies of the map in case you need them.

ASSESS YOUR PROPERTY

During a rainstorm, preferably one that is intense or long in duration, observe how water flows on your block and across your property and note it on the map. Stormwater runs off the surface of most residential lots from the back of the lot to the street where the catch basins and drainage pipes are located. Does more water flow out of any downspouts more than others? Are there areas by downspouts that erode due to the water outflow? If you do not have gutters and downspouts, does water that runs off the roof erode grass or soil where it hits the ground? If so, mark those locations. Does water flow from adjacent property or the street onto your property? Where does water collect and stand for an extended time after a rainstorm? Where does the lawn remain soggy after a rainstorm? Where does runoff leave your property?

Consider how you use the outdoor spaces at your home. Do you have large groups for barbecues or crawfish boils? Do you have dogs that need lawn space for running? Do you have small children or those who visit who need lawn space for playing? How much do you like to garden?



MAKE A GREEN INFRASTRUCTURE PLAN

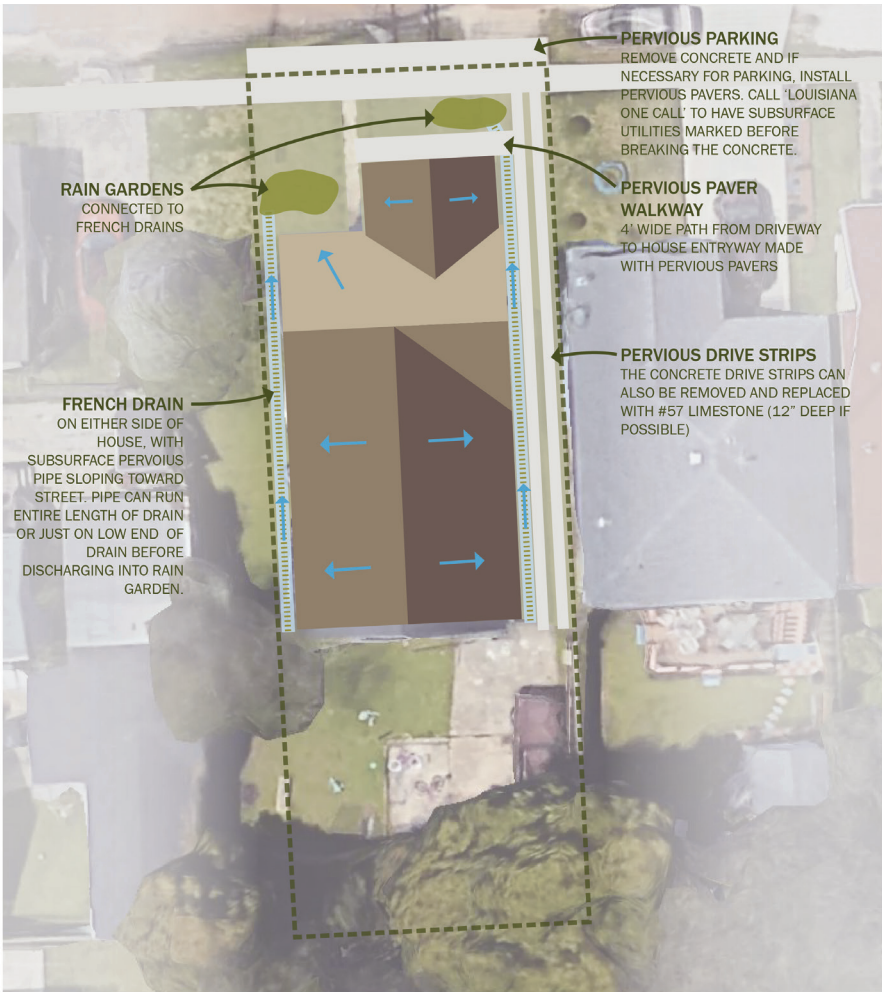
You can be ambitious with the plan but implement it a little at a time. One of the best characteristics of green infrastructure is that it can be built incrementally and have a positive impact on managing water as you go. Develop a plan that will manage the drainage problems you observed. Using one of the copies of your property map, draw where you would like to build green infrastructure.

The locations where you observed standing water or soggy lawn is a low point. Since runoff is already collecting there, it indicates a good location for a raingarden. Is there room in the area to excavate and plant a raingarden? You will size it in the next step when you calculate your stormwater runoff. Consider a bioswale or French drain to collect and convey runoff from other areas to the raingarden. Either of those linear green infrastructure features works well along narrow side yards.

French drains are well-suited along your house to collect downspout water and keep it away from the foundation. Also consider installing one or more rain barrels at downspouts, particularly if you like to garden, as plants and vegetables would prefer rainwater to tap water. Another downspout option is to build a stormwater planter to detain the roof water. If your roof does not have gutters, French drains can also be installed where the sloped roof water falls and hits the ground in order to dissipate the water's energy, as well as collect and convey it to the front of your property or a raingarden. If areas of your property collect a lot of water, consider building an infiltration column or pit, which can draw runoff farther downward into the soil than other green infrastructure types.

Are there paved areas of your front or back yards that can be removed or replaced with pervious paving? De-paving impervious surfaces reduces the amount of runoff you have to manage. Replacing it with pervious pavers or gravel helps the water infiltrate back into the ground.

Plant a tree, or more than one. If you build a raingarden, plant a water-loving tree, such as a Swamp Red Maple or Cypress, in it. As the tree matures, it will uptake more and more stormwater to the point when it can uptake as much as 1,000 gallons in a day if the water is available to the tree.



CALCULATE YOUR RUNOFF

You now know where and what types of green infrastructure you would like to implement and have drawn that on your plan. The next step is to calculate your runoff and size any raingardens you plan to build.

To calculate runoff, first measure in square feet (length in feet X width in feet, estimating distances for irregular shapes) the area of your roof, patio, driveway, or other impervious surface you plan to flow into the raingarden or bioswale, whether directly or indirectly by way of a French drain or bioswale. Consider whether you have runoff from more than one area, such as part of the roof and a patio. Use the following formula to calculate the amount of stormwater runoff, which may be of interest to you.

Area of impervious surface (in square feet) X 0.0833 X 7.48 = Gallons of water runoff

The simple formula provided below is based on a specific raingarden design. Raingardens, regardless of the amount of area they cover, are designed to be excavated at least 12 inches deep, filled with 9 inches of sandy soil leaving 3 inches of surface runoff storage, and planted with native plants.

Area of impervious surface (in square feet) X 0.18 = Area of the raingarden (in square feet)

As an example, a 500 square foot area of roof X 0.18 = 90 square foot raingarden

Raingardens do not have to manage all the stormwater runoff you calculate, so do not feel like you have to size the raingarden to be as large as calculated. Other factors determining raingarden size include the size of available area in the appropriate location and budget. Managing even a percentage of the runoff from your property provides benefits to you and your neighborhood. A raingarden can always be expanded in the future if there is space to do so.

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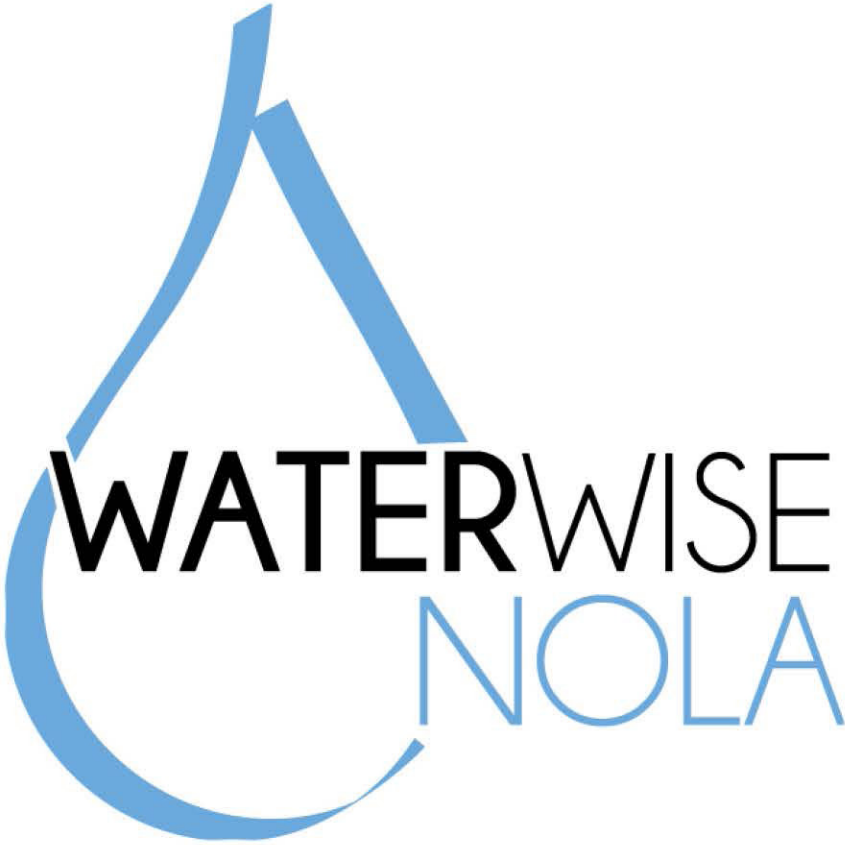


