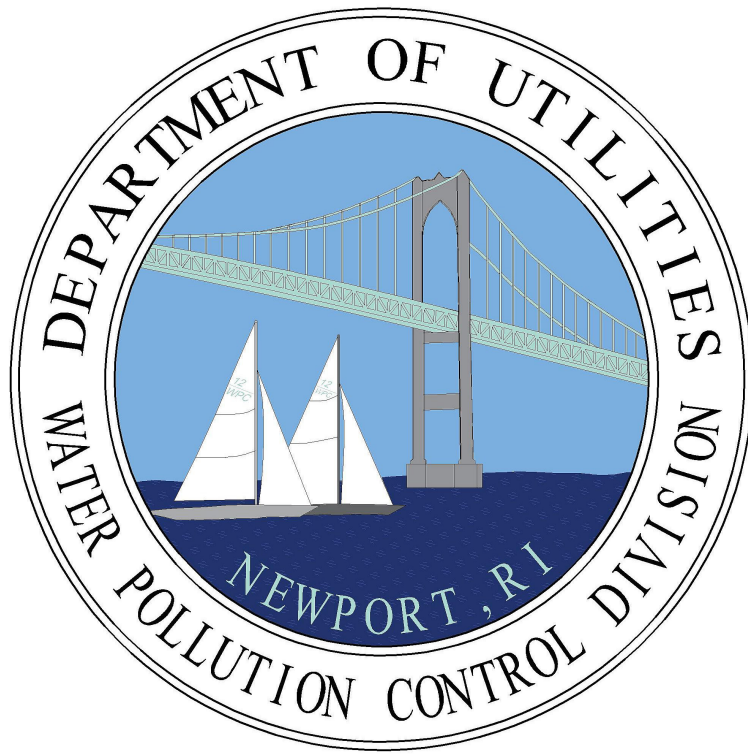


Homeowners' Guide to Stormwater Management

Newport, RI





Funding for this residential stormwater guide is provided by sewer rates as part of the Department of Utilities, Water Pollution Control Division's Capital Improvement Program.

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1 OUR STORMWATER PROBLEM

BACKGROUND

Across the City of Newport, **stormwater runoff is a major contributor to both flooding and pollution in our local waterways.** When it rains or snow melts, water flows across roofs, driveways, roads, and other hard surfaces, picking up **debris, oil, fertilizers, pet waste, and other pollutants** along the way. This runoff then drains into the storm drain system or directly into nearby waters.

Unlike wastewater, **stormwater receives no treatment**, most storm drains lead straight to our bays, ponds, and reservoirs, with the exception of the Easton's Beach outfall, where an ultraviolet disinfection system has been installed.

Newport's **aging infrastructure**, much of which was built decades ago, was not designed for today's more **frequent and intense storms.** As a result, many neighborhoods experience flooding when heavy rain overwhelms the system. At the same time, **polluted runoff has become one of the leading causes of water quality degradation** in Narragansett Bay, local watersheds, and Newport's drinking water reservoirs.

According to the Rhode Island Department of Environmental Management's **2021 Total Maximum Daily Load (TMDL) Report**, urban/residential runoff is the largest source of pollution for six of Newport's nine drinking water reservoirs, with agricultural runoff contributing the most to the remaining three.

Effective stormwater management is essential, not only to prevent flooding, but to protect our environment, public health, and the long-term sustainability of Newport's water resources for future generations.



2 WPC'S STORMWATER MANAGEMENT EFFORTS

Each year, the Water Pollution Control Division (WPC) invests millions \$ to manage stormwater, reduce flooding, and improve water quality across Newport. Over the years, WPC has carried out an extensive range of projects to support long-term environmental and resilience strategies. These efforts include:

- Drainage System Upgrades:**
Projects like the *Prescott Hall Road & Hillside Ave Drainage Improvements* and *Queen Anne Square System Repairs* replaced deteriorating infrastructure, improved conveyance capacity, and reduced localized street flooding during heavy rains.
- Green Infrastructure Installations:**
WPC has installed *bioretention cells*, *infiltration swales*, and *permeable pavers* in flood-prone neighborhoods to reduce runoff and promote groundwater recharge. These “green” practices mimic natural hydrology and improve the quality of water entering local waters.
- Flood Mitigation & Tide Control:**
Newport’s coastal setting makes it especially vulnerable to high tides and storm surges. WPC has installed and maintained *tide gates* at key outfalls including Bridge Street and Wellington Avenue to prevent backflow during coastal storms. Storm drainage improvement projects including *replacement of Marsh Street Storm Drain* and *rehabilitation of the West Marlborough Street Storm Drain* further help manage high-water events.



Water Quality Enhancements:

The WPC installed a *UV disinfection system* at Easton's Beach outfall, improving water quality at Newport's public beach. Projects like the *Washington St. CSO Treatment Facility Upgrades*, *Wellington Ave CSO Treatment Facility Upgrades*, *Wastewater Treatment Plant Modernization*, *Long Wharf Pump Station Improvements* advanced treatment processes and disinfection for CSOs and increased flow capacity allowing the combined system components to handle higher wet weather volumes. These upgrades build upon the City's decades-long effort to reduce combined sewer overflows and safeguard recreational waters.

Ongoing Monitoring & Maintenance:

WPC performs regular *asset inspection, cleaning, and maintenance*. These activities help reduce sediment, debris, and pollutants from reaching coastal waters, extend the life of existing infrastructure, and enhance system efficiency.

With most federally mandated Combined Sewer Overflow (CSO) projects completed, the WPC is now focused on a smarter, integrated approach that connects clean water protection, flood control, and climate resilience. Through partnerships with local organizations, residents, and regulatory agencies, WPC is investing in infrastructure and community programs that make our city more resilient to storms while improving water quality.



3 WHAT CAN I DO?

Every resident in Newport plays an important role in protecting our waterways and reducing neighborhood flooding. While WPC continues to invest in large-scale infrastructure improvements, **individual actions at home are just as critical** to keeping stormwater clean and under control. Even small changes, like how you maintain your yard, wash your car, or manage runoff on your property can make a big difference when practiced citywide. This guide outlines several ways you can help:

- **Practice pollution reduction habits at home** to prevent contaminants like oil, fertilizer, and debris from washing into storm drains.
- **Adopt a catch basin** near you to help keep drains clear of leaves, trash, and sediment.
- **Reduce impervious surfaces** on your property to decrease runoff and minimize flooding.
- **Build green solutions** that capture and infiltrate stormwater, such as rain gardens, rain barrels, or permeable pavers, by learning how to identify which options fit your space, your budget, and your goals.

Together, these steps form a comprehensive, community-wide approach to stormwater management, protecting both our properties and Newport's waters for generations to come.



4 POLLUTION REDUCTION HABITS

Stormwater pollution often begins with everyday habits around the home. Healthy household habit matter, they mitigate contamination and thereby risks of harming ecosystems and water quality. The following pages outline practical steps residents can take to reduce pollution and protect our waterways.

You'll learn how to practice practice pollution reduction...

In your: LAWN & GARDEN



With: HOME IMPROVEMENT



With your: VEHICLE & GARAGE



LAWN & GARDEN

A healthy lawn and garden can benefit the environment, but poor maintenance practices can lead to excess runoff and nutrient pollution.



