

RETAIN YOUR RAIN



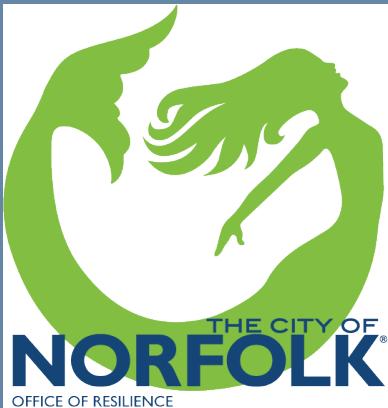
THE CITY OF
NORFOLK[®]

April 2021

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CONTRIBUTIONS

The **CITY OF NORFOLK**'s Office of Resilience would like to extend a gracious thank you and gratitude to our partners for all the hard work put into this project for the future of our city.





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INTRODUCTION

RETAIN YOUR RAIN (RYR) OVERVIEW

As a coastal city with **144** miles of shoreline, Norfolk is shaped by water. Water supports Norfolk's economy and provides beauty and recreation, yet water also represents one of our greatest challenges- flooding.

Several factors contribute to flooding in Norfolk. Sea level rise exacerbates flooding through higher tides and increases in storm surge, which reduce the effectiveness of storm water systems. Flat land and old undersized pipes in parts of the city delay rainwater runoff and cause water to pool in the streets. Currently after each rain event, Norfolk drains or pumps every drop of runoff, but our pipes and pumps can only handle so much at a time. When everyone forces water from their property into the drain at the same time, back flooding will occur. Think of our pipes as a roadway network at rush hour. There is simply too much too quickly resulting in a water traffic jam that causes flooding. In order to deal with increased flooding, Norfolk needs to think differently about how we manage water.

Norfolk has adopted a Resilience Strategy that focuses largely on finding new ways to manage and live with water and is encouraging its citizens to play a role. By installing home **RETAIN YOUR RAIN** Projects like rain barrels, rain gardens, bioswales, green roofs, and trees, you are capturing runoff and storing rain water so it doesn't

flow into the drain all at once or even at all. This takes pressure off the city's pipes and pumps and reduces flooding. Better yet, that water is used in a more beneficial way. You are not only helping to reduce flooding, but you are also addressing goals of other initiatives that the City has adopted including the Green Infrastructure Plan and the Climate Action Plan that contribute to the overall health and resilience of our communities and environment.

This is a comprehensive manual on how to incorporate **RETAIN YOUR RAIN** projects so that you can contribute to Norfolk's resilience and help build the coastal community of the future!



The **RETAIN YOUR RAIN** App is a web tool to help you determine whether you live in an "INFILTRATION" or "STORAGE" zone so that you can pick the appropriate **Home Projects**. Click the image to access the app.



BENEFITS

HERE ARE A FEW REASONS TO RETAIN YOUR RAIN

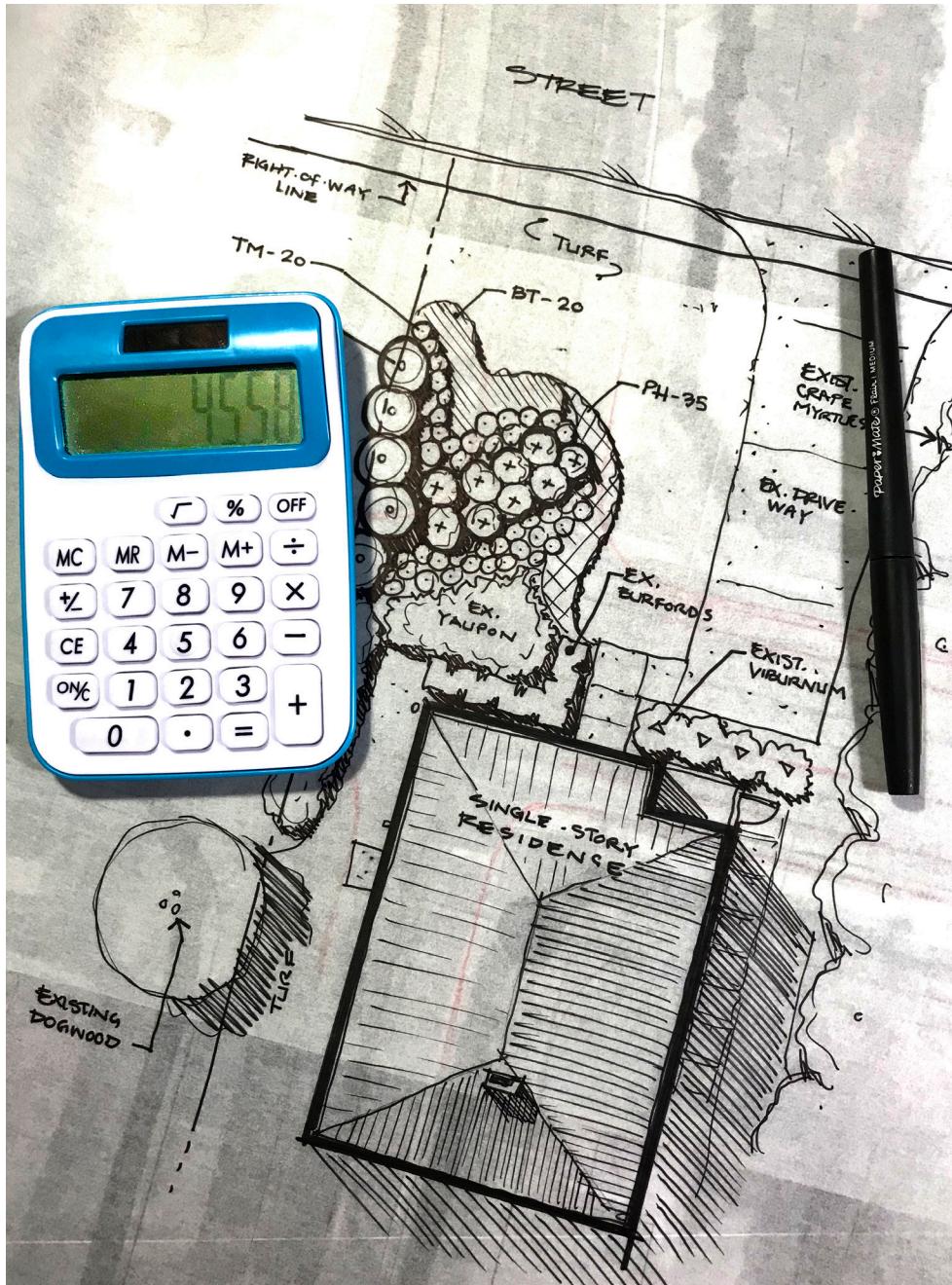
- Help mitigate storm and flood damage to your property in addition to mitigating flooding throughout the city of Norfolk.
- Storing water on your property to use for your plants or for other activities, instead of using city water.
- Trees provide beauty, habitat, absorb heat, produce oxygen, drink up lots of water, and when placed appropriately, reduce heating/ cooling costs of your home throughout the seasons.
- Reduce overload and wear-and-tear of stormwater infrastructure. The more water sent to the street means bigger pipes needed, and more tax money to maintain the system.
- Save on municipal water use, avoid purchases of unnecessary fertilizers and chemicals, & reduce maintenance costs.
- Plants provide beauty, food for pollinators, habitat, add value to your property, absorb and break down pollutants.



- You will be doing your part to contribute to the protection of the Chesapeake Bay and other watersheds.
- Properly maintained downspouts will keep water away from your home, reduce erosion, and prevent water from leaking into crawl spaces and under slabs.
- Minimize runoff and pollutants which can cause erosion and damage to waterways. When water soaks into the ground, this also recharges groundwater.
- Concrete and other impervious surfaces collect and radiate high amounts of solar heat during the summer. Reduce the urban heat island effect from buildings and pavement by planting trees and using green roof technology.
- Increase the presence of nature in the city. This has health as well as psychological benefits.

FINDING HELP

It is possible to receive grants from local foundations to help fund your **Home Projects**. Some of these groups may also have free or low-cost supplies and kits to help you. Consider signing up with one or more of these groups and be an advocate for sustainability. They can also provide you with additional advice and information.



Organizations:

Ask HR Green | Bay Star Homes

<https://askhrgreen.org/programs/bay-star-homes/>

Chesapeake Bay Foundation

<http://www.cbf.org/join-us/education-program/student-wave/shared-action-projects/>

City of Norfolk Office of Resilience

<https://www.norfolk.gov/3612/Office-of-Resilience>

City of Norfolk Stormwater

<https://www.norfolk.gov/index.aspx?NID=1689>

Elizabeth River Project

<https://elizabethriver.org/get-involved-0>

Friends of Norfolk's Environment

<http://www.foneonline.org/>

Norfolk Botanical Garden

<https://norfolkbotanicalgarden.org/learn/>

Norfolk Master Gardeners

<https://www.nmgy.org/>

Virginia Cooperative Extension

<https://ext.vt.edu/>

Virginia's Soil & Water Conservation Districts

<https://vaswcd.org/>

Wetlands Watch

<http://wetlandswatch.org/citizen-action>

HOME PROJECTS DEFINED



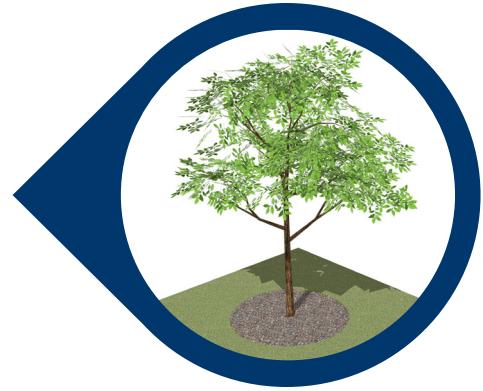
1. DOWNSPOUT DISCONNECTION:

The process of separating the roof gutter from the storm system or from discharging onto pavement.

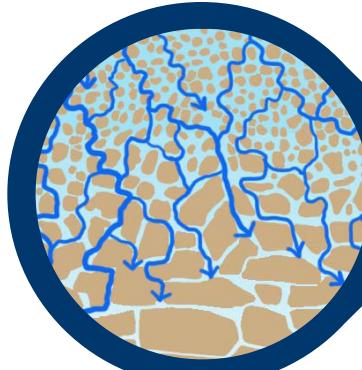
The gutter downspout gets redirected to disperse rainwater across a permeable surface, such as a garden or a lawn.



3. RAIN GARDEN: A small sunken garden that collects rainwater from a roof, driveway, or other paved area to provide a place for the water to soak into the ground. They help filter pollutants collected by the rainwater, provide shelter for wildlife, and beautify your property.



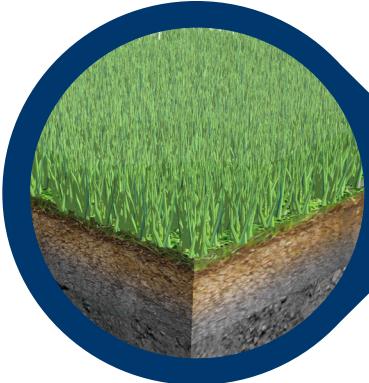
4. TREE PLANTING: The process of planting a tree into your yard for aesthetic appeal, wildlife habitat, flood reduction, and reduction in home energy cost. As the tree matures, these benefits increase over time.



5. INFILTRATION: The process by which water soaks into the ground through the soil. This is done by means of buried pipes and tanks that have holes for water to collect and soak into the ground instead of going to the storm drain.

6. CONSERVATION

LANDSCAPING: Is the practice of managing your property in a way that incorporates environmentally sensitive design, low-impact construction, non-invasive native plants, and integrated pest management.

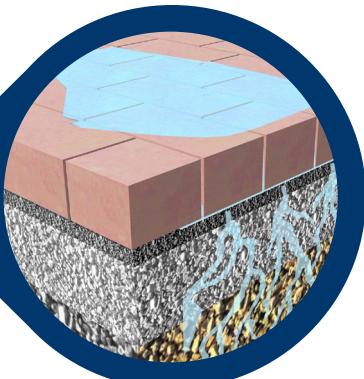


7. LAWN MANAGEMENT:

Is the practice of maintaining a lawn that promotes a healthy environment through functional, recreational, and ornamental benefits.

8. PERMEABLE PAVERS:

Are designed with void spaces between each paver to allow rainwater to be captured and stored underneath. The gravel space underneath allows water to be stored then slowly released into the ground naturally, acting as a temporary storage to reduce the amount of rainwater that flows into the storm drain.



9. BIOSWALE:

Similar to a grass ditch that is an earthen channel used to direct rain water into a storm drain or nearby body of water. Bioswales are designed to slow and remove trash and pollutants collected from stormwater. They are filled with rocks, compost, and vegetation to control flow, soak up water, and provide visual appeal.



10. GREEN ROOF:

A system on a flat or gently sloped roof that is made up of plants and soil on top of a water-proof membrane. The system of plants provides insulation, holds rain water, and absorbs heat from the sun. Other benefits include using these plants for decoration or food crops.



CONSIDERATIONS

PROTECTING THE PUBLIC AND YOURSELF

Before selecting a home project and starting construction, make sure that you understand everything that is required for the project. If you are unsure of your capabilities, then you should hire a contractor. If you do hire a contractor, make sure that they are licensed, bonded, and insured. This should cover anyone who may get hurt on your property. The **CITY OF NORFOLK** assumes no liability for any issue arising from or risks associated with the **Home Projects**.



IF YOU RENT, CONSULT WITH YOUR LANDLORD BEFORE MAKING ANY CHANGES.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

It is recommended to protect yourself and others around you when constructing any of the **Home Projects**. Items to consider include:

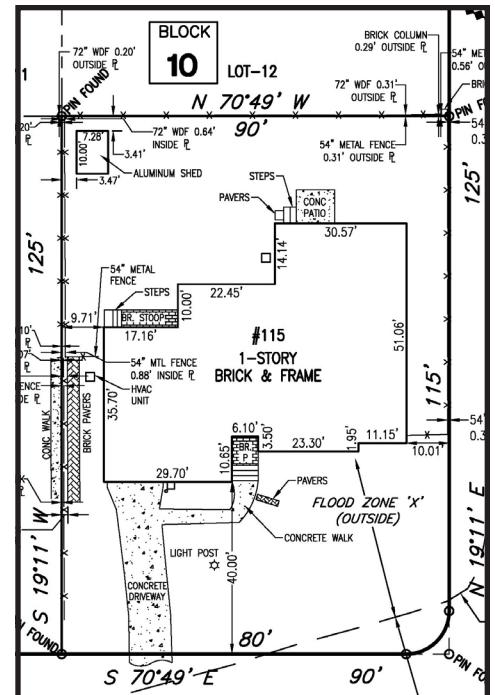
- Safety Glasses
- Gloves
- Earplugs
- Hair Ties or Clips
- Hard Hats
- Closed Toe Shoes or Boots



MEASURE YOUR SPACE

There is always something you can do for your space, whether you have a small courtyard or a large lawn, even a simple project can have an impact. Take note of how much space you have and where you can put a Home Project. Each property will have different conditions and limitations. Some key items to take into consideration:

- Trees
- Utilities
- Sidewalks
- Driveways
- Changes in Elevation
- Distances Between Elements



UTILITY MARKINGS

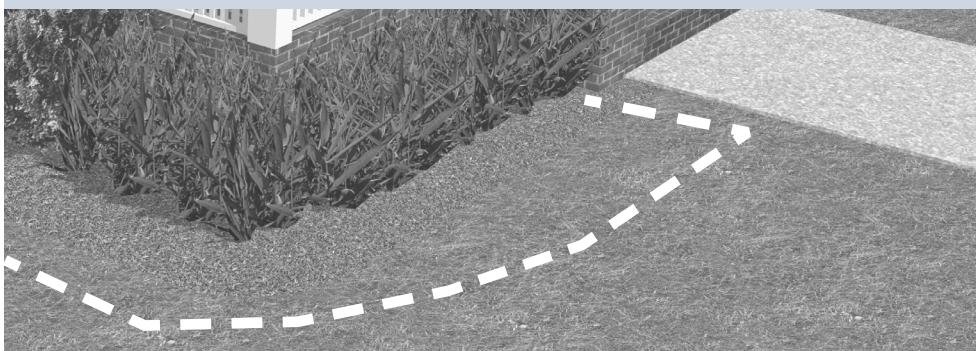
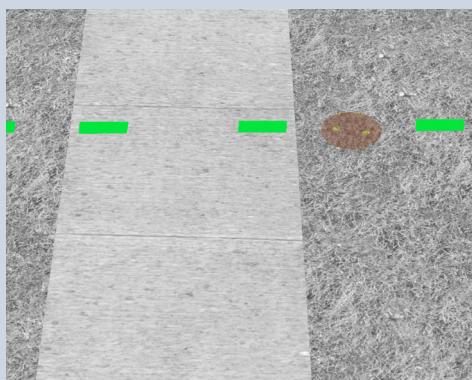
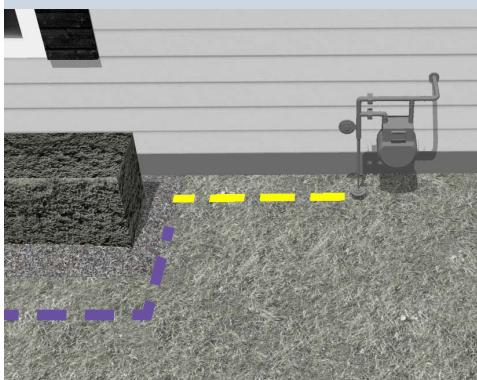
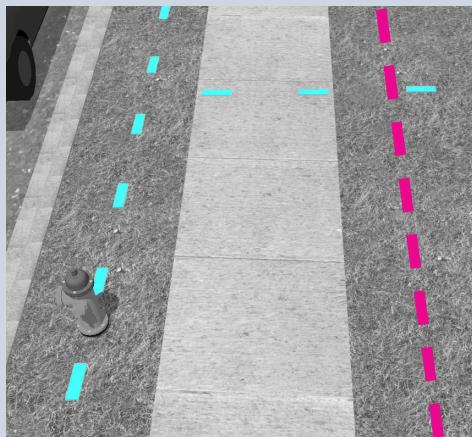
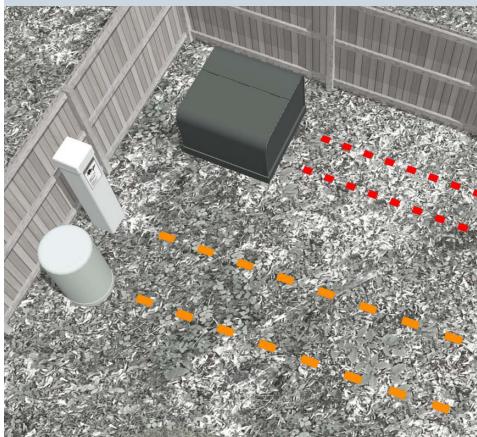
BEFORE YOU DIG

To avoid damaging underground utility lines, notify Miss Utility of Virginia to get your underground utility lines marked before you dig. If you are using any type of heavy equipment, you are required by law to call. Even hand tools can damage utility lines. Dial **1-800-552-7001**, or **811** at least three working days ahead of time. You can also submit a request Online <https://va811.com/homeowners/>. A representative from each utility company with existing service on your property will mark the location of their underground lines with different colors of spray paint. There is no cost to this service.



**Know what's below.
Call before you dig.**

TYPES OF UTILITY MARKINGS



PAINT MARKING LEGEND:

- PINK - SURVEY MARKERS**
- RED - ELECTRIC**
- ORANGE - COMMUNICATIONS**
- YELLOW - GAS • OIL • STEAM**
- GREEN - SEWER • DRAINAGE**
- BLUE - POTABLE WATER**
- PURPLE - RECLAIMED WATER • IRRIGATION**
- WHITE - PROPOSED EXCAVATION • PROJECT LOCATION**



PERMITS & APPROVALS

BEFORE YOU START

Review the information below for special considerations that need to be taken.

Historic Districts & Cultural Conservation Zones

If you wish to complete a project in one of the below areas you will need to go through the Design Review Process conducted by Architectural Review Board (ARB) and City Planning Commission to obtain a Certificate of Appropriateness:

IF the project is in one of the established Historic and Cultural Conservation Base Zoning districts

- Ghent: HC-G1, HC-G2, HC-G3
- West Freemason: HC-WF1, HC-WF2
- East Freemason: HC-EF

OR if the project is in a Historic Overlay District

- Downtown Historic Overlay
- Norfolk & Western Historic Overlay

Information on this process can be found at <https://www.norfolk.gov/1090/Architectural-Review-Board>

Or by contacting the Planning Department at **(757) 664-4752** or planning@norfolk.gov to begin this process.



Chesapeake Bay Preservation Act (CBPA)

If your property is located in the CBPA Buffer Area:

- you must obtain a CBPA tree permit for removal of any tree and require replacement planting for any trees lost. Contact Jack Erwin at jack.erwin@norfolk.gov to begin this process.
- you must go through a minor site plan review for installation of permeable pavers. Contact Environmental Services at **(757) 664-4368** to first discuss your project and then they will guide you to the next steps.

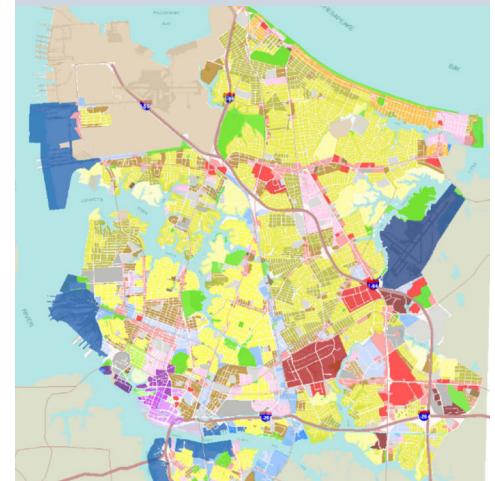
Information on the Site Plan Review can be found here:

<https://www.norfolk.gov/1647/Site-Plan-Review>

Coastal Resilience Overlay

If the project is located within the Coastal Resilience Overlay, all plants are to be of native and salt tolerant species. In order to determine if your property is located in any of these zones visit the Norfolk Air site <https://air.norfolk.gov/#/> to type in your address into search bar. Scroll down to the **Planning** section to see Zone(s), Overlay District(s), CBPA, and Historic District Name references.

Screen shot of Norfolk Air map showing zoning and overlay districts..



Right-of-Way

For all tree related matters in the ROW including pruning, removing, and planting, submit a Tree Permit Application to the City Forester. For all other projects in the ROW you must go through the Design Review Process conducted by the ARB and City Planning Commission. Then you will submit a ROW Encroachment Application to ROW management, second floor City Hall. Note that you must list the **CITY OF NORFOLK** as an additional insured on liability coverage for the property to which the encroachment is attached.

Tree Permit Application

<https://www.norfolk.gov/DocumentCenter/View/917/Tree-Street-Application?bidId=>

ROW Encroachment Application

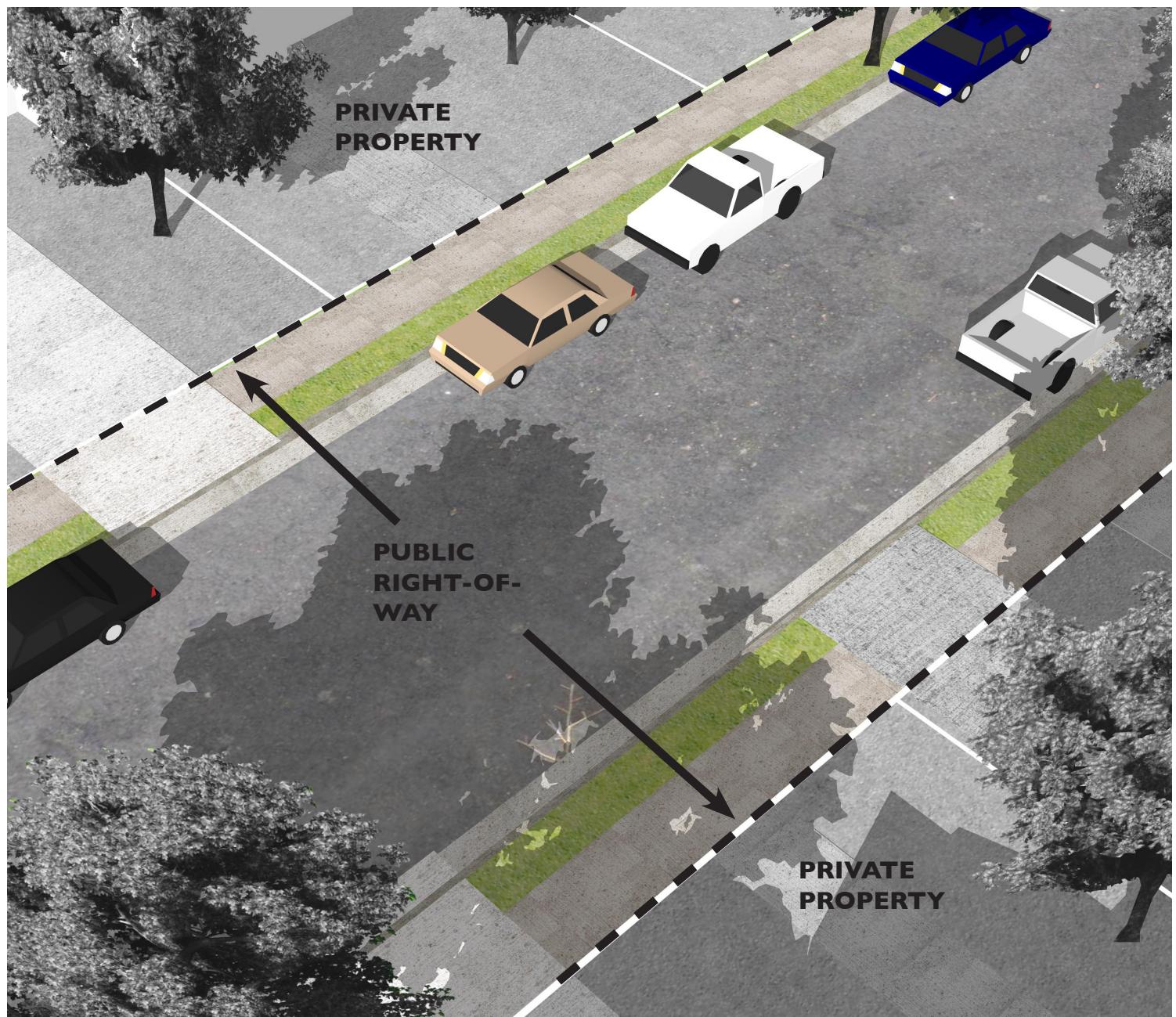
<https://www.norfolk.gov/DocumentCenter/View/44215/Encroachment-Application?bidId=>

THE PUBLIC RIGHT-OF WAY (ROW)

LOCATION

The public right-of-way is defined as the area parallel to the roadway outside of your property lines. This includes the sidewalk, the apron of driveway that connects to the street, the space between the sidewalk and street, and any ditch or curbs. This area is public property under **CITY OF NORFOLK** jurisdiction and **CITY PERMISSION IS REQUIRED** if a home project is desired within the public right-of-way.

See Permits & Approvals on page **14** for more information - click —»



SOIL TESTING

TESTING FOR NUTRIENTS

Your local Virginia Cooperative Extension office can provide soil testing kits that will help you determine your current soil fertility, and steps you must take to make the soil suitable for healthy plant growth. Using these kits, you will take samples of your soil and send them to Virginia Tech for analysis.

REQUEST YOUR OWN SOIL NUTRIENT TEST:

Contact your local extension agent to request a soil test kit (on this **page**). The testing kit includes instructions on how to take your samples, but further sampling guidance is available [here](#):

<https://www.soiltest.vt.edu/sampling-instructions.html>

Kit Cost: (In-State) \$10 - \$16

REVIEW THE RESULTS:

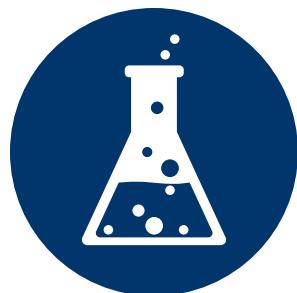
Soil sample testing is usually completed within **10-14** days. When testing is complete you will receive an electronic copy of the results and recommendations. Your local Extension Agent is available to walk you through how to interpret the results if you need assistance.

SOIL TEST REPORT EXAMPLE:

 Virginia Cooperative Extension Virginia Tech • Virginia State University		Virginia Tech Soil Testing Laboratory Publication 452-125 Revised 2019
Soil Sample Information Sheet for Home Lawns, Gardens, Fruits, and Ornamentals		
Please Type or Write Legibly (Form expires January 2020) Use another form for commercial crop production. Not for growth media containing greater than 50% organic matter. See other side for sampling instructions. Processing will be delayed if soil is not received in the lab's sample container. For a recommendation, be sure to fill in a plant code number. Each sample must have its own form. For more information, go to www.cooperativedept.vt.edu or contact your local Virginia Cooperative Extension office.		
Your Name: _____ E-mail To Send Report To: _____ Mailing Address: _____		Phone: _____ Date sampled: _____ MM/DD/YY Office Use only Extension

Poor Drainage?

If water is not draining in your yard, you may need to assess your soil's structure. Poor drainage is usually the result of poor structural qualities that are quite common in urban soils, such as severe compaction or high levels of clay or silt. While soil testing kits can't diagnose these issues, your local Extension Agent can assess the site in person for this and other problems.



Office Location
830 Southampton Avenue
Suite 2069
Norfolk, VA 23510-1045

The Norfolk Office of Virginia Cooperative Extension is located on the second floor of the Norfolk Public Health Building.