Section 6
Building Green Infrastructure

6. BUILDING GREEN INFRASTRUCTURE

HOW TO BUILD EACH TYPE OF GREEN INFRASTRUCTURE

Raingardens

A raingarden is a landscape feature designed to collect, retain, and infiltrate rainwater runoff before it can enter a storm drain. Raingardens allow water to percolate back into the ground, recharging the water table. Allowing water to flow through layers of porous, permeable material such as sand, gravel, and soil filters out pollutants, heavy metals, oil, and grease. Note: The raingarden build described below is for small-scale, residential use only. Any large-scale landscape feature should be advised and guided by a certified landscape architect or landscape designer.

Time Required: 2 days (weekend project)
Intensity of construction: Moderate: Heavy lifting; Excavating
Estimated Cost: Under $100.00

Materials needed (amount of materials will depend on raingarden dimensions):

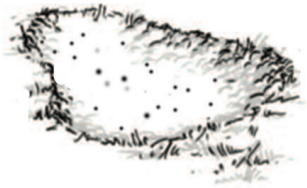
- *3" size gravel or crushed concrete*
- *Sand*
- *Planting soil*
- *Mulch*
- *String/paint (optional)*
- *Plant material*
- *Permeable liner (optional)*

Tools for construction:

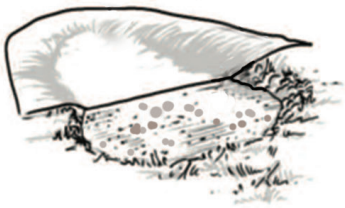
- *Shovel*
- *Gloves*
- *Tape measure*
- *Scissors/knife*

EXCAVATE

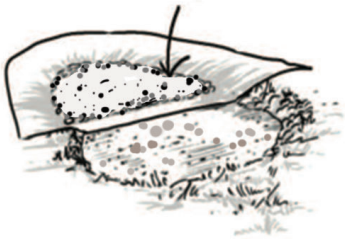
FILL WITH SAND



TOP SAND WITH GRAVEL AND A PERMEABLE LINER (OPTIONAL)



TOP WITH SOIL



PLANT NATIVE PLANTS

How to Build:

Step 1: Locate and assess site. Note nearby downspouts, natural pooling, and flow of rainwater.

Step 2: Calculating the drainage area. This can be measured multiple ways. Site plans for your building provide accurate square footage and usually display downspout locations. Google Earth's Ruler tool is a useful application to obtain these measurements. Observing your building and downspouts also works. Note: Roof drainage may not be evenly dispersed per downspout. Observing the slope of your roof and location of downspouts can help determine where rainwater drains. Be sure to capture the square footage of the roof draining towards your garden, along with additional yard space and/or pervious surfaces such as driveways, sidewalks, porches, etc.

Step 3: Mark perimeter of rain garden with string & stakes or paint. Excavate site according to measurements calculated. For this guide, 8"-12" is the recommended depth. Note: This step can be very labor intensive. Keep excavated soil nearby, as it can be used later (depending on type).

Step 4: Sand layer. The first layer to lay down into your excavation site is the sand. For a 12" depth, fill the site with 3.5" of sand, or about 30% of excavation, making sure to have a level surface once the sand is added. Lay the permeable membrane over the sand layer, allowing excess along the sides to be folded over the gravel layer. This will help keep the porous spaces free of debris and sediment.

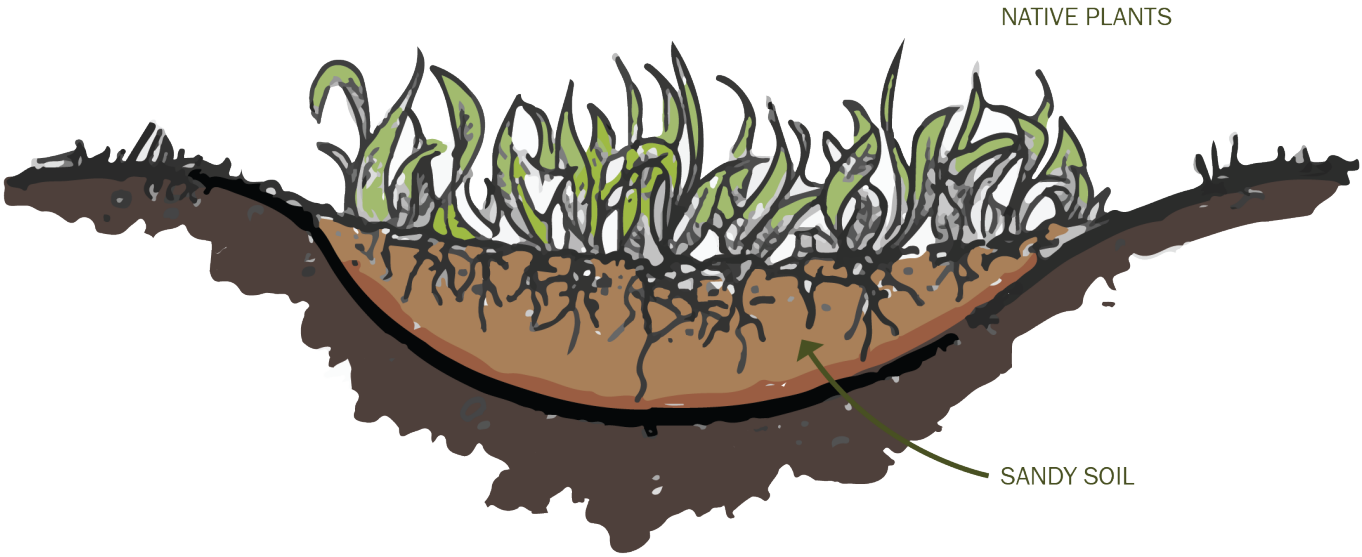
Step 5: Gravel/crushed concrete layer. Fill the next layer with 3.5" of gravel, or 30% of the garden depth with gravel or crushed concrete with a level surface. Wrap excess permeable membrane over the gravel layer, covering entire surface area.

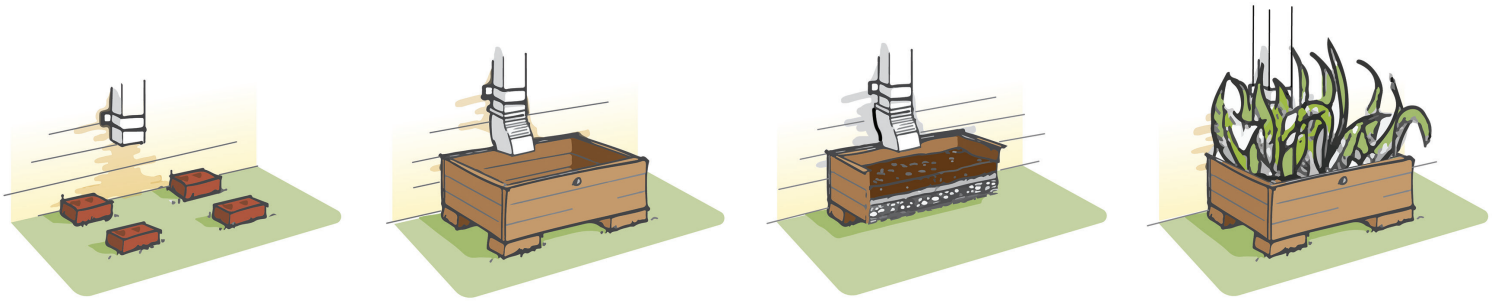
Step 6: Soil layer. Depending on the soil condition excavated earlier (avoid re-using clay soil), you can recycle the soil and use it for the garden or use store bought topsoil. Fill in the remaining site with soil, 3.5" or about 30% of garden depth, leaving a slight depression where surface runoff flows into the raingarden.