You can help by:

- Water your lawn without waste.
 - Water during the cool times of the day to prevent evaporation; make your water work smarter, not harder!
- Use a **phosphorus-free fertilizer or no fertilizer at all** on your lawn. Unnecessary fertilizer can quickly run off into storm drains and cause algae blooms in raw drinking water reservoirs, among other harmful effects.
 - Try grasscycling. Mow high and leave grass clippings on the lawn. It helps improve the lawn's health and quality, making you less likely to need fertilizer.
- Avoid using pesticides or herbicides in your yard and garden. If you do use them, do so appropriately. Visit the **EPA's website** for more information about minimizing risks.
- Garden organically and use alternatives to chemicals when possible.
- **Select native plants and grasses** that are drought and pest-resistant. Native plants require less water, fertilizer, and pesticides.
- Plant trees in your yard, if possible. One tree reduces stormwater runoff by over 4,000 gallons a year, helping prevent water pollution.
 - The **Newport Tree Conservancy** offers multiple tree planting programs, offering benefits such as connecting Newport residents with free and reduced-cost tree plantings up to 20ft onto private property, along a street or sidewalk, or on City property. Additionally, regardless of where they live, anyone can sponsor a commemorative tree to memorialize a loved one or celebrate a special event.
- Sweep up driveway, patio, and sidewalk debris rather than hosing debris into street gutters or drains.
 - Compost or recycle yard waste, and take advantage of Waste Management's **Yard Waste Collection Program!**
- **Pick up pet poo, and dispose of it properly.** Pet waste contains bacteria that can degrade water quality and harm public health.
 - The Department of Public Services has a Mutt Mitt Program, offering free waste bags at over 40 dispensers across the city. Look for a white "Mutt Mitt" dispenser, and be sure to throw the poo bag in the trash!
- Responsibly maintain your swimming pool and use best practices when draining it.
 - Properly store pool and spa chemicals to prevent leaks and spills, preferably in a covered area to avoid exposure to stormwater.

VEHICLE & GARAGE

Vehicle maintenance and cleaning can introduce oil, grease, and detergents into storm drains if not managed carefully.



You can help by:

- Go to a full or self-serve car wash rather than washing your cars, trucks, RVs, or boats at home to minimize the dirty, soapy water flowing into the stormwater system and eventually local waterbodies.
- If you are going to wash your car at home, wash it on the lawn or other unpaved surfaces rather than on the driveway. The ground will filter the dirt and soap out of the water, protecting our waterways.
 - Use soaps sparingly and without phosphates (which leads to algal blooms that release toxins and remove oxygen from the water).
 - When you're done, pour your bucket of soapy water down the sink, not in the street.
- Check your car, boat, motorcycle, and other machinery and equipment regularly for leaks and spills and fix them promptly.
 - Keep your car tuned to reduce oil use. If possible, move leaking vehicles inside garages.
 - If possible, move leaking vehicles inside garages.
 - Clean up spills immediately.
 - Don't rinse the spills into a nearby storm drain. Use absorbent material like cat litter or sand to soak up leaked oil, which can then be thrown into the trash once it's dry. If your vehicle has leaks or you are doing engine work, use ground cloths or drip pans beneath it. Collect all used oil and other fluids in containers with tight-fitting lids. Do not mix different engine fluids.
 - If your vehicle has leaks or you are doing engine work, use ground cloths or drip pans beneath it. Collect all used oil and other fluids in containers with tight-fitting lids. Do not mix different engine fluids.
 - Recycle used motor oil and other automotive properly at participating service centers. Many auto supply stores and gas stations will accept used oil.

HOME IMPROVEMENT

DIY projects and household chemicals can be major sources of stormwater pollution if mishandled.



You can help by:

- Purchase non-hazardous household cleaning products when possible.
 - Lemon juice, vinegar, hot water, borax, soap, and baking soda are good alternatives to harsh chemical cleansers. Check online for non-toxic home cleaning recipes.
- **Never pour household chemicals down the drain.** They are likely to end up in local waters. Dispose of them properly.
 - Rhode Island residents can dispose of household **hazardous waste** for free by making an appointment at the Rhode Island Resource Recovery Corporation (RIRRC) Eco-Depot in Johnston, RI. In partnership with Clean Earth, RIRRC also hosts about 19 Saturday collection events each year throughout the state, including Newport and neighboring towns. Visit **RIRRC's site** for more information.
- Sweep up and properly dispose of construction debris from outdoor projects such as concrete and mortar.
- Use hazardous substances like paints, solvents, and cleaners in the smallest amounts possible, follow the directions on the label, and dispose of them properly.
 - Clean up any spills immediately.
 - Don't rinse the spills into a nearby storm drain. Use absorbent material like cat litter or sand to soak up the spill, which can then be thrown into the trash once it's dry.
- Never clean brushes or rinse paint containers into a street, gutter, or storm drain.
 - For water-based paints, paint out brushes to the extent possible and rinse in the sink. For oil-based paints, paint out brushes to the extent possible. Clean them with thinner, filter the thinner or solvent, and reuse it.
 - Reduce the amount of paved area in your yard and increase the amount of vegetated area. Use native plants in your landscaping to reduce the need for watering during dry periods.
- Reduce the amount of paved area and increase the vegetated area in your yard to aid ground filtration of stormwater runoff.
 - Consider directing downspouts away from paved surfaces onto lawns to increase infiltration further and reduce polluted runoff.



5 ADOPT A CATCH BASIN

With over 3,000 catch basins citywide, Newport's stormwater system depends on clear and functioning inlets, requiring constant attention. Free-flowing catch basins prevent rainwater from ponding on streets and reduce the number of pollutants entering our waterways.

Residents and business owners can help our dedicated WPC field crew by “adopting” a local catch basin and keeping it free of debris.

HERE'S HOW YOU CAN HELP:

- **Clear your drain only if it's safe, watch for traffic and never clear drains in the middle of the street.**
- **Be careful of standing water and sharp objects.**
- **If children are helping, ensure they are supervised.**
- **Do not attempt to lift storm drain grates, they are very heavy.**
- **Clear only drains next to the curb and remove surface debris like leaves or litter.**
- **Leave any hazardous or large obstructions for the WPC's crews to handle.**

If the drain remains clogged after you've cleared surface debris, please contact the Department of Utilities at (401) 845-5600 so staff can investigate further.

EXAMPLES OF GREEN SOLUTIONS

INFILTRATION

EVAPOTRANSPIRATION

STORE AND USE



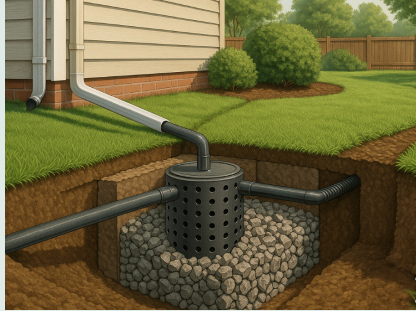
Infiltration Trench



Plant a Tree



Rain Barrel



Dry Well



Rain Garden



6 BUILD A GREEN SOLUTION

Reducing runoff from your property helps both you and your community. Every impervious surface, like a driveway, patio, or roof adds to the amount of stormwater entering the City's drainage system. Even small projects that manage water on-site can have a citywide impact.