Office Hours
8:30 a.m. to 5:00 p.m.,
Monday through Friday

Mailing Address
830 Southampton Avenue
Suite 2069
Norfolk, VA 23510

Phone Numbers
(757) 683-2816
(757) 683-2300 (Fax)

For more information on soil sampling see VCE Publications - Soil Sampling for the Home Gardener at:

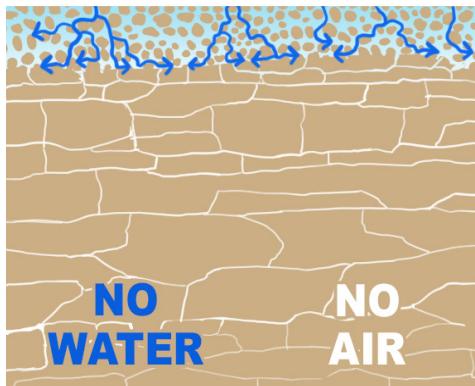
<https://www.pubs.ext.vt.edu/452/452-129/452-129.html>

TESTING FOR SOIL DRAINAGE

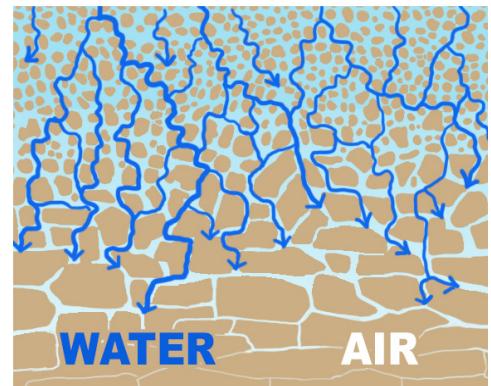
For some **Home Projects**, you will need to test your soil to find out how quickly the water soaks into the ground and to see if you may need to amend the soil for better results.

SOIL COMPACTION:

Below is a diagram depicting the difference in how water and air interact with soils. This can be tested simply by how hard the soil is to dig up. The harder the soil is the more compacted it is and thus needs to be loosened up to allow more water and air into the soil.



COMPACTED SOIL



NORMAL SOIL

PERFORM YOUR OWN SOIL INFILTRATION TEST:

Here are **3** ways to test your soil on your own:

- **Feel for Texture**
- **Infiltration Rate (percolation test)**
- **Depth to Groundwater**

To start off any of these tests you first need to dig a hole in the location of the **Home Projects** you wish to install. Dig down to approximately what will be the bottom of the practice to take your samples. An example would be digging a hole for a rain garden, you would need to dig down at least **21** inches.

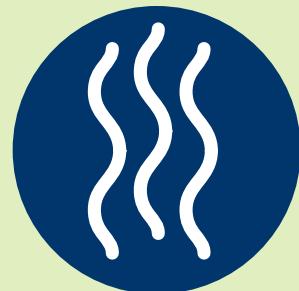
Testing the **Soil Texture** by hand is done by using the ball, feel, and ribbon methods. These are described in the WSAR Manual link below.

To find out what the **Infiltration Rate** is for your chosen location you will perform a percolation test. See the WSAR Manual link below.

Note, if you hit water, you will have to look at a different project as you may be too close to the watertable.

Depth to groundwater is important in that the practice will not drain properly. You do not want your practice to be full of water and allow contaminants to enter the groundwater table. To find out if you are in a high water table area find your property on the [RYR APP](#).

All this info and more details can be found in the **Watershed Stewards Academy Rainscaping Manual**. Click the link to the [WSAR Manual](#) for more detailed Soil Assessment info.





HOME PROJECTS

DNWSPOUT DISCONNECTION



DEFINITION

It is the process of separating a roof gutter from the stormwater system. The gutter's downspout gets redirected to disperse rainwater across a permeable surface, such as a garden or a lawn, preventing excess water from entering the street and down the storm drain.

The intent of disconnection is to separate rainwater from the municipal stormwater system. The flow of rainwater from a roof is redirected to a rain barrel, infiltration method, or a permeable surface such as a lawn, rain garden, bioswale, or conservation landscape that can filter and slowly absorb the rainwater into the ground.



BEFORE



DIRECTED ONTO DRIVEWAY

AFTER



DIRECTED TO STORMDRAIN

DIRECTED TO LAWN

EXAMPLES

SPLASH BLOCK

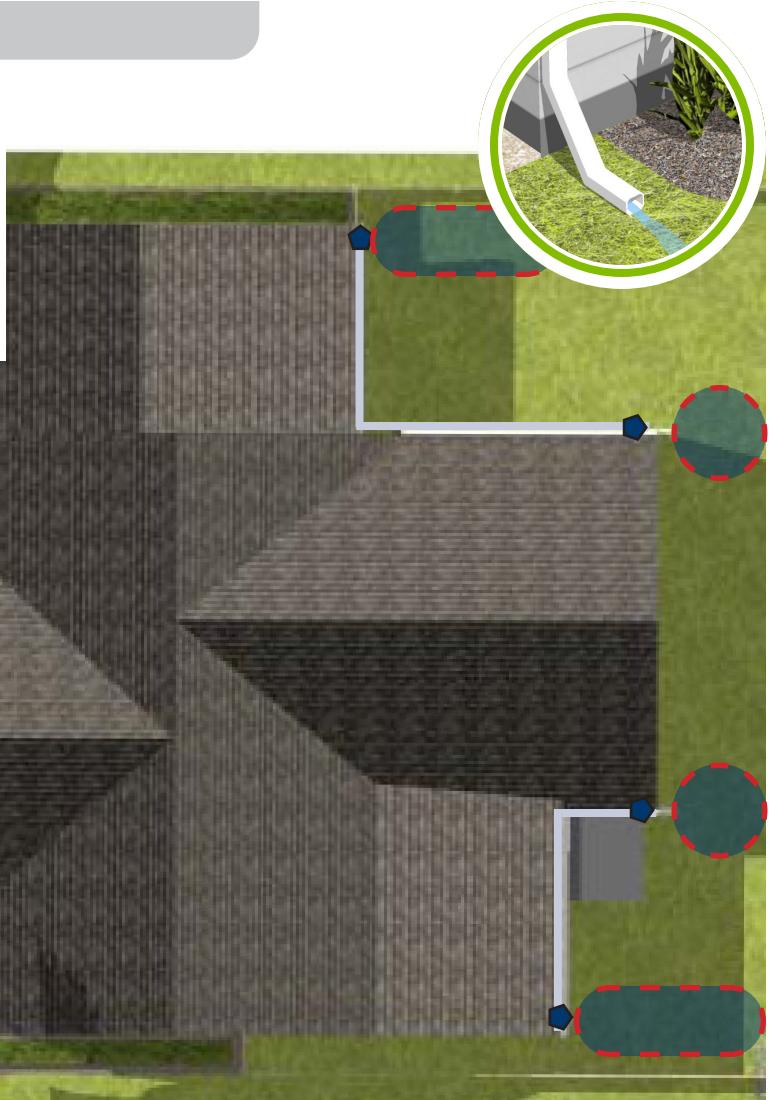


DOWNSPOUT EXTENSION



CONSIDERATIONS

If you don't have gutters this does not apply to you. If you do have gutters and the downspout discharges water onto a hard surface or into a pipe, consider this home project. Account for obstacles and ground slope to determine the desired direction to redirect the water coming out onto a surface such as lawn, rain gardens or planted areas that will absorb the runoff.



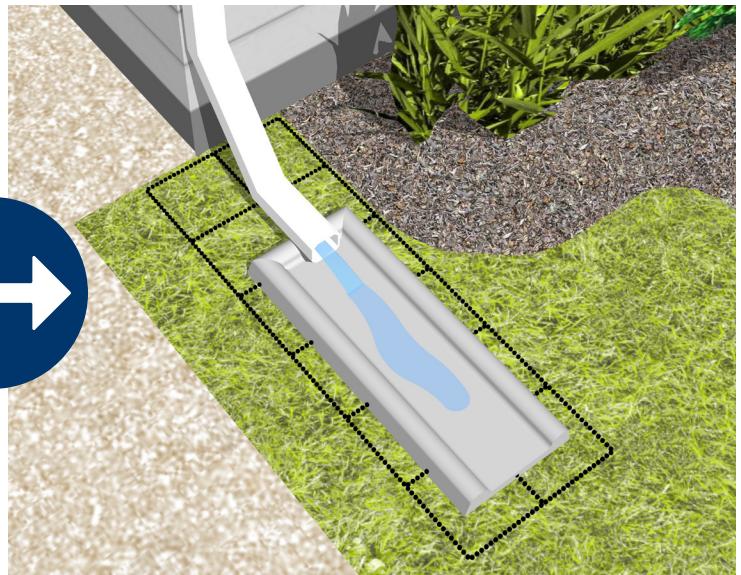
SIZE

The size of space needed for a downspout disconnection can be as little as three square feet to install.

3 SQUARE FEET



12 SQUARE FEET



GETTING STARTED

Disconnecting gutter downspouts is the least expensive of the proposed projects. To evaluate which project works best for you, examine associated costs and materials. Below are suggested items to help you get started.



DO IT YOURSELF (DIY)

If you intend to perform this work yourself, see the lists for general tools and materials you may need to help you get started.



Tools & Materials:

- Personal Protective Equipment (PPE)
- Hacksaw
- Drill
- Pliers
- Screwdriver
- Tape measure
- Shovel (optional)
- Gutters (If you don't already have them for the portion of roof where you want to collect rainwater)

- Metal screws or adhesive
- Standpipe cap
- Downspout elbow
- Downspout extension
- Splash block
- Splash box: 2 x 6 Pressure treated wood 12 linear feet total, 4"- 6" sized stone - 2 bags (50 lbs each), &
- #57 stone (3/4" size), 1 bag 50 lbs



HIRE OUT THE WORK

You can also find a local handyman or contractor to do the work for you. Prices will vary on complexity and time needed to complete the job.



KIT or SPECIALTY ITEM

You can purchase a downspout disconnection kit from home improvement stores and Online. Wherever you purchase it, check your kit to ensure all parts needed are included.



MAINTENANCE

Seasonal

- Check on gutters and downspouts, especially during times of heavy rain and snow: overflows, leaks, and large icicles are all signals of a need for maintenance.

- Remove leaves and other debris from the gutters.
- Keep downspouts from clogging to keep water away from your home.



HOW TO

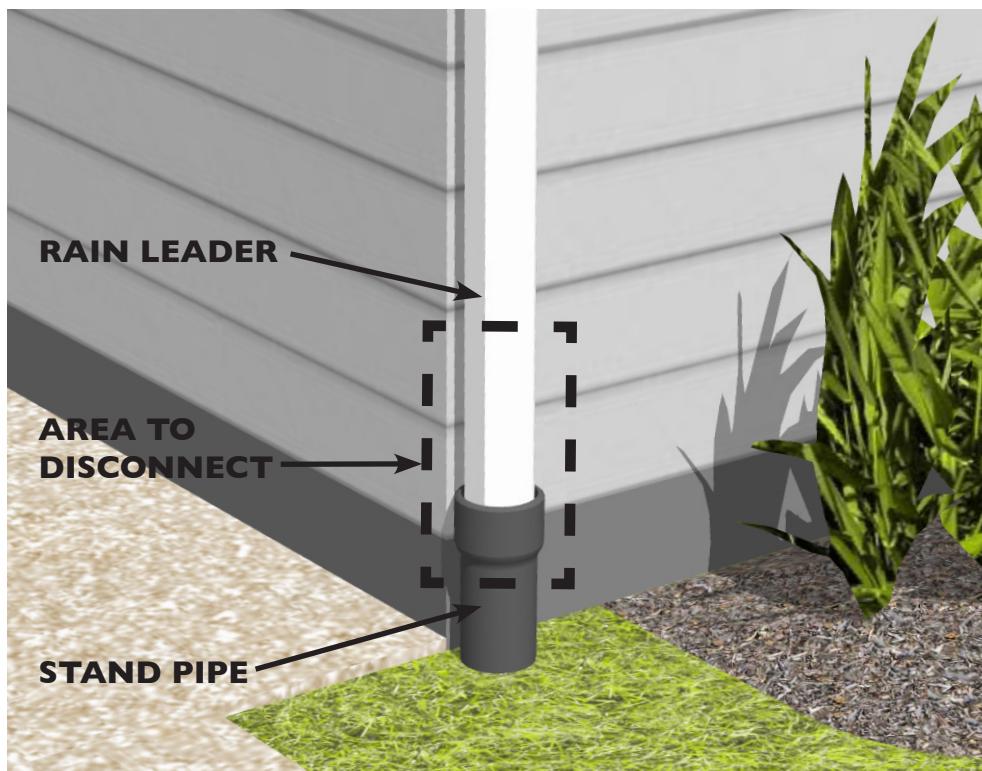
Step 1: Water Direction

Before disconnecting a downspout, consider the following guidelines for redirecting stormwater:

The downspout should redirect rainwater away from the building at a minimum of 2 feet. For homes with crawlspaces or basements,

maintain at least 5 feet.

The downspout must be directed to permeable surfaces such as a yard, garden, forest, or a conservation landscape element. Make sure it is not directed to steep slopes. Check for drainage and compaction by doing a test [Click —>](#)



Step 2 : Cut

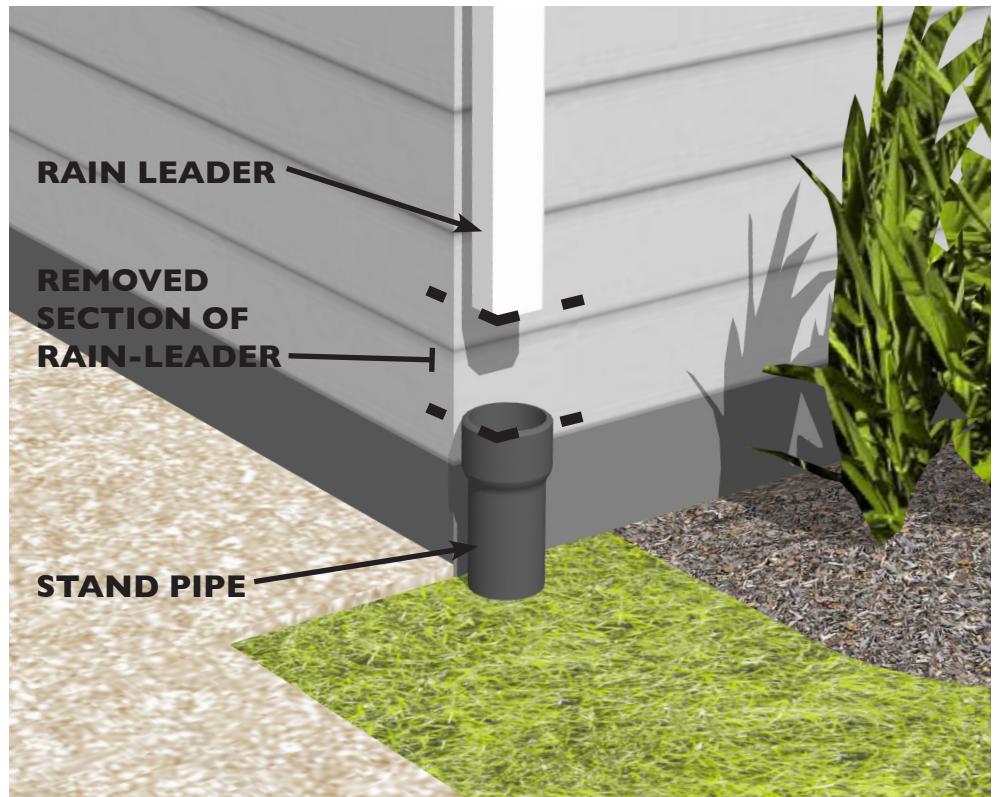
Cut the existing rain-leader to redirect the rainwater from the vertical stand pipe.

- Measure **9** inches above where the rain-leader pipe enters the ground at the standpipe. Using a hacksaw, cut the rain-leader and remove the excess pipe.
- To prevent rainwater and debris from entering, seal the standpipe with a fitting plug or cap.

Step 3: Add

Install new elbow and extension with the hardware provided. Extra screws and screwdriver may be needed.

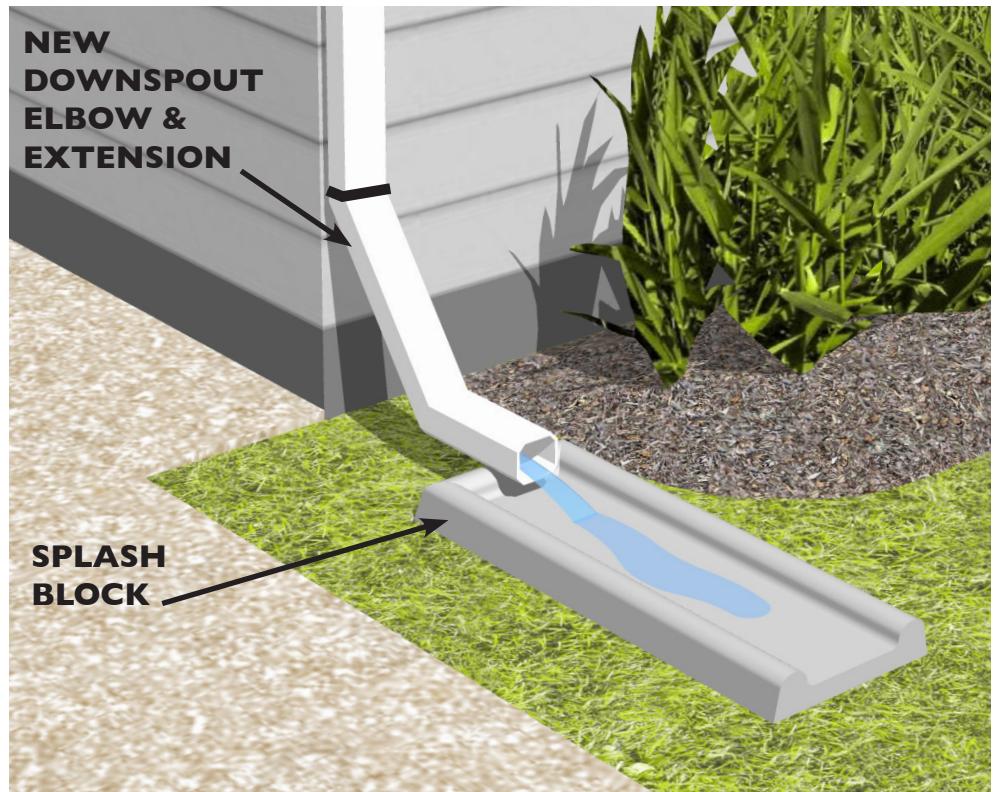
- The elbow and extension should direct the water away from the building. There are various methods to redirect the rainwater including similar downspout pipe materials, plastic hoses, and flexible extensions.



Step 4: Erosion Control

Use a shovel or rake to level a spot to add a splash block or other erosion control device.

- Water flowing from the roof to the gutters and downspout moves very quickly and should be slowed to avoid erosion on pervious surfaces. There are several types of alternative splash blocks including plastic or stone splash guards and loose stone or rocks.
- Disconnected downspouts can be redirected to rain barrels, rain gardens, conservation landscaping, tree plantings, or various means of infiltration.



Project Completion!

To return to the Table of Contents - click [→](#)



RAIN BARREL



DEFINITION

A tank or barrel that collects and holds rainwater from the roof of a structure. The water from the container can be used for watering plants and for general yard or home maintenance. It should be used as a non-potable water source (not to be used for drinking water). The water is intended to be used or emptied out BEFORE the next rain event. A full container during a rain event does NOT have added benefit in reducing the amount of water going into the storm drain during that rain event.

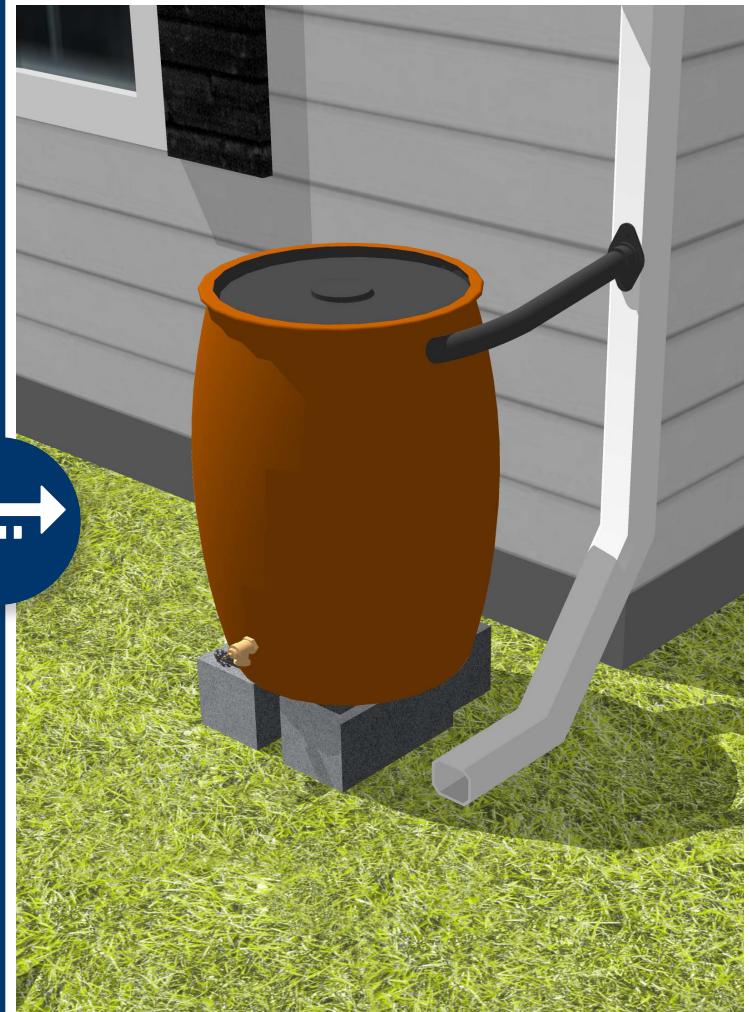


BEFORE



DOWNSPOUT

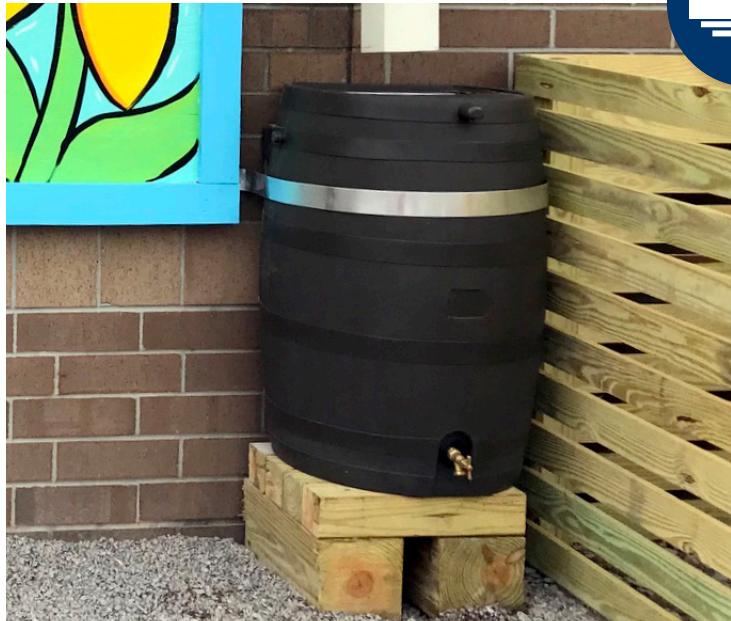
AFTER



INSTALLED RAIN BARREL

EXAMPLES

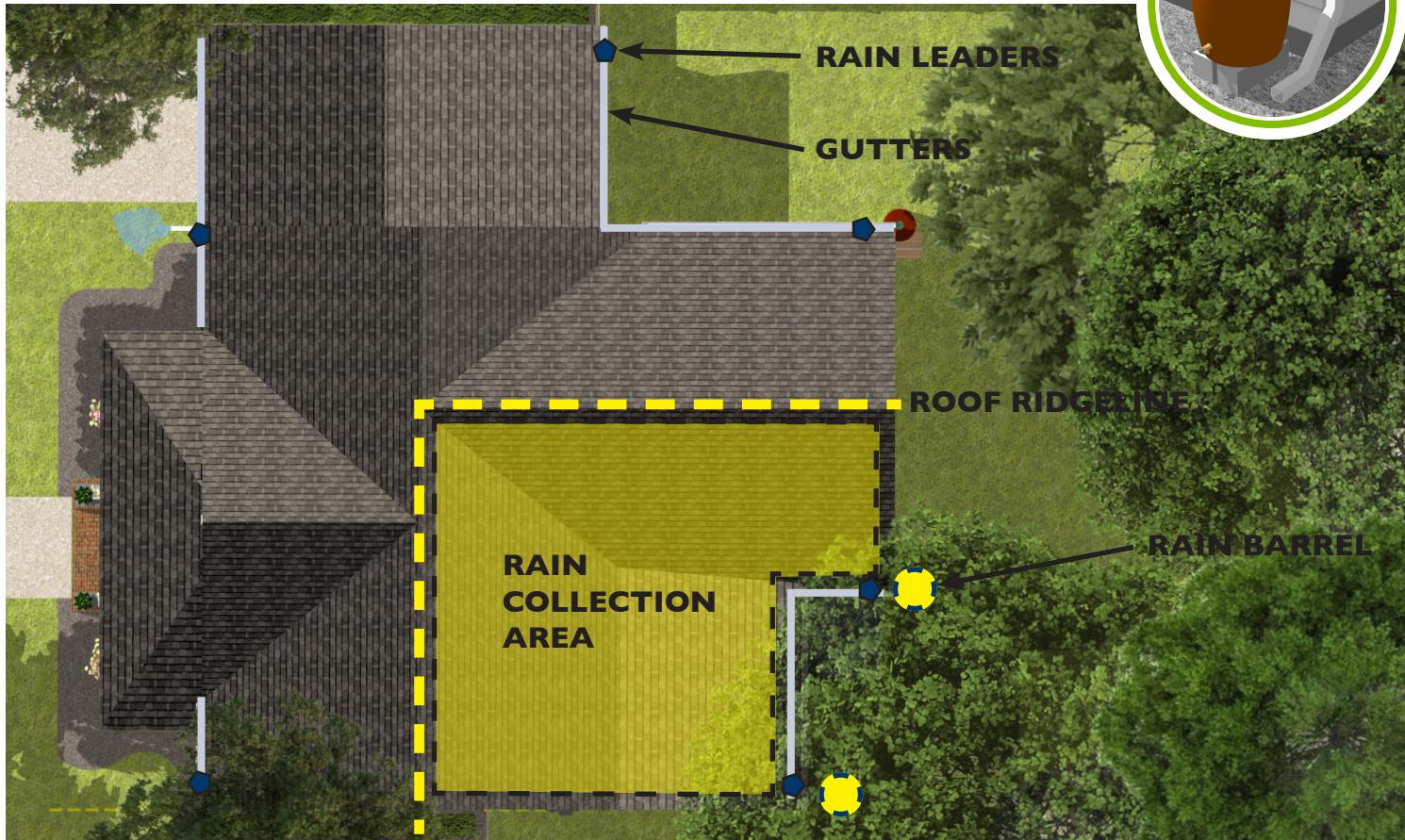
SINGLE RAIN BARREL



CONNECTED RAIN BARRELS (110 gallons)



BE MINDFUL OF PLACEMENT



The **RETAIN YOUR RAIN APP** is an application intended to be used by **CITY OF NORFOLK** residents to estimate the amount of rain runoff generated from the rooftops of buildings. Runoff amounts are displayed in the number of typical sized bathtubs for rain event at half-inch increments up to three inches of rainfall. A typical bathtub filled with water is approximately **50** gallons and an average sized rain barrel is **100** gallons.

In the example, the area for the **ENTIRE** roof area is given. As in the above diagram, you will have to calculate the amount of water that a section of roof will generate. You can locate your property visiting the link below.



Norfolk Retain Your Rain APP

<https://orf.maps.arcgis.com/apps/webappviewer/index.html?id=7e8dc203eadf45b2b-4422095f44b194c>

RETAIN YOUR RAIN

Green Infrastructure Zone: **Storage**

Approximate number of bath tubs per inch(es) of rain:

0.5" = **5** Bath Tubs

1" = **10** Bath Tubs

1.5" = **15** Bath Tubs

2" = **20** Bath Tubs

2.5" = **25** Bath Tubs

3" = **30** Bath Tubs

[Click here to find out the best home project for your property.](#)

Above is an example from the **RYR** app of a typical residential property. Use these numbers for your calculations.



Calculating Rain Barrel Size:

The calculations, as follows, use the chart from the **RYR** app and the house diagram as the example of your home. With a **1"** rain event we get **10** bathtubs. **10** bathtubs equals **500** gallons of water to account for. The roof design is divided into **4** quarters. Taking the bottom quarter of the roof, in yellow, we divide **500** by **4** giving us **250** gallons of water to capture. This tells us that having two rain barrels that hold **100** gallons each will be adequate for yard water needs.

You will not capture all of the rainwater! Consider a second barrel or larger storage container depending on your watering needs.

Have a bypass or overflow for full tanks!

Rain Barrel recommendations include:

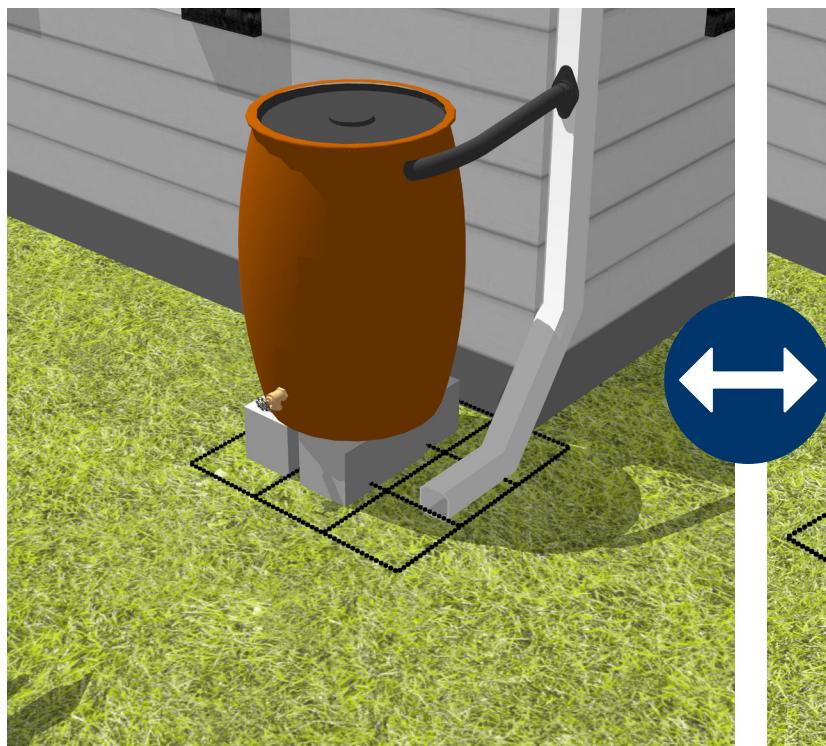
- Must have a gutter with a downspout
- To avoid unnecessary piping, locate barrel or storage tank close to the downspout
- Check that water will flow away from the house
- **50-300** gallons in size
- Each tank collects from one downspout
- Gravity-fed overflow or bypass for full tank
- Has basic screening for filtration (e.g., leaf screens on gutters)
- Use a screen at barrel inlet, if open, to filter material out of downspout before it enters the barrel or tank.
- Use of mosquito dunks (seasonally) or screen to keep insects out.