Step 7: Planting vegetation. Native vegetation is recommended. Look for a local list or guide for your area to find native vegetation. After vegetation is planted, a layer of mulch can be added to help improve soil productivity and keep weeds down.

Bioswales

Bioswales are designed just like raingardens, except that they are shallow, linear channels that convey runoff from one area of your property to another. As an example, a bioswales can be used to bring runoff from the backyard to a raingarden in the front yard.





Stormwater Planter Boxes

A planter box is a bioretention structure comprised of soil, gravel, and sand that holds rainwater usually received from a downspout. The structure can be made of a variety of recycled materials, such as an old wooden barrel, durable containers, bathtubs, etc. Within the planter box are layers of materials that help absorb and clean water. These layers include gravel on the bottom, followed by a layer of sand, and layer of soil media on top within native vegetation.

As water drains from the downspout, it is directed into the planter box instead of into a storm drain, the street, sidewalk, or urban site. If the amount of incoming water reaches the maximum capacity to which the planter box can hold, and overflow system will alleviate local flooding in the box. The ultimate goal is to allow the water to soak through the layers and allow the plants to absorb as much as possible, using the outflow as a mitigation measure for extreme quantities. As stormwater passes through the planting soil, pollutants are filtered, absorbed, and biodegraded.

TIME REQUIRED: 1 day
INTENSITY OF CONSTRUCTION: Moderate
ESTIMATED COST: Under $100

MATERIALS:

- *One whiskey barrel (half size) available at Home Depot (or other structure of choice)*
- *Permeable membrane*
- *Impermeable liner (options)*
- *Dependent on downspout and amount of water capturing:*
- *Sand*
- *Potting soil*
- *2.5" – 3" gravel or crushed concrete*
- *One 3" diameter PVC pipe (at least 3' in length)*
- *One 3" diameter elbow*
- *Two cinder blocks (recommended) or bricks*

TOOLS:

- *Electric drill*
- *3" Hole saw*
- *Handsaw and/or electric saw*
- *Scissors*
- *Staple gun (optional)*
- *Pen/pencil*
- *Level (recommended)*
- *Safety goggle*

HOW TO BUILD:

Step 1: Determine if you need a downspout diverter. If the downspout collects water from a roof area 100 square feet or less, it is possible for the planter to handle all of the rooftop runoff in a typical storm. If the square footage is greater than 100 square feet, an inline downspout diverter will need to be installed in the selected downspout.

There are many types of inline downspout diverters available that fit most downspouts.

Save the Rain Water Metal Diverter (2 x 3 or 3 x 4 dimensions) is available at Wal-Mart and online through Amazon, eBay, and Hayneedle. Y-Downspout Diverter (2 x 3 or 3 x 4 dimensions) is available at most major hardware stores. This diverter also calls for a flexible downspout extension. These diverters call for manually switching the flow of water either to the planter box or continuing down the downspout.

Step 2: Setting up a base. Position cinder blocks in place to provide a flat, sturdy base to hold the planter box. Bricks may also be used, but cinder blocks ensure evenness. You may not need a base if the site is already flat and even. Test the sturdiness of the base with the box (unfilled) -- this will also allow you to visualize where you will need to alter the downspout.

Step 3: Altering the downspout. While the planter box is in place, measure where to cut the downspout and add the inline diverter and/or flexible extension. Installation of the diverter depends on the type you choose.
Installation of inline downspout diverter:
Mark on your downspout where you will be installing the diverter (approximately 9" above planter box). Cut the downspout and attach the diverter by setting it into the downspout at the bottom and overlapping the downspout at the top. You can crimp the sides of the downspout so that the diverter fits tightly if necessary.

Installation of inline Y-shaped diverter:
This calls for the same technique with measuring and cutting the downspout. Additionally, use the zigzag component to reconnect to the main downspout and the flexible extension to direct a path to planter box. Additional component pieces are available to construct downspout diversion if necessary.

Installation of flexible downspout extension (only):
Rain water should be able to flow into the planter box without major splash. Use the extension to guide where you need to alter the downspout. Then, using safety goggles and a helping hand cut the downspout. The flexible downspout extension can fit over the cut line and can be directed as preferred into the planter box. Be careful of sharp edges.

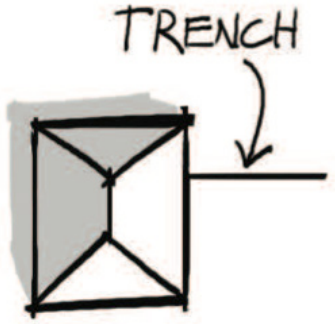
Step 4: Constructing the planter box. First you will drill the hole for the outflow pipe. The box should be empty. With a 3" hole saw, safety goggles, and a helping hand, drill a hole from the outside using an electric drill. The hole should be roughly 4" from the bottom of the box. This outflow will allow excess rainwater to drain out and should be positioned on the box and at the site where water can flow either into a grassy area or rock bed.

Step 5: Optional. Lining the planter box. Depending on the material of the box, an impermeable liner may be needed as a waterproof lining. Some wood materials may be treated and do not call for additional lining. Line the inside with the membrane, cut to size, and fasten using nails or a staple gun.

Step 6: Installing overflow pipe. The 3" PVC piping may need to be cut down to fit into the planter box. The overflow will ultimately take an "L" shape in the box. First measure the horizontal pipe and alter it using a saw. Fit it through the outflow hole, attach the elbow, and connect the vertical pipe. This pipe may also need to be cut down. It should rise up just below the brim of the box, allowing water to drain out

through the pipe before spilling over the edge in a heavy rain event. Once the overflow pipe is installed you can start filling in the planter box.

Step 7: Before adding layers of rock, sand and soil -- position the planter box in place as it will become extremely heavy and difficult to move once filled. First, add the layer of rock or crushed concrete to fill 30% of the barrel. Add a layer of permeable membrane (this will prevent smaller particles of sand and debris from clogging the pore spaces). Continue layering with sand (20% of barrel) and another layer of permeable liner with soil (30% of barrel) as the top layer. A splash box should be placed to dissipate energy from the outflow water and prevent any local erosion.



French drains

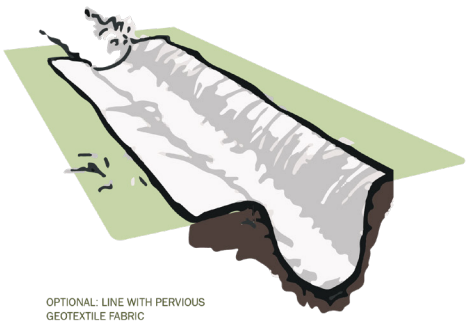
A gravel trench, also known as a French drain, is a long, narrow, gravel-filled ditch that catches and treats stormwater runoff. A gravel trench is ideal for narrow spaces, often found alongside buildings and driveways, and for receiving water from downspouts. A gravel trench works by allowing for natural infiltration of runoff into subsurface soils, while trapping pollutants and sediment and reducing peak flows. The majority of runoff is stored in the void spaces within the gravel and eventually released into subsurface soils or through an underdrain, if applied. A major advantage of implementing a gravel trench around your home is that they can be easily integrated into existing developments and require little maintenance.

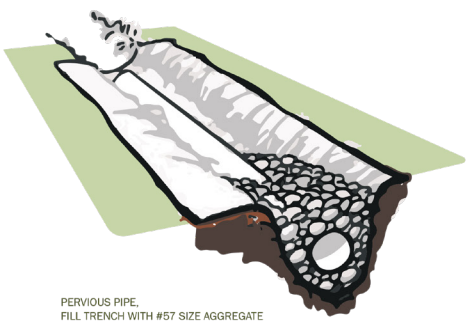
A gravel trench is constructed by layering beds of filter medias – sand, 1.5 to 2.5-inch gravel or crushed concrete, and pea gravel on top. A permeable membrane should be laid between the different layers, to prevent clogging as well as help to trap debris and sediment. An average size of a homeowner's gravel trench is around 2 feet wide and 4-5 feet deep plus a necessary foot of native soil. The deeper depth of the trench will allow for more storage capacity of water and flow control of runoff. An overflow pipe as well as an underdrain are optional additions and may be more beneficial in southeast Louisiana given our excessive rainfall and flash flooding events. These will both prevent ponding and resuspension of sediments during heavy rainfall events.