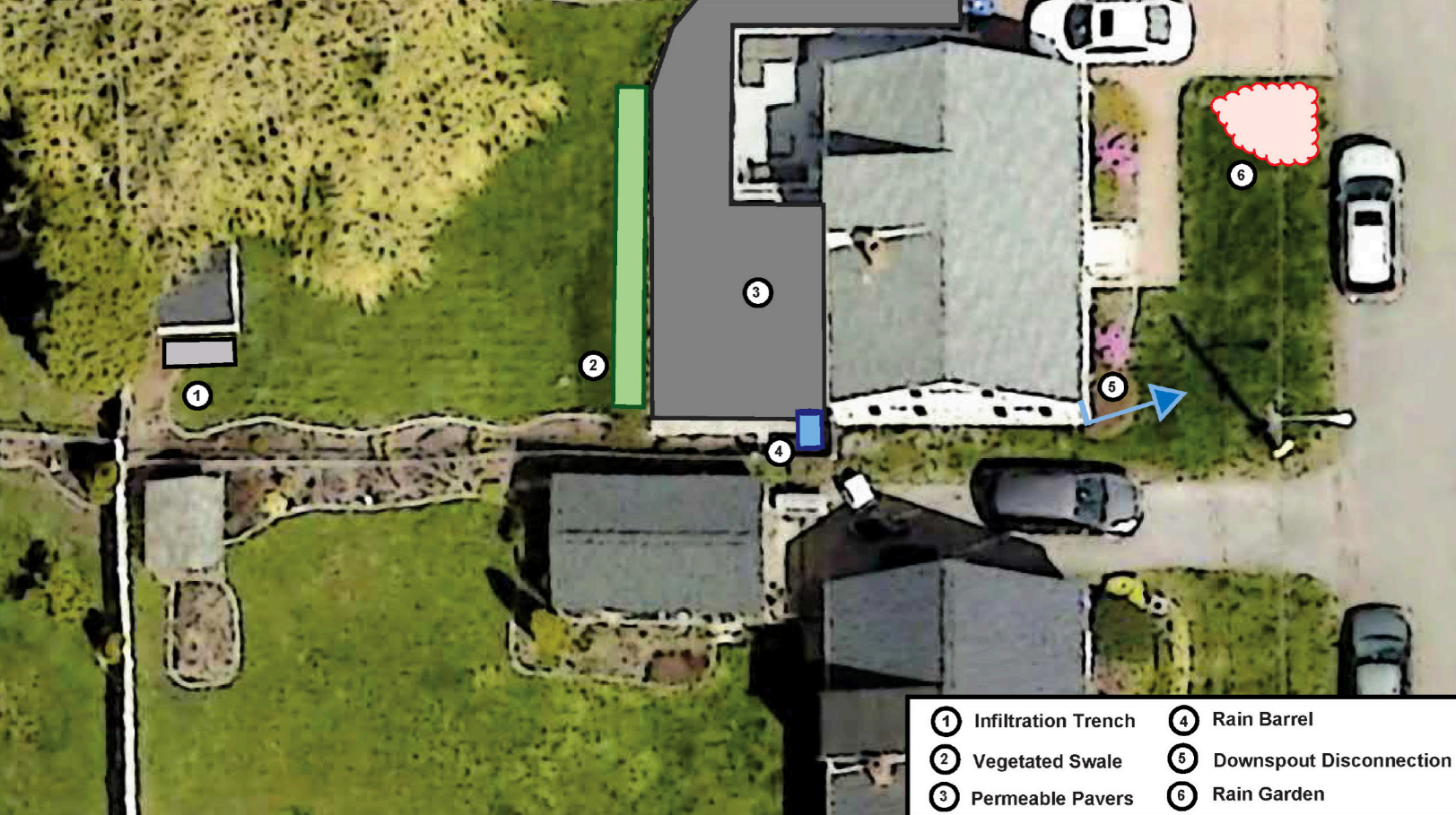
Consider installing Green Solutions. Green Solutions use landscaped elements to disconnect impervious surfaces from drainage systems. These landscape-based practices help stormwater infiltrate & soak into the ground where it falls, reducing both flooding and water pollution.

By working together, residents, businesses, and the Department of Utilities can continue to improve water quality, reduce flooding, and build a more resilient city.

While there are many dozens and variations of green solution designs, several that would be a good fit in Newport neighborhoods include:

- Downspout Disconnection
- Paved Surface Disconnection
- Rain Barrel
- Rain Garden
- Vegetated Swale
- Dry Well
- Permeable Pavers
- Infiltration Trench

More information on how to build these features are described at the end of this manual.



7 USING GREEN SOLUTIONS ON YOUR PROPERTY

Green Solutions can be utilized to disconnect virtually any impervious surface (those that prevent stormwater from infiltrating into the ground) on your property. This includes building roofs, driveways, patios, and walkways. The graphic to the right highlights where different types of green infrastructure can be used.

HOW MUCH IS ENOUGH?

Our goal is to manage two-inches of runoff from all new impervious surfaces.

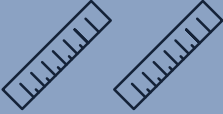
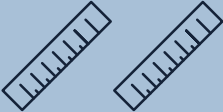
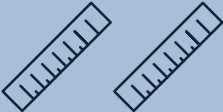
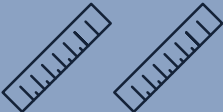
TO CALCULATE THE VOLUME OF GREEN SOLUTIONS NEEDED:

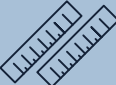
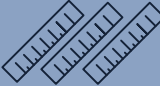
_____ square feet of new impervious surface x 2 inches/12 inches per foot =
_____ cubic feet of volume needed

Example:

Construct a 200 square foot patio.

200 square feet x 2 inches/12 inches per foot = 33 cubic feet

Solution	Cost	Space Required	Installation Time
Downspout Disconnection	\$		
Paved Surface Disconnection	\$		
Rain Barrel	\$		
Rain Garden	\$\$-\$\$\$\$		
Vegetated Swale	\$\$		
Dry Well	\$\$		
Permeable Pavers	\$\$\$		
Infiltration Trench	\$\$		

	Cost	Space Required	Installation Time
Minimal	\$ <\$200	 Smaller than a 4-door sedan	 1-3 hours
Moderate	\$\$ \$200 - \$600	 4-door sedan	 1/2 day
High	\$\$\$\$ >\$600	 Driveway/Patio Size	 Full day+

8 HOW CAN I BUILD THIS?

STORMWATER PRACTICE SELECTION FOR GREEN SOLUTIONS

I Want to Deal With St

Rooftop

I Have Gutters

Rain Garden



Rain Barrel



Dry Well

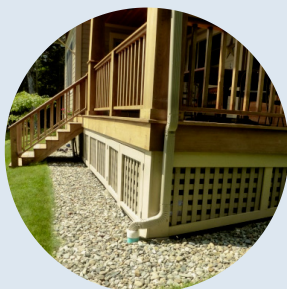


Downspout Disconnection



I Do Not Have Gutters

Dripline Infiltration Trench



Driveway

Runoff Runs Down Sides

Infiltration Trench



Rain Garden



Runoff Runs Straight Down

Permeable Pavers



Stormwater From My...



HOW CAN I BUILD THIS?

1 CALCULATE THE AMOUNT OF NEW RUNOFF YOUR PROJECT IS CREATING. THE NEW IMPERVIOUS COVER WORKSHEET ON PAGE 11 OF THIS GUIDE CAN HELP.

2 IDENTIFY WHICH GREEN SOLUTIONS FIT YOUR PROPERTY.

3 CALCULATE THE AMOUNT OF RUNOFF THOSE GREEN SOLUTIONS CAN MANAGE, USING THE NEW IMPERVIOUS COVER WORKSHEET, OR FOLLOWING THE INSTRUCTIONS ON THE FOLLOWING FACT SHEETS.



If you are going to install a rain garden, dripline or driveway infiltration trench, or dry well on your property, follow these steps for best results

Contact DigSafe

(888-DIG-SAFE; 888-344-7233),

72 hours in advance to locate underground obstructions such as gas, water, electrical, and

sewer lines or bedrock. This is **REQUIRED** if you are digging with heavy equipment.



One important note: this service will not locate small utility lines such as wires run from your house to outside fixtures. These things are your responsibility to locate.

INFILTRATION TEST:

Perform a simple perc test to determine the ability of the soil to infiltrate water. Infiltration practices (rain gardens, dry wells, infiltration trenches and stairs) should only be built in areas where a simple perc test, conducted on a non-rainy day, drains completely within 24 hours. To complete a simple perc test:

- Using a shovel or a post hole digger, dig a 1-foot deep hole.
- Fill the hole with water and allow it to drain completely. If the hole fills with water on its own or if water is still in the hole after 24 hours, choose a new location.

This is important to prevent mosquito habitat.