Be mindful Water is Heavy!
24 gallons = 200 pounds

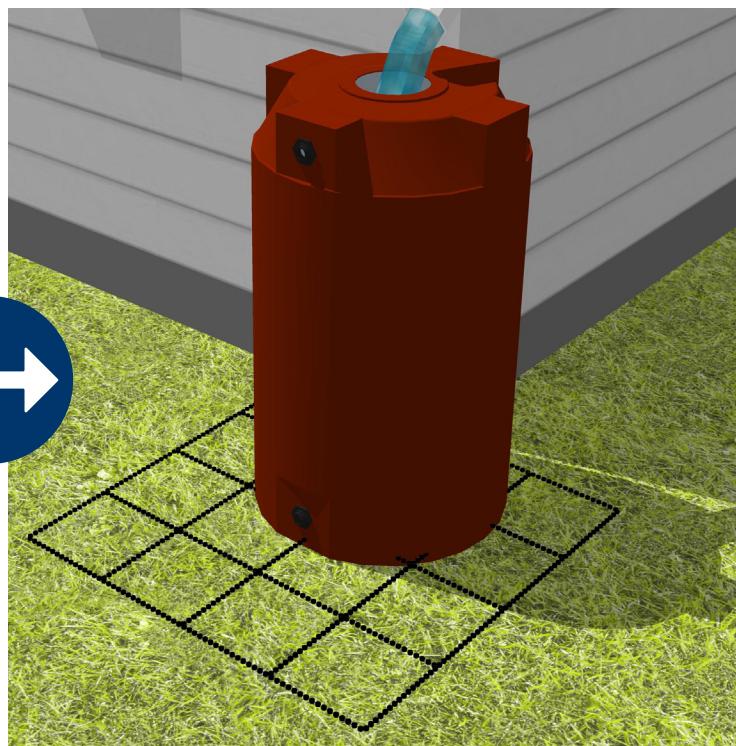
SIZE

The size of space needed for a rain barrel can be as little as nine square feet to install.

9 SQUARE FEET



16 SQUARE FEET



GETTING STARTED

Evaluating the cost and materials of your project is a good start. Design and construction is simple and can be done by handy homeowners, volunteers, or contractors with a little guidance. The most difficult part of assembly may be cutting and re-routing downspouts and installing hardware at bottom end of Rain Barrel. Below are suggested items to help you get started.



DO IT YOURSELF (DIY)

If you intend to perform this work yourself, see the lists for general tools and materials you may need to help you get started.



Tools & Materials:

- Personal Protective Equipment (PPE)
- Marker

- Compass or circle template
- Ruler
- Drill
- **1/2"** spade bit
- **3/4" & 1 5/8"** hole saw
- Screwdriver
- Pliers
- Jigsaw
- Recycled Barrels
- Plastic colander
- **1 1/4"** barbed fitting w/ female threaded end
- **1 1/4"** male coupling
- **5'** section of sump pump hose
- **1/2"** barbed fitting with male threaded end

- Hose coupler for **5/8" & 3/4"** garden hose
- Shutoff valve w/ male & female threaded ends
- **1** hose clamp fits **3/8" to 3/4"** hose
- **1** hose clamp fits **3/4" to 1 1/8"** hose
- **10" x 10"** piece of screening material to cover holes
- Silicone sealant
- PVC glue
- Elbow for downspout



HIRE OUT THE WORK

You can also find a local handyman or contact a [CBLPro](#) contractor to do the work for you. Prices will vary on complexity and time needed to complete job.



KIT or SPECIALTY ITEM

You can purchase a downspout disconnection kit from home improvement stores and Online. Wherever you purchase it, check your kit to ensure all parts needed are included.



MAINTENANCE

Seasonal

- Check gutters, screens, and downspout for debris and clogging
- Check mosquito screens and patch holes or gaps
- Add mosquito dunks or similar for short-term control of larvae

Yearly

- Inspect and clean storage tank lids, clean screens and spigots
- Inspect tank for sediment buildup
- Inspect structural integrity of tank, pump, pipe, and platform
- Replace damaged

or defective system components

- Drain tank before long periods of freezing temperatures

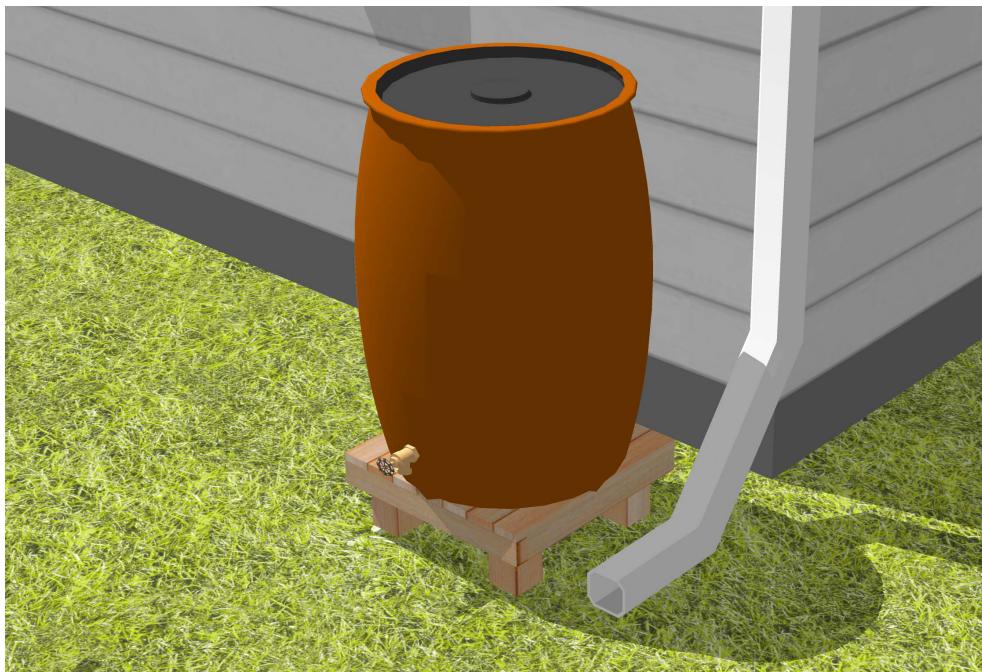
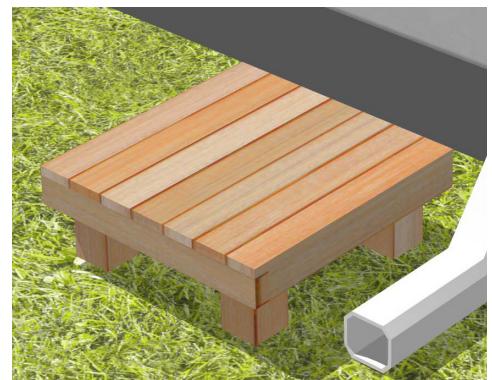
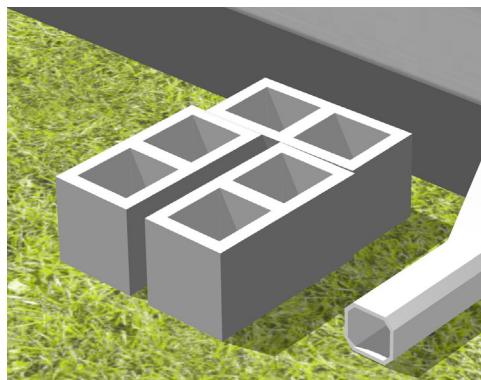
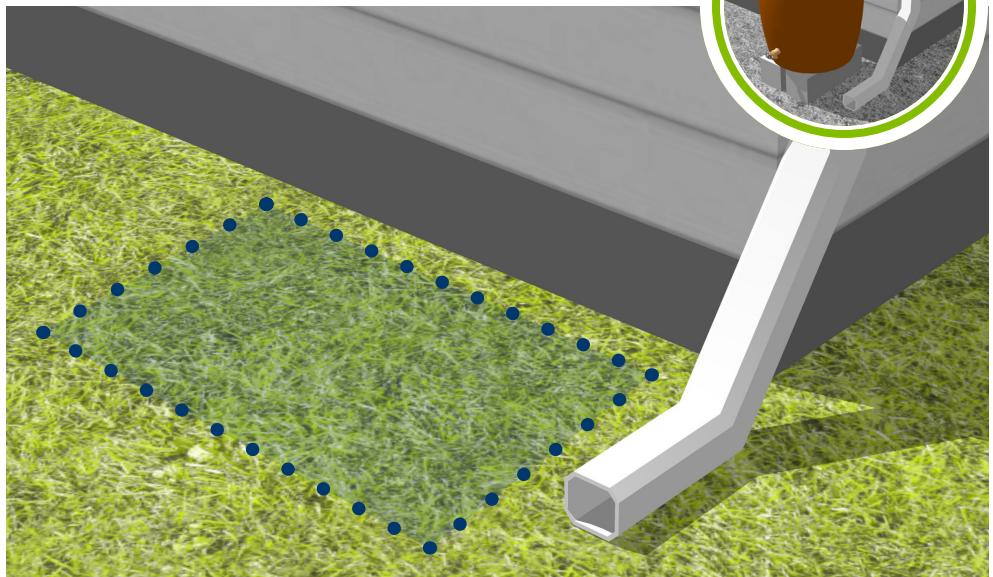


HOW TO

Step 1: Ground Prep

Create a level surface with a rake or shovel that will support the heavy weight of a full container. Dirt or sand can be added to help level the ground. The container can be placed directly on the ground or on a platform to elevate for ease of use.

- Pavers, cinder blocks, or a wooden platform make good supportive base for rain barrels.



Step 2: Set Up

Place your barrel onto the prepared surface or platform while empty. To prevent damage to the bottom be sure no rocks or hard objects are under the container. Have the parts and tools ready for the next step.

Step 3: Install

Connect downspout to the barrel.

- Use a drill with a hole-saw attachment to make a hole in the downspout and the rain barrel for the diverter. Follow any instructions that may have come with the parts.



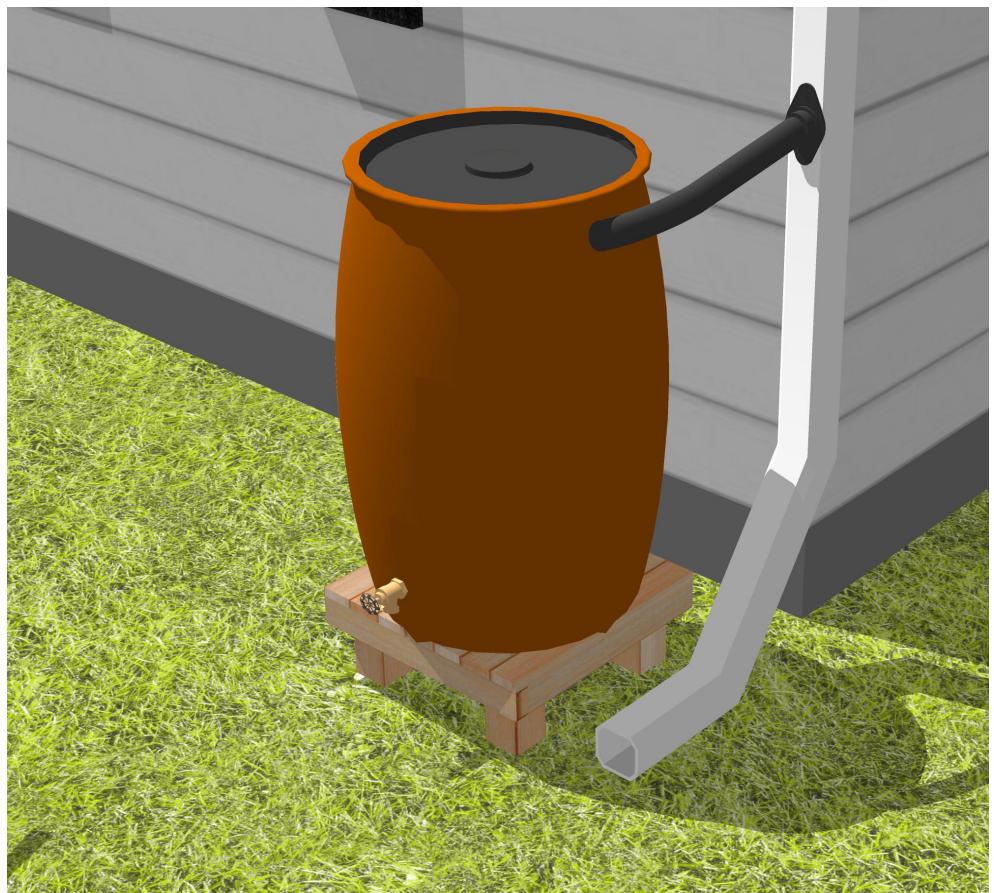
- Install downspout diverter and faucet to rain barrel.
- Ensure any openings are sealed or covered with screening material.



Step 4: Inspect & Follow-up

Check that all connections are secure and functioning with no leaks.

Monitor during/after first rain event and make adjustments as needed.



Rain Barrels & Water Harvesting

[Https://www.Norfolk.Gov/documentcenter/view/28621](https://www.Norfolk.Gov/documentcenter/view/28621)

American Rainwater Catchment Systems Association

<https://www.arcsa.org/default.aspx>

Watershed Stewards Academy

<http://aawsa.org/rain-barrels-and-cisterns>

Bay Star Homes Program

<https://www.norfolk.gov/3304/Rain-Barrels>

Project Completion!

To return to the Table of Contents - click →



RAIN GARDEN



DEFINITION

A rain garden is a small garden-like practice that sits in a recessed area that has been backfilled with a **1.5 to 2** ft filter bed of amended native soil mix or special rain garden soil media. Designed to capture rain water from your roof, driveway, sidewalks, or other paved area around your home that allows the water to slowly soak into the ground within a **24 to 48** hour period. Rain gardens are typically planted with suitable native trees, shrubs, flowers, and other plants that are water tolerant and can survive dry periods of no rain.

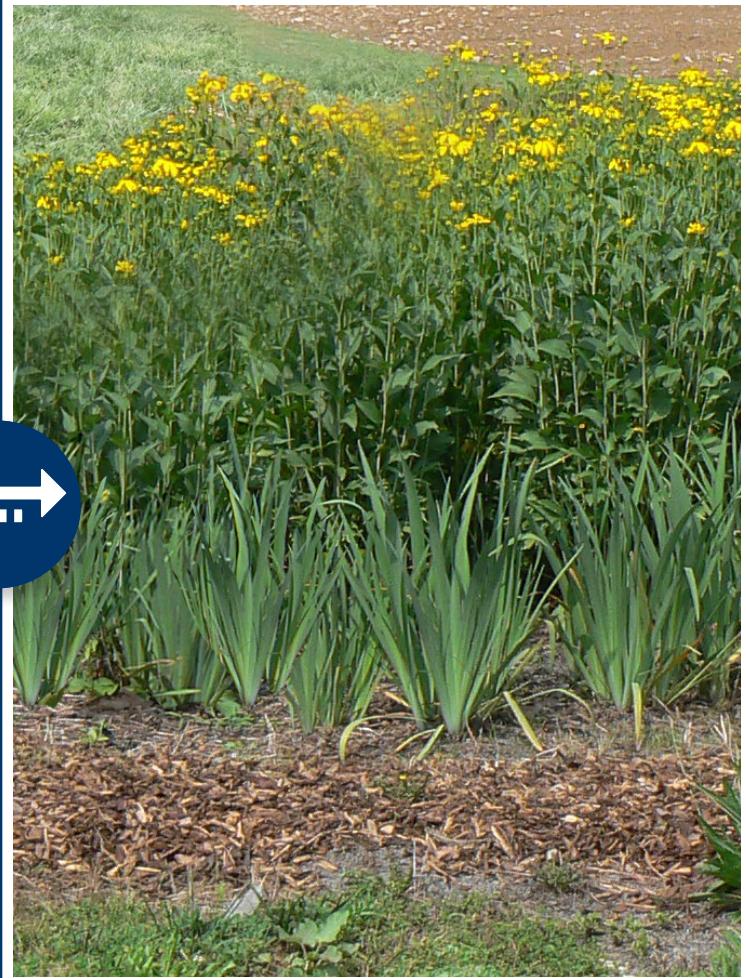


BEFORE



OVERGROWN TURF AREA

AFTER



INSTALLED RAIN GARDEN



EXAMPLES

COMMERCIAL RAIN GARDEN



RESIDENTIAL RAIN GARDEN



BE MINDFUL OF PLACEMENT

The location of your rain garden should be at least **10** feet from the foundation of your home and from the edge of your neighbor's property. Some disqualifiers for rain gardens: impermeable or low permeable soils and high water table. See the app to determine if you are in an Infiltration Zone and refer to the illustration below for an example of recommended rain garden placement.



Norfolk Retain Your Rain APP

<https://orf.maps.arcgis.com/apps/webappviewer/index.html?id=7e8dc203eadf45b2b4422095f44b194c>



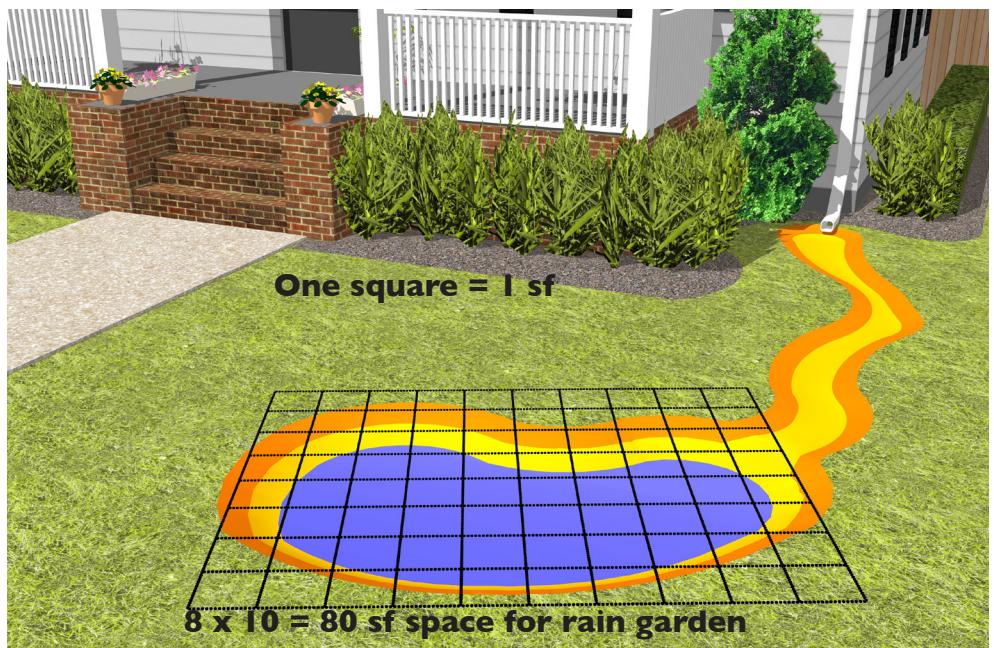
SIZE

Generally, for every **1000** square feet of roof or paved area that will be draining to your rain garden, you should allow approximately **80** square feet of surface area in your rain garden. This assumes about **6** inches of depth for the water to pond. The depth of the ponding area can be up to **12** inches, if needed, and only if the groundwater level is not too high.

Also, be sure to plan for overflow from your rain garden. Although your garden will be sized to contain most frequent storms, it will likely

not contain the increased volumes of water from larger storms. This is OK, but you will need to be aware of where the water will go if it overflows from the garden.

In most cases this will just be on your lawn, but you want to make sure the overflow is not directed toward your home's foundation or someone else's property.



GETTING STARTED

There are many factors that influence how much your rain garden will cost. Here are a few questions to ask before you start: Can you do the digging yourself? Do you have a place for the removed soil to go? Will you need special soil mix? Are you buying full plants or starting from seed?



DO IT YOURSELF (DIY)

Small and simple rain garden designs can be done by anyone with some experience in planting or gardening. If you intend to perform this work yourself, see the lists for general tools and materials you may need to help you get started. Note that this is a more labor-intensive project and may take help and time to complete.



Tools & Materials:

- Personal Protective Equipment (PPE)
- Paint, hose or sticks for marking ground
- Shovel
- Rake
- Equipment rental - digging machine/ sod cutter
- Garden hose
- Tape measure
- Wheelbarrel

- Gutters (If you don't already have them for the portion of roof where you want to collect rainwater)
- Soil amendments (if needed based on soil test)
- Mulch
- Plants
- Downspout extension
- Hand sized rocks



HIRE OUT THE WORK

Find installers and designers that have advanced training on Design and Installation of rain gardens can be found via <https://www.cblpro.org>.



A landscape architect or engineer may need to be involved if

underground piping is required. Prices will vary on complexity and time needed to complete job.



MAINTENANCE

Seasonal

- Water your plants so that they get about an inch of water per week for the first few months. Plants need more water during hot, summer months and drought periods.
- Inspect the area(s) where water enters and exits the garden for erosion. Make repairs as necessary, and add extra stones if needed to

dissipate heavy water flow. If erosion occurred, remove the sediment and correct the problem.

- Remove any weeds or invasive species that may start to grow in the garden.

covers are best.

- Maintain a **6** inch to **12** inch ponding area. Mulch may need to be removed every **2** to **3** years and replaced in order to maintain the depression.
- Replace any dead or dying vegetation as needed.

Yearly

- Add a thin layer of un-dyed hardwood mulch annually, if desired. Vegetated ground



CHOOSING & PLACING PLANTS

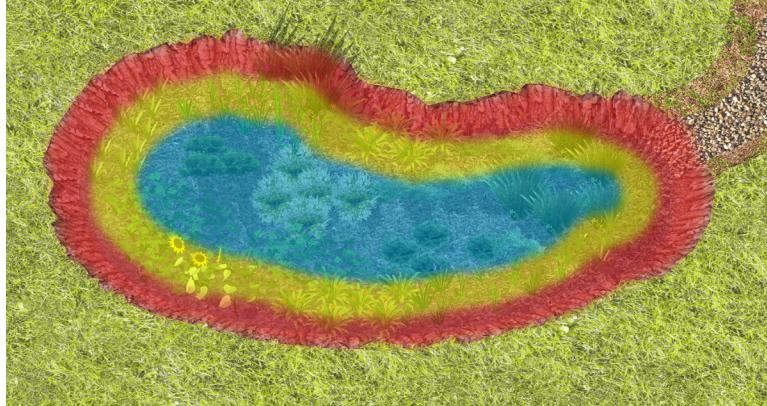
Typically, a rain garden is comprised of three zones that correspond to the tolerance plants have to standing water; the better a plant can handle "wet feet," the closer it is placed to the center of the garden. Whenever possible, shop for native and drought-tolerant plants, keeping in mind that parts of a rain garden might remain wet for long periods of time while other parts dry quickly.



Zone 1 is usually only wet during and immediately after rain storm events. It is best planted with species that prefer both wet and dry soils.

Zone 2 is the lower area of the slope, should have plants that can tolerate occasional standing water and like either wet or dry conditions.

Zone 3 is the bottom area of the rain garden, should be stocked with plants that like frequent water and may sit in wet soils for a period of time. Ponding water should dissipate within a **24** to **48** hour period after rain stops.



PLAN VIEW

A bird's-eye view of your rain garden area might look something like this if you were to look at the various zones for water tolerance.



CROSS SECTION VIEW

See the appendix for a list for recommended plants. Click —»

When selecting and placing plants use the below suggestions to help with the process of planting your rain garden.

- Choose native plants appropriate for Norfolk that match USDA Plant Hardiness Zone **8a**.
- Assess how much sun your site gets. Not all rain garden plants will do well if the site is shady.
- Plan for future growth. Plant descriptions will include the fully grown size. If a “fuller” look is desired early on, it is **OKAY** to have plants a bit closer together.
- Group plants in odd numbers, such as groups of **3** or **5** of the same plants together, and avoid straight lines for better design appeal.

- Arrange plants so that taller ones will not block the view of shorter ones.

- Using seeds or smaller plants such as plugs will save money, but it will take a full season or two for the plants to grow to full size. Typically, shrubs come in **3** gallon containers and grasses and perennials come in **1** gallon containers. You can also get larger shrubs and trees in larger containers.

- Select plants based on a combination of benefits such as beauty, wildlife value, and management.

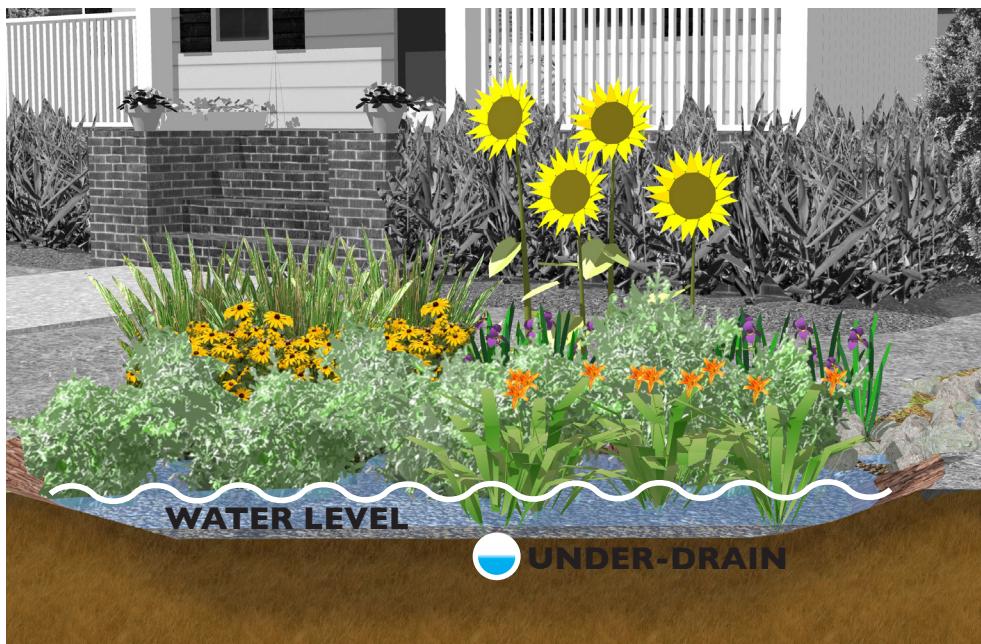
- Seeds are an option as well. Note weather forecast so that your seeds do not wash away during a heavy rain. Be sure to cover according to seed package to prevent birds from eating.



1 GALLON



3 GALLON



KEEP IN MIND:

If you are using a pipe to get water to the garden, you may want to consider placing some stones in the area where the pipe or gutter enters the garden. During intense storms, water inflow from the gutters can wash out mulch and/or plants. The stones will help to dissipate this heavy water flow and prevent erosion.

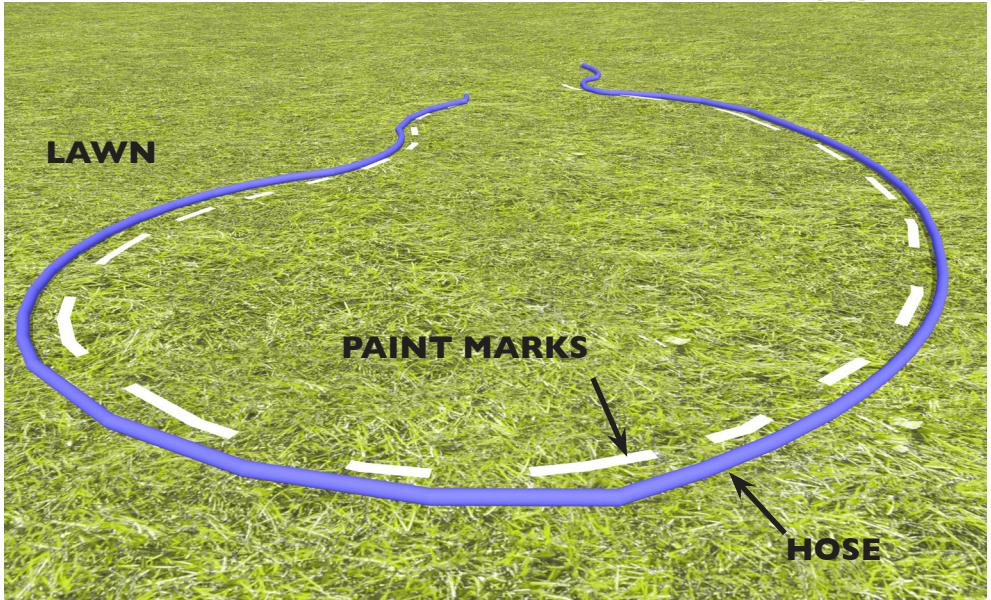
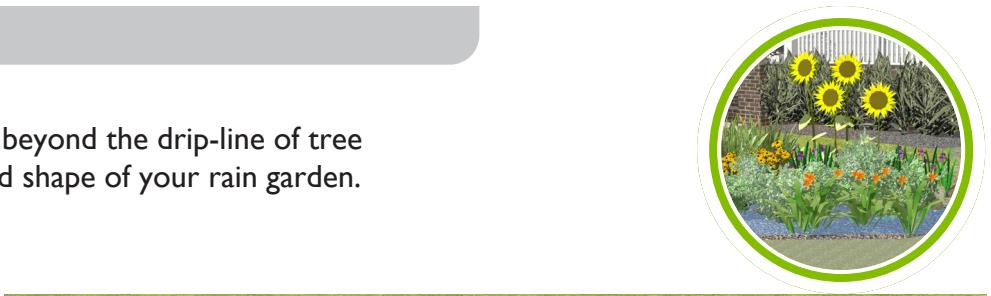
If you need to install an under-drain in the bottom of the rain garden seek to hire a trained landscape contractor.