Time required – 1 day
Intensity of construction – Moderate: Some heavy lifting; Excavating
Estimated Cost - Under $100.00

Materials needed:

- Amount of materials will depend on gravel trench dimensions
- Permeable iner (optional)
- 3" size gravel or recycled/crushed concrete
- 4" diameter of Polyethylene perforated pipe (for underdrain)





Tools for construction:

- *Shovel*
- *Gloves (optional)*
- *Scissors or knife*
- *Handsaw*

HOW TO BUILD:

Step 1: Survey site. Using a hose or string, mark out the path or area for your trench.

Step 2: Dig your trench. Dig the ditch approximately 24 - 36” deep and at least 6” wide. The larger the surface area, the more drainage you will achieve, however, the depth must be greater than the width. Additionally, the receiving end needs to be shallower than the terminal end to allow water to slowly flow the length of the trench.

Step 3: Filling in the trench. Lay the liner down, covering the entire surface area of the trench, with plenty of excess along the sides to lap over the gravel. Add a thin layer (4-6” deep) of gravel along the entire length of the trench. *Be sure to keep the slope. Lay the perforated pipe in along the entire length of the trench. Once the pipe is in, the remaining crushed stone can be added around and covering the pipe. Fold the liner back over the surface of the crushed stone (similar to a burrito), making sure to cover the entire surface area. This will help keep the pore spaces within the large stone open and not clogged with pea gravel, debris, or sediment. Add a layer of pea gravel, soil, or stone of your choosing over the liner. Note: Pea gravel is not necessary, and the trench can be comprised of all larger, crushed stone, depending on preferred aesthetics.

Additional Notes:
Removing trash and debris from gravel is a routine maintenance check to help keep the feature from clogging. It is also a good idea, as with all constructed BMPs, to observe the gravel trench in action during a rain event. Check the condition of the permeable membrane every so often. If holes in the liner are present, repair is recommended. If the damage is excessive, the membrane should be replaced.

Rain barrels

A rain barrel is a rainwater capturing feature that collects and stores water for non-potable usage. Rainwater is collected as it drains from rooftops via a downspout or sheet flow and captured before entering storm drains. They are an easy and efficient way to harvest and reuse water in gardens and other planted areas and a way to save money. Diverts rainwater from municipal drainage system - reduces stormwater runoff - less pollutants in our lakes and water bodies

- *Provides vital resource - free water supply - more valuable than gold!*
- *Better than tap water for plants and soil microbes*
  -- more oxygen and nitrogen
  -- no chlorine, ammonia, or fluoride
  -- no calcium or magnesium ("soft" water)
- *Reduces demand from Mississippi River and water treatment plants*

COMPONENTS OF A RAIN BARREL

1. RAINWATER = key component
2. CATCHMENT = surface where rainwater falls (roof)
3. CONVEYANCE = gutter and downspout
4. FLEXI-PIPE / ELBOW = modifies downspout (A DIVERTER can be used at the downspout to intercept the rainwater flow and fill the barrel)
5. INLET = screened opening at top
6. CONTAINER = barrel for detention of rainwater
7. OVERFLOW = means to direct excess rainwater
8. OUTLET = hose bibb or spigot
9. BASE = elevated and level
10. SPLASH BLOCK = used at end of overflow to prevent erosion
11. THE HARVESTER = You! The person who manages the system

INSTALLATION BASICS

Where will you place your rain barrel?

- Connected to a downspout or capturing rain from roof sheet flow?
- Easy access for regular use and daily maintenance

How will you direct rainwater into your barrel?

- Modify downspout by cutting above barrel top and attaching elbow(s) to direct rainwater
- Install diverter connecting downspout and barrel via tubing

It's all about that base

- Elevate your barrel to increase water pressure
- You will want to fit your watering can or 5-gallon bucket under spigot
- Use materials able to support weight of full barrel and will not rot
  -- concrete blocks, bricks, stacked pavers, wood, fiberglass, reinforced plastic
- Level! Level! Level! (pea gravel helps)

MAINTENANCE REGIME

DAILY

- Watch the weather and anticipate rain!
- Empty your rain barrel to make room for the next downpour.

WEEKLY

- Empty the colander of all debris.
- Monitor for mosquitoes and mosquito larvae in your barrel. If you see evidence of mosquitoes in your barrel, empty it or add Bti (mosquito dunk).
- Make sure the screen over your inlet is taut and all gaps are covered with screen.
- Check your overflow to make sure it's not clogged. Clean it, if it is.
- Since you're thinking about the big picture, clean the storm drains around your house, even if they're next door or across the street.

MONTHLY

- Monitor base to make sure your barrel is level. Shore it up if it is not.
- Check conveyance to make sure all parts are connected and flowing.

SPRING/FALL

- Remove all debris from your roof.
- Clean out your gutters, even if you have a leaf guard.

ANNUAL

- Clean out barrel with mild detergent or vinegar using a long-handled scrub-brush. Rinse barrel over lawn—not over the street drain.

HURRICANE SEASON

- If a tropical storm or hurricane is predicted to hit, empty barrel and put it inside. Consider modifications to your downspout. If you want to fill your barrel, take it off the base to fill.

FEAR OF MOSQUITOES? BE PROACTIVE!

- Know the life cycle of a mosquito: adult > eggs (raft) > larvae (wriggler) > pupae > adults
- Check your barrel for possible entry points or exposed standing water
- Every couple of days, use your hand to splash any rainwater that may be standing on the lid to speed up evaporation. Mosquitoes love standing water.
- If you believe mosquitoes are breeding in your rain barrel, add a mosquito dunk or (Bti), or your empty barrel completely. Check your gutters. Check for mosquito entry points. Are all barrel openings covered by mosquito screen?
- Eliminate exposed standing water from other culprits around the house
- If your mosquito netting is intact and there are no leaks where mosquitoes can enter the barrel, your rain barrel should be mosquito-free

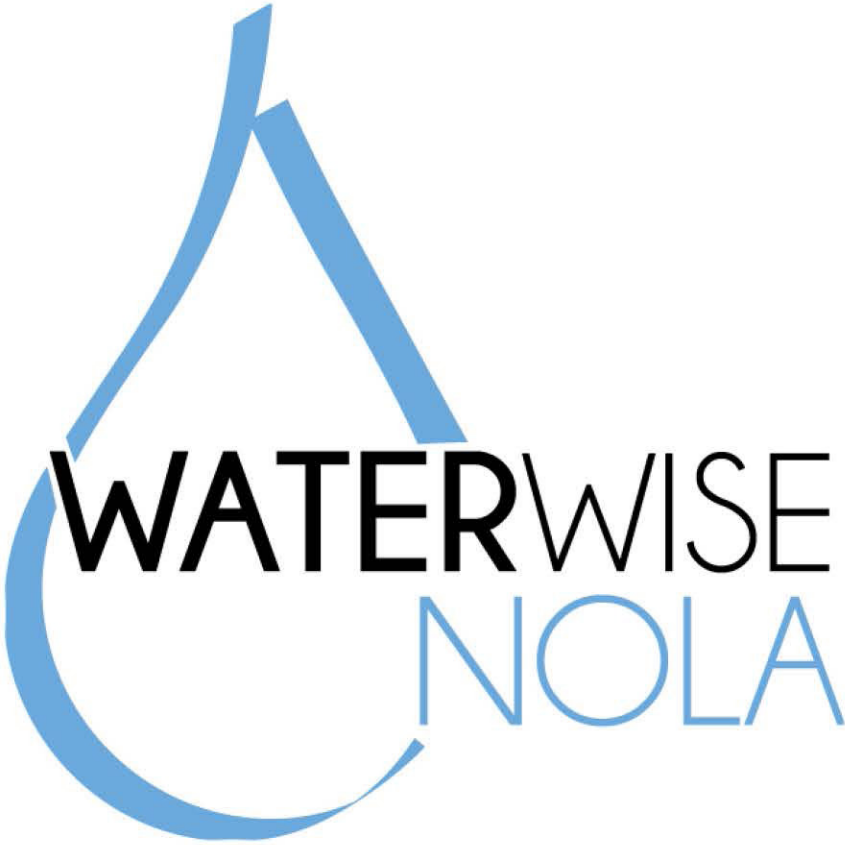
Trees

A mature Cypress tree can uptake as much as 1000 gallons of water each day if water is available to it, making it a champion stormwater manager. To achieve even more benefits, consider de-paving areas of your property and planting one or more trees there.