SETBACKS:

Be sure to locate the infiltration solutions:

- At least 10 feet away from buildings with basements to prevent seepage into the basement.
- Away from tree roots

10'+



DOWNSPOUT DISCONNECTION

Disconnecting a downspout redirects runoff to a vegetated area instead of a paved area, allowing it to soak into the ground. This solution is best-suited when roof downspouts drain to a driveway or sidewalk leading to the street or when connected directly to City storm drain.



Credit: Wisconsin Department of Natural Resources

DESIGN

Identify a stable, vegetated area to receive water from the downspout. This area should be at least 5' away from structures. It is critical that the disconnected downspout does not cause a hazard or nuisance to neighboring properties.

SIZING AND CREDIT

To be effective, water from the downspout needs to travel across at least 15 feet of a pervious surface, such as lawn or a gravel trench.

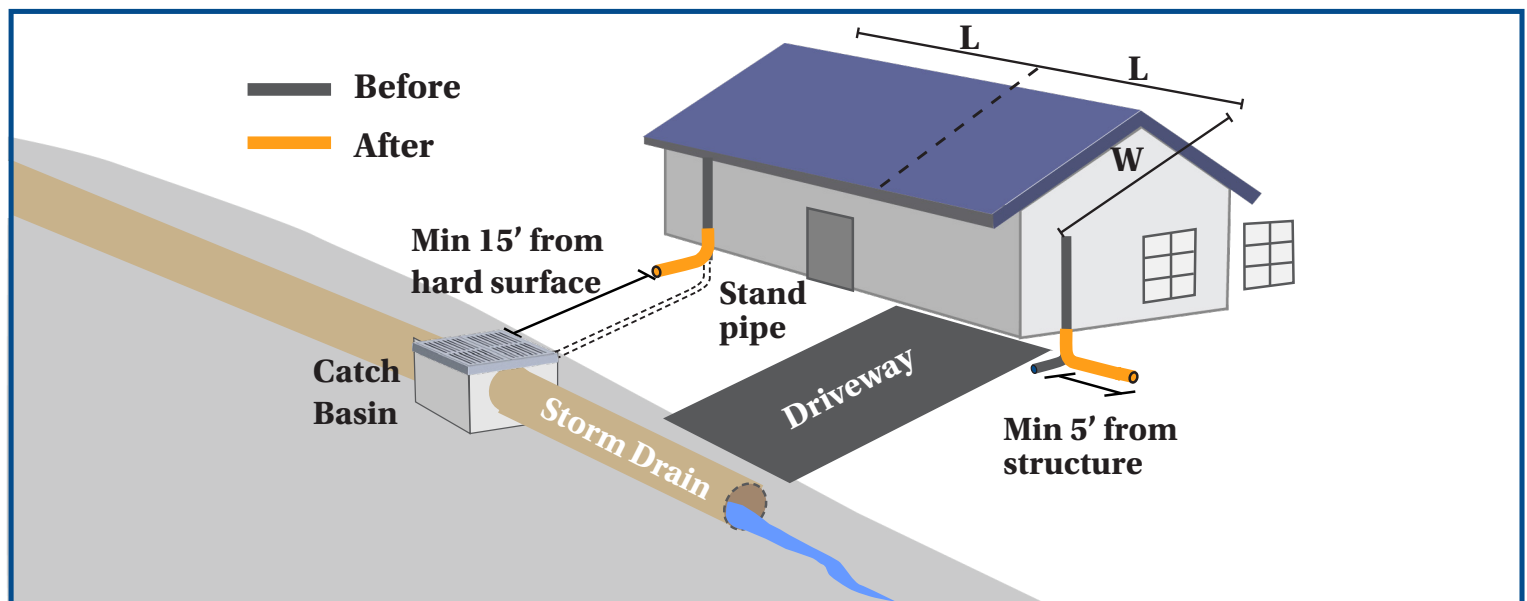
TIP: If possible, redirect your downspout into a rain garden, dry well, or rain barrel. See those fact sheets for more information.

EQUIPMENT AND MATERIALS

- Hacksaw
- Drill
- Screwdriver
- Pliers
- Tape measure
- Sheet metal screws
- Downspout elbow
- Downspout extension
- Standpipe cap
- Splash block

Calculating Volume of Stormwater Managed

$$\text{Roof Area draining to Downspout} \div 4 = \text{Cubic Feet Managed}$$



INSTALLATION

STEP 1:

For downspouts connected to a standpipe:

- a. With a hacksaw, cut the downspout at an appropriate height (typically around 9" above the top of the standpipe).
- b. Cap any pipe from the downspout connected to the street drainage system

STEP 2:

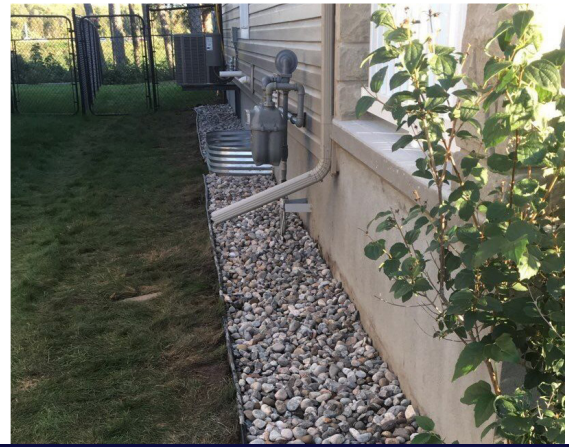
Connect a flexible or rigid downspout extension and add a splash block at the end in the vegetated area. Adding small stones after the splash block can help prevent erosion.

DESIGN REFERENCE

- New Hampshire Homeowner's Guide to Stormwater Management 2016
- Vermont Guide to Stormwater for Homeowners 2018

DRIPLINE INFILTRATION TRENCH

An infiltration trench collects and infiltrates stormwater from your shed or garage until it soaks into the ground. It helps control stormwater from running off of your property. Use for roofs without gutters, for buildings without basements.



SIZING AND DESIGN

STEP 1:

Soffit depth. A soffit is the underside of a roof overhang. Measure the depth of the soffit by aligning your body under the edge of your roof and measuring the distance from your body to the house. **This is the reference line.**

STEP 2:

Reference line. Mark the reference line on the ground along the perimeter of your house where you will be installing the dripline trench.

STEP 3:

Outside boundary. Measure and mark 12" from the reference line away from your building. This is the outside boundary line for excavation.

STEP 4:

Inside boundary. Measure and mark 6" from the reference line toward your building. This is the inside boundary line for excavation.

Calculating Volume of Stormwater Managed

$$\text{Trench Length} \times \text{Width} \times \text{Depth} = \text{Trench Volume (ft}_3\text{)}$$

$$\text{Trench Volume} \times 0.4 \text{ void ratio} = \text{Cubic feet managed}$$

EQUIPMENT AND MATERIALS

- Measuring tape
- Shovel
- ½" to 1 ½" Crushed stone
- Landscaping weed fabric

OPTIONAL

- String or spray paint

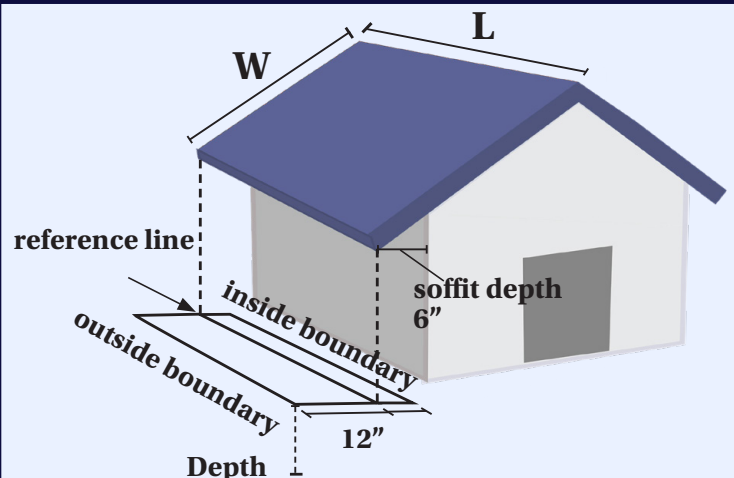
STEP 5:

Determine materials needed.