HOW TO

Step 1: Measure & Mark

Select a site away from structures and beyond the drip-line of tree canopies while determining the size and shape of your rain garden.

- Perform soil test. If encounter water in the hole, the water table is too shallow to install a rain garden.
- Ovals, kidneys, and teardrops often look best, but rain gardens can also be long and skinny.
- Use a garden hose or large rope to test possible shapes.
- Once you settle on a design, decide where the water will flow into the garden and where any overflow will exit.
- Mark the shape with WHITE spray paint to indicate to Miss Utility of project location to insure no underground conflicts.
- Check local codes and permit requirements and always call **811** before digging.



Step 2: Remove Lawn & Topsoil

Strip away any lawn by slicing off the roots with a sharp spade directed at a low angle to cut **2-3** inch thick chunks of sod.

- You can also use a sod cutter, which you can rent for about **\$80** a day. You should be able to roll up sections of the stripped lawn as if they were pieces of carpet.



Step 3: Digging

Using a shovel or equipment, dig down to the depth you need.

- This would equal a total of **21** to **39** inches deep.
- The depth should be added up by considering the ponding area (**6** inches to **12** inches), **3** inches of mulch, and **12** to **24** inches of tilled or amended soil.
- Create a flat bottom so that water will soak down into the soil evenly.

Step 4: Fill with Amended Soil Mix

Soil amendments are recommended if the location is appropriate for a rain garden - even if the native soil percolates. You can buy a pre-made Rain Garden soil mix from a local vendor.

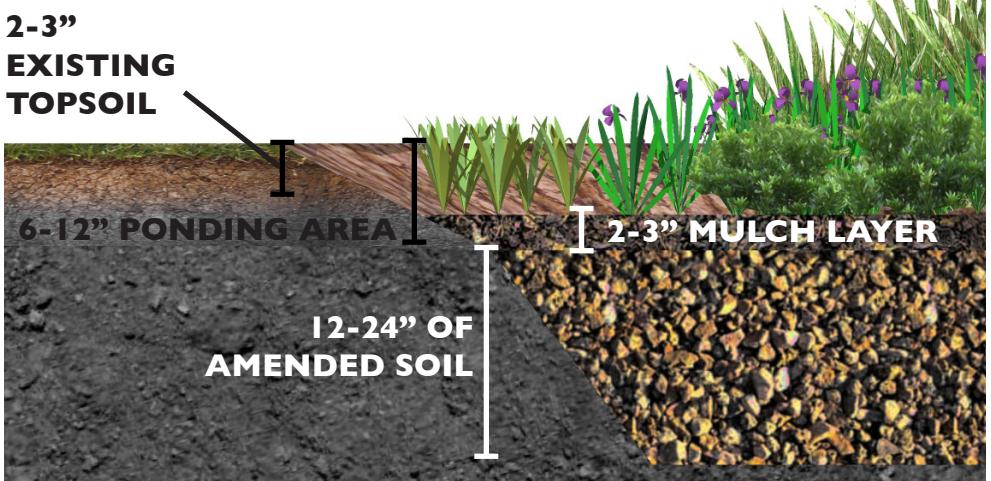
- Fill all but the top **6 to 12** inches of the excavated area back up with tilled or amended rain garden soil.
- If the rain garden is on a slope, you can pile some of the excavated soil into a berm on the low side to retain the water. Side slopes should be no steeper than **1** foot of vertical drop for every **3** horizontal feet.



Step 6: Mulching & Water

Mulch should be considered temporary. The planting plan should seek to cover the ground layer with native plants and over time this will suppress weeds.

- Add about **2-3** inches of mulch on the ground in the rain garden area, being careful not to put the mulch too close to the plant's stem or trunk.
- Thoroughly water your plants immediately after planting and add one inch of water per week (unless it rains) for the next **3-4** weeks.



Project Completion!

To return to the Table of Contents - click →



TREE PLANTING



DEFINITION

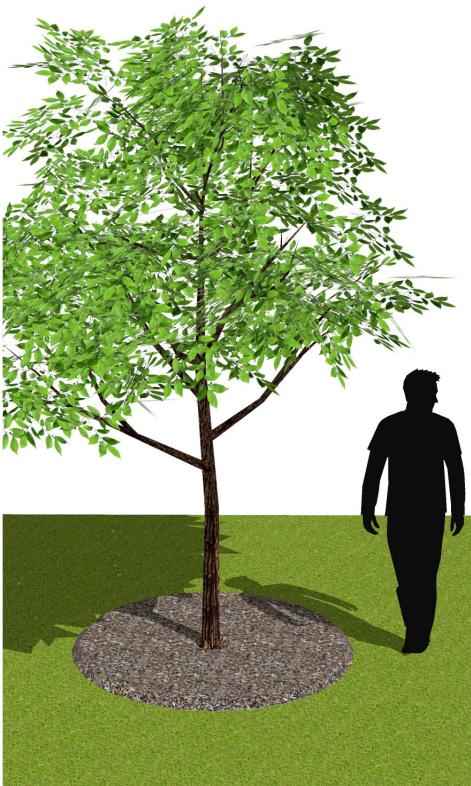
Tree planting can be implemented for reducing runoff and erosion, increasing your home value, reducing your heating and cooling costs, providing habitat and aesthetics, and adding important psychological benefits for you and your community.



A tree's underground network of roots absorbs water and spans outward in all directions from the trunk. Roots can be found to reach **2-3** times beyond the circumference of the tree's canopy. The roots of a large mature tree with its network of roots is estimated to drink up **50 - 150** gallons of water in a day!

Think of the tree you purchase as a lifetime investment. The health of your tree depends on the type selected, location you pick for planting, the care you provide when the tree is planted, and follow-up care the tree receives after planting. This will ensure decades of benefits and enjoyment. A healthy tree can live to be of historic status or have multi-generational family value.

Below is a general depiction of how large a tree may be at **1** year of growth up to **20** years of growth depending on the type of tree and size when planted.



1-2 YEARS GROWTH

5-10 YEARS GROWTH

10-20 YEARS GROWTH



BEFORE



NO PRIOR TREE

AFTER



NEWLY PLANTED TREE

EXAMPLES



The Willoughby Live Oak on Norfolk Naval Station has existed for at least **400** years. Volunteers cleared weeds from the tree on April **18, 2016**.
(Brock Vergakis)



American Elm at Elmwood Cemetery Norfolk

FINES & TRANSGRESSIONS



Parks & Urban Forestry Operations

Physical Address:
2839 Dana Street
Norfolk, VA **23509**

Phone:
757-823-4023

Fax:
757-441-5141

Staff:
Steven Patton, Jr.
Bureau Manager of Parks & Urban Forestry Operations

Email:
steven.patton@norfolk.gov
757-823-4029

Steven Traylor
City Forester

Email:
steven.traylor@norfolk.gov
757-823-4037

Forms

If you have a request for work that involves trees within the Public ROW fill out the form found on the Parks & Forestry Page.

<https://www.norfolk.gov/1224/Parks-Urban-Forestry>

TREE PERMIT APPLICATION

In accordance with the provisions of Chapter 45 of the Norfolk City Code (see reverse), I _____ (Name of Applicant) of _____ (Address) request authorization to perform the following work on or within the _____ (Address or Project Name) in accordance with ANSI A300: Professional Tree Care Standards of Practice, the City of Norfolk Arboriculture Specifications and Standards of Practice Manual, and any special conditions or restrictions stated herein.

PLEASE CHECK ALL BOXES THAT APPLY:

() Prune () Crown Clearing () Plant () Overhead wires present
() Root Prune () Crown Reduction () Other Species/Caliper () Other
() Utility Clearance () Remove () Fertilize () Inject/Implant
() Other (Specify below) () Other. Specify: _____

() Excavate within the dripline
() Root Prune
() Store equipment/supplies within the dripline
() Remove for driveway/sidewalk installation
() Remove, other (Specify below.)
Purpose for which permit is requested:

I, the undersigned, upon approval of this permit, hereby agree to abide by the terms and conditions of this permit and to cease work immediately if required by the Director of Recreation, Parks & Open Space or his/her representative. I also acknowledge that I have read and understand all provisions of the City of Norfolk City Code attached to this permit and further agree to comply with any violation of the provisions of this chapter or the terms of this permit, upon conviction, shall constitute a class I misdemeanor for each day such violation shall occur or continue.

Signature of Applicant

Phone No.

Date

A signed original copy of this request form is to be returned to: (No faxed forms or photocopies accepted.)
City of Norfolk, Bureau of Parks & Urban Forestry
2839 Dana Street
Norfolk, VA 23509
Phone: (757) 423-4023



See the Considerations section on [page 15](#) for Public Right-of-Way definition and location.



Transgressions

Topping, improper or unapproved pruning and/or other damage (graffiti, carving, root pruning, etc.) caused to any City tree as assessed by the City Forester is considered a transgression. If the tree needs to be removed because of these transgressions, the property owner shall be responsible for removing the tree(s).

For more info

<https://www.norfolk.gov/DocumentCenter/View/23107/Norfolk-tree-mitigation-standards-2015?bidId=>

Fines

Damage to plants can cost you **\$150.00** to **\$500.00** per tree & shall be guilty of a class I misdemeanor.



EXAMPLE OF TOPPING

CONSIDERATIONS

Poorly located trees are doomed from the beginning, no matter how carefully they are planted. Look for obstructions that the tree will be in conflict with as it grows tall and wide. This will avoid costly repairs or tree removal in the future. The following are common reasons to be mindful of location.



- Power lines
- Property line
- Foundations
- Roofs
- Sidewalks

- Utilities
- City Code
- Neighborhood Associations
- Local Watershed Regulations



Underground

Tree roots continually seek out water and nutrients as they grow. Underground sewer and stormwater pipes with cracks or holes can become clogged over time.



Ground-Level

Large species of trees can grow large trunks and large roots that can bulge sidewalks and crack house foundations.



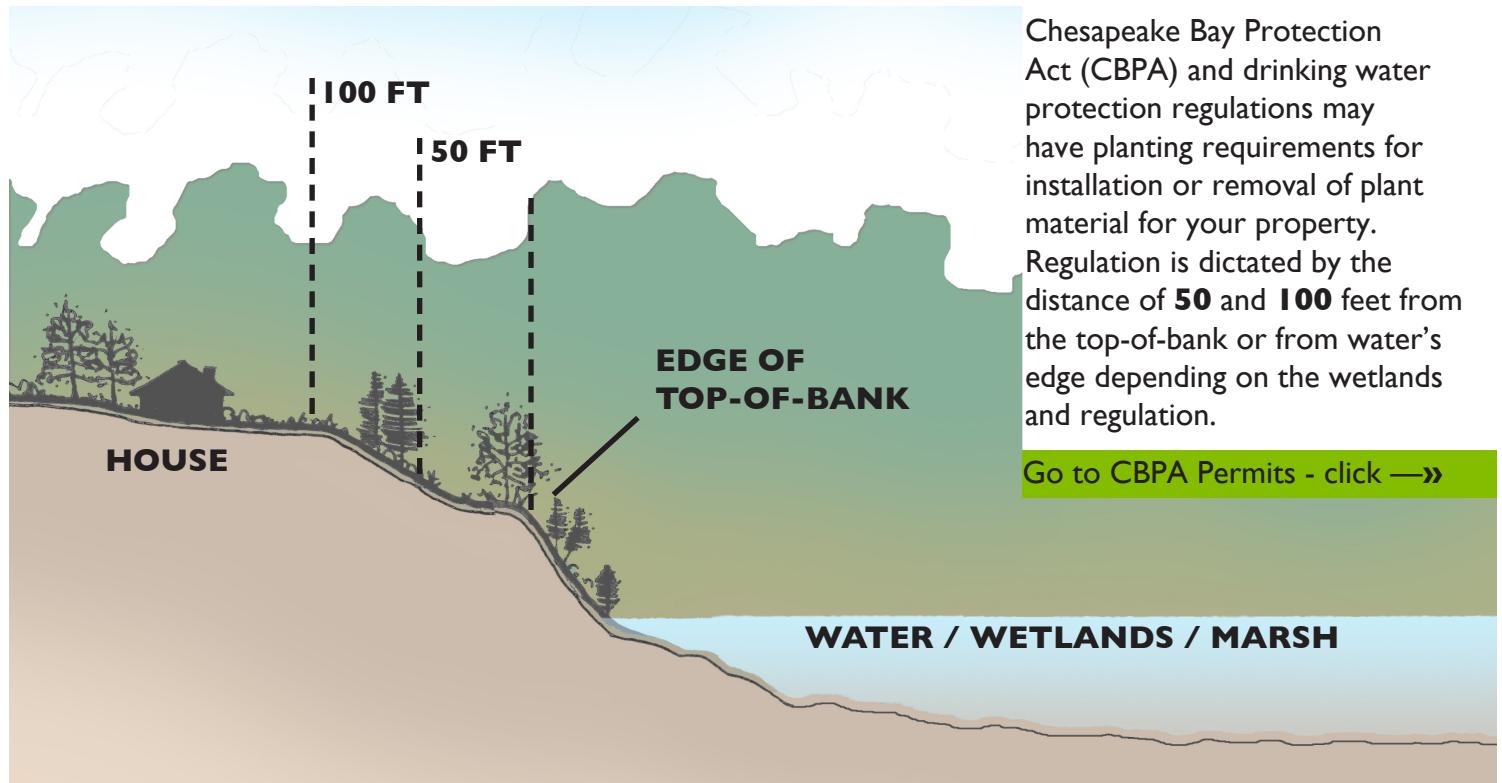
Overhead

If the tree selected grows tall into overhead structure or cables it will likely be subject to topping damage and weakened structure.



Proximity

Trees have a variety of canopy types from narrow to wide. How close to a house, structure, or utilities should be considered when selecting a tree's location. Select the right tree based on its estimated mature size to ensure there is space for it to live long and flourish.



GETTING STARTED

Trees are ideally planted during the dormant season, which is in the fall after leaf drop or in early spring before budding. Trees can be balled and burlapped or they can come in containers. Proper site preparation, handling, and follow-up care will help to promote health and growth from transplanting.



DO IT YOURSELF (DIY)

If you intend to perform this work yourself, see the lists for general tools and materials you may need to help you get started. Note that larger trees may require help and more time to plant.



Tools & Materials:

- Personal Protective Equipment (PPE)
- Paint for marking the ground
- Shovel
- Wooden or metal stakes
- Wire or tree ties
- Rubber tubing (protect tree from wire)

- **2 - 3** wooden stakes or metal fence post
- Rubber tubing (protect tree from wire)
- Wire cutter
- Hammer or mallet
- Mulch
- Tree(s)



HIRE OUT THE WORK

Contact a [CBLPro](#) licensed and bonded landscape or site contractor. Prices will vary on amount and size of the trees to be planted.



MAINTENANCE

Seasonly

- Remove grass and weeds from mulched area.
- Adjust stakes and wires to allow tree growth.

Yearly

- Before applying new mulch, stir up the existing compacted mulch with a rake or similar hand tool. This will ensure proper gas exchange and allow

moisture to access the root-ball.

- Mulch should be maintained at a **2-3** foot radius, **2-3** inches deep, and **2-3** inches from the trunk of each tree.
- Remove mulch in excess of **3** inches thick.
- Prune out dead, damaged, & diseased limbs.
- Prune limbs that hang into walkways or are brushing against structures.

- Remove stakes and wires **1** year after planting.



TREE SELECTION

Consider selecting a tree as a lifetime investment that will provide beauty, privacy, and value to your property. The growth of the tree, and investment, depends on the care you provide it. Following the tips and instructions provided will ensure years of enjoyment and value.

A tree can come in one of four forms:

- Bare-root (deciduous plants only)
- Balled & Bur-lapped (B&B)
- Container-grown (most common)
- Containerized



TREE FORMS

summer as heat stress and water demand is high in turn reducing chance of survival. Have a spot picked out beforehand as you will need to plant your newly purchased tree as soon as possible.

the winter. Conifers can provide a wind screen in the winter. Tree selection may be noted for locations that are drier or remain wet longer than other areas. Go to your site in the morning and then again in the afternoon on a sunny day to properly categorize it. These are the categories you can choose from to describe your site:

- Full sun: **6** hours or more a day
- Partial sun: **4** to **6** hours a day
- Shady: Fewer than **4** hours a day

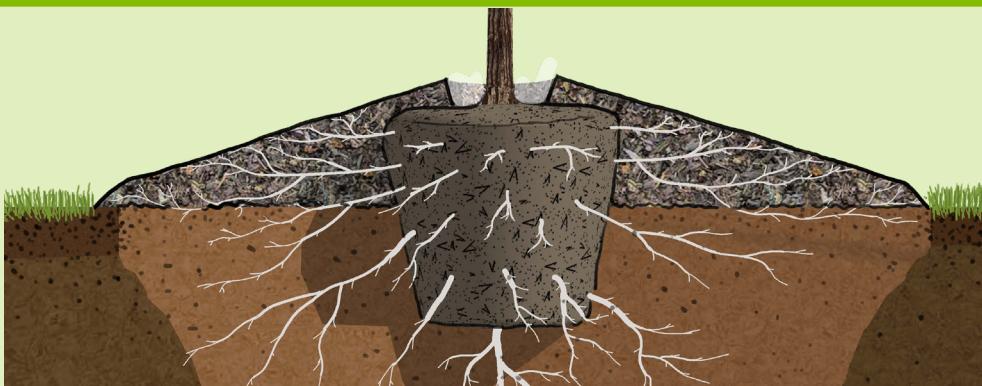
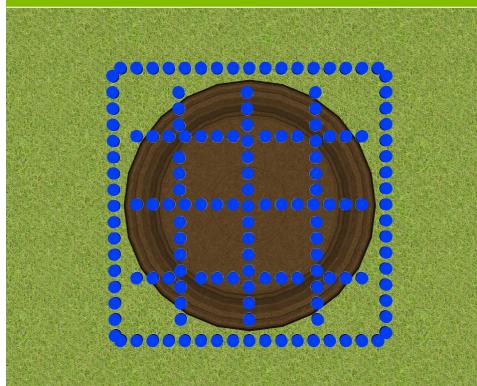
See the Plant List - click —»

When to Plant

Tree planting can take place year-round if properly cared for and watered. The ideal season is during the dormant season in the fall after leaf drop or after the last frost in early spring before bud-break. Do avoid planting in the hottest days of

How Much Sun

The shade from deciduous trees planted on the east or west sides of a house can help to keep your house cooler and conserve energy in the summer. Because deciduous trees lose their leaves, they will let in the sun to warm your home in



Area Needed For Planting

- Bare-root - **12** to **16** inch wide hole (or depending on root size)
- B&B and Container - **2** to **3** times the width of the root ball or container.

Deadly Combos

Planting the root-ball above ground level and then mounding mulch promotes shallow rooting into the surrounding soil. This results in:

- Stunted tree growth

- Increases chance of mechanical, pest, and fungus damage to roots.
- Creates a poorly anchored tree that may fall in maturity incurring addition financial cost and lost benefits.

HOW TO

Once you have selected a location and a tree from the list that will grow to a mature size and not be an obstruction in the future you are ready to proceed. Planting can be accomplished by the homeowner, volunteers, or a landscape contractor.



- Check local codes and permit requirements

Step 1: Assess & Mark

Once you have selected the type of tree and where you want to plant it, use white paint to mark the location. Then call **811** before digging.

Step 2: Preparation

Dig a hole **2-3** times as wide as the root ball but not deeper than root ball.

- Take care NOT to break up root-ball.
- Tap lightly on sides and bottom to remove tree from container.
- If wire is present remove sections from top of burlap ball.

Pro Tip: If root-bound, cut an X across the bottom of the root ball and four vertical slices along the sides of the root ball with a sharp knife.

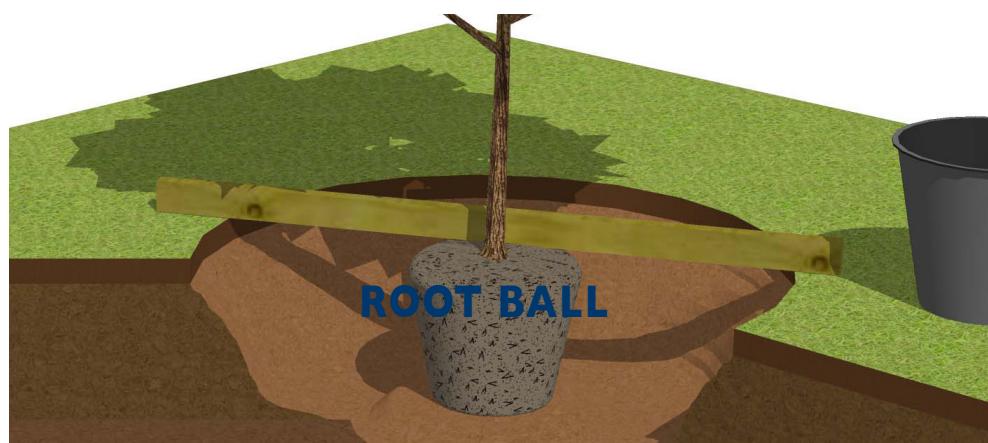
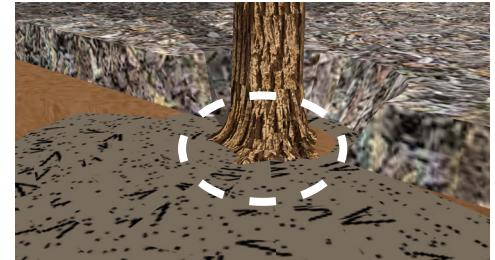


2-3 TIMES SIZE OF POT

A ROOT-BOUND TREE



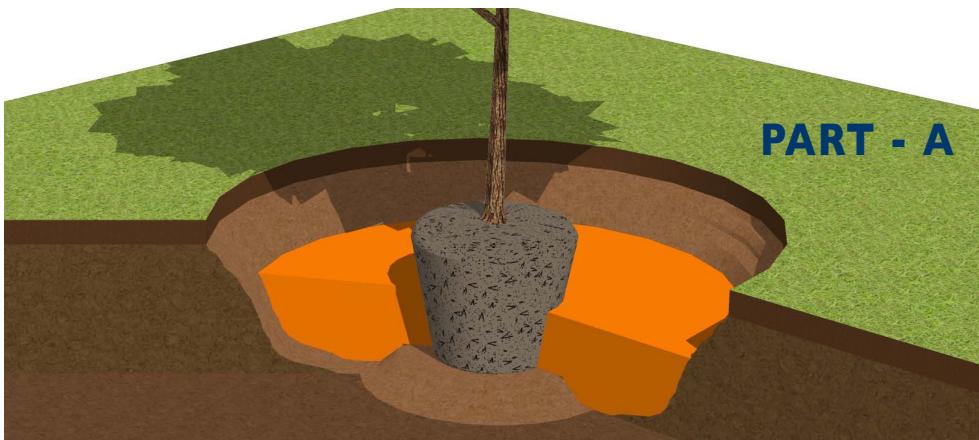
ROOT-FLARE OF A TREE



USE A BOARD TO LEVEL

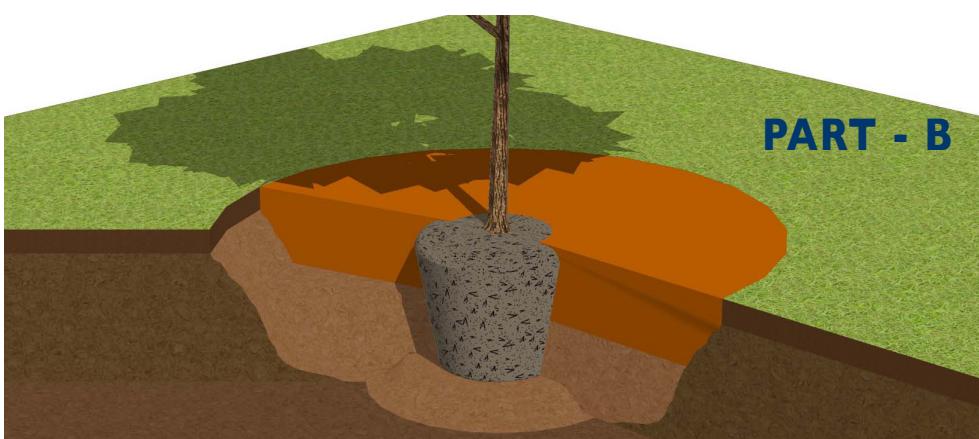
Step 3: Placement

- Place tree in middle of hole.
- Fill bottom of hole to elevate root-ball.
- Use board to ensure root-flare is at ground level.



Step 4: Fill

- Use original soil.
- Fill **1/2** of hole and lightly pack
- Fill Rest of hole
- Cover root-ball with **1/2** inch of soil and level remaining soil around tree.

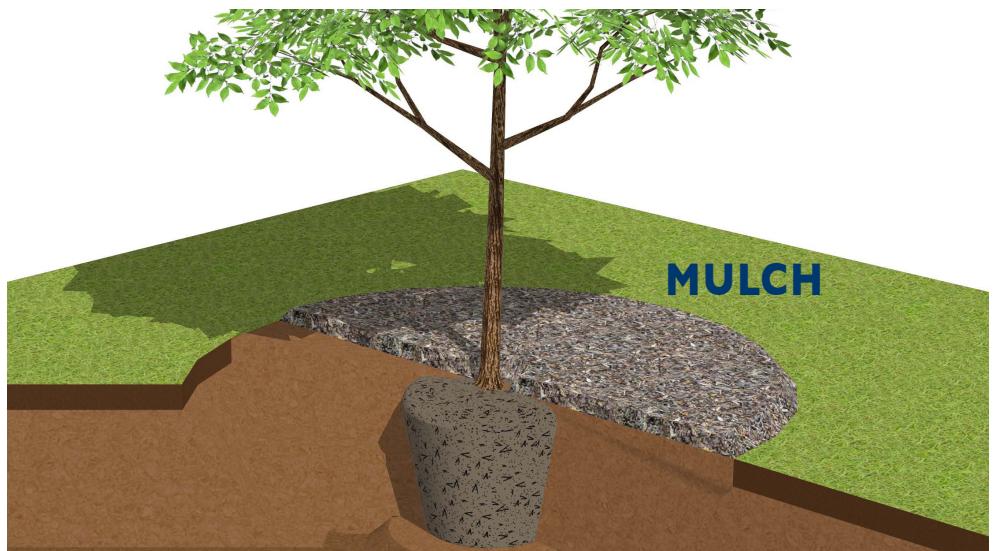


Pro Tip: Remove strings, wire, or rope that is wrapped around the tree trunk. These will eventually strangle and kill your tree as it grows. This is called Girdling.

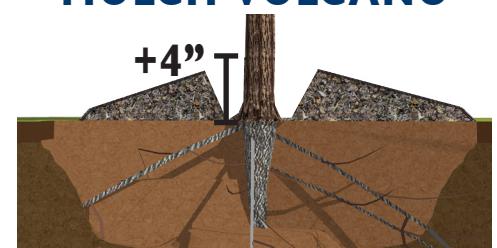
Step 5: Mulching

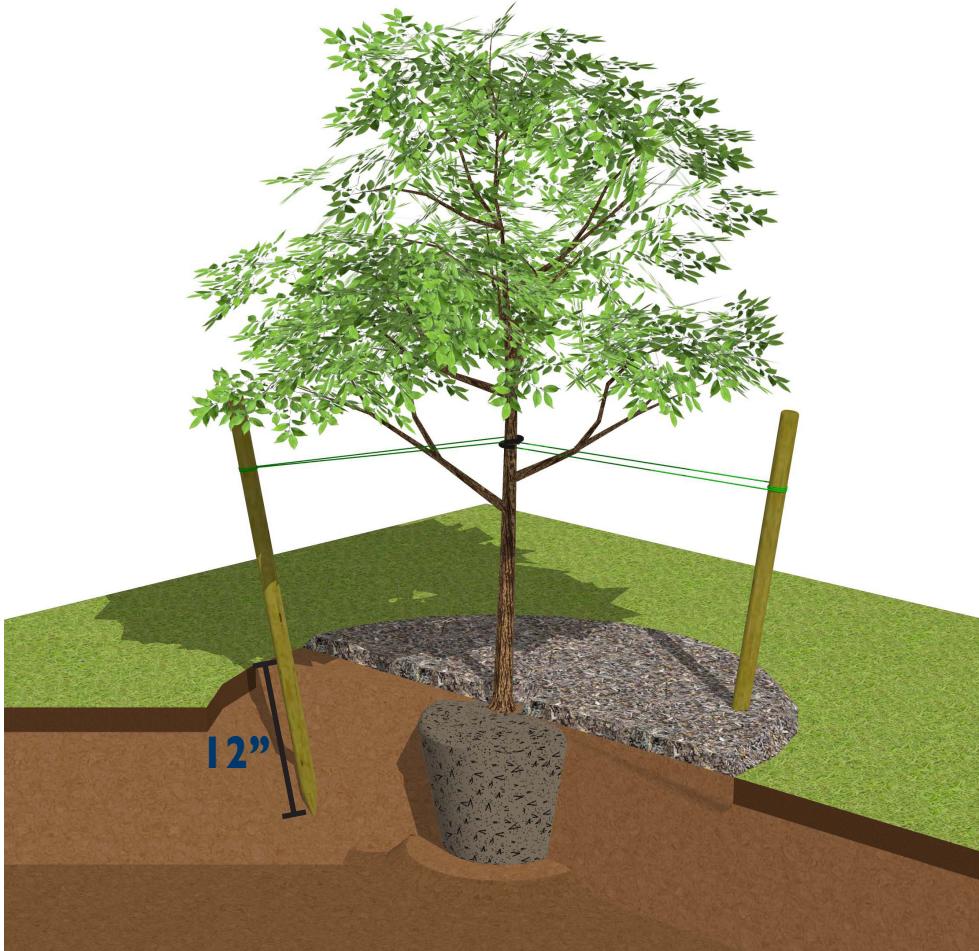
Use mulch to make a ring around the base of the tree **2-3** inches deep. (Takes about **2** bags of wood mulch)

- Do not use plastic or fabric as a mulch.
- Use organic materials or natural colored rock.