How to plant a Tree:

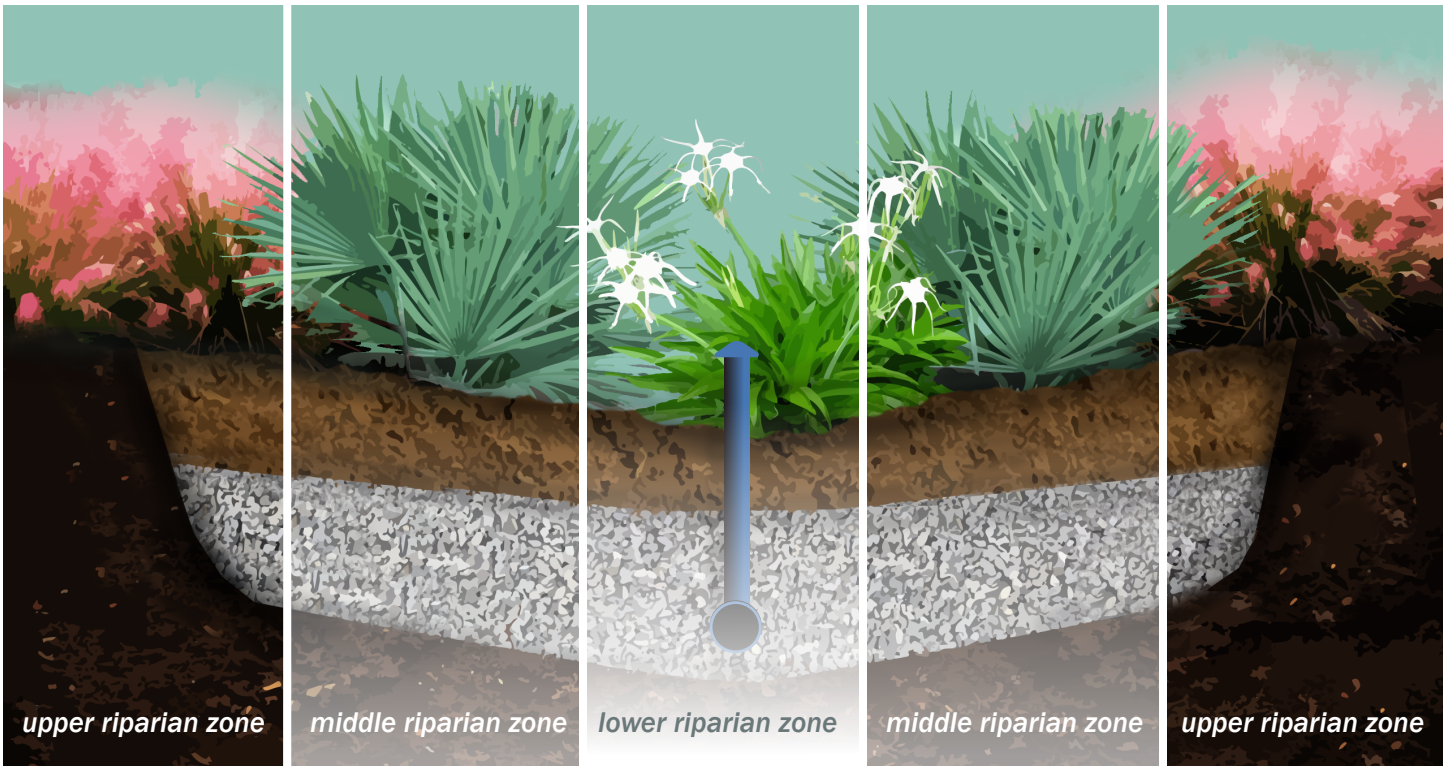
1. Determine an appropriate location
   -- If you place a tree in the public right of way, you will need a permit
   -- If in front of the house, call ahead to have utility lines marked
2. Select the appropriate tree
3 Obtain a permit to plant the tree (see https://www.nola.gov/nola/media/One-Stop-Shop/Parks%20and%20Parkways/PP-Tree-Planting-Permit-Application.pdf for more information)
4. Dig a hole 3-4 times wider than the container of the tree
5. Dig the hole so that the root collar sits just above the soil
6. Create a water basin around the tree
7. Add Mulch around the tree
8. Water the tree once or twice a week during the first year of planting the tree

Water Wise Workbook



Section 7
Planting Green Infrastructure

7. PLANTING GREEN INFRASTRUCTURE



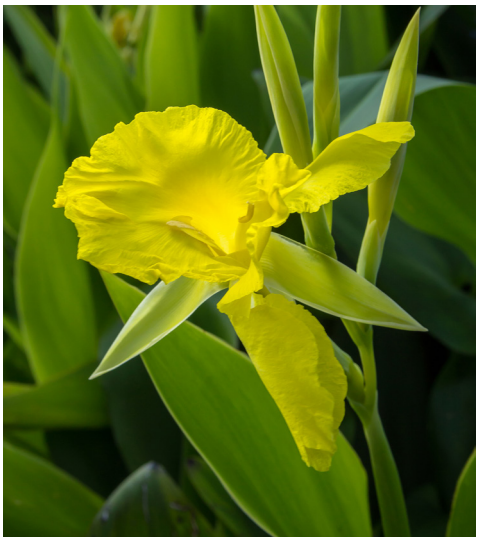
Green infrastructure is designed to be inundated with stormwater runoff and times and to be dry at other times. Raingardens, bioswales, and stormwater planters will thrive and perform stormwater management functions best if they are planted with native plants and in accordance with how wet the soil will become. Green infrastructure seeks to mimic natural hydrology, so riparian habitats, found along the banks of streams and lakes, are used as a model for proper planting.

Riparian habitat zones can be very complex along some water bodies, but for the purpose of green infrastructure design zones are simplified into only three: upper, middle, and lower riparian zones. Upper riparian zones endure frequent downpours, but overall remain relatively dry. Vegetation planted in the upper zone requires well-drained soils because these plants cannot endure inundation. In the middle riparian zone, plants may experience 1 to 2 inches of temporary inundation, so they are selected based on their ability to tolerate saturated soils for longer periods of time than plants in the upper zone. Lower riparian plants will tolerate up to 6 inches of temporary inundation, even thriving in consistently saturated soils, a condition sometimes called “wet feet.”

SCIENTIFIC NAME	COMMON NAME	PLANT TYPE	WATER			SUN			SIZE	
			Upper Riparian	Middle Riparian	Lower Riparian	Full Sun	Partial Shade	Shade	Height	Spread
Small Shrubs: 1' - 5'										
Crinum americanum	American Crinum Lily	perennial			■	■	■		3'	3'
Dietes bicolor	Fortnight Lily	perennial				■	■		30"	1'
Dietes grandiflora	African Iris	perennial			■	■	■		4'	2'
Dietes x 'Nola Alba'	Katrina Bi-Color Iris	perennial			■	■			3'	4'
Glandularia bipinnatifida	Prairie Verbena	perennial					■		1'	1'
Hymenocallis liriosme	Swamp Lily/Spider Lily	perennial			■	■			2'	2'
Iris brevicaulis	Zig Zag Iris	perennial			■	■	■		2'	1'
Iris fulva	Copper Iris	perennial			■	■	■		3'	1'
Iris hexagona	Dixie Iris	perennial			■	■	■		4'	2'
Iris virginica	Southern Blue Flag Iris	perennial			■	■	■		4'	2'
Juncus effusus	Soft Rush	perennial			■	■			2'	1'
Liriope muscari	Liriope	groundcover					■	■	6"	2'
Lobelia cardinalis	Cardinal Flower	perennial					■		3'	1'
Muhlenbergia capillaris	Pink Muhly Grass	grass				■	■		3'	3'
Muhlenbergia capillaris 'White Clou	White Muhly Grass	grass				■	■		3'	3'
Neomarica gracilis	Walking Iris	perennial			■	■	■		2'	2'
Phlox divaricata	Louisiana Phlox	perennial					■	■	1'	1'
Schizachyrium scoparium	Little Bluestem	grass				■			2'	1'
Medium Shrubs: 5' - 10'										
Callicarpa americana	American Beautyberry	deciduous shrub				■	■		6'	6'
Callicarpa americana var. *lactea*	White American Beautyberry	deciduous shrub				■	■		6'	6'
Canna flaccida	Water Canna	perennial			■	■			5'	2'
Canna glauca	Water Canna	perennial			■	■	■		6'	2'
Crinum asiaticum	Asian Crinum Lily	perennial			■	■	■		6'	6'
Hibiscus coccineus	Native Red Hibiscus	deciduous shrub			■	■	■		6'	5'
Hibiscus militaris	Soldier Mallow	deciduous shrub			■	■	■		5'	4'
Iris giganticaerulea	Giant Blue Iris	perennial			■		■		6'	1'
Iris pseudacorus	Yellow Flag Iris	perennial			■	■	■		5'	2'
Itea virginica	Virginia Sweetspire	deciduous shrub			■		■		6'	4'
Osmunda regalis	Royal Fern	fern			■		■	■	5'	3'
Sabal minor	Dwarf Palmetto	evergreen shrub			■	■	■	■	8'	5'
Solidago altissima	Goldenrod	perennial				■			5'	2'
Solidago rugosa 'Fireworks'	Dwarf Rough Goldenrod	perennial			■	■			5'	2'
Spartina alterniflora	Smooth Cordgrass	perennial			■	■			6'	1'
Large Shrubs: > 10'										
Myrica cerifera	Southern Wax Myrtle	evergreen shrub				■	■		10'	8'
Rhododendron canadense	Honeysuckle Azalea	deciduous shrub				■	■	■	10'	5'
Viburnum nudum	Swamp Viburnum	deciduous shrub					■		12'	12'