CRUSHED STONE Calculate the volume of the trench in cubic feet by using the calculation below. If needed, convert cubic feet to cubic yards by dividing cubic feet by 27.

$$\text{Trench Length} \times \text{Width} \times \text{Depth} = \text{Trench Volume (ft}_3\text{)}$$

$$\text{Trench Length} \times \text{Width} \times \text{Depth} \div 27 = \text{Cubic Yards of Stone Needed}$$



LANDSCAPE FABRIC To prevent migration of soil from the sides of the trench into the stone reservoir, it is recommended to line the sides of the trench with landscape fabric. For ease of maintenance, you may also want to line the top of the stone with landscape fabric. Purchase enough landscape fabric to extend twice the length of the trench.

Trench Length x 2 = Landscape Fabric Needed

INSTALLATION

STEP 1:

Dig a trench at least 8" deep between the outside and inside boundary lines marked along the perimeter of your house. Slope the bottom of the trench away from the structure so that water will drain away from the foundation (Figure 1).

STEP 2:

Line the sides with a landscaping weed fabric to extend the life of the trench.

STEP 3:

Fill the trench with stone. Fill the trench with ½" to 1 ½" crushed stone until it is about 3" below the ground level. Place a piece of landscaping weed fabric over the stone layer and fill the remaining 3" with additional stone (Figure 1).

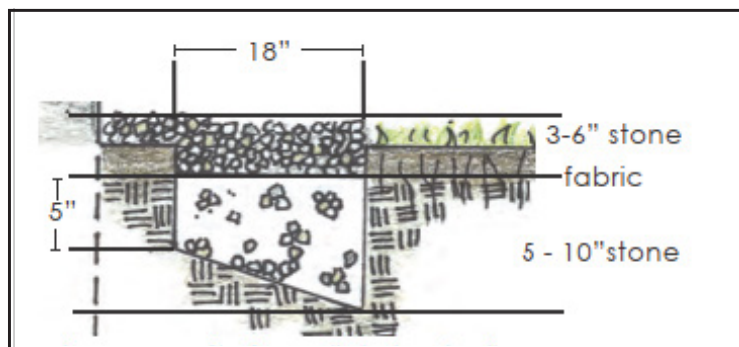


Figure 1: Trench cross section

Credit: NH Stormwater Guide

MAINTENANCE

Inspect: Periodically and after rain events, inspect the practice for any obvious signs of stress or potential failure. Remove accumulated debris and sediment as needed. Check for ponding or poorly draining water - this can be a sign of clogging.

Other Materials: Trenches lined with landscaping weed fabric will require less frequent maintenance, but will still clog over time. Ponding or slowly draining water can be a sign of clogging. The stone and fabric, if used, will need to be washed or replaced to remove the accumulated sediment and debris.

DESIGN REFERENCE

- New Hampshire Homeowner's Guide to Stormwater Management 2016
- Vermont Guide to Stormwater for Homeowners 2018

DRIVEWAY INFILTRATION TRENCH

An infiltration trench collects and infiltrates stormwater from your driveway until it soaks into the ground. It helps control stormwater from running off of your property.



SIZING AND DESIGN

STEP 1:

Observe Driveway. Observe your driveway during a rain storm to determine how stormwater runoff flows across it. Depending on the volume of runoff and where it flows, you may only need an infiltration trench along one side or only a portion of your driveway.

STEP 2:

Determine Width. Decide the width of the trench you want to install. It should be between 12" and 18", as space allows. Mark the trench width (12" - 18") along the edge of your driveway where you will be installing the trench. This is the boundary line for excavation.

STEP 3:

Determine materials needed.

CRUSHED STONE Calculate the volume of the trench in cubic feet by using the calculation below. If needed, convert cubic feet to cubic yards by dividing cubic feet by 27.

$$\text{Trench Length} \times \text{Trench Width} \times \text{Trench Depth} = \text{Trench Volume}$$

EQUIPMENT AND MATERIALS

- Measuring tape
- Shovel
- ½" to 1 ½" Crushed stone
- Landscaping weed fabric

OPTIONAL

- String or spray paint

$$\text{Trench Length} \times \text{Width} \times \text{Depth} \div 27 = \text{Cubic Yards of Stone Needed}$$

LANDSCAPE FABRIC To prevent migration of soil from the sides of the trench into the stone reservoir, it is recommended to line the sides of the trench with landscape fabric. For ease of maintenance, you may also want to line the top of the stone with landscape fabric. Purchase enough landscape fabric to extend twice the length of the trench.

$$\text{Trench Length} \times 2 = \text{Landscape Fabric Needed}$$

Calculating Volume of Stormwater Managed

$$\text{Trench Volume (ft}^3\text{)} \times 0.4 \text{ Void Ratio} = \text{Cubic Feet Managed}$$

INSTALLATION

STEP 1:

Dig a trench at least 8" deep between the edge of your driveway and the excavation boundary line marked along the perimeter of your driveway.

Slope the bottom of the trench away from the driveway so that water will drain away from the foundation (Figure 1).

STEP 2:

Line the sides with a landscaping weed fabric to extend the life of the trench.

STEP 3:

Fill the trench with stone. Fill the trench with ½" to 1 ½" crushed stone until it is about 3" below the ground level. Place a piece of landscaping weed fabric over the stone layer and fill the remaining 3" with additional stone (Figure 1).

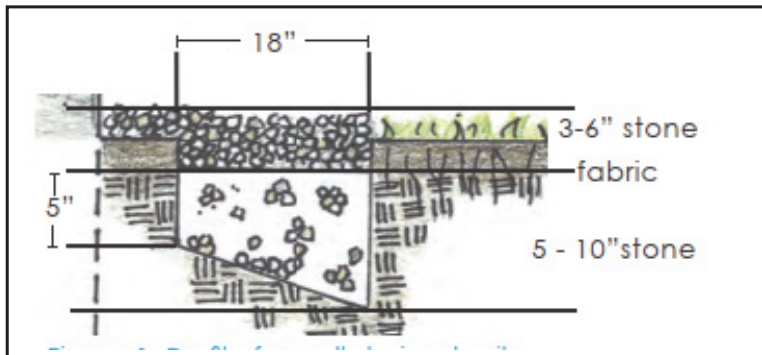


Figure 1: Trench cross section

Credit: NH Stormwater Guide

MAINTENANCE

Inspect: Periodically and after rain events, inspect the practice for any obvious signs of stress or potential failure. Remove accumulated debris and sediment as needed.

Check for ponding or poorly draining water - this can be a sign of clogging.

Other Materials: Trenches lined with non-woven geotextile fabric will require less frequent maintenance, but will still clog over time. Ponding or slowly draining water can be a sign of clogging.

The stone and fabric, if used, will need to be washed or replaced to remove the accumulated sediment and debris.

DESIGN REFERENCE

- New Hampshire Homeowner's Guide to Stormwater Management 2016
- Vermont Guide to Stormwater for Homeowners 2018

DRY WELL

A dry well collects runoff from gutter downspouts, roof valleys, and other areas where water concentrates and flows. They help infiltrate runoff and reduce erosion.



SIZING AND DESIGN

STEP 1:

Choose the location. A good location for a dry well is an area that can receive and infiltrate large amounts of concentrated runoff, such as from a roof valley or gutter downspout. The area should be large enough to accommodate the dry well and should have good separation to groundwater.