Pro Tip: Prevent mulch volcanoes (mulch piling up against the trunk) by keeping mulch **4** inches away from root flare to prevent disease and insect damage.





Step 6: Staking

NOT always necessary to stake - only use stakes if you find that the tree is in a highly trafficked or windy area - or if you find that it needs extra support and is leaning.

- Use **2** or **3** stakes that are at least **6** feet long
- Arrange stakes at locations **12 & 6** or **10, 2, & 6** in a triangular arrangement.
- Drive stakes at least **12** inches deep
- Tie nylon rope or wire from the stake to the mid-section of the tree (**do not over tighten** - some slack is needed for tree to sway and grow stabilization roots)
- Remove stakes after one year max

Pro Tip: Use old garden hose or other soft rubber tubing to protect the bark from the tree tie.

Step 7: Watering

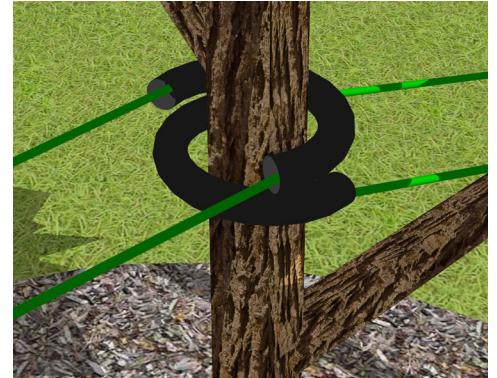
When dry, apply **3-5** gallons of water **3** times a week for first month, twice a week for the next month, and once a week for the rest of the growing season.

- Reduce to **1-2** times a month for second growing season. If drought conditions are present, apply water once a month through the third growing season.

For more detailed information on trees see VCE Publications:



https://www.pubs.ext.vt.edu/tags.resource.html/pubs_ext_vt_edu:trees-shrubs-groundcovers



The following VCE articles are specific to this Home Project:

- How To Plant A Tree - HTML SPES-**226NP**
- Planting Trees - PDF Publication **426-702**
- Tree & Shrub Planting Guidelines - PDF Publication **430-295**

Project Completion!

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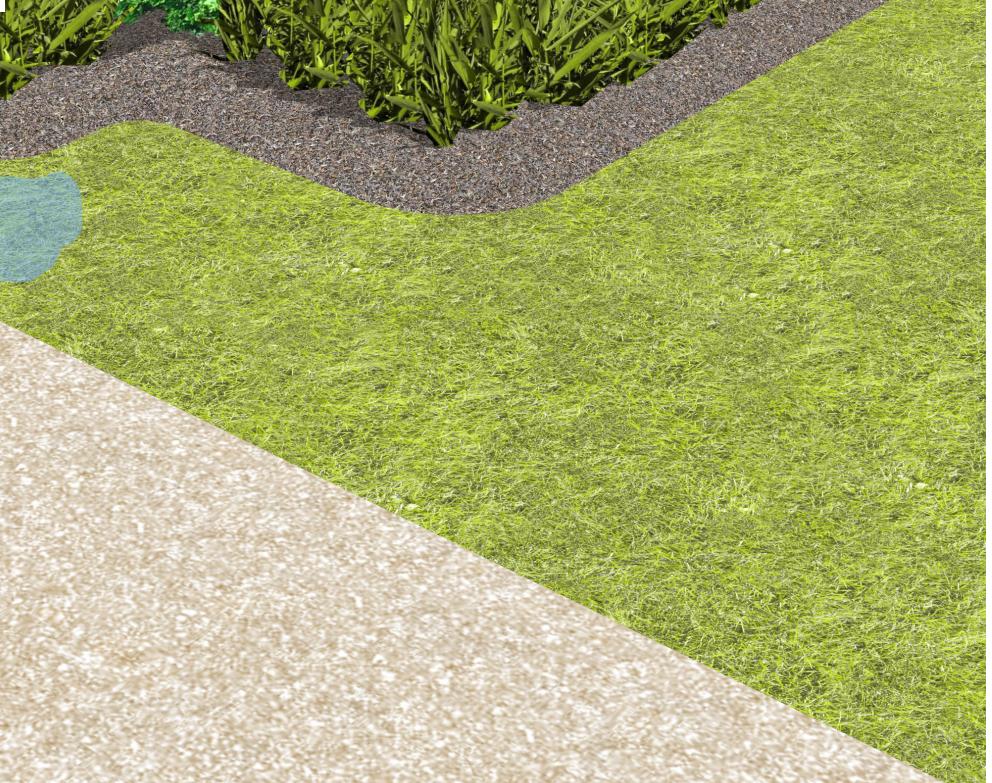
INFILTRATION

DEFINITION

Infiltration is a term used to describe the process of rainwater soaking into the soil. You can utilize various methods of infiltration to get water into the ground faster and to direct water to a certain area in your yard in order to keep it away from your foundation or any other highly trafficked area. There are several methods that are considered infiltration. Be sure that your soil can pass a percolation test before selecting any of these projects.

[Go to Soil Testing - click —»](#)

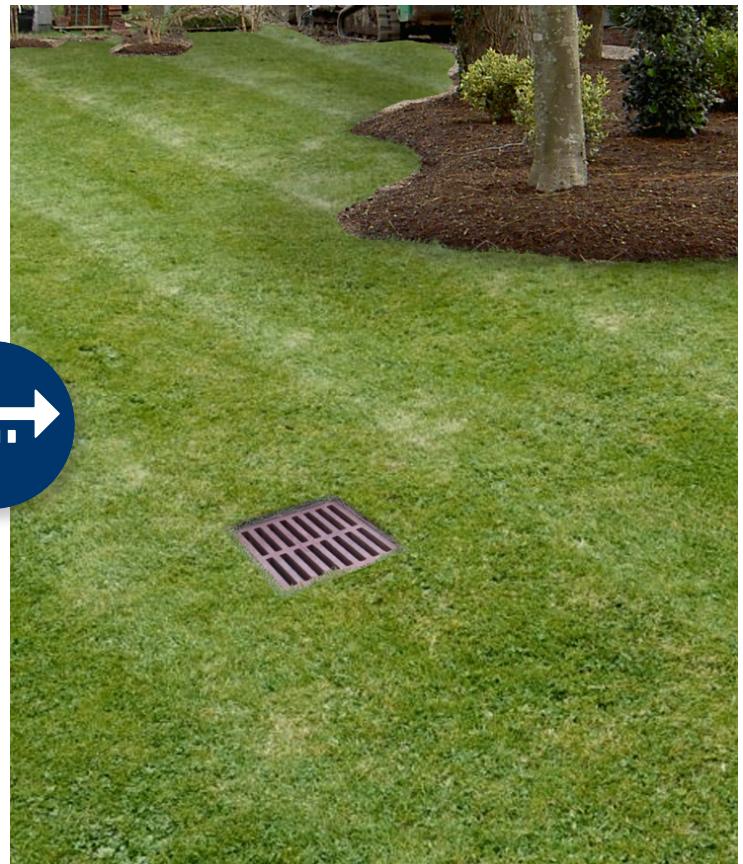
In this section we will focus on infiltration trenches, dry wells, and engineered soils. See the following pages for the **3** options within this Home Project.



BEFORE



AFTER



NO DRAINAGE

DRAIN CONNECTED TO UNDERGROUND PIPE

EXAMPLES

DRY WELL



INFILTRATION TRENCH



BE MINDFUL OF PLACEMENT



If you have a problem with water leaking into your foundation or basement, or ponding water somewhere in your yard, then you can use infiltration techniques to direct water away from your home or allow water to soak into the ground at a faster rate. Any of these techniques should be located at least **10** feet away from your foundation and sloped away from your house. If there is a low spot in your yard that you want to direct water to, site the infiltration so that it directs overflow to that area. You can also direct your downspouts into an infiltration area.

Most importantly, determine where you want the water to exit and determine if the drainage end is in a suitable location such as a low-lying area of your property away from your house. Be sure that you are not draining water toward your house or onto a neighbor's property.

- Infiltration methods should not be placed where the water table is located within **1.5** feet of the soil surface or where slopes exceed **10%**. They should be located down-slope from any rooftop or paved area that you want to drain.
- Runoff from downspouts will need some sort of pre-treatment before the downspout is discharged to the practice otherwise leaves, sediment and debris will clog the pipes in the practice.



3 TYPES

INFILTRATION TRENCH

Infiltration trenches or French drains are typically used around foundations or anywhere in your yard where you might have foundation/basement leakage occurring, water ponding, or subsurface moisture. They are shallow, linear excavations backfilled with just gravel or gravel with a perforated pipe within that funnels water away from where you do not want it and allows water to filter into the surrounding soils.



SIZE

The trench for your French Drain should be no less than **12** inches wide by **18-to-24** inches deep, depending on your pipe size and your foundation depth, if running it along your foundation. The length will vary depending on where you want your water to go. The pipe should be sloped one inch for every **8** feet in length.

DRY WELL

A dry well is a stormwater storage facility that is placed underground and receives runoff from roofs, gutters, or pavement. It temporarily holds rainwater and slowly discharges it into the surrounding soils. A dry well can be either a pre-made plastic chamber / bucket, a tank with holes or an excavated pit filled with gravel.



SIZE

Dry wells can be as large as you want them to be, but a standard size for a DIY project is about **4** feet by **4** feet. You will also need to dig a trench from your downspout to the well for the downspout connection if you decide to connect to a downspout.



ENGINEERED SOIL

Soil based infiltration systems are amended soils that are applied to areas of your yard that might have compacted soils or soils that do not drain properly. These amended soils can reduce stormwater runoff and may be used along with downspout disconnections, grass channels, and other home projects to infiltrate stormwater into the ground rather than allowing it into the public stormwater system. Due to their relatively small size, they can only handle smaller rainfall events. They can be vegetated with turf grasses, ornamental grasses, shrubs, and other native vegetation. Effectiveness may be enhanced through the addition of an earthen berm at the bottom side of the slope.



SIZE

Compost amendments for soil-based infiltration can be applied to an entire area of yard space or be applied only to select areas. Typically, they are placed downslope from a patio or rooftop in a linear format to capture stormwater runoff before it goes into the street or a body of water. They can be as large or small as you want them to be, but a typical filter strip would run the length of your patio or rooftop, have a depth of **18** inches and a width of **3** feet.

GETTING STARTED

The tools and materials for installation are similar but have a few key differences among the **3** infiltration methods. Here are a few questions to ask before you start: If you can do the digging yourself? Do you have a place for the removed soil to go? Which method would benefit you the most?



DO IT YOURSELF (DIY)

If you intend to perform this work yourself, see the lists for general tools and materials you may need to help you get started. Note that this is a more labor-intensive project and may take help and time to complete.



Tools & Materials:

- Personal Protective Equipment
- Shovel OR Trenching machine

- Wheelbarrow
- Scissors or Utility knife
- Hammer
- Mason's line/ Line level
- Tarp or canvas
- Tape measure
- Wood stakes
- Rake
- $\frac{1}{2}$ " to $\frac{3}{4}$ " coarse washed gravel that is screened (~4 cubic ft. per 10 ln. ft. of drain)
- Non-woven, Class C geotextile fabric
- Fabric staples
- Pop-up emitter

- **8" - 12"** Catch basin
- Downspout adapter
- PVC glue
- Pipe connectors **40** gallon prefabricated polyethylene tank (Dry Well)
- Perforated PVC drainpipe (**3-4** inch diameter) OR Corrugated pipe with slits (Infiltration Trench)
- Engineered soil (**50%** sand, **30%** compost, and **20%** topsoil mixture)



HIRE OUT THE WORK

Contact a [CBLPro](#) licensed and bonded landscape or site contractor. Prices will vary on complexity and time needed to complete job.



KIT or SPECIALTY ITEM

Check online or your local home supply store



MAINTENANCE

Infiltration trenches & dry wells generally require little maintenance but can sometimes get clogged or damaged. Landscape fabric (filter fabric) acts as a barrier to prevent dirt and debris from entering the pipe or clogging up the gravel. However, regular maintenance is still required to make sure nothing blocks the flow of water.

Engineered soils are intended to be vegetated and left to naturalize.

Seasonal / Yearly

- Inspect your drain. The drain may have an inspection (clean-out) pipe or if it's connected to your downspouts, the downspout can be disconnected to allow access to your drainpipe.
- For clogged PVC pipe, rent an electric sewer snake to clean out the pipe. Do not use with

corrugated pipe as it will tear.

- Hose out the drain with a garden hose or pressure washer.
- If you have a severe clog, call a professional.



HOW TO - INFILTRATION TRENCH

Step 1: Assess & Mark

Verify your drainage will not adversely affect your house foundation, the health and root structure of nearby trees, anyone else's land or any public areas. Mark the trench route with white paint & call **811** before digging.

Step 2: Dig

Use a trenching machine or shovel to dig trench at minimum, **12** inches wide by **18** inches deep. Use the mason's line and a level to check the slope of the trench. Your trench and pipe should slope **1** inch for every **8** feet of distance at a minimum.

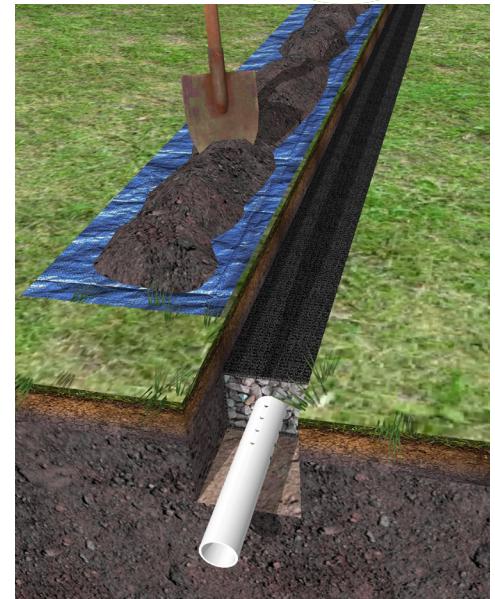
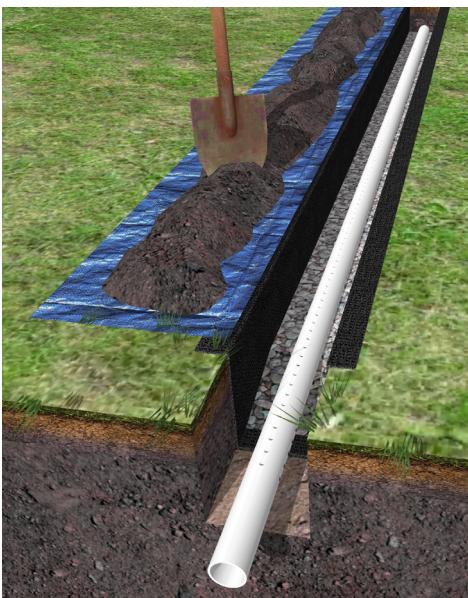
- Perform soil test. If encounter water in the hole, the water table is too shallow to install.

Step 3: Line the trench

Use a continuous swath of landscape fabric, if possible, to line the sides and top. Overlap pieces of fabric by at least **12** inches at the ends and secure with fabric staples driven into the ground with a hammer. Fold back the excess fabric to each side of the trench.



Landscape fabric ends needs to overlap in the direction of the desired flow of water.



Step 5: Fill & Wrap

Cover the pipe with gravel until there's about **3** to **5** inches of space between the gravel and the top of the trench. Then take the landscape fabric and fold it over the layer of gravel like a burrito.

Step 4: Gravel & Pipe

Fill the bottom of the trench with coarse washed gravel so that it is about **2** to **3** inches deep. Place the perforated drainpipe into the trench on top of the gravel. Make sure the drain holes are facing down.

Pro Tip: Test fit your parts before glueing!

Step 6: Cover up

Fill the top of the trench with the displaced soil. You can then lay sod on top, reseed, or use decorative river rocks or rounded stones to create a decorative landscape feature.

Project Completion!

To return to the Table of Contents - click →



HOW TO - DRY WELL

Step 1: Assess & Mark

Verify your drainage will not adversely affect your house foundation, the health and root structure of nearby trees, anyone else's land or any public areas. Mark the trench route with white paint & call **811** before digging.

Measure the distance from your downspout to the middle of your dry well to figure out how much PVC pipe length and connections you will need.

Step 2: Dig

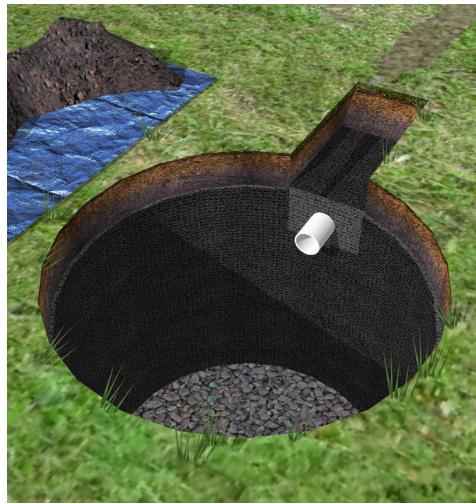
Using a machine or a shovel to dig a circular hole that is sized so that it is approximately **6** inches wider on all sides than your barrel. Depth will depend on the slope of your pipe and where you want the dry well to go as well as what material you want on top of your well. Try to dig the walls straight down. Depending on what kind of dry well you select will depend on the size of the hole you end up with.



Pro Tip: Test fit your parts before glueing!

Step 3: Trench

If you are connecting your downspouts to the dry well, dig a trench from where your downspout is located to the dry well. For more info about digging an infiltration trench return to the previous page.



Step 4: Fabric & Gravel

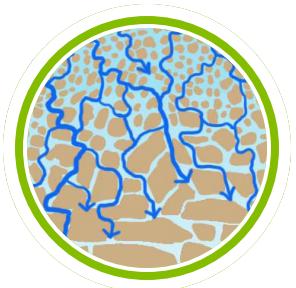
Line the sides with a layer of landscape fabric. Secure the sides with stakes to hold up the fabric until you fill the hole with gravel. Use a wheelbarrow to pour the first **2** to **3** inches of washed gravel over the bottom of your well hole. Tamp down the gravel.

Step 5: Connect

Make sure that leaf screens are installed at the roof gutter so that debris from the roof won't enter the downspouts and clog any pipes. Connect your downspout to a downspout adaptor and elbow. Use PVC glue to connect each one. Place the PVC pipe in your trench

Project Completion!

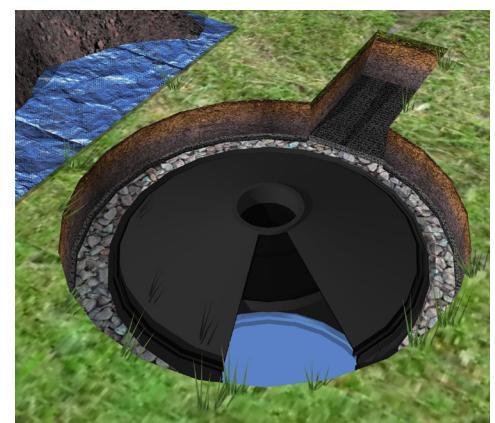
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and connect the elbow to the PVC pipe that you will be using to direct water to your dry well. Lower your tank into the hole and make sure the opening at the top lines up with your PVC drainpipe and the lawn surface.

Step 7: Fill

Use a wheelbarrow to pour **4** to **6** inches of washed gravel around the tank at a time. Tamp down the gravel between each load. Repeat till fill the hole. Take care not to pull fabric down as you fill in.



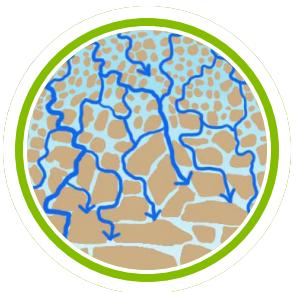
Step 8: Cover

Fold the landscape fabric to cover the top of the gravel and cut around the PVC pipe. Spread soil on top of the gravel and landscape fabric if you want to grow grass on top of it. Otherwise, you can put decorative stone on top.



HOW TO - ENGINEERED SOIL

Engineered soils are amended soils that are applied to areas of your yard that might have compacted soils or soils that do not drain properly. These amended soils can reduce stormwater runoff and may be used along with downspout disconnections, grass channels, and other home projects to infiltrate stormwater into the ground rather than allowing it into the public stormwater system. Due to their relatively small size, they can only handle smaller rainfall events. They can be vegetated with turf grasses, ornamental grasses, shrubs, and other native vegetation. Effectiveness may be enhanced through the addition of an earthen berm at the bottom side of the slope.



Step 1: Assess & Mark

Engineered soil filter strips should be placed parallel to a downward slope in your yard. The standard size for a filter strip is **3** feet wide by the length of the area that you are trying to capture runoff from. Mark the area with white spray paint and call **811** before digging.

Step 2: Clear

Clear and grub site as needed. Care should be taken to disturb as little existing vegetation as possible and to avoid soil compaction.

Step 3: Surface Prep

Rough grade the filter strip area including the berm at the bottom of the slope, if proposed. The berm should be about **3** inches in height by **18** inches in width.

Step 4: Dig

Trench approximately **18** inches deep and **3** feet wide upslope from the berm.

Step 5: Fill

Dump soil mixture (**50%** sand, **30%** compost, and **20%** topsoil mixture) into trench and fine grade the filter strip area.

Step 6: Plant

Seed, sod, or plant the area with shrubs, grasses or groundcover. If

using plants other than turf grass, be sure to add **3** inches to **4** inches of mulch on top of the compost mixture. Water regularly.

Step 7: Follow up

The soil-based infiltration area should be inspected at least once after each storm event that exceeds

½ inch of rainfall. Look for bare or eroding areas and make sure that they are stabilized with grass cover or mulch. Water once every three days for the first month and then weekly for the first year to establish turf grass or other vegetation.



Project Completion!

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CONSERVATION LANDSCAPING

DEFINITION

Conservation landscaping is the practice of preserving areas of native vegetation along with converting turf grass, bare soils, or areas with non-native invasive plants into areas filled with native plants and habitats. Sustainable design practices including invasive plant removal, environmentally sensitive design, the use of native plants, integrated pest management, amending soil, and conserving material resources can all be used when designing a conservation landscape.

Many homeowners would prefer starting with a clean slate when choosing plant material for their yard, but it is important to assess the existing plant material in order to preserve the native plants that might already be there. This will help preserve the natural habitat and processes that are occurring, and it allows you to make the most of the site without drastically altering the site and expending too many resources.

Planting native species is important to provide food and habitat for pollinator insects, songbirds and other wildlife along with reducing water use and minimizing chemical fertilizer use. Since water is such a valuable resource, the need for irrigation in conservation landscapes can be reduced or eliminated. Non-native invasive plants should be removed and replaced with native species. Native plants are adapted to local climate and soil conditions and therefore typically require the least amount of maintenance.



BEFORE



REGULARLY MOWED TURF AREA

AFTER



NATIVE SHRUB PLANTING

EXAMPLES

PERENNIAL GARDEN



NATIVE TREE, SHRUBS, & GRASSES



CONSIDERATIONS



The best place to start when designing a conservation landscape is by performing a site analysis. Consider the following:

- Existing vegetative and lawn areas
- Existing native plants
- salt tolerance if in a tidally influenced area.
- Soil types
- Sun / Part Sun / Part Shade / Shade
- Wind direction
- Slopes
- Views (to preserve or screen)

It is recommended to preserve existing environmental features and native plant communities on your site to the greatest extent practicable. If there are non-native invasive plant species, it is recommended that you remove them and institute an invasive species management plan. More information on non-native invasive plants and their management can be found from the Virginia Department of Conservation and Recreation website: <https://www.dcr.virginia.gov/natural-heritage/invspdflist>

Converting turfgrass lawns to plant beds or meadows creates a more natural habitat. Conventional lawns require high maintenance including water, fertilizer, and herbicide use.

When designing a conservation landscape, it is a good idea to look to nature when placing plants. Different layers of trees, shrubs, perennials, grasses and groundcover should be used to provide habitat for wildlife and aesthetics for your home. Choose the right plant for the right place. See plant species appendix for growing requirements.

See the **Plant List** - click —»

If you want to capture and treat rainwater runoff, locate your conservation landscape downslope from any paved surface or lawn and create a rain garden (see “Rain Garden” section) or bioswale (see “Bioswale” section). These practices are considered Best Management Practices or BMPs.

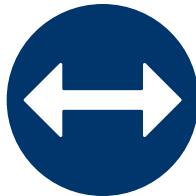
See more about **BMP's** in the appendix. Click —»

SIZE

Conservation landscapes can be any size that fits into your existing property. Yards with large open spaces may be more suitable for meadow plantings that can be mowed annually, while smaller sections of yard may be more appropriate for plantings in mulch beds that can be maintained by hand.



A useful online tool for designing conservation landscapes can be found at the Watershed Stewards Academy at <http://aawsa.org/conservation-design-tool/>. This tool contains plant layout templates for various landscape sizes in different configurations. See plant species appendix, this booklet, for appropriate plant selections for Norfolk. If large areas are to be cleared and graded (anything over **2,500** square feet of land disturbance), check with the **CITY OF NORFOLK** to see if an erosion and sediment control plan is required.



See the **Plant List** - click —»

GETTING STARTED

The cost of a conservation landscape project is determined by the area covered, amount of plants, and the materials used. Here are a few questions to ask before you start: If you can do the digging and planting yourself? Do you want it all done at once or over a few seasons? Do you have the resources to care for the plants on the property?

DO IT YOURSELF (DIY)

If you intend to perform this work yourself, see the lists for general tools and materials you may need to help you get started.



Tools & Materials:

- Personal Protective Equipment (PPE)
- Paint for marking out plant beds
- Shovel
- Rake
- Heavy equipment rental
- Garden hose or bucket

- Tape measure
- Utility knife
- Wheelbarrow
- Wooden or metal stakes
- Hammer or mallet



HIRE OUT THE WORK

Contact a [CBLPro](#) licensed and bonded landscape or site contractor. Prices will vary on amount of design and planting.



SPECIAL PLANTS / SEEDS

Specialty plants or seeds can be ordered Online or Visit this website to find native plant nurseries in Virginia: <https://vnps.org/view-native-plant-nurseries/>



MANAGEMENT PRACTICES

Check with the **CITY OF NORFOLK** on updated regulations for meadow management and if meadow management is allowed in your area.

All native grasses and wildflowers should be mowed twice per year:

- Early summer after the emergence of seed heads
- Early fall to prevent seeds of annual weeds from maturing

Turf grasses should be mowed on a regularly-scheduled basis during the growing season. See the Lawn Management section for more info-
[click —»](#)

Leave grass clippings on the lawn to provide nutrients and encourage stormwater infiltration.

Plants should be mulched to a minimum thickness of **2** inches.

Mulch should be removed and replaced every two years.

Groundcover established by seeding and/or consisting of grass should not be covered with mulch.

Naturalized areas should be maintained with a cover of pine straw and/or leaf litter.

Watering of plant material should be performed regularly during the establishment period and thereafter, as needed, to ensure survival.

The soil should be sampled if you notice sick plants or at least once every **4** years and tested at a qualified soil testing laboratory.

Avoid lime and costly fertilizers by using organic materials such as leaf mulch and compost to top dress your plant beds and lawn.

Inspect quarterly the first two years and bi-annually thereafter.

If invasive species or weeds are

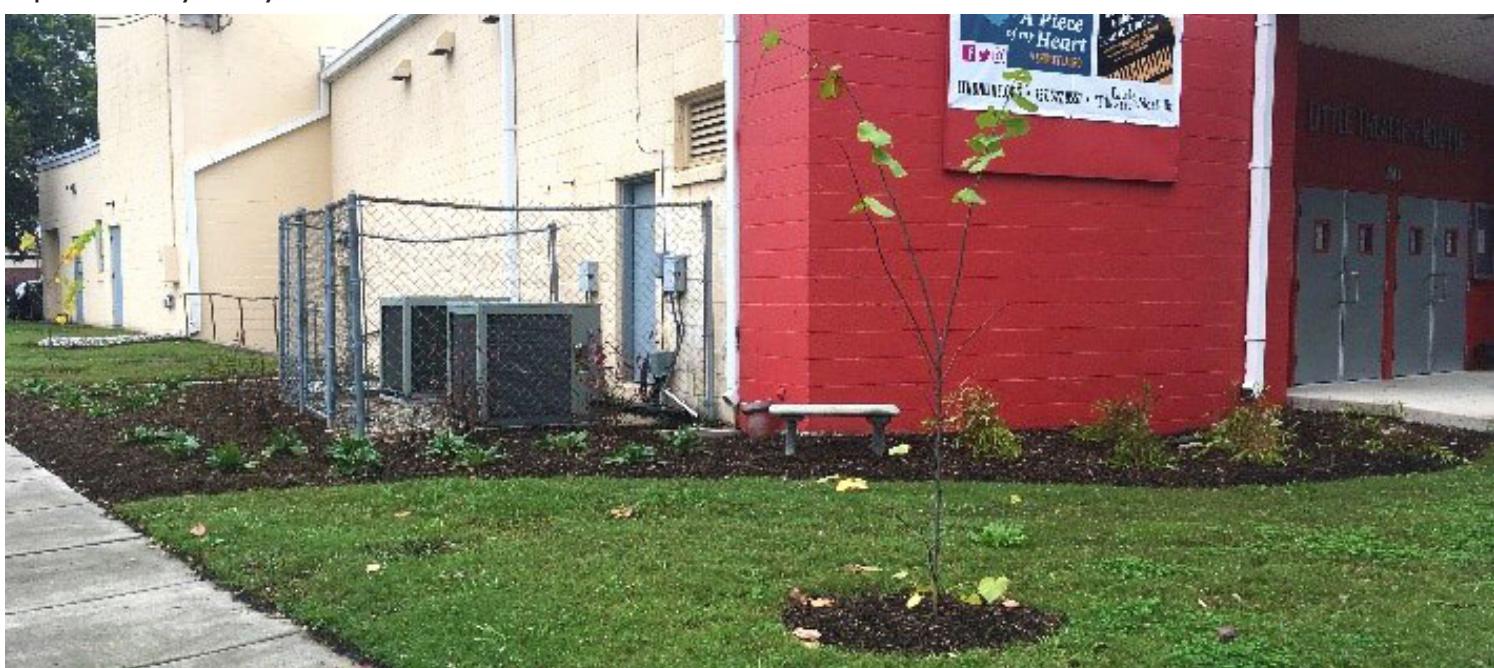
present, correctly destroy or remove the invasive species and weeds.