SCIENTIFIC NAME	COMMON NAME	PLANT TYPE	WATER			SUN			SIZE	
			Upper Riparian	Middle Riparian	Lower Riparian	Full Sun	Partial Shade	Shade	Height	Spread
Small Trees: < 25'										
Cercis canadensis	Eastern Redbud	deciduous tree							20'	15'
Ilex decidua	Possum Haw	deciduous tree							12'	8'
Ilex x attenuata 'Fosteri'	Foster's Holly	evergreen tree							20'	12'
Medium Trees: 40' - 25'										
Betula nigra 'Heritage'	Heritage River Birch	deciduous tree							30'	20'
Ilex cassine	Cassine Holly	evergreen tree							30'	12'
Ilex vomitoria	Yaupon Holly	evergreen tree							25'	15'
Salix nigra	Black Willow	deciduous tree							35'	25'
Large Trees: > 40'										
Acer rubrum var. *drummondii*	Swamp Red Maple	deciduous tree							60'	40'
Nyssa aquatica	Water Tupelo	deciduous tree							50'	30'
Quercus falcata var. *pagodifolia*	Cherrybark Oak	deciduous tree							60'	40'
Quercus lyrata	Overcup Oak	deciduous tree							80'	100'
Quercus nuttallii	Nuttall Oak	deciduous tree							40'	25'
Quercus virginiana	Southern Live Oak	evergreen tree							50'	75'
Taxodium ascendens	Pond Cypress	deciduous tree							80'	20'
Taxodium distichum	Bald Cypress	deciduous tree							100'	60'
Ulmus alata	Winged Elm	deciduous tree							50'	30'
Ulmus americana	American Elm	deciduous tree							60'	40'

Lower Riparian Zone Only



Canna flaccida

Spartina alterniflora

Nyssa aquatica

Lower and Middle Riparian Zones

Hymenocallis liriosme

Iris brevicaulis

Iris fulva

Iris hexagona

Iris virginica

Juncus effusus

Neomarica gracilis

Canna glauca

Hibiscus coccineus

Hibiscus militaris

Iris giganticaerulea

Iris pseudacorus

Itea virginica

Osmunda regalis

Sabal minor

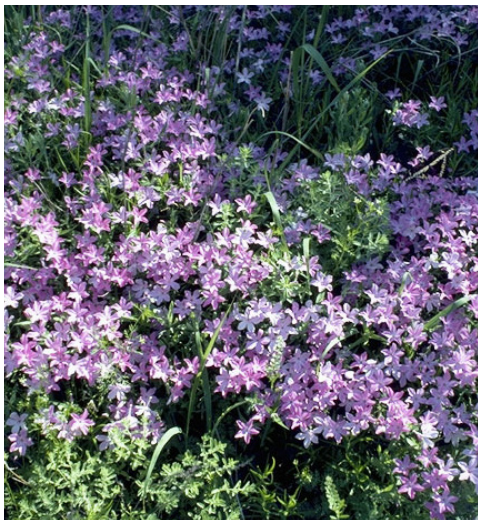
Lower and Middle Riparian Zones

Solidago rugosa 'Fireworks'

Ilex deciduc

Taxodium Ascendencs

Middle Riparian Zone Only



Phlox divaricata

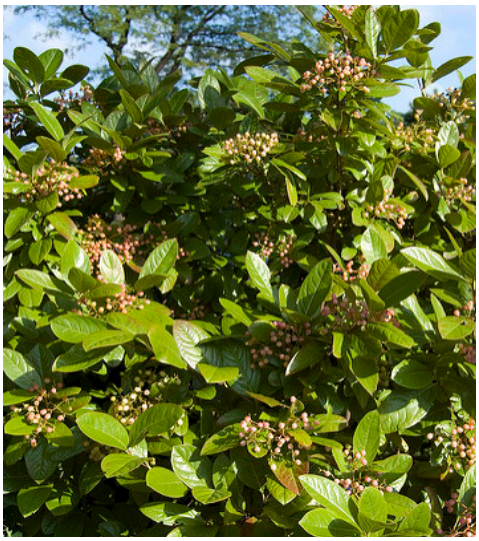
Dietes bicolor

Liriope muscari

Lobelia cardinalis

Schizachyrium scoparium

Myrica cerifera



Viburnum nudum

Ilex attenuata 'Fosteri'

Betula nigra 'Heritage'

Quercus lyrata

Middle and Upper Riparian Zones

Quercus nuttallii

Ulmus americana

Upper Riparian Zone Only

Glandularia bipinnatifida

Muhlenbergia capillaris

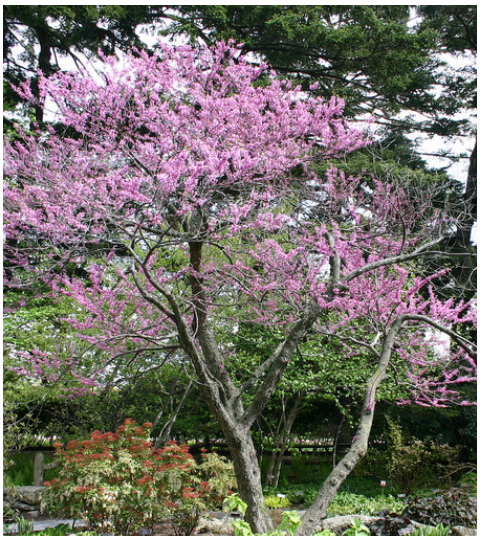
Muhlenbergia capillaris 'White Cloud'

Callicarpa americana

Callicarpa americana var. *lactea*

Solidago altissima

Rhododendron canadense



Cercis canadensis

Ulmus alata

Suitable for Upper, Middle, and Lower Riparian Zones

Crinum americanum

Dietes grandiflora

Dietes x ' Nola Alba'