STEP 2:

Design how runoff will enter the dry well. Roof downspouts can be extended underground through a flexible pipe/trench into the dry well. This allows the dry well to be buried and planted. Consider installing a flow diverter to allow you to easily disconnect the gutter from the dry well during winter months if you are concerned with freezing conditions. In the following steps, fill the dry well with gravel up to the surface of your yard.

STEP 3:

Calculate runoff volume. To determine how large the dry well needs to be, you need to know the volume of water it will receive during a typical rain storm.

EQUIPMENT AND MATERIALS

- Measuring tape
- Shovel
- ½" to 1½" Crushed stone
- Landscape weed fabric for smaller projects

OPTIONAL

- String or spray paint
- Splash guard
- Gutter downspout extension

Complete steps a. through c. to calculate runoff volume.

- a. Calculate the square footage of the drainage area:

$$\text{Drainage Area Length (ft)} \times \text{Drainage Area Width (ft)} = \text{Drainage Area (ft}_2\text{)}$$

- b. If multiple areas will be directed to the dry well, calculate the square footage of each and add them together.
- c. Find the volume of stormwater from the total drainage area for a 2-inch storm by dividing the drainage area by 6 to convert the inches to feet:

$$\text{Drainage Area (ft}_2\text{)} \div 6 = \text{Stormwater Volume (ft}_3\text{)}$$

STEP 4:

Determine the dimensions of the dry well.

Dry wells are typically 3 feet deep and should be designed to accommodate the stormwater volume (determined in Step 2). Adjust the dimensions of your dry well as needed to fit your site.

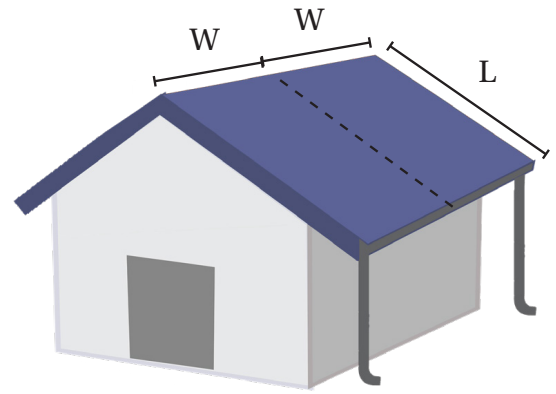
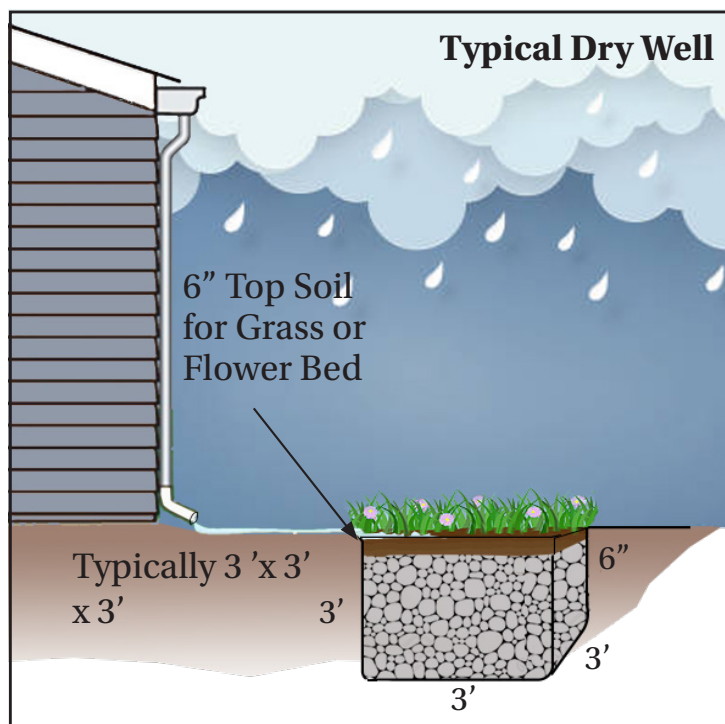
- a. Calculate the surface area of your dry well in ft²:

$$\text{Stormwater Volume (ft}^3\text{)} \div 3\text{ft (depth)} \div 0.4 \text{ (void ratio)} = \text{Dry Well Area (ft}^2\text{)}$$

- b. Identify any limitations on the length or width of the dry well in the chosen location. For example, tree roots, large rocks, or other structures could be limiting factors. Use the most limiting dimension to help determine the shape. For example, if the dry well area should be 12ft² and it can only be 2 feet wide, it will need to be 6 feet long to accommodate the stormwater volume.

Calculating Volume of Stormwater Managed

$$\text{Length (ft)} \times \text{Width (ft)} \times \text{Depth to dig (in)} \div 12 \times 0.4 \text{ void ratio} = \text{Cubic Feet Managed}$$



Example: If two downspouts, divide roof evenly.

STEP 5:

Determine materials needed.

CRUSHED STONE:

To calculate the volume of stone needed, use the dimensions of the dry well, determined in Step 4. If burying the downspout, you will also need to purchase extra stone to fill in the trench around the inlet pipe. If needed, convert cubic feet to cubic yards by dividing cubic feet by 27.

TIP: Crushed stone takes up about 60% of the space in a dry well, leaving about 40% for water storage. A typical dry well is 3'x3'x3'. This will store about 11ft³ of water, which is equal to the runoff from a 12 ft. x 6 ft. drainage area in a storm that produces two inches of rain.

LANDSCAPE FABRIC: To prevent migration of soil from the sides of the dry well into the stone reservoir, it is recommended to line the sides of the dry well with landscape fabric. For ease of maintenance, you may also want to line the top of the stone with landscape fabric.

DOWNSPOUT ADAPTER AND FLEXIBLE PIPE:

If you are trenching your downspout into the dry well underground, you will need to purchase a downspout adapter and flexible pipe, which can be purchased at a local hardware store.

INSTALLATION

STEP 1:

Mark the boundaries. Once you have determined the location and dimensions, clearly mark the boundary of your dry well to identify where to dig. Landscape flags, string, or spray paint work well.

STEP 2:

Dig the dry well. Excavate down 3' within the marked dry well boundary. Consider separating the good topsoil from the deeper soil layers to use as a planting bed.

STEP 3:

Dig a trench to bury your inlet pipe from the gutter downspout to the dry well. Carefully remove and set aside the sod growing over the trench to use later to re-cover once it is complete. Be sure to pitch the trench toward the dry well so that the water easily drains from the gutter to the dry well.

STEP 4:

Shape the bottom. Slope the bottom of the dry well away from the building or other buildings so that water drains away from the foundation.

STEP 5:

Line with landscape fabric. Extend the life of the dry well by lining the sides with non-woven landscape fabric.

STEP 6:

Fill with stone. Fill the excavated dry well with crushed stone to the depth where the pipe from the gutter will be laid. Be sure to place the pipe deep enough to allow for a 6" planting bed or sod layer on top.

STEP 7 (Optional):

Install the flow diverter. Flow diverters allow you to easily direct flow from your gutter

downspout into your dry well during warm seasons. They can be closed during winter month, which allows your gutter to operate normally. To install the diverter, cut the gutter with a hand saw and install per manufacturers' instructions at a height that allows the water to flow from the diverter into the dry well.

STEP 8:

Connect pipe to dry well. Attach the pipe to the downspout or flow diverter, if using one. Lay the pipe in the trench with the outlet near the center of the well. Use crushed stone and a level to make sure it is pitched toward the dry well so it will drain.

STEP 9:

Continue to Fill with Stone. Fill with stone to within 6" of the ground surface.

Cover with Landscape Fabric. Fold a flap of filter fabric over the top of the crushed stone.

STEP 10:

Top coat with soil. Cover landscape fabric with a 6" planting bed of soil. Densely plant dry wells with native groundcover, grasses, or other perennials. Fertilize sparingly and only as needed.