Virginia Invasive Plant Species List
<https://www.dcr.virginia.gov/natural-heritage/invsppdflist>

If you choose to install an Infiltration Home Project and the vegetation density is less than **90%** cover, reseed and fertilize (if necessary) the exposed soil or area.

Organic means of disease and pest control should be used on an as-needed basis based on monitoring activities.

All dead and diseased plants should be removed and disposed of appropriately. Then replace plant material as necessary.



HOW TO

The focus of this Home Project is to have a holistic approach to improving the local environmental quality of your property and those surrounding you. While also providing years of benefits and beauty for your own enjoyment.



OPERATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Aeration (Aerate lawn if needed)			↔↔						↔↔			
Cleanup (Rake leaves out of planting beds & cut back fall blooming plants) (Rake leaves / compost leaves & garden refuse)			↔↔							↔↔		
Fertilization (Fertilize evergreens if needed) (Fertilize specimen trees and shrubs if needed) (Fertilize lawn if needed)	↔↔		↔↔		↔↔				↔↔			
Mowing (Mow lawn as needed, edge and trim)				↔								↔
Mulch (Mulch all plant beds or replace mulch as needed)	↔↔		↔↔		↔↔				↔↔			
Planting (Plant B&B species - trees) (Plant container species - shrubs and perennials) (Divide groundcover & perennials as needed)		↔↔							↔↔			
Pools & Fountains (Winterize pools and fountains)												↔↔
Propagation (Propagate plants by cuttings)	↔↔											
Pruning (Cut back or prune vines and climbers) (Trim and shape needled evergreens) (Dormant pruning of fruit trees, evergreens and late-blooming ornamentals) (Prune and shape hedges) (Prune spring flowering shrubs and remove spent flowers) (Prune summer-flowering shrubs) (Deadhead perennials as needed)		↔↔			↔↔							↔↔
Seeding (Primary time to seed lawns) (Secondary time to seed lawns)		↔↔										
Transplanting (Transplant trees and shrubs)	↔↔		↔↔		↔↔							↔↔
Watering (Water all plant beds, trees, shrubs, gardens and lawns as needed)				↔↔								
Weeding (Weed all plant beds and lawns as needed)				↔↔								

Project Completion!



To return to the Table of Contents - click →

LAWN MANAGEMENT

DEFINITION

Lawns are typically mono-cultures of turfgrass. They require special attention that involves a regimen of tasks to keep it looking healthy and enjoyable. They provide a place for you and your family to play, relax, and enjoy.



The objective is to have a lawn that absorbs rainwater and does not harm local water bodies with over-application of fertilizers and chemicals.

In order to have a lawn that has a low impact on the environment, choosing the appropriate type of turfgrass along with proper lawn management is very important. For further info see the **10** core practices for urban nutrient management and bay-friendly lawns. Click —»



BEFORE



Patchy or Dead Spots

AFTER



Thin, Short, Bare, & Weedy



Uniform, Proper Cut Height

EXAMPLES

Bermuda grass



Tall fescue grass



LAWN TYPES



Cool season

These lawns consist of grasses that grow straight up. Fescues, Colonial bent, and perennial ryes are a few examples. These lawns will require more water during extended periods of heat during summer months. Establish or overseed in Late Spring to Mid-Summer.

Cool-season grasses

- Tall Fescue
- Kentucky Bluegrass
- Fine Leaf Fescues
- Perennial Rye

Seedling or recently established lawns within a year have very low drought tolerance. Establishing a lawn at the appropriate time optimizes root growth and reduces needed irrigation.



Warm season

These lawns consist of grasses that creep along the ground. Bermuda, Zoysia, and St. Augustine are a few examples. These lawns do well with minimal water during summer months and go dormant (TURN BROWN) during the winter season. If you do not like the looks of dormant grass, You can overseed during the winter with annual rye. Establish or overseed in Spring or Late Summer to Early Fall.

Warm-season grasses

- Bermuda
- Zoysia
- Centipede
- St. Augustine



No-mow

For those who have allergies, the shaded bare patch, or other reasons for not being able to care for a large lawn a no-mow approach may be better suited for your lifestyle. The approach is to select alternative short growing mat-forming plants that will take the place of turf grasses. Examples of these are clovers, phlox, and sedums. See the Plant List for more options.

The no-mow approach is a good way to compliment the Conservation Landscape Home Project.



Fun Fact: Water makes up 75% - 85% of a healthy grass plant.

LAWN AERATION

Aeration involves the removal of small soil plugs or cores out of the lawn. This can be done mechanically or by hand tool with the primary intent to alleviate compacted soils. Holes are **1-6** inches deep with a spacing of **2-6** inches apart depending on the severity of compaction and condition of the lawn.



Why aerate:

- Breaks up thatch layer.
- Allows for extra water, nutrients, and air to reach the roots of the grass.
- Gets more food for soil microorganisms that benefit the lawn.
- Loosens overly compacted areas for better absorption.

When to aerate:

- Take a sample (refer to the soil test)
- The lawn is heavily used or driven on.
- Thatch layer is greater than **1/2** inch thick.
- Have heavy clay or construction soils.

When not to aerate:

- Newly seeded or sodded lawns within the first year.
- Lightly used lawns- Seasonal freeze/ thaw cycles and earthworm activity will loosen soils naturally.

**DEEPER ROOTS =
BETTER DROUGHT
TOLERANCE = LESS
IRRIGATION**

- Can be aerated once a year under heavy use or less frequently under light use.

Where to get an aerator:

- Contact your local rental center or garden center.
- Contact your local lawn or landscape companies for service.



DE-THATCHING

Thatch is the layer of dead grass blades and clippings that collect on the surface of the soil. This layer over time decomposes and forms a thick layer that prevents water from quickly being absorbed into the soil. During heavy rain events, a thick layer of dry thatch will increase the amount of water leaving your lawn and collecting in the storm drain. In-turn increasing water demand and creating an environment for fungal diseases and pests.

Perform de-thatching by hand tool or machine annually or as needed. The practice of aeration also helps to break up the thatch layer. These two practices can be used in conjunction or alternated from season to season.



GETTING STARTED

The cost of lawn management project is determined by what you have existing or are looking to establish as new lawn. Here are a few questions to ask before you start: If you can do the tilling and seeding? Which type of lawn do you want and will it need irrigation? Is your existing lawn full of weeds, unlevel and holding water in some areas?



DO IT YOURSELF (DIY)

If you intend to perform this work yourself, see the lists for general tools and materials you may need to help you get started.



Tools & Materials:

- Personal Protective Equipment (PPE)
- Lawn Mower
- Seed, sod, sprigs or plugs
- Spreaders and sprayers
- Fertilizer
- String trimmer
- Leaf blower
- Shears
- Wheelbarrow
- Rake
- Aerator
- Rain Gauge
- Hose, sprinkler or Irrigation System



TURF SELECTION

See the chart below to help determine the type of lawn to establish.

Cool-Season Grasses	Seed	Sod	Sprigs	Plugs
Kentucky bluegrass	Yes	Yes	No	No
Tall fescue	Yes	Yes	No	No
When to plant	Sept. 1 to Oct. 15 or Feb. & March	Anytime soil is not frozen		
Warm-Season Grasses	Seed	Sod	Sprigs	Plugs
*Bermudagrass	Yes	Yes	Yes	Yes
*Zoysiagrass	Yes	Yes	Yes	Yes
Perennial ryegrass	Yes	No	No	No
When to plant	Late May to Mid Aug	Late May to Mid Aug	Late May to Mid July	Late May to Mid July

*some varieties can only be established vegetatively, not by seed.

HIRE OUT THE WORK

Contact any licensed and bonded landscape or site contractor. Prices will vary on amount of area to be worked and turf selection.



SEED, SOD & LOW PLANTS

See your local landscape supply or hardware store for seed and sod. Your local nursery will carry low growing plants if trying to achieve a no-mow lawn.



MANAGEMENT PRACTICES

Watering

A general practice is to ensure most turf-grasses get approximately 1 inch of water per week either by rainfall or irrigation.

Use a method of measurement to track the amount of water your lawn receives.

- Rain Gauge
- Small Container or Shallow Lid
- Rain Sensor
- Soil Moisture Sensor

A watering depth of **4** inches is ideal so that roots grow deep into the soil. To be most effective and reduce runoff, watering may need to be done in multiple cycles over a couple of days.

Apply water early in the morning around sunrise to reduce evaporation loss, allow the grass to absorb, and allowing blades to air-dry.

Over-watering leads to:

- Excess blade growth
- Summer fungal diseases
- More frequent mowing
- Water wasting
- Runoff of fertilizer and pesticide into local waterways

Thirsty lawns will show “foot-printing” when walked on due to the grass blades lack of spring back. This is a sign of wilting and lack of water.

Newly seeded or sodded lawns will need more water for the first **3-4** weeks.



Browning

Severe drought or excessive heat may cause some cool-season grasses to die or go dormant until conditions become favorable again. Similar for warm-season grasses going dormant during the winter season due to cold temperatures.



MANAGEMENT PRACTICES - CONT.



Mowing

Cutting the grass blades at the right height impacts the overall health of the lawn. This promotes deeper root growth and shading of the soil to reduce evaporation.

- Maintain Cool-season Grasses at **2.5 - 3** inches tall.
- Maintain Warm-season Centipede grass at **2 - 2.5** inches tall.
- Maintain Warm-season Bermuda and Zoysia at **1 - 1.5** inches tall.

Pro Tip: Keep mower blade sharp for a clean cut, not tearing.

Fertilizer

Late summer or early fall is the ideal application time. Avoid large spring applications as this promotes heavy growth during summer season. Reduce or eliminate fertilizer. If you choose to fertilize, adopt a reduced rate or apply less than a pound of Nitrogen per **1000** square feet per application. Maximize your use of slow-release N fertilizer. Sweep off any fertilizer that lands on a paved surface and never apply fertilizer within **15** to **20** feet of water body.

Pro Tip: Take a soil sample annually. This way you know what to buy, how much to apply, and don't pollute local waterways.

Fungicide & Pesticide

Only use if needed, for specific issues, and follow directions on package. Over broadcasting and overuse of these chemicals stay in your soil and end up in local waterways.



Weeds

Try to avoid using weed killer. With a good, dense lawn cover, the lawn should crowd out the weeds. If you do need to use weed killers, read labels when applying weed killers as your desired grass may be in one of these categories and susceptible to the chemicals used.

The categories of weed killers are:

- Selective
- Non-selective
- Pre-emergent
- Post-emergent
- Wetting Agents

The **5** groups of weeds to look for in your lawn are:

- Broadleaf
- Grassy
- Sedges
- Poa Anna
- Common Bermuda

Sprinkler Systems

Avoid watering roads, sidewalks, driveways and other hard surfaces. Rain and soil sensors can reduce watering by **50 - 75%** by water only when needed. Monitor the forecast - Don't irrigate when it is raining. Use the appropriate spray nozzle for the watering task to reduce water loss.

Project Completion!

To return to the Table of Contents - click →



PERVIOUS PAVERS

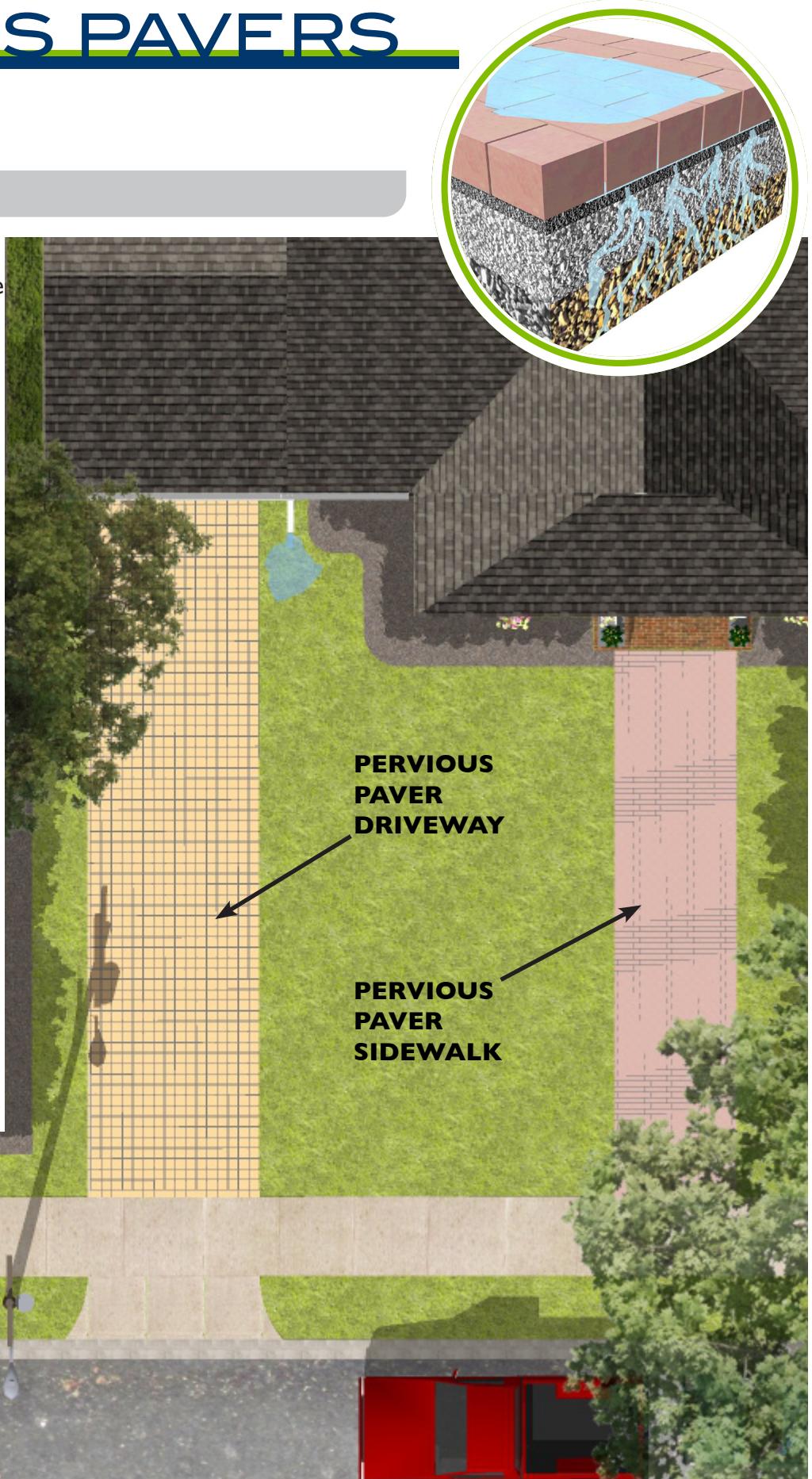


DEFINITION

Pervious pavers are pavers made out of concrete bricks and are separated by joints or gaps. These gaps are filled with small stones. The pavers are laid over a bed of washed gravel or clean aggregate stones that have no fine material to fill gaps. This way water is able to move through the gaps between the pavers and is stored in the gravel or aggregate area beneath the pavers until it infiltrates into the soil.

You can walk and drive on pervious pavers, just like on regular pavement. Although you can install them in small patio areas yourself, it is recommended that you hire a contractor to install them in larger areas, especially if you are trying to get credit for stormwater management criteria or if you are using them for vehicular loads such as driveways or parking.

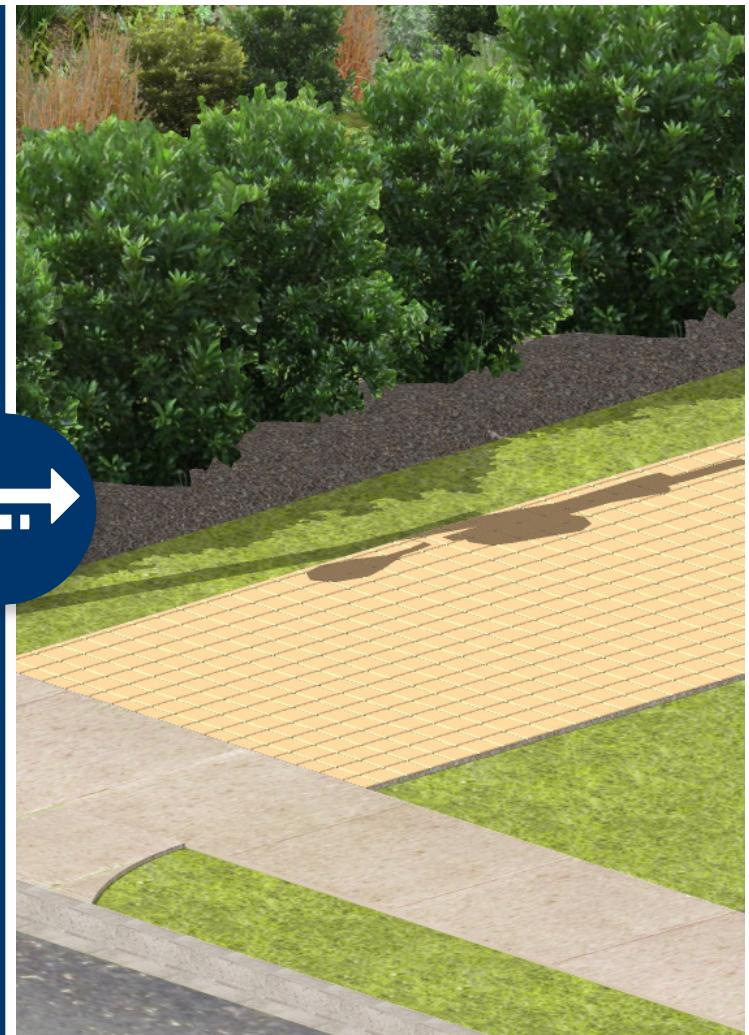
An Interlocking Concrete Pavement Institute (ICPI) certified contractor should be the one to install your pervious pavers.



BEFORE



AFTER



CONCRETE DRIVEWAY

PERVIOUS PAVER DRIVEWAY

EXAMPLES

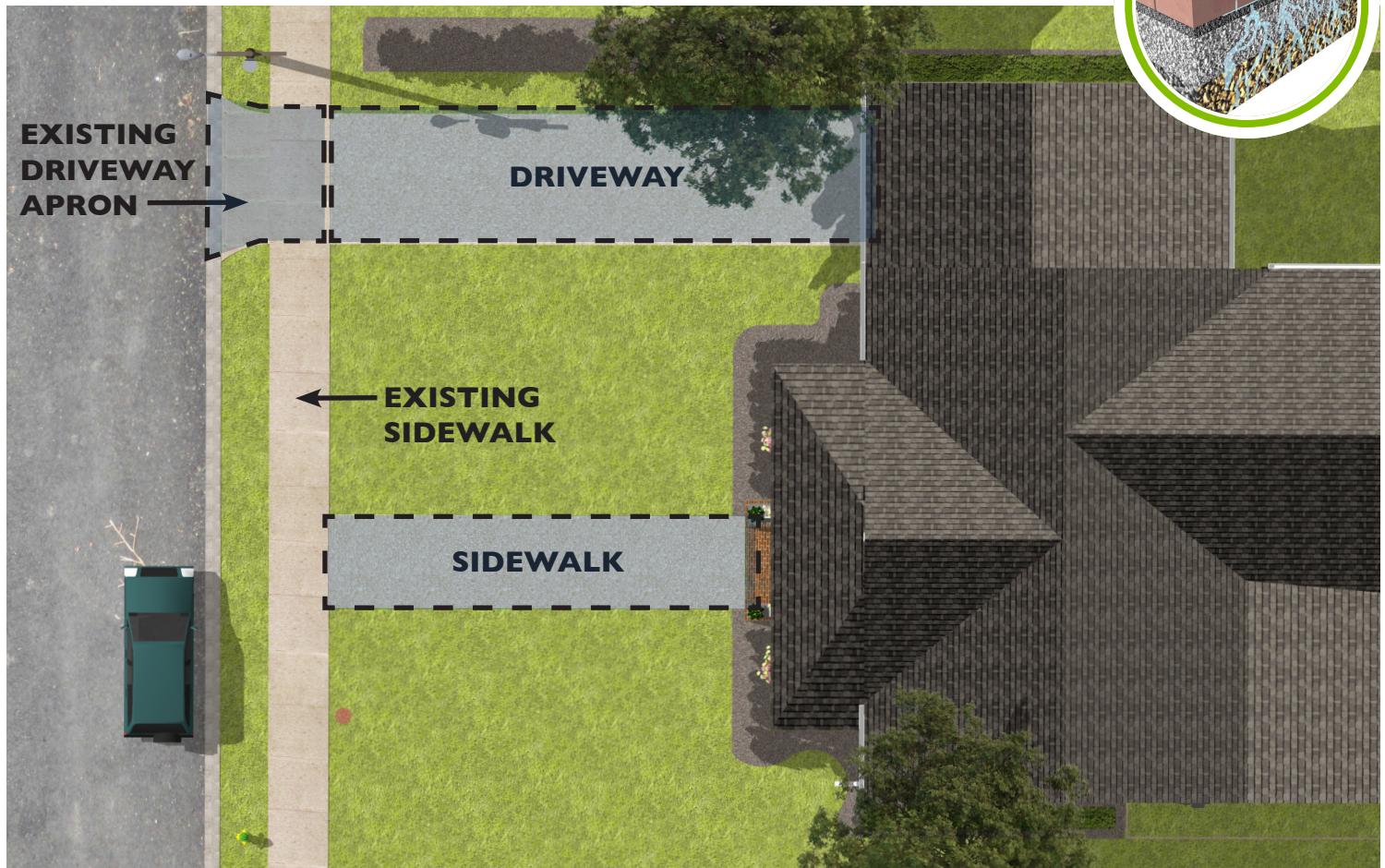
PERVIOUS DRIVEWAY



PERVIOUS SIDEWALK



CONSIDERATIONS



Typically pervious pavement replaces traditional concrete surfaces. These surfaces are commonly driveways and sidewalks. Driveway aprons have to remain concrete due to city code and vehicle weight requirements. Pervious pavers can also be used to create patio spaces and other paths on your property. The following items discuss several site conditions that need to be considered prior to determining whether a particular location is suitable for pervious pavers.

Steep slopes:

- Pervious pavers should not be placed on slopes greater than **5%**. This may cause too much shifting of base materials and pavers.

High Water Table:

- The bottom of the base aggregate should be at least **2** feet above the seasonal high water table.

Poor Soil Conditions:

- Be sure to test your soil beforehand to make sure that water percolates through it.

Floodplain:

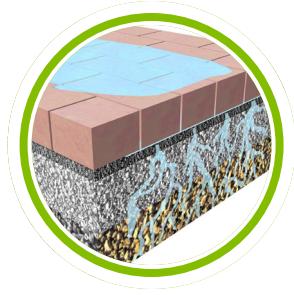
- Pervious pavers should not be constructed within the **100**-year floodplain.



GETTING STARTED

Due to the increased complexity of pervious pavers and the need for specialty equipment, it is strongly recommended that you work with an ICPI certified contractor.

If you want to install small areas of pervious pavers yourself, you will need the following items to help you get started.



DO IT YOURSELF (DIY)

If you intend to perform this work yourself, see the lists for general tools and materials you may need to help you get started.



Tools & Materials:

- Personal Protective Equipment (PPE)
- Paint for marking the ground
- Shovel
- Rake
- Heavy equipment rental
- Garden hose or bucket
- Tape measure
- Utility knife
- Wheelbarrow
- Hammer or mallet
- Pervious concrete pavers

- No. **2** Aggregate
- No. **57** Aggregate
- No. **8** Aggregate
- Plastic, steel or concrete edging
- Wooden or metal stakes
- Levels
- Tamper or Mechanical compactor
- Roller
- Underdrain (if needed)



HIRE OUT THE WORK

Contact a [CBLPro](#) licensed and bonded landscape or site contractor. Prices will vary on amount of digging and length of pipes.



SPECIALTY ITEM or KITS

Specialty items or drainage supplies can be ordered Online or found at a landscape supply store.



MAINTENANCE

Yearly

1 to 2 times annually (typically spring/fall): vacuum surface, remove surface sediment and soiled aggregate, and refill joints with clean aggregate, sweep surface clean and test infiltration rate.

Replenish aggregate in joints if more than $\frac{1}{2}$ in. (**13** mm) from chamfer bottoms on paver surfaces.

Inspect vegetation around perimeter for cover & soil stability, repair/replant as needed to prevent soil from washing onto pavers.

Inspect and repair all paver surface deformations exceeding $\frac{1}{2}$ in. (**13** mm)



HOW TO

Step 1: Assess & Mark

Verify your drainage will not adversely affect your house foundation, anyone else's land or any public areas. Call **811** before beginning the construction process.

Step 2: Site Prep

Set up temporary erosion and sediment controls during install and divert stormwater away from project site. Stabilize the area surrounding the pervious hard-scape. Do not install the system in wet conditions.

Step 3: Removal

When removing concrete keep from compacting the soil the permeable hard-scape will be placed on. Excavators or backhoes should work from the sides to excavate to the appropriate design depth and dimensions.

Step 4: Subsoil Work

The native soils along the bottom of the permeable hard-scape should be Scarified or tilled to a depth of **3 to 4** inches prior to the placement of stone.

Step 5: Rock & Edging

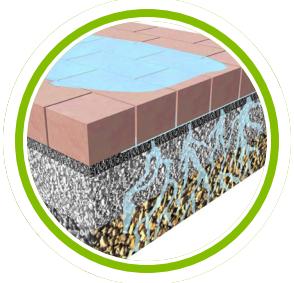
Moisten and spread the appropriate clean, washed stone aggregate (usually No. **2** or No. **57** stone) **6**-inches at a time to the desired depth. Place at least **2** inches of additional clean pea sized aggregate above and then lightly compact it.

Install edging restraint to keep stone and pavers in place.

Step 6: Lay Pavers

Paving materials shall be installed in accordance with manufacturer or industry specifications for the particular type of pavement.

- Pavers may be placed by hand or with mechanical installers.
- Fill gaps at the edge of the paved areas with cut pavers or edge units.
- Fill the joints and openings with stone. Joint openings must be filled per the paver
- Compact and seat the pavers into the bedding course.



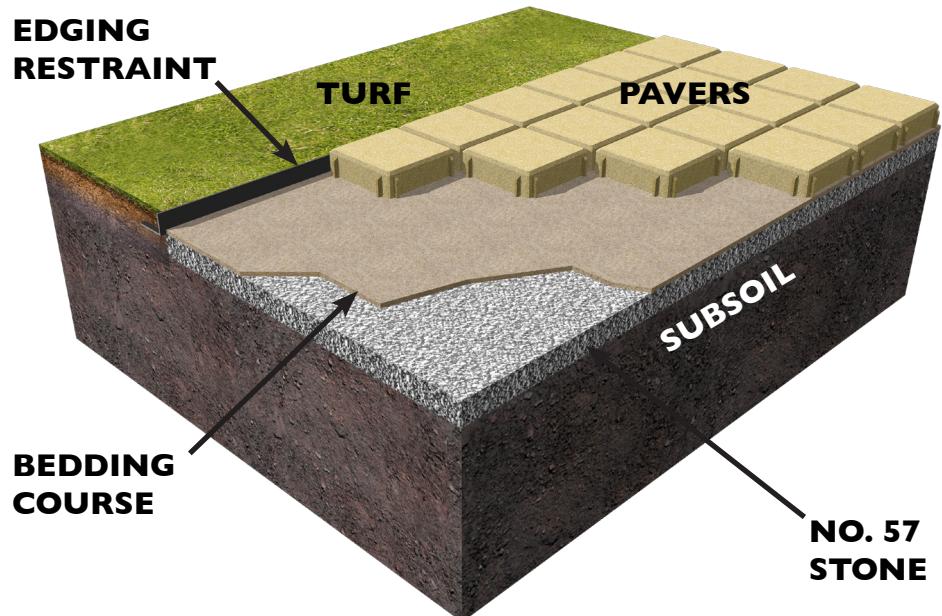
- Thoroughly sweep the surface after construction to remove all excess aggregate.

Step 7: Inspect

Inspect the area for settlement. Any pavers that settle or are not level must be inspected and reinstalled.

Within **6** months, top off the paver joints with additional stones if any areas are missing stone.

Pro Tip: Keep construction materials clean from being contaminated by sediment as this will clog the pavers.



Project Completion!

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BIOSWALE



DEFINITION

Bioswales are linear landforms sunken into the ground that convey rainwater into a drainage system, similar to a roadside ditch. The key difference is function. Bioswales consist of plants to help remove pollutants and sediment from the collected rainwater. Bioswales also may contain structures to help hold and slow the flow of water such as short walls and grouping of rocks, whereas a ditch simply moves water away from the source as quick as possible with no ecological benefit. The bottom of the bioswale may also infiltrate water and can be comprised of special soil media like a rain garden, or compost amended soils to enhance infiltration and treatment of the water.