Crinum Asiaticum

Ilex cassine

Ilex vomitoria

Suitable for Upper, Middle, and Lower Riparian Zones

Salix nigra

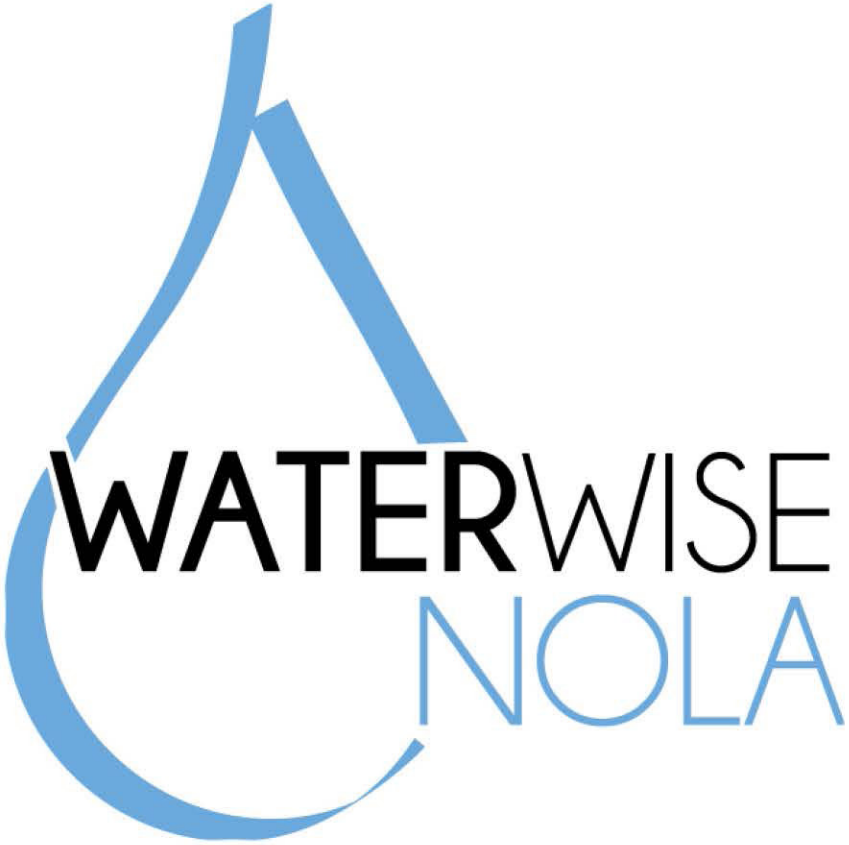
Acer rubrum var. *drummondii*

Quercus falcata var. *pagodifolia*

Quercus virginiana

Taxodium distichum

Water Wise Workbook



Section 8
Getting Involved in Your Neighborhood

8. GETTING INVOLVED IN YOUR NEIGHBORHOOD

BECOME A STORMWATER CHAMPION

Even if only a few homeowners in your neighborhood get involved, localized flooding and pollution can be tremendously decreased. We encourage you to share this workbook with your friends and neighbors.

REPORT A PROBLEM AREA

Preventing stormwater pollution is everyone's responsibility. If you notice anything other than rain flowing into the street or down a storm drain, it could be a stormwater violation. If you think your neighbors are in violation:

- *Identify the source of the problem (leaking car, spill, wash water, crawfish boil residue, etc.)*
- *Prevent further damage: catch the leak, clean up the spill, stop washing, etc.*
- *Report the violation to your local municipality.*

MANAGE YOUR PROPERTY

How we manage materials on our property can affect the water quality in our local waterways. Debris from home improvement projects is easily pulled into the stormwater system if materials are not secured before a rainstorm. To protect our watershed, remember the following tips:

- *Cover piles of dirt and mulch being used in landscaping projects to prevent these pollutants from blowing or washing off your yard and into local waterbodies. Vegetate bare spots in your yard to prevent soil erosion.*
- *Pick up pet waste.*
- *Before beginning an outdoor project, locate the nearest storm drains and protect them from debris and other materials.*
- *Sweep up and properly dispose of construction debris such as concrete and mortar.*
- *Clean paint brushes in a sink, not outdoors. Filter and reuse paint thinner when using oil-based paints. Properly*

dispose of excess paints through a household hazardous waste collection program, or donate unused paint to local organizations, such as the Green Project.

- *Use a commercial car wash or wash your car on a lawn or other unpaved surface to minimize the amount of dirty, soapy water flowing into the storm drain and eventually into our local waterbody.*
- *Recycle used oil and other automotive fluids at a local participating service station. DO NOT dump these chemicals down the storm drain or dispose of them in your trash.*
- *Sweep, instead of hosing off the driveway, street, or sidewalk.*
- *Remove all grass, leaves, dirt, and debris. Do not wash, sweep, or blow grass or yard waste into the storm drain. This material can be the basis of new rich soil if it is composted, or can be deposited in the trash.*
- *Keep drains clean and cleared of debris, leaves, and trash. In the fall, this may mean removing fallen leaves weekly.*
- *Use pesticides and fertilizers sparingly and follow the directions recommended by the manufacturer. Do not apply chemicals just before a rainstorm.*

ORGANIZE A NEIGHBORHOOD CATCH BASIN CLEANING DAY

The buildup of materials such as grass clippings, leaves, dirt, and trash can obstruct catch basins and lead to localized flooding during storm events. In the rainy Gulf South, this can be a serious problem. In many municipalities you simply call 311 to report a clogged or damaged catch basin, although you can do your part to keep them clean. Keep catch basins clear of debris by disposing of yard waste properly. In some municipalities you can even clean your catch basin out yourself. Make sure to check with your local municipality for any regulations.

Storm drain cleaning is relatively easy and is something that should be done consistently to capture litter, dirt, and debris and to ensure flow from our streets can enter into the system without carrying with it harmful pollutants.

Storm drain marking is labeling a stormdrain inlet with a pre-printed marker, tile, sticker, or stencil that reads “Dump No Waste - Drains to Lake”, “Drains to Wetlands”, or a similar written message that specifies

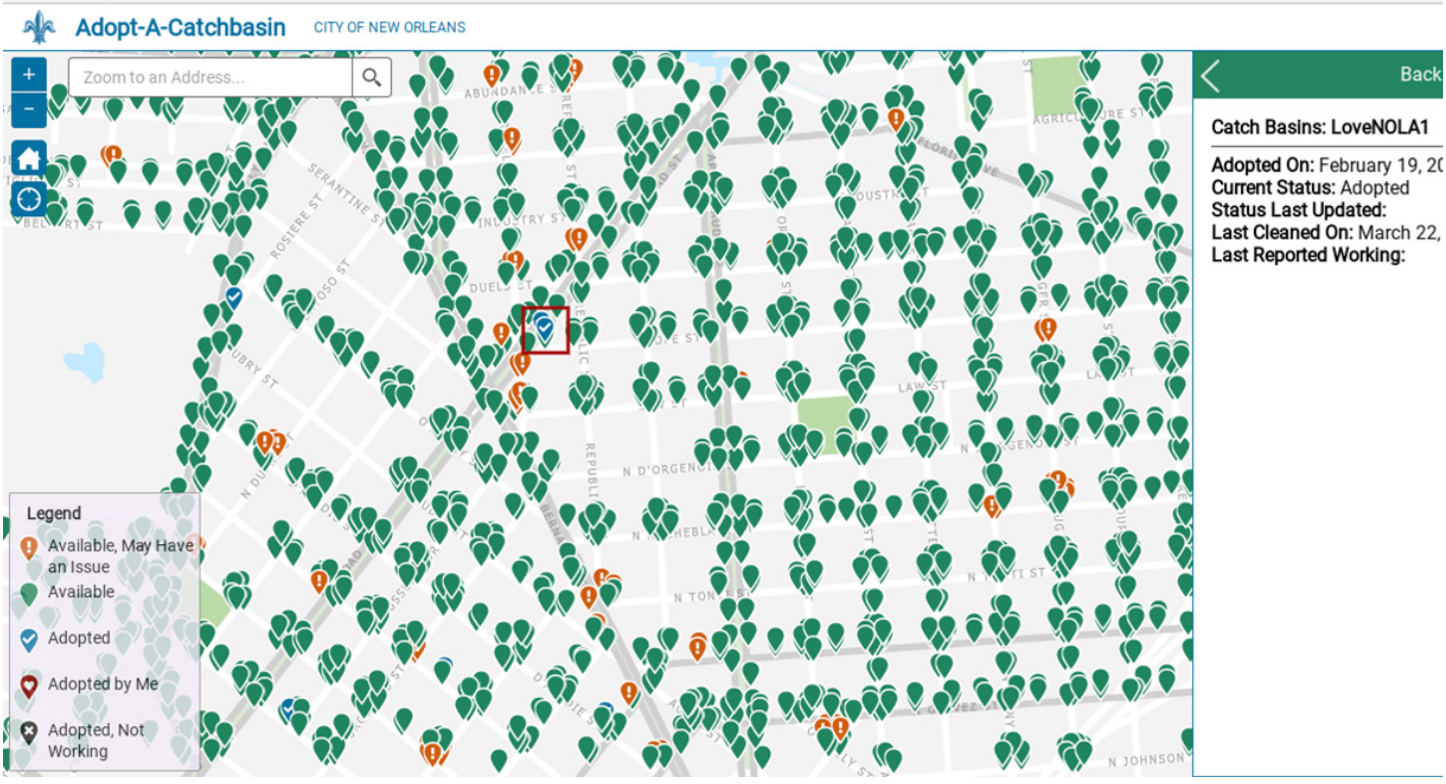
the waterbody to which the storm drain inlet drains. These markers can be requested locally through the Bayou Land RC&D Council or the Sewerage and Water Board (by calling 52-Water).