MAINTENANCE

Inspect: Seasonally and after large storms. Look for signs of clogging such as ponding at the surface or water backing up into gutter.

Clean Out: The use of filter fabric will extend the life of dry wells, but will eventually clog over time. If clogging occurs, remove and wash or replace stone and fabric.

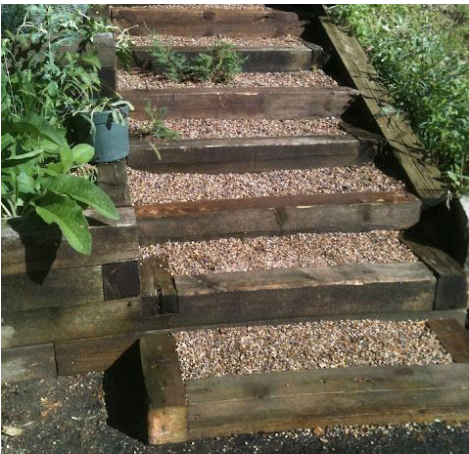
Plant Care: Prune, thin, or replace plants as needed on the surface of the dry well.

DESIGN REFERENCE

- New Hampshire Homeowner's Guide to Stormwater Management 2016

INFILTRATING LANDSCAPE STEPS

Infiltrating landscape steps slow down and infiltrate runoff on moderate slopes to reduce erosion and stormwater runoff.



SIZING AND MATERIALS

This retrofit works best on a slope of 1:1 or less (step height is same or less than step depth). For gentle slopes, wooden stakes or large rocks can also secure the timbers. For slopes that are greater, this retrofit can still work by extending the run of the steps.

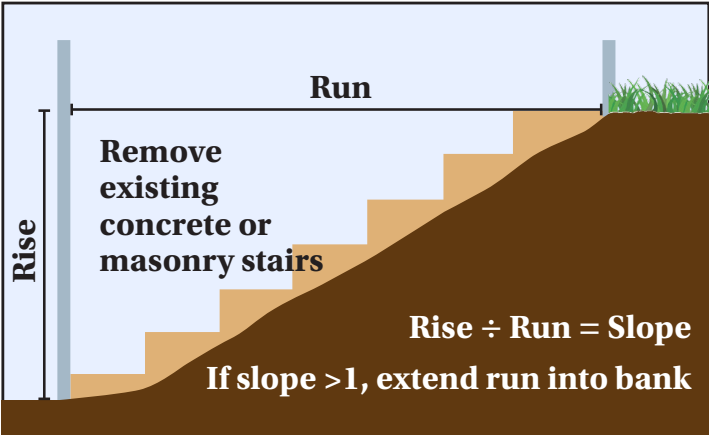


Figure 1

$$\begin{aligned} \text{Rise} \div \text{Timber Height} &= \text{Number Of Steps} \\ \text{Run} \div \text{Number Of Steps} &= \text{Tread Depth Measure} \\ \text{existing step width} &= \text{Step Width} \end{aligned}$$

TIP: Side timbers may not be needed if the steps are in a pathway where the surrounding land is higher. In this case, increase the length of the riser timbers so they extend into the adjacent banks 6" so water will not go around the steps.

Materials Needed:

TIMBERS: If you are using side timbers, add the length of each side timber (the tread depth) to the step width to get the total length of timber you'll need per step. As a guide, use the following equations to estimate the length (in feet) of timber material you will need.

$$\begin{aligned} \text{Step Width} + (2 \times \text{Tread Depth}) &= \text{Timber Length Per Step} \\ \text{Timber Length Per Step} \times \text{Number of Steps} &= \text{Total Timber Length} \end{aligned}$$

EQUIPMENT AND MATERIALS

- Measuring tape
- Shovel
- Sledge hammer
- 2 Wooden stakes
- String or spray paint
- Level
- 3/4" crushed stone or pea stone
- Landscaping weed fabric
- 6" x 6" pressure treated or cedar timbers
- 24" long pieces of 1/2" diameter steel rebar
- Power drill with 5/8" drill bit

REBAR:

Each step:

4 x 24" Rebar

LANDSCAPE FABRIC (NON-WOVEN):

Number of Steps x Step Width (ft) x Tread
Depth (ft) = Square feet of landscape fabric

CRUSHED STONE OR PEA GRAVEL:

Number of Steps x Step Width (ft) x Tread
Depth (ft) x Timber Height (ft) =
Cubic Feet of Stone
Cubic Feet of Stone ÷ 27 = Cubic Yards of
Stone

Calculating Volume of Stormwater Managed

Cubic Feet of Stone x 0.4 void ratio =
Cubic Feet Managed

INSTALLATION

STEP 1:

Prepare materials. Cut the timbers to the appropriate length. For each step, cut one riser timber as long as the step width and 2 timbers as long as the tread depth for the side timbers (remember that each side timber should extend 6" past the next step's riser timber).

For each timber, drill a minimum 5/8"-diameter, vertical hole 3 inches from each end of the timber, along the center line of the timber.

TIP: Most lumber supply stores have a cutting station to cut timbers to the correct length if you do not have a saw.

STEP 2:

Remove existing step material.

BOTTOM STEP

STEP 3:

Position timbers. Position the timbers in the step and remove or add soil as needed to level them.

STEP 4:

Anchor timbers. Drive the 24" steel rebar through the drilled holes on the end of each timber and into the ground. Make sure the rebar is level with the timber surface or slightly recessed since the edges may be sharp (Figure 2).

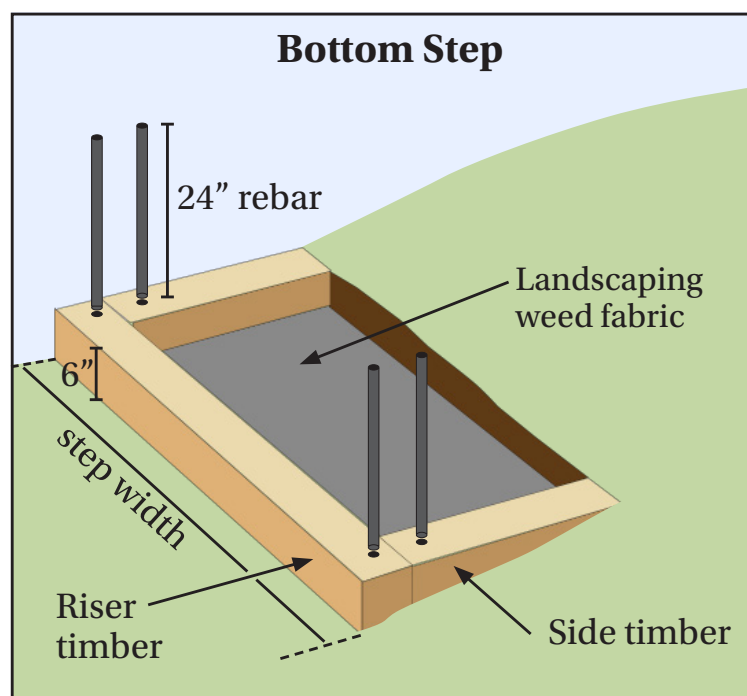


Figure 2

STEP 5:

Dig and level inside step. Shovel out the soil inside the step to create a surface roughly level with the bottom of the timbers. Additional soil can be removed to provide more area for infiltration if desired. Make sure to dispose of excavated soil in a place where it will not wash away (Figure 2).

SECOND STEP AND UP

STEP 6:

Build next step. To build the next step, place the riser timber across the side timbers and attach the riser timber to the side timbers with the galvanized bolts. Measure from the front of the riser timber below and mark the tread depth on the side timbers below with a pencil.

STEP 7:

Excavate side timbers. Align the front of the next step riser timber with the pencil lines on the side timbers of the step below. Secure the side timbers to the timbers below using 24" rebar (Figure 3).