BEFORE



AFTER



BIOSWALE WITH NO PLANTING

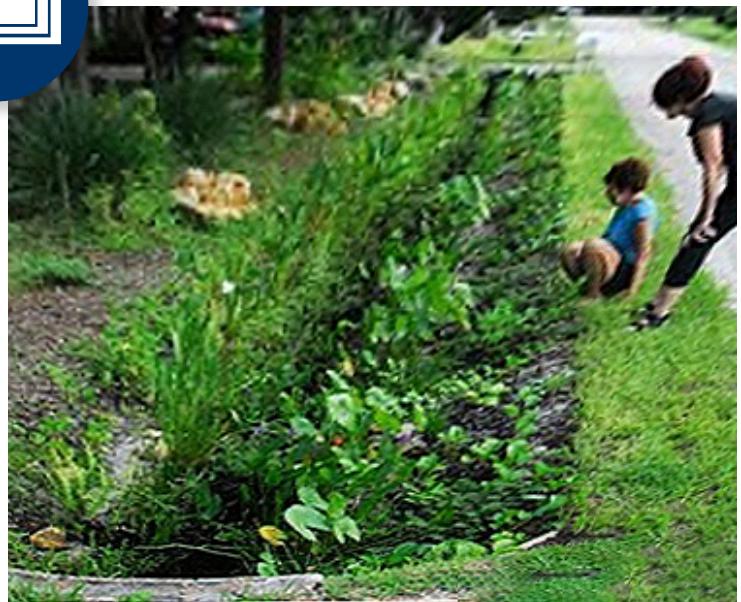
BIOSWALE WITH PLANTS ADDED

EXAMPLES

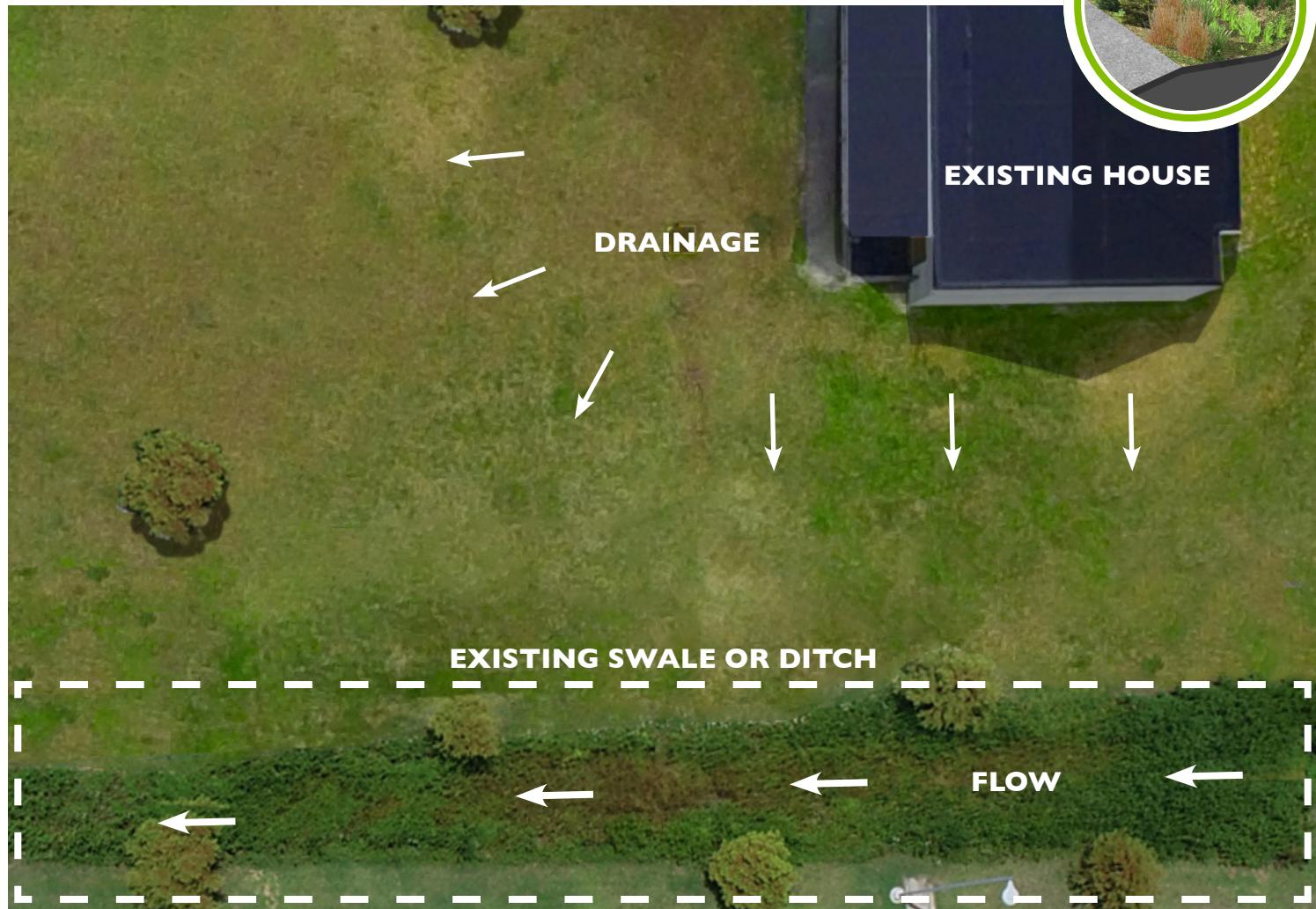
TURF BIOSWALE



PLANTED BIOSWALE



CONSIDERATIONS



An existing ditch may be the best location for a bioswale. Ditches typically reside in the public right-of-way space and will need an appropriate permit with approval from the city to install.

Other locations might be in your side yard to convey rainwater from your back yard to your front yard or vice versa if you have any drainage issues that you want to convey to a lower part of your yard, out into the street, or to an existing drainage system.

Ensure that the location you select is at least **6** feet away from your house and **5** feet away from your property line. This will help you avoid any water damage in case of future drainage issues.

Bioswales convey water from one area to another, therefore the slope should be fairly flat but enough that water will move from one end to the other. The minimum slope from one end to the other should be **1%**.

The side slopes should be at a ratio of no steeper than **3:1** and if possible, planted with native plant species. It is best to follow the contour of the land for the bioswale to capture rainwater.



GETTING STARTED

The cost of an bioswale project is determined by the length of trench, whether an underdrain is needed, and amount of plants used. Here are a few questions to ask before you start: If you can do the digging yourself? Have a place for the removed soil to go? Is an underdrain needed?



DO IT YOURSELF (DIY)

If you intend to perform this work yourself, see the lists for general tools and materials you may need to help you get started.



Tools & Materials:

- Personal Protective Equipment (PPE)
- Paint, hose, or sticks for marking the ground
- Shovel
- Rake
- Garden hose or bucket
- Tape measure
- Wheelbarrow
- Soil
- Non-woven geotextile fabric
- Plants
- Rocks (if needed)
- Perforated drain pipe (4")
- Heavy equipment rental



HIRE OUT THE WORK

Contact a [CBLPro](#) licensed and bonded landscape or site contractor. Prices will vary on amount of digging and length of pipes.



SPECIALTY ITEM or KITS

Specialty items or drainage supplies can be ordered Online or found at a landscape supply store.



MAINTENANCE

It is very important to maintain storage capacity and functional integrity of a bio-swale. Regular monitoring of infiltration capacity, structures, and management of vegetation are key in having a successful bio-swale.

Annually

- Soil infiltration test

- Maintain at least a 6 inch depression
- Replace or add plants

Seasonally

- Trimming of vegetation
- Fix areas of erosion
- Replace or add plants
- Remove undesired plants such as volunteer tree saplings

As needed

- Remove trash and undesired debris
- Remove any undesired blockage



HOW TO

Unlike a rain garden, bioswales carry water from one area to another and typically include a drain at one end to take away water that doesn't infiltrate. It is important to consider where water will move to during very large rainfalls. It could spill over into a natural area, a rain garden, or tie into a storm sewer system.



It is recommended to enlist the help of professionals before changing the drainage on your property. Landscape architects, engineers, and contractors who specialize in grading and drainage can survey your property to determine the best way to direct water while keeping your house and your neighbor's property safe.

Check local codes and permit requirements and always mark the area with white paint & call **811** before digging.

Step 1: Measure & Mark

Select a site and determine the size, shape, and length of your bioswale. Verify your drainage will not adversely affect your house foundation, the health and root structure of nearby trees, anyone else's land or any public areas.



Step 2: Remove Lawn & Topsoil

Strip away any lawn by slicing off the roots with a sharp spade directed at a low angle to cut **2-3** inch thick chunks of sod.

- You can also use a sod cutter, which you can rent for about **\$80** a day to aid in removal. Reuse or dispose of extra sod in a lawful manner.

Step 3: Digging

The sides of the bioswale should be constructed with slopes of **3:1** or less. The bottom of the longitudinal slope can range from **1%** to **4%**. Anything higher than **4%** would require the use of a weir or check

dam. These may be constructed of any resilient or waterproof material including rock gabions, earth berms, or stones.



- Be sure that you leave a minimum of **6** to **12** inches for ponding and that you keep the bottom of your trench **2** feet above the high water table.

- The depth should be added up by considering the ponding area (**6** to **12** inches), **3** inches of mulch, and **12** to **24** inches of tilled or amended soil. This would equal a total of **21** to **39** inches deep.



Step 4: Fill

Fill all but the top **6** inches of the excavated area back up with tilled or amended soil.

- If you need a pipe for overflow purposes or to connect to the public stormwater system, see the Infiltration **Home Projects** section on [Infiltration Trench](#) for instructions.
- Additional overflow connections to the drain pipe may be needed or added at the end of the bioswale where it can drain into a natural area or storm system. Raise the overflow drain system approximately **6** inches above the finished soil surface.
- Ensure that runoff can enter from the sides and that grading slopes towards the bioswale.

Step 5: Planting

See Rain Garden Home Project for [Choosing & Placing Plants](#) per water tolerance zone. See Appendix for [Plant List](#).

- Holes should be as wide as the plant's root structure and deep enough so that the surface of soil in the pot or top of root ball is level with the soil in the garden.
- If the plants are root-bound, loosen up the roots before planting them.

Step 6: Mulching & Water

Add about **2-3** inches of mulch on the ground in the swale area, being careful not to put the mulch too close to the plant's stem or trunk.

- Thoroughly water your plants immediately after planting and add one inch of water per week (unless it rains) for the next **3-4** weeks.

As an alternative groundcover, river stones can be used to create the look of a dry river bed.



Project Completion!

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GREEN ROOF

DEFINITION

A green roof is a layer of plant material that is placed on top of a flat or slightly-sloped roof along with a waterproof membrane and a growing medium. The plants are typically drought-tolerant paired with light-weight soils. The types of plants that make up the vegetation typically consist of succulents, grasses, wildflowers, and aromatic herbs to support insect, wildlife, and human needs. They also absorb and filter rainwater, provide insulation, lower air temperatures, provide noise attenuation, and increase the lifetime of your rooftop waterproofing by protecting against UV rays.

There are several types of green roofs with different depths of growing medium, but the focus of this home project is a less intensive green roof on a smaller scale that can range from covering a dog house, a storage shed, a detached garage, or a small portion of your home. Special soil mixes are used to help reduce weight and retain water. Using regular dirt or soil is NOT recommended.

Safety is of a high concern with green roofs. Adding extra weight to a structure not designed for the extra load can cause collapse or other structural issues. Professional advice is important when considering a green roof over living spaces.



BEFORE



STANDARD ROOF SHINGLES

AFTER



PLANTED WITH SEDUMS

EXAMPLES

SEDUMS



SEDUMS CLOSEUP



BE MINDFUL OF PLACEMENT

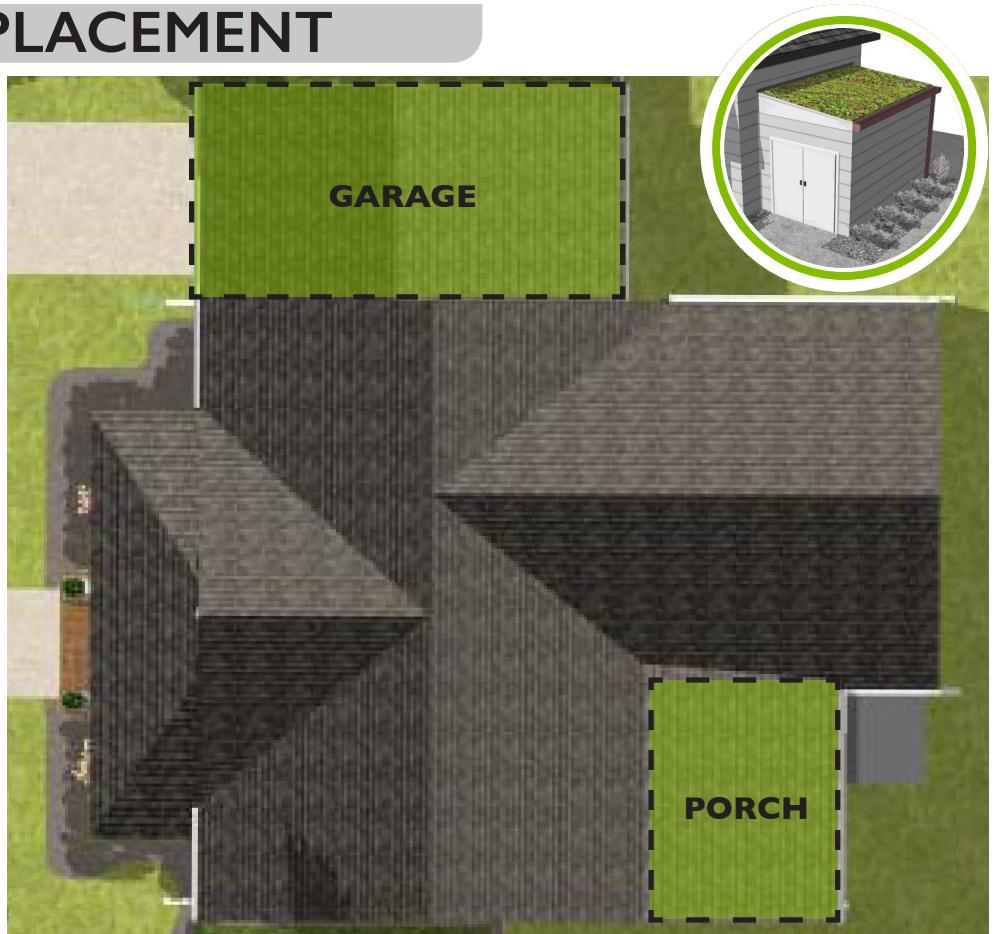
A few key factors are going to determine the location of a green roof:

- Over non-living quarters
- Roof pitch
- Structural capacity

The size is determined by how much weight the structure can hold. Materials in the structure that are damaged or old may have to be replaced to meet requirements. For this reason an extensive form of greenroof with a profile of **2 - 8** inches of growing soil is recommended.

Can the existing structure take the extra weight of the green roof?

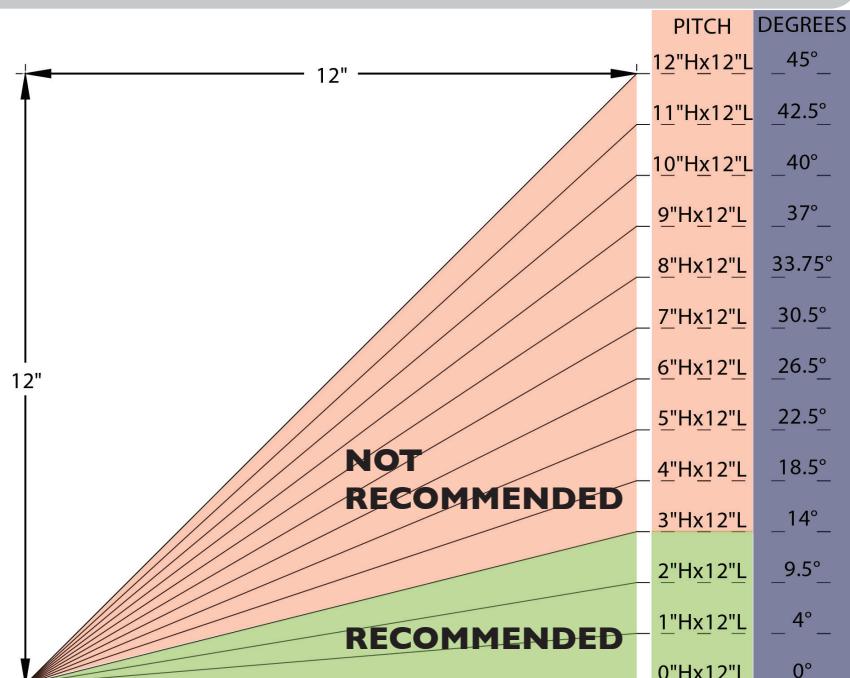
- Simple lightweight green roofs weigh between **13.0-30.0** lb/sq.ft (**60-150** kg/m²). If you are unsure of the loading your roof can take, consult an architect or structural engineer before



you do anything else. When calculating the weight that the green roof will impose on the roof, you must also take into

account the weight of the green roof when saturated with rain or snow.

ROOF PITCH DIAGRAM



It is recommended (in green) to only use a roof with a slope in the range of **2** to **14** degrees.

Greater than **14** degrees (in red - not recommended) requires support measurements to be in place to keep the soils from sliding off the roof and crashing to the ground.

It is also recommended to have a perimeter around the edge of the roof to access the planted area for containment and as needed for service access.

GETTING STARTED

The cost of a green roof project is determined by the area covered and materials used. Here are a few questions to ask before you start: Is it above living space? Can the structure support the weight? Can you get the materials on top of the roof? Is the roof pitch too steep?



DO IT YOURSELF (DIY)

If you intend to perform this work yourself, see the lists for general tools and materials you may need to help you get started.



Tools & Materials:

- Personal Protective Equipment (PPE)
- Shovel
- Rake
- Ladder
- Garden hose & bucket
- Tape measure
- Utility knife
- Wheelbarrow
- Hammer or mallet
- Level
- Line level
- Irrigation tubing
- Landscape fabric
- Light weight soil mix
- Edging material such as aluminum or steel edging



HIRE OUT THE WORK

Contact a [CBLPro](#) licensed and bonded landscape or site contractor. Prices will vary on amount area to be covered and structural capacity.



SPECIALTY ITEM or KITS

Kits and trays can be ordered Online or through a specific supplier.



MAINTENANCE

Seasonly

- Add plants to fill in bare spots.
- During dry season plants may need to be watered and during periods of severe drought.
- Check drainage outlets for debris and vegetation.
- Clear gravel margins of vegetation.
- Re-plant bare areas with seeds, plug plants, or cuttings.

Yearly

- Remove dead, diseased, or damaged plants.
- Check structure for cracks or leaks.

Access

- Maintenance requires access to the roof and likely use of materials and tools.

- Consider how this will be addressed based on your situation.
- Consider how and at which location will you climb up onto the roof and move around the planted area.

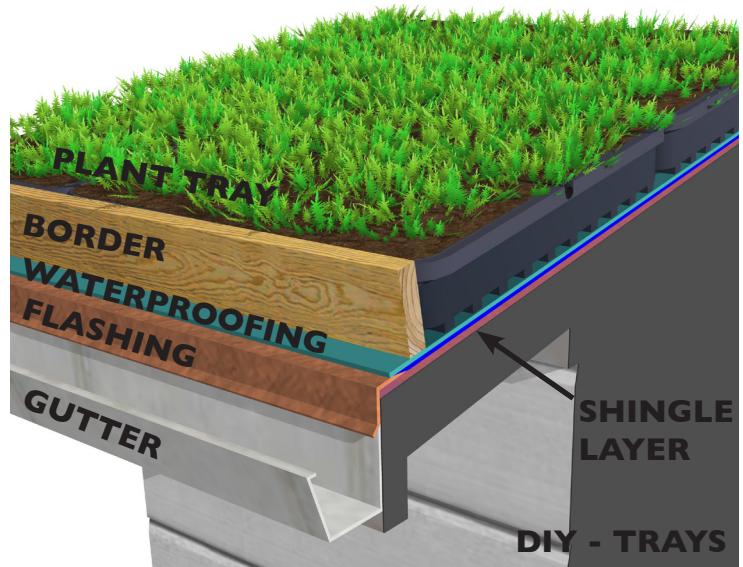
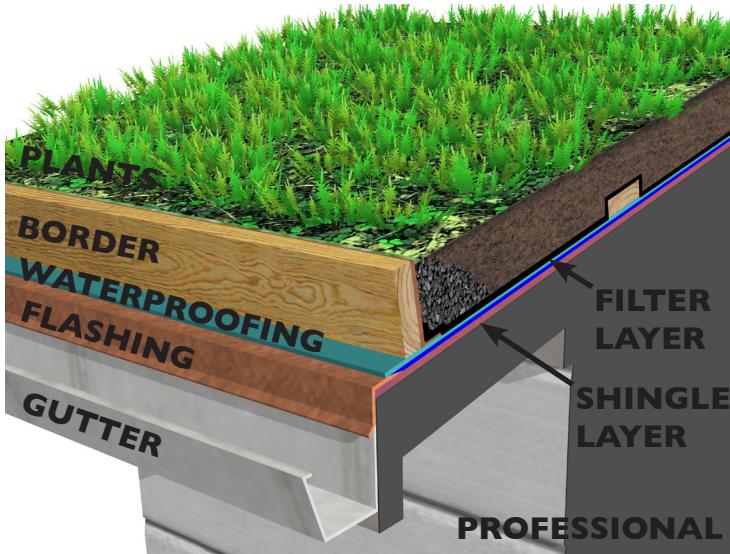


HOW TO

It is recommended to convert smaller structures on your property such as a detached garage, a shed, or a dog house if you are doing the work yourself. If converting a roof on your home, you should hire a professional to investigate your structure and to construct the green roof rather than doing it yourself.



- Check local codes and permit requirements.
- Always take care when working off the ground.



STEP 1: Evaluate

Select the structure with appropriate slope and materials that will be adequate. Reference the chart.

Specific layers of materials are added that are not used on regular roofs. The following, in order from bottom to top, are the layers in general terms:

- Waterproof layer
- Drainage layer
- Filter membrane
- Growing medium (soil mix)
- Plants

STEP 2: Waterproof

Add waterproof layer. Waterproof according to manufacturer's specifications based on material used.

STEP 3: Border & Filter Layer

Frame in the growing area and leave space around edge for access. Be sure there is free flow of excess water off the roof.

The border is used to pin the filter fabric or hold the trays in place.

Pro Tip: To prevent damage to materials or compacting of soil during planting lay down plywood to accommodate foot traffic during the install.

STEP 4: Engineered Soil & Plants

Add and spread out growing media mix evenly over filter fabric surface. Install selected plants once soil is in place. OR. Place trays if DIY. (Trays may be pre-planted before installing into place) Typical plants to install are sedums, herbs, and small perennials.

STEP 5: Inspect & Water

Water plants and soil thoroughly to ensure good coverage and growth.

Project Completion!

To return to the Table of Contents - click →





APPENDIX

ADDITIONAL RESOURCES

NORFOLK RETAIN YOUR RAIN APP

<https://orf.maps.arcgis.com/apps/webappviewer/index.html?id=7e8dc203eadf45b2b4422095f44b194c>

SOIL ASSESSMENT

(All Home Projects)

<https://static1.squarespace.com/static/544916c3e4b09edc336b555e/t/5668b0149cadb6552c1cb628/1449701396474/Rainscaping+Manual+Soil+Assessment.pdf>

SOIL COMPOST AMENDMENT

(Rain Garden, Tree Planting, Engineered Soils, Conservation Landscaping, Lawn Management, Bioswale, & Green Roof **Home Projects**)

https://swbmpvrrc.wp.prod.es.cloud.vt.edu/wp-content/uploads/2018/07/BMP_Spec_No_4_SOIL_AMENDMENT.pdf

RAIN GARDENS

(Rain Garden **Home Projects**)

<https://static1.squarespace.com/static/544916c3e4b09edc336b555e/t/5668a60c0e4c11de024f547d/1449698828908/Rainscaping+Manual+Rain+Gardens.pdf>

URBAN NUTRIENT MANAGEMENT

(All Home Projects)

http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/06/U5.-Urban-Nutrient-Management-Fact-Sheet-in-Chesapeake-Bay_August-2015.pdf

CREDITING RESIDENTIAL BMP'S

(Landscape Management & Infiltration **Home Projects**)

<https://chesapeakestormwater.net/bmp-resources/crediting-residential-bmps/>

INFILTRATION TRENCHES & DRY WELLS

(Infiltration **Home Projects**)

<https://static1.squarespace.com/static/544916c3e4b09edc336b555e/t/5668aa9d841aba7940a29e95/1449699997823/Rainscaping+Manual+Infiltration+Trenches+%26+Dry+Wells.pdf>

NATIVE PLANTS FOR STORMWATER BEST MANAGEMENT PRACTICES

(Rain Garden, Engineered Soils, Conservation Landscape, Bioswale, & Green Roof **Home Projects**)

<https://certified.cblpro.org/product/plants-for-stormwater-bmps/>

PLANT HR NATIVES

(Rain Garden, Engineered Soils, Conservation Landscape, Bioswale, & Green Roof **Home Projects**)

<https://www.plantvirginiannatives.org/plant-southeast-virginia-natives>

CHESAPEAKE BAY LANDSCAPE PROFESSIONAL

Landscape Professional Directory

<https://certified.cblpro.org/>

PLANT LIST

The following list has been created by landscape professionals to include a selection of plants that are native to the Eastern United States and to be suitable for planting in Norfolk, VA. When you are choosing plants, the following info will help you to select the plants that will be most suited to your specific location. These lists are suggestions and are not to be construed as exclusive lists. There are many other suitable plants for this region but this is a place to start for native species that grow in Norfolk.



Here's what to look for:

- Native to the Eastern United States and Mid-Atlantic Coastal Regions
- USDA Hardiness Zone **8a** (**10°F** to **15°F** Average Annual Low Temperature)

LEGEND: Look through the following plants on the next few pages and reference the key below to understand the different features and limitations of each species.

Sun Tolerance



Full Sun – 6 or more hrs.



Part Sun/ Part Shade – 2 to 6 hrs. sun



Full Shade – 2 or less hrs. sun

Leaf Persistence



Evergreen - holds leaves year round



Deciduous - loses leaves in winter

Water Tolerance



Wet (***Zone 1** – may have saturated soils or ponding for various lengths of time)



Moist (***Zone 2** – damp soil for various lengths of time)



Dry (***Zone 3** – no signs of soil moisture within short length of time)

***Zone applies to Rain Garden & Bioswale Home Projects**

Characteristics



Average Size (Height and width at maturity)



Plant Spacing (Planting distance needed between plants)



Seasonal Interest (Flowers, fruits, and leaf colors)

THE FOLLOWING ARE PLANTS THAT MAY BE MORE READILY AVAILABLE LOCALLY AND THAT GROW WELL IN THE HAMPTON ROADS AREA.

CHECK THE TAG

Check the tag tucked or attached to the pot of the plant you are considering for valuable information about the care instructions. Before purchasing a plant consider the specific recommendations for:

- Sun
- Water
- Cold Hardiness (Zone)
- Bloom cycle
- Fertilization
- Animal resistance
- Growth
- Planting tips

Common and scientific names describe the plant's genus, or group, and species. This helps to prevent confusion when selecting plant varieties.

Sun exposure describes the number of hours of sunlight a plant variety needs per day.

Water needs vary by plant variety and indicate how moist the soil around a plant's root system should be.

Cold Hardiness/ Zone indicates the regions the plant grows best and their ability to withstand low temperatures.

Bloom cycle describes which season to expect flowering, whether in spring, summer, fall or winter.

Fertilization may be recommended to support a plants performance.

Animal resistance characterizes a plant animals will not typically feed on or not eat at all.

Growth refers to the maximum average size that a variety of plant will grow.

Planting tips give a brief description of steps to take at time of planting.

Follow the "about" guidelines when choosing a plant other than what is on the list provided here.

Do not plant non-native invasive plant species.

Virginia Invasive Plant Species List:
<https://www.dcr.virginia.gov/natural-heritage/invsppdlist>





River Birch - *Betula nigra*



Deciduous



Plant Spacing: **20 - 30 ft.**



Sun Tolerance



High wildlife value
Papery light brown bark
Multi-trunk common
Gold/Yellow fall color



Water Tolerance



Height: **40 ft. - 90 ft.**

Width: **40 ft. - 60 ft.**



Hackberry - *Celtis occidentalis*



Deciduous



Plant Spacing: **20 - 30 ft.**



Sun Tolerance



Gold/Yellow fall color
Wildlife value
Rapid growing
Smooth bark w/ corky wart
Wide pH tolerance



Water Tolerance



Height: **40 ft. - 100 ft.**

Width: **40 ft. - 60 ft.**



Atlantic White Cedar - *Chamaecyparis thyoides*



Evergreen



Plant Spacing: **5 - 10 ft.**



Sun Tolerance



Wildlife value
Red/Brown flat ridged bark
Fall Copper/Yellow cone fruits



Water Tolerance



Height: **40 ft. - 60 ft.**

Width: **10 ft. - 20 ft.**



American Persimmon - *Diospyros virginiana*



Deciduous



Plant Spacing: **15 - 20 ft.**



Sun Tolerance



Gold/Purple/Red fall color
Edible globular berry
High wildlife value
Slow growing
Cobbled bark
Wide pH tolerance



Water Tolerance



Height: **30 ft. - 80 ft.**

Width: **20 ft. - 35 ft.**



American Holly - *Ilex opaca*



Evergreen



Plant Spacing: **10 - 15** ft.



Sun Tolerance



High wildlife value



Water Tolerance

Fall-winter Orange/Red
berry fruit
Light gray-white smooth
bark



Height: **40** ft. - **60** ft.

Width: **10** ft. - **20** ft.



Eastern Red Cedar - *Juniperus virginiana*



Evergreen



Plant Spacing: **10 - 15** ft.



Sun Tolerance



High wildlife value
Wide pH tolerance
Fragrant wood
Reddish-brown bark
Round blueish fruits



Water Tolerance



Height: **30** ft. - **40** ft.

Width: **10** ft. - **20** ft.



Tulip Poplar - *Liriodendron tulipifera*



Deciduous



Plant Spacing: **20 - 30** ft.



Sun Tolerance



Showy Yellow/Orange
blooms
Gold/Yellow fall Color
Rapid growth



Water Tolerance



Height: **70** ft. - **130** ft.

Width: **30** ft. - **60** ft.



Black Gum - *Nyssa sylvatica*



Deciduous



Plant Spacing: **30 - 40** ft.



Sun Tolerance



Gold/Orange/Purple/Red
fall color



Water Tolerance



Height: **30** ft. - **100** ft.

Width: **30** ft. - **50** ft.



Southern Magnolia - *Magnolia grandiflora*



Broadleaf Evergreen



Plant Spacing: **30 - 40** ft.



Sun Tolerance



Spring-summer bloom



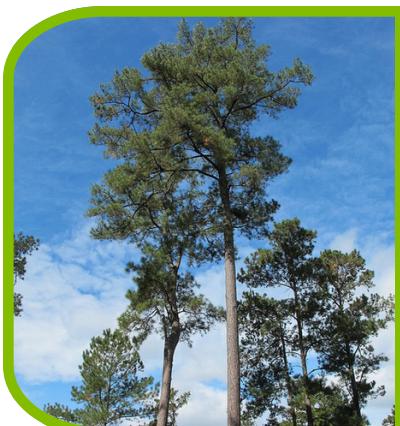
Water Tolerance

Fragrant showy Cream/
White flowers
Fall cone-like follicle fruits
Brown/Gray smooth to
plated bark



Height: **60** ft. - **80** ft.