- *Sweep, instead of hosing off the driveway, street, or sidewalk.*
- *Remove all grass, leaves, dirt, and debris. Do not wash, sweep, or blow grass or yard waste into the storm drain. This material can be the basis of new rich soil if it is composted, or can be deposited in the trash.*
- *Keep drains clean and cleared of debris, leaves, and trash. In the fall, this may mean removing fallen leaves weekly.*
- *Use pesticides and fertilizers sparingly and follow the directions recommended by the manufacturer. Do not apply chemicals just before a rainstorm.*

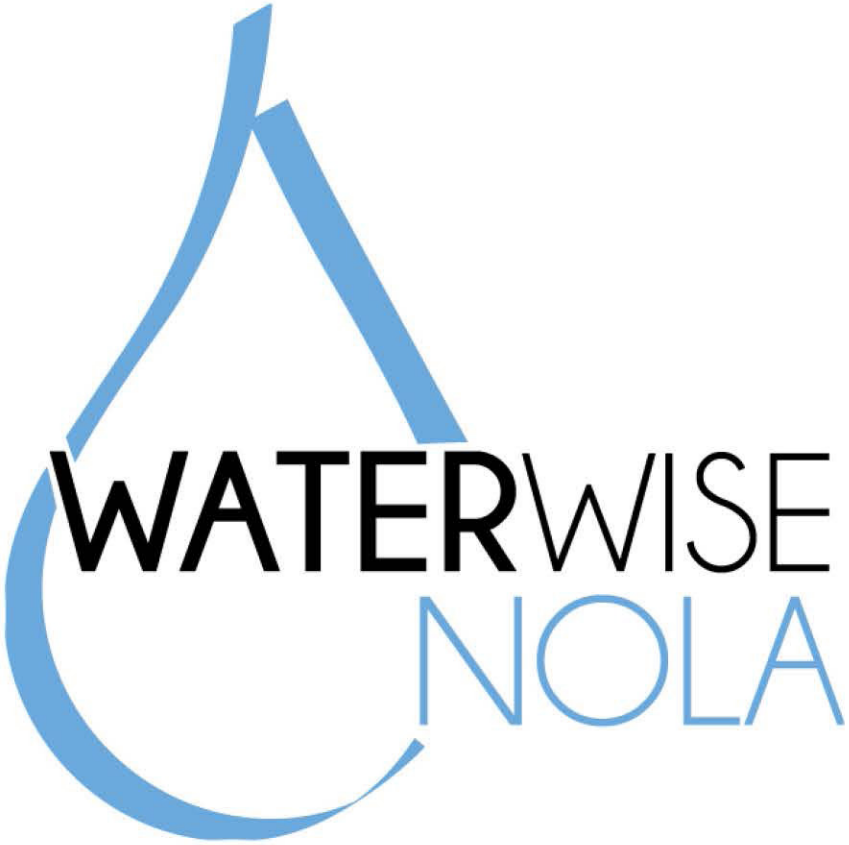
ADOPT A CATCH BASIN

To Participate:

1. Go to https://catchbasin.nola.gov/
2. Select a catch basin on the map, adopt it, and give it a name.
3. Sweep out the debris (leaves, trash, dirt, beads) from in front of the catch basin, bag it, and throw it away (see https://www.nola.gov/sanitation/trash/yard-waste/ for proper disposal procedures).
4. Watch the catch basin during the next storm.
5. Let the city know how it works! Report any clogged catch basins to 311.



Water Wise Workbook



Section 9
Water Wise Vocabulary

9. WATER WISE VOCABULARY

Aggregate or Gravel	Small rocks or stones that are graded based upon size. Crushed stone, gravel, or recycled concrete that is ¾" to 1" in size is categorized as #57. Crushed stone 3/8" to ½" in size are #8. Aggregate is used as a subbase of green infrastructure to provide water storage space.
Backflooding	Occurs when stormwater in an area has drained but comes back through pipes and catch basins because lower (down pipe) areas are overwhelmed.
Backflow	Stormwater that flows back up a pipe or canal.
Berm	A bank of soil that creates a small levee to contain water.
Best Management Practice (BMP)	Methods or techniques considered to be the most effective and practical for a particular situation.
Bioretention	Utilizes plants, soils, and soil microbes to removed pollutants from stormwater runoff.
Bioswale	A shallow channel with gentle side slopes that is planted with water-loving plants. It conveys and filters stormwater and allows water to soak into the ground and be taken up by plants.
Detention	Temporarily holding stormwater.
Downspout	A pipe that connects to gutters and directs stormwater runoff from the roof to the ground. Some are connected directly into an underground drain pipe.
Evapotranspiration	The total water evaporated by the sun and transpired by plants back into the atmosphere.
Filtration	The process by which plants, soils, and soil microbes clean pollutants from stormwater runoff.
French Drain	A narrow, aggregate-filled trench that catches and conveys runoff and allows it to soak into the ground. It also filters out sediment.
Grey Infrastructure	Catch basins, pipes, canals, and sometimes pumps to drain stormwater.
Green Infrastructure	Features that mimic the natural water cycle processes to detain, filter, and allow for infiltration of stormwater.
Groundwater	The water present below the surface in soil.
Hydraulics	The human-made way water is collected and moved through pipes and canals.
Hydrology	The natural way water runs off over land, in streams, and through soils.
Impermeable or Nonpervious	Areas with surfaces that do not allow water to flow through.
Infiltration	The process by which stormwater soaks into the ground, thereby recharging the groundwater.
Infiltration Column or Pit	A vertical hole or pit in the ground that is filled with aggregate. Located at low points, it captures and detains runoff, allowing it to soak into the ground.
Localized Flooding	Flooding of relatively small areas, such as a street or block, due to a drainage system that is at capacity.
Low Impact Development (LID)	A land development strategy that uses natural hydrological techniques to manage stormwater.

Pervious or Permeable Paving	A form of paving that allows water to flow through the paving to an aggregate layer and then to subsurface soils or storage. Can be pervious unit pavers, aggregate, pervious concrete.
Pervious Pipe	A plastic pipe with small holes that collects and convey water from surrounding soils.
Rain Barrel	A catchment barrel or system of barrels that catch and store stormwater runoff from roofs for reuse.
Rain Garden	A shallow depressed area planted with water-loving plants that receives stormwater runoff. Its functions are detention, filtration, and infiltration.
Recharge	Groundwater is recharged when stormwater has space, time, and permeable soils to infiltrate into the ground. The natural hydrologic cycle maximizes this. In urban areas, groundwater recharge is greatly reduced due to impervious surfaces.
Retention	Water that is retained, such as in a retention basin, and is held permanently. This creates a pond, lake, or basin. The area above the standing water line to the top of the banks is known as freeboard and allows for additional water to be stored.
Stormwater Planter Box	An above ground planter box of plants, gravel, and soil that receives stormwater runoff from a roof. Its function is bioretention.
Stormwater Runoff or Runoff	Rainwater that does not soak into the ground but rather flows over impervious areas or areas already saturated with water.
Subsidence	Settling or sinking of soil such that its elevation is lower than before it subsided. Clay soils shrink when ground water is drained and swell when the ground becomes wet again. Organic soil oxidizes (decomposes) when exposed to air due to draining of groundwater, making it permanently subsided.
Tree Canopy	The area of land that is covered by the above-ground branches and leaves of a tree. Tree canopies shade the ground, provide habitat, and intercept rainwater.
Tree Drip Line	The perimeter of a tree canopy where rainwater drips down. It generally reflects the extent of the tree's subsurface roots, but roots often extend beyond.
Urban Heat Island Effect	Higher air temperatures in urban areas are caused by paving with concrete and asphalt that absorb heat during the day and do not fully cool at night.
Watershed	An area of land surface that drains to a low point or water body. A watershed as small as a back yard is called a catchment area, while one as large as a region is called a basin, such as the Lake Pontchartrain Basin.