Width: **30** ft. - **50** ft.



Longleaf Pine - *Pinus palustris*



Evergreen



Plant Spacing: **10 - 20** ft.



Sun Tolerance



Wildlife value
Fall purple-blue cone fruits
Orange/Red/Brown flaky
plated bark

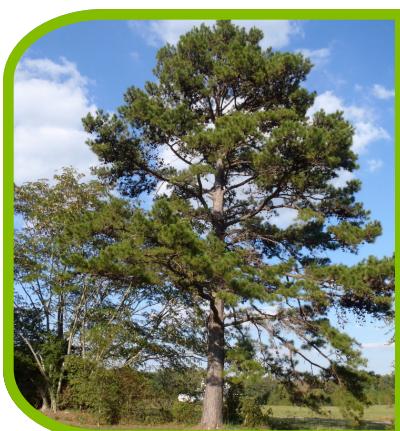


Water Tolerance



Height: **60** ft. - **120** ft.

Width: **30** ft. - **40** ft.



Loblolly Pine - *Pinus taeda*



Deciduous



Plant Spacing: **10 - 20** ft.



Sun Tolerance



Pine cones
High wildlife value
Rapid growing
Ridged bark



Water Tolerance



Height: **60** ft. - **90** ft.

Width: **20** ft. - **40** ft.



Swamp White Oak - *Quercus bicolor*



Deciduous



Plant Spacing: **30 - 40** ft.



Sun Tolerance



High wildlife value
Acorn fruit
Scaly Brown to Gray bark
Brown/Copper/Gold/Red
fall color



Water Tolerance



Height: **50** ft. - **90** ft.

Width: **30** ft. - **100** ft.



Southern Red Oak - *Quercus falcata*



Deciduous



Plant Spacing: **30 - 40** ft.



Sun Tolerance



High wildlife value



Water Tolerance



Acorn fruit

Height: **60** ft. - **100** ft.

Width: **50** ft. - **60** ft.



Overcup Oak - *Quercus lyrata*



Deciduous



Plant Spacing: **30 - 40** ft.



Sun Tolerance



Brown/Copper/Red/
Burgundy fall color

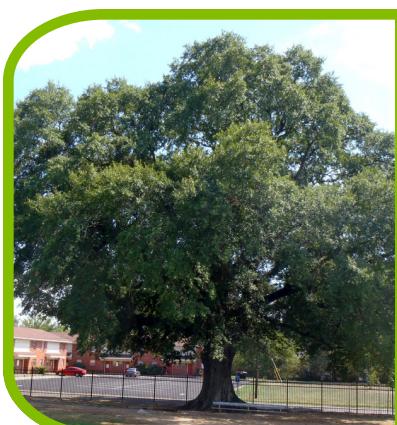


Water Tolerance



Height: **35** ft. - **60** ft.

Width: **35** ft. - **60** ft.



Water Oak - *Quercus nigra*



Deciduous



Plant Spacing: **30 - 40** ft.



Sun Tolerance



Brown/Copper/ fall color
Acorns
Fast grower



Water Tolerance



Height: **50** ft. - **100** ft.

Width: **35** ft. - **60** ft.



Willow Oak - *Quercus phellos*



Deciduous



Plant Spacing: **30 - 40** ft.



Sun Tolerance



High wildlife value
Acorn fruit
Ridged Brown to Gray bark
Copper/Gold/Yellow fall
color



Water Tolerance



Height: **50** ft. - **80** ft.

Width: **30** ft. - **40** ft.



Northern Red Oak - *Quercus rubra*



Deciduous



Plant Spacing: **30 - 40** ft.



Sun Tolerance



Acorns
Brown/Copper/Red/
Burgundy fall color
Rapid growth



Water
Tolerance



Height: **60** ft. - **90** ft.
Width: **60** ft. - **75** ft.



Southern Live Oak - *Quercus virginiana*



Broadleaf Evergreen



Plant Spacing: **30 - 40** ft.



Sun Tolerance



High wildlife value
Slow growth
Acorn fruit
Long arching branches
Furrowed Dark Brown bark



Water
Tolerance



Height: **40** ft. - **80** ft.
Width: **30** ft. - **100** ft.



Bald Cypress - *Taxodium distichum*



Deciduous



Plant Spacing: **20 - 30** ft.



Sun Tolerance



Root knees
Round cones
Textured bark
Brown/Copper/Orange fall
color



Water
Tolerance



Height: **50** ft. - **100** ft.
Width: **30** ft. - **60** ft.



American Arborvitae - *Thuja occidentalis*



Evergreen



Plant Spacing: **5 - 10** ft.



Sun Tolerance



High wildlife value
pH tolerance
Red-brown exfoliate bark



Water
Tolerance



Height: **40** ft. - **60** ft.
Width: **10** ft. - **15** ft.



American Elm - *Ulmus americana* 'Princeton' or 'Valley Forge' species only



Deciduous



Plant Spacing: **30 - 60** ft.



Sun Tolerance



Gold/Yellow fall Color
Rapid growth



Water
Tolerance



Height: **80** ft. - **100** ft.
Width: **60** ft. - **120** ft.



Downy Serviceberry - *Amelanchier arborea*



Deciduous



Plant Spacing: **10 - 15 ft.**



Sun Tolerance



Gold/Yellow/Red fall color
Spring bloom



Water
Tolerance

Fragrant white flowers
High wildlife value



Height: **15 ft. - 25 ft.**
Width: **10 ft. - 15 ft.**

Slow growing
Multiple trunks
Wide pH tolerance



Shadblow Serviceberry - *Amelanchier canadensis*



Deciduous



Plant Spacing: **10 - 15 ft.**



Sun Tolerance



High wildlife value
Berry-like pome fruit
Showy Pink/White flowers
Orange/Red/Burgundy fall color



Water
Tolerance



Height: **30 ft. - 40 ft.**
Width: **10 ft. - 20 ft.**



Eastern Redbud - *Cercis canadensis*



Deciduous



Plant Spacing: **10 - 15 ft.**



Sun Tolerance



High wildlife value
Edible flowers
Legume fruit
Blooms before leafing
Showy Pink/Purple/
Lavender flowers
Gold/Yellow fall color



Water
Tolerance



Height: **20 ft. - 30 ft.**
Width: **25 ft. - 35 ft.**



American Hornbeam - *Carpinus caroliniana*



Deciduous



Plant Spacing: **10 - 15 ft.**



Sun Tolerance



Gold/Yellow/Orange/Red
fall color
Nutlet with leaf fruit
Wildlife value
Smooth gray bark



Water
Tolerance



Height: **20 ft. - 30 ft.**
Width: **20 ft. - 35 ft.**



Fringe Tree - *Chionanthus virginicus*



Deciduous



Plant Spacing: **10 - 15** ft.



Sun Tolerance



Wildlife value
Spring bloom
Copper/Gold/Yellow fall color
Fragrant showy Cream/Tan flowers
Black/Blue berry fruits



Water Tolerance
Height: **12** ft. - **30** ft.
Width: **12** ft. - **20** ft.



Dogwood - *Cornus florida*



Deciduous



Plant Spacing: **10 - 15** ft.



Sun Tolerance



High wildlife value
Spring bloom
Showy Pink/White flowers
Glossy bright shiny Red drupe fruits
Purple/Red/Burgundy fall color



Water Tolerance
Height: **15** ft. - **25** ft.
Width: **15** ft. - **30** ft.



American Smoketree - *Cotinus obovatus*



Deciduous



Plant Spacing: **10 - 15** ft.



Sun Tolerance



Summer bloom
Showy Gold/Yellow flowers
Brown/Copper drupe fruits
Gold/Yellow/Purple/Red fall color
Wide pH tolerance
Multi-stem trunk



Water Tolerance
Height: **20** ft. - **30** ft.
Width: **20** ft. - **30** ft.



Witchhazel - *Hamamelis virginiana*



Deciduous



Plant Spacing: **10 - 15** ft.



Sun Tolerance



High wildlife value
Multi-stem trunk
Fall-winter bloom
Cream/Yellow/Red flowers
Two-valved capsule fruits



Water Tolerance
Height: **15** ft. - **30** ft.
Width: **15** ft. - **20** ft.



Yaupon Holly - *Ilex vomitoria*



Evergreen



Plant Spacing: **5 - 10** ft.



Sun Tolerance



High wildlife value



Water Tolerance

Bright Red Berries



Height: **10** ft. - **20** ft.
Width: **10** ft. - **15** ft.

Multi-stem trunk



Sweetbay Magnolia - *Magnolia virginiana*



Evergreen



Plant Spacing: **10 - 20** ft.



Sun Tolerance



High wildlife value



Water Tolerance

Follicle palm sized fruit



Height: **15** ft. - **35** ft.
Width: **10** ft. - **20** ft.

Multi-stem trunk

Large Cream/Tam/White flowers



Sourwood - *Oxydendrum arboreum*



Deciduous



Plant Spacing: **10 - 15** ft.



Sun Tolerance



Gold/Yellow/Purple/Red fall color



Water Tolerance

Summer bloom



Height: **20** ft. - **30** ft.
Width: **10** ft. - **15** ft.

Fragrant white flowers

Silver-gray capsule fruits



Chokeberry - *Aronia arbutifolia*



Deciduous



Plant Spacing: **4 - 6 ft.**



Sun Tolerance



Wildlife food value



Water Tol.



Height: **6 ft. - 10 ft.**

Width: **3 ft. - 5 ft.**



Multi-stem trunk
Spring bloom
Showy Pink/White flowers
Edible glossy Red berry fruits
Orange/Pink/Red fall color



Groundsel Bush - *Baccharis halimifolia*



Deciduous



Plant Spacing: **4 - 6 ft.**



Sun Tolerance



High wildlife value



Water Tolerance



Height: **5 ft. - 12 ft.**

Width: **5 ft. - 7 ft.**



Multi-stem trunk
Summer-fall bloom
Cream/White flowers
Jet Black berry-like drupe fruits



American Beautyberry - *Callicarpa americana*



Deciduous



Plant Spacing: **4 - 6 ft.**



Sun Tolerance



High wildlife value



Water Tolerance



Height: **3 ft. - 5 ft.**

Width: **3 ft. - 6 ft.**



Multi-stem trunk
Fall Pink/Purple drupe fruits
Gold/Yellow fall color



Carolina Allspice - *Calycanthus floridus*



Deciduous



Plant Spacing: **4 - 6 ft.**



Sun Tolerance



Wide pH tolerance



Water Tolerance



Height: **6 ft. - 12 ft.**

Width: **6 ft. - 12 ft.**



Spring bloom
Fragrant showy Copper/Gold/Red flowers
Summer-fall Brown capsule fruits
Gold/Yellow fall color



Devilwood - *Cartrema americana* (formerly *Osmanthus americana*)



Evergreen



Plant Spacing: **6 - 8** ft.



Sun Tolerance



Multi-stem trunk
Spring bloom
Fragrant Cream/White flowers
Summer-fall nut fruits



Water Tolerance



Height: **10** ft. - **30** ft.

Width: **6** ft. - **15** ft.



Buttonbush - *Cephaelanthus occidentalis*



Deciduous



Plant Spacing: **4 - 6** ft.



Sun Tolerance



High wildlife value
Summer bloom
Fragrant showy Cream/White flowers
Reddish-brown ball-like fruits
Gold/Yellow fall color



Water Tolerance



Height: **5** ft. - **8** ft.

Width: **3** ft. - **6** ft.



Summersweet - *Clethra alnifolia*



Deciduous



Plant Spacing: **3 - 4** ft.



Sun Tolerance



High wildlife value
Summer bloom
Fragrant showy Pink/White flowers
Brown capsule fruits
Copper/Gold/Yellow fall color



Water Tolerance



Height: **5** ft. - **10** ft.

Width: **4** ft. - **6** ft.



Silky Dogwood - *Cornus amomum*



Deciduous



Plant Spacing: **4 - 6** ft.



Sun Tolerance



High wildlife value
Spring-summer bloom
Showy Yellow/White flowers



Water Tolerance



Height: **10** ft. - **15** ft.

Width: **6** ft. - **12** ft.



Redtwig Dogwood - *Cornus sericea*



Deciduous



Plant Spacing: **3 - 5** ft.



Sun Tolerance



High wildlife value



Water Tolerance

Multi-stem
Spring-summer bloom
Cream/Gold/White flowers
White-Blue berry fruits
Silver/Purple/Red fall color
Bright Red smooth bark



Height: **5** ft. - **9** ft.



Width: **5** ft. - **10** ft.



Oakleaf Hydrangea - *Hydrangea quercifolia*



Deciduous



Plant Spacing: **4 - 6** ft.



Sun Tolerance



High wildlife value
Spring-summer bloom
Showy Cream/Pink/White flowers
Brown/Copper fall fruits
Purple/Red fall color
Brown/Orange papery bark



Water Tolerance



Height: **4** ft. - **8** ft.



Width: **4** ft. - **10** ft.



Inkberry - *Ilex glabra*



Evergreen



Plant Spacing: **2 - 4** ft.



Sun Tolerance



High wildlife value
Summer bloom



Water Tol.

White flowers
Jet Black berry-like drupe fruits



Height: **5** ft. - **10** ft.



Width: **5** ft. - **8** ft.



Winterberry - *Ilex verticillata*



Deciduous



Plant Spacing: **3 - 6** ft.



Sun Tolerance



High wildlife value



Water Tolerance

Multi-stem trunk
Spring bloom
Bright Red berry-like drupe fruits
Gold/Yellow fall color



Height: **3** ft. - **15** ft.



Width: **3** ft. - **12** ft.



Virginia Sweetspire - *Itea virginica*



Deciduous



Plant Spacing: **2 - 4 ft.**



Sun Tolerance



Spring-summer bloom



Water Tolerance

Fragrant showy White flowers



Height: **4 ft. - 8 ft.**

Width: **3 ft. - 6 ft.**

Woody capsule fruits

Orange/Red/Burgundy fall color



Wax Myrtle - *Myrica cerifera*



Evergreen



Plant Spacing: **4 - 6 ft.**



Sun Tolerance



High wildlife value



Water Tolerance

Multi-stem trunk



Height: **8 ft. - 15 ft.**

Width: **6 ft. - 10 ft.**

Spring bloom

Fragrant Gold/Yellow flowers

Showy Blue/Silver drupe fruits



Swamp Azalea - *Rhododendron viscosum*



Evergreen



Plant Spacing: **2 - 4 ft.**



Sun Tolerance



Summer bloom



Water Tolerance

Fragrant showy White flowers



Height: **2 ft. - 8 ft.**

Width: **3 ft. - 8 ft.**

Summer-Fall elongated capsule fruits



Dwarf Palmetto - *Sabal minor*



Evergreen



Plant Spacing: **3 - 5 ft.**



Sun Tolerance



Blue-green palmate leaves



Water Tolerance

Multi-stem trunk



Height: **2 ft. - 7 ft.**

Width: **4 ft. - 6 ft.**

Summer bloom

Blue/White panicle flowers

Showy Black drupe fruits



Highbush Blueberry - *Vaccinium corymbosum*



Deciduous



Plant Spacing: **3 - 6** ft.



Sun Tolerance



Edible Blue berry fruit



Water Tolerance

High wildlife value



Height: **3** ft. - **12** ft.

Width: **3** ft. - **10** ft.

Spring bloom

Showy Pink/White flowers

Gold/Yellow/Purple/Red fall color



Arrowwood - *Viburnum dentatum*



Deciduous



Plant Spacing: **4 - 6** ft.



Sun Tolerance



Water Tolerance



Height: **5** ft. - **10** ft.

Width: **6** ft. - **10** ft.

High wildlife value

Multi-stem trunk

Spring bloom

Showy White flowers

Summer-fall Blue-black drupe fruits

Gold/Purple/Red fall color



Bluestar - *Amsonia tabernaemontana*



Deciduous



Plant Spacing: **12-18** in.



Sun Tolerance



High wildlife value



Water Tolerance

Spring-summer bloom
Showy Blue flowers
Fall beanlike pod fruits
Good cut flowers



Height: **2** ft. - **3** ft.

Width: **2** ft. - **3** ft.



Swamp Milkweed - *Asclepias incarnata*



Deciduous



Plant Spacing: **2 - 3** ft.



Sun Tolerance



High wildlife value
Summer bloom
Fragrant showy Pink/White flowers
Fall showy Cream/White pod fruit



Water Tolerance



Height: **3** ft. - **5** ft.

Width: **2** ft. - **3** ft.



Heath Aster - *Aster ericoides*



Deciduous



Plant Spacing: **12 - 18** in.



Sun Tolerance



Wildlife value
Summer-fall bloom
Showy Gold/White flowers



Water Tolerance



Height: **12** in. - **36** in.

Width: **12** in. - **18** in.



Joe Pye Weed - *Eupatorium spp.*



Deciduous



Plant Spacing: **1-2** ft.



Sun Tolerance



High wildlife value
Summer-fall bloom
Large showy fragrant Pink/Purple flowers
Flowers turn to seeded fruits
Winter interest



Water Tolerance



Height: **4** ft. - **8** ft.

Width: **2** ft. - **4** ft.



Swamp Sunflower - *Helianthus angustifolius*



Deciduous



Plant Spacing: **1-2 ft.**



Sun Tolerance



High wildlife value



Water Tolerance

Summer-fall bloom

Showy Gold/Yellow flowers



Height: **5 ft. - 8 ft.**

Width: **2 ft. - 4 ft.**



Rose-mallow - *Hibiscus moscheutos*



Deciduous



Plant Spacing: **2 - 3 ft.**



Sun Tolerance



High wildlife value

Summer-fall bloom

Large showy Pink/Red/White flowers

Oval seed capsule fruits



Height: **4 ft. - 7 ft.**

Width: **2 ft. - 4 ft.**



Irises - *Iris virginica*



Deciduous



Plant Spacing: **6-18 in.**



Sun Tolerance



Tolerate standing water

Spring bloom

Showy Blue/Purple/Lavender flowers

Summer Green capsule fruits



Height: **12 in. - 30 in.**

Width: **12 in. - 36 in.**



Blazing Star - *Liatris spicata*



Deciduous



Plant Spacing: **6 - 9 in.**



Sun Tolerance



Bulb

Summer bloom

Showy Pink/Purple/Red/White flowers

Fall Brown/Copper bristle fruits

Winter interest



Cardinal Flower - *Lobelia cardinalis*



Deciduous



Plant Spacing: 1 - 2 ft.



Sun Tolerance



High wildlife value
Summer-fall bloom
Showy Pink/Red/White flowers
Fall display of fruit



Water Tolerance



Height: 4 ft. - 5 ft.

Width: 12 in. - 24 in.



Blue Lobelia - *Lobelia siphilitica*



Deciduous



Plant Spacing: 12 - 18 in.



Sun Tolerance



Wildlife value
Summer-fall bloom
Showy Blue flowers
Fall display of fruits



Water Tolerance



Height: 3 ft. - 4 ft.

Width: 12 in. - 18 in.



Beebalm - *Monarda didyma*



Deciduous



Plant Spacing: 1 - 2 ft.



Sun Tolerance



High wildlife value
Summer-fall bloom
Showy Red flowers
Fall brown capsule fruits



Water Tolerance



Height: 2 ft. - 4 ft.

Width: 2 ft. - 3 ft.



Pickerelweed - *Pontederia cordata*



Deciduous



Plant Spacing: 1 - 2 ft.



Sun Tolerance



High wildlife value
Frequent Standing Water
Fast growth
Summer-fall bloom
Showy Blue/Purple flowers
Summer-fall capsule fruits



Water Tolerance



Height: 2 ft. - 4 ft.

Width: 18 in. - 2 ft.



Black-eyed Susan - *Rudbeckia hirta*



Deciduous



Plant Spacing: 1 - 2 ft.



Sun Tolerance



High wildlife value



Water Tolerance

Spring-summer bloom
Good cut flowers
Showy Gold/Orange/Red flowers
Small brown seed fruits



Height: 2 ft. - 4 ft.

Width: 12 in. - 24 in.



Broad-leaved Arrowhead - *Sagittaria latifolia*



Deciduous



Plant Spacing: 12 - 18 in.



Sun Tolerance



Wildlife value
Summer-fall bloom
Showy White flowers
Fall display of fruits
Standing water



Water Tolerance



Height: 24 in. - 32 in.

Width: 24 in. - 32 in.



Lizard Trail - *Saururus cernuus*



Deciduous



Plant Spacing: 1 - 2 ft.



Sun Tolerance



Frequent Standing Water
Rapid growth
Spring - summer bloom
Showy White flowers



Water Tolerance



Height: 1 ft. - 4 ft.

Width: 1 ft. - 2 ft.



Goldenrod - *Solidago rugosa*



Deciduous



Plant Spacing: 1 - 2 ft.



Sun Tolerance



High wildlife value
Summer-fall bloom
Showy Gold/Yellow flowers



Water Tolerance



Height: 30 in. - 42 in.

Width: 30 in. - 36 in.



Dixie Wood Fern - *Dryopteris australis*



Deciduous/ Semi-evergreen



Plant Spacing: 1 - 2 ft.



Sun Tolerance



Glossy soft leaf texture
Brown/Copper fall color



Water
Tolerance



Height: 4 ft. - 5 ft.

Width: 2 ft. - 3 ft.



Cinnamon Fern - *Osmunda cinnamomeum*



Deciduous



Plant Spacing: 1 - 2 ft.



Sun Tolerance



Fine soft texture
Copper fronds
Showy Gold/Yellow fall leaf
color



Water
Tolerance



Height: 2 ft. - 3 ft.

Width: 2 ft. - 4 ft.



Royal Fern - *Osmunda regalis*



Deciduous



Plant Spacing: 1 - 2 ft.



Sun Tolerance



Soft leaf texture
Gold/Yellow fall color
Standing water



Water
Tolerance



Height: 5 ft. - 6 ft.

Width: 2 ft. - 3 ft.



Plantain Pussytoes - *Antennaria plantaginifolia*



Deciduous



Plant Spacing: **6 - 12** in.



Sun Tolerance



High wildlife value



Water Tolerance

Spring bloom
Small Pink/White flowers
Wooly Gray/Silver/Green leaves



Height: **6 in. - 12 in.**

Width: **12 in. - 24 in.**



Wild Ginger - *Asarum canadense*



Deciduous



Plant Spacing: **6 - 12** in.



Sun Tolerance



Heavy shade



Water Tolerance

Spring bloom
Bell Copper/Purple/Lavender flowers
Blue/Gray/Silver/Green leaves



Height: **6 in. - 12 in.**

Width: **4 in. - 6 in.**



Green and Gold - *Chrysogonum virginianum*



Semi-evergreen



Plant Spacing: **6 - 12** in.



Sun Tolerance



Wildlife value
Spring-summer bloom
Showy Gold/Yellow flowers
Spring Purple capsule fruits



Water Tolerance



Height: **1 in. - 2 in.**

Width: **12 in. - 24 in.**



Sweet Woodruff - *Galium odoratum*



Broadleaf Evergreen



Plant Spacing: **6 - 12** in.



Sun Tolerance



Spring bloom
Fragrant White flowers
Summer bristled fruits
Leaves fragrant when crushed



Water Tolerance



Height: **6 in. - 12 in.**

Width: **9 in. - 18 in.**



Dwarf Crested Iris - *Iris cristata*



Deciduous



Plant Spacing: **6 - 12** in.



Sun Tolerance



Wildlife value



Water Tolerance

Spring bloom
Showy Blue/Gold/Pink/
Purple/White flowers
Summer Brown capsule
fruits



Height: **6** in. - **9** in.

Width: **6** in. - **12** in.



Creeping Juniper - *Juniperus horizontalis*



Evergreen



Plant Spacing: **2 - 5** ft.



Sun Tolerance



Spreading shrub
Blue-green needles
Blue berry-like cone fruits



Water Tolerance



Height: **6** in. - **18** in.

Width: **4** ft. - **10** ft.



Creeping Phlox - *Phlox subulata*



Semi-evergreen



Plant Spacing: **6 - 12** in.



Sun Tolerance



High wildlife value
Spring bloom
Showy Blue/Gold/Pink/
Purple/Red/White flowers
Gray/Silver/Green leaves



Water Tolerance



Height: **4** in. - **6** in.

Width: **12** in. - **24** in.



Foamflower - *Tiarella cordifolia*



Deciduous



Plant Spacing: **6 - 9** ft.



Sun Tolerance



Wildlife value
Spring bloom
Pink/White flowers



Water Tolerance



Height: **5** in. - **12** in.

Width: **12** in. - **18** in.



White Clover - *Trifolium repens*



Deciduous



Plant Spacing: **3 - 6** in.
(Establish by seed)



Sun Tolerance



Lawn alternative
Edible flowers & leaves
Spring-summer bloom
Showy White flowers
Wide pH tolerance



Water
Tolerance



Height: **4** in. - **6** in.
Width: **6** in. - **12** in.



Broomsedge - *Andropogon virginicus*



Deciduous



Plant Spacing: **1 - 2 ft.**



Sun Tolerance



High wildlife value



Water Tolerance



Clumping habit



Height: **2 ft. - 4 ft.**

Width: **1 ft. - 2 ft.**

Poor soil tolerance

Fall Orange color

Green/Orange/Purple/
Burgundy stems



Pennsylvania Sedge - *Carex pensylvanica*



Deciduous



Plant Spacing: **6 - 12 in.**



Sun Tolerance



Wildlife value



Water Tolerance

Clumping/ spreading habit

Fall Gold/Yellow color



Height: **1 in. - 8 in.**

Width: **1 in. - 12 in.**



Tussock Sedge - *Carex stricta*



Deciduous



Plant Spacing: **2 - 3 ft.**



Sun Tolerance



Wildlife value



Water Tolerance

Clumping habit

Standing water



Height: **1 ft. - 3 ft.**

Width: **2 ft. - 3 ft.**



River Oats - *Chasmanthium latifolium*



Deciduous



Plant Spacing: **2 - 3 ft.**



Sun Tolerance



Hige wildlife value



Water Tolerance

Clumping habit

Fall Copper/Gold color

Summer/fall Copper/Tan

seed heads



Height: **2 ft. - 5 ft.**

Width: **1 ft. - 3 ft.**



Virginia Wildrye - *Elymus virginicus*



Deciduous



Plant Spacing: **1 - 2 ft.**



Sun Tolerance



Wildlife value
Spreading habit
Wheat-like Green/Tan
flower & fruit



Water
Tolerance



Height: **2 ft. - 5 ft.**

Width: **1 ft. - 2 ft.**



Soft Rush - *Juncus effusus*



Deciduous



Plant Spacing: **1 - 2 ft.**



Sun Tolerance



Wildlife value
Clumping/ spreading habit
Standing water
Summer Copper/Gold
flower cluster
Smooth Green stems



Water
Tolerance



Height: **1 ft. - 3 ft.**

Width: **1 ft. - 3 ft.**



Switchgrass - *Panicum virgatum*



Deciduous



Plant Spacing: **2 - 3 ft.**



Sun Tolerance



High wildlife value
Clumping habit
Summer - winter Pink/
Lavender/Burgundy flower
spike



Water
Tolerance



Height: **3 ft. - 7 ft.**

Width: **2 ft. - 3 ft.**



Little Bluestem - *Schizachyrium scoparium*



Deciduous



Plant Spacing: **1 - 2 ft.**



Sun Tolerance



Hige wildlife value
Clumping habit
Blue/Green/Orange leaves
Fall Gold/Orange color
Summer/fall Gold/Purple
seed heads



Water
Tolerance



Height: **1 ft. - 4 ft.**

Width: **1 ft. - 2 ft.**



Indiangrass - *Sorghastrum nutans*



Deciduous



Plant Spacing: **1 - 2 ft.**



Sun Tolerance



Wildlife value

Clumping habit

Fall Gold/Orange flower & fruit

Fall Gold/Orange leaves



Water Tolerance



Height: **5 ft. - 7 ft.**

Width: **1 ft. - 2 ft.**



Trumpet Vine - *Campsis radicans*



Deciduous



Plant Spacing: **6 - 12** ft.



Sun Tolerance



Wildlife value
Summer Gold/Orange/Red
trumpet flowers
Fall Brown bean-like pods
Fall Gold/Yellow leaves



Water
Tolerance



Height: **30** ft. - **40** ft.

Width: **4** ft. - **10** ft.



Virgin's Bower - *Clematis virginiana* - (formerly *Clematis canadensis*)



Deciduous



Plant Spacing: **3 - 6** ft.



Sun Tolerance



Wildlife value
Fall White small saucer
flowers
Fall plume-like seed-heads



Water
Tolerance



Height: **15** ft. - **20** ft.

Width: **3** ft. - **6** ft.



Carolina Jasmine - *Gelsemium sempervirens*



Evergreen



Plant Spacing: **6 - 12** ft.



Sun Tolerance



Wildlife value
Winter - Spring Gold/
Yellow trumpet flowers
Fall Gold/Lavender leaves
Fall Brown capsule fruit



Water
Tolerance



Height: **10** ft. - **20** ft.

Width: **20** ft. - **30** ft.



Coral Honeysuckle - *Lonicera sempervirens*



Evergreen



Plant Spacing: **3 - 6** ft.



Sun Tolerance



High wildlife value
Spring - Summer Gold/
Orange/Burgundy trumpet
flowers
Summer - Fall Black/Red
berries



Water
Tolerance



Height: **10** ft. - **20** ft.

Width: **3** ft. - **6** ft.



Virginia Creeper - *Parthenocissus quinquefolia*



Deciduous

Plant Spacing: **6 - 12 ft.**

Sun Tolerance



High wildlife value



Water Tolerance

Height: **30 ft. - 50 ft.**Width: **5 ft. - 10 ft.**Insignificant flowers
Summer - Fall Black/Purple berry
Spring - Fall Green/Purple/Burgundy leaves

Virgin's Bower - *Clematis virginiana* - (formerly *Clematis canadensis*)



Evergreen

Plant Spacing: **3 - 6 ft.**

Sun Tolerance



Water Tolerance

Height: **15 ft. - 20 ft.**Width: **3 ft. - 6 ft.**High wildlife value
Spring - Summer Blue/Pink/Purple/White flower
Summer - Fall egg-shaped fruit