Set and anchor side timbers by driving the steel rebar through the drilled holes on the end of each timber into the ground (Figure 3).

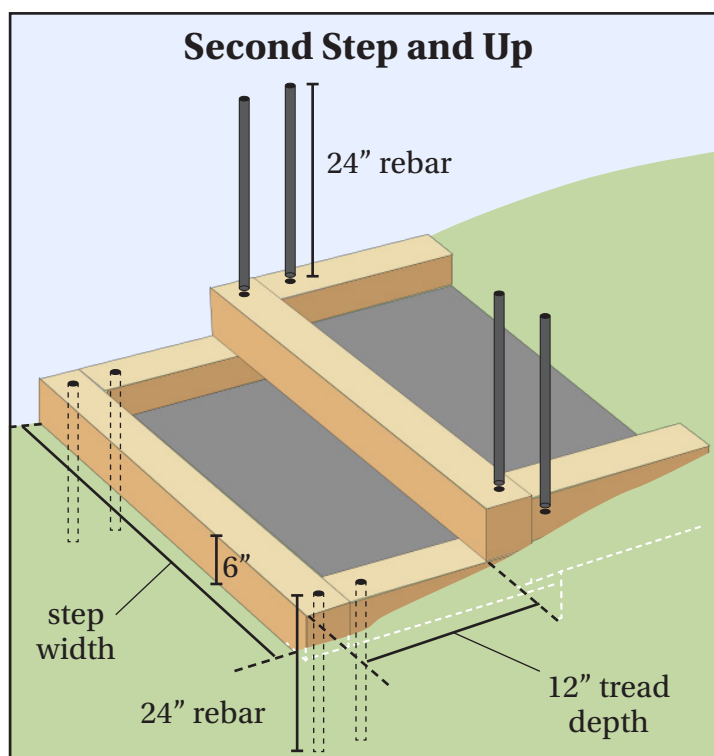


Figure 3

STEP 8:

Dig and level inside step. Shovel out the soil inside the step to create a surface roughly level with the bottom of the timbers as in Step 5.

STEP 9:

Repeat. Repeat Steps 6 through 8 for each remaining step. When installing the top step, cut the side timbers 6" shorter than the ones on the lower steps - these timbers do not need the extra length since no stairs will rest on them.

STEP 10:

Fabric and backfill. Lay down landscape fabric and backfill with stone.

- Line the area inside each set of timbers with non-woven geotextile fabric. Make sure the fabric is long enough to extend a few inches up the sides of the timbers.
- Fill each step with 3/4" crushed stone or pea stone until it is about 1" below the top of the timber (Figure 4).
- Seed and/or mulch bare soil adjacent to the steps.

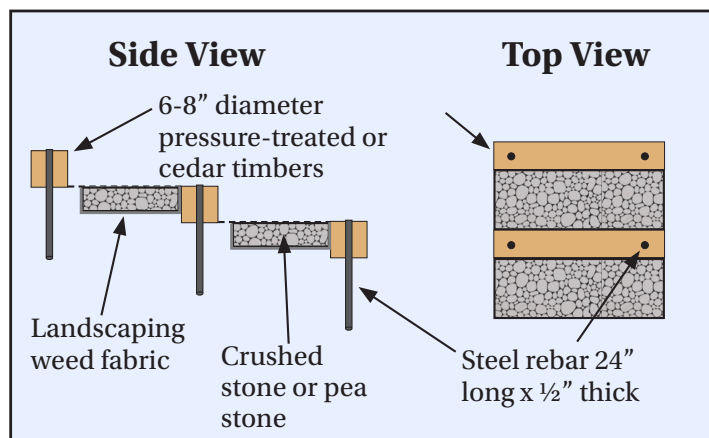


Figure 4

MAINTENANCE

Inspect: Seasonally and after large storms, look for signs of erosion or clogging such as ponding at the surface or accumulated sediment.

Clean Out: If clogging occurs, remove and wash or replace stone and fabric. Remove any vegetation growing on the steps if not included in the design.

Replace: Replace timbers if damaged or rotted, as needed.

DESIGN REFERENCE

- New Hampshire Homeowner's Guide to Stormwater Management 2016

PERVIOUS PATIOS, DRIVEWAYS, AND WALKWAYS

Pervious pavers look like traditional pavers, but are able to absorb and store stormwater and snowmelt to reduce runoff from your property.



Pervious pavers can actually last longer than conventional paved driveways and walkways when properly maintained. Pervious paver manufacturers typically provide instructions for design and installation. **If the information in this fact sheet differs from the manufacturer's instructions, follow the manufacturer's instructions.**

SIZING AND DESIGN

STEP 1:

Identify installation area.

Determine the areas where you will be installing pervious pavers. Pervious pavers are best for areas with slopes of less than 5%.

STEP 2:

Determine depth to dig.

Paver thickness (inches)

- 6" of 3/8" pea gravel
- 4" to 12" of 1 1/2" crushed stone

$$\text{Paver Thickness} + 6" + \text{Crushed Stone Depth (in)} = \text{Depth to Dig (in)}$$

Calculating Volume of Stormwater Managed

$$L \text{ (ft)} \times W \text{ (ft)} \times \text{Depth to dig (in)} \div 12 \times 0.4 \text{ void ratio} = \text{Cubic Feet Managed}$$

EQUIPMENT AND MATERIALS

- Measuring tape
- Shovel
- Rake
- Broom
- 1 1/2" crushed stone
- 3/8" pea stone
- Landscaping weed fabric
- Tamper or roller
- Pervious pavers
- Level

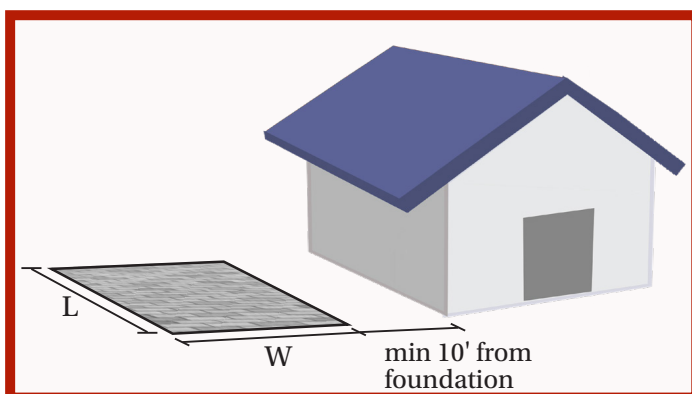
STEP 3:

Determine materials needed.

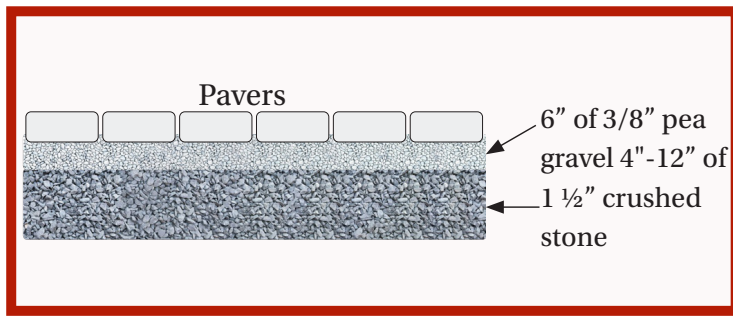
$$L \text{ (ft)} \times W \text{ (ft)} = \text{Pavement Area (ft}^2\text{)}$$

$$\text{Pavement Area (ft}^2\text{)} \times \text{Crushed Stone Depth (in)} \div 12 \div 27 = \text{Cubic Yards of Crushed Stone}$$

$$\text{Pavement Area (ft}^2\text{)} \times 0.5\text{ft} \div 27 \text{ (ft}^3\text{/yd)} = \text{Cubic Yards of 3/8" Pea Gravel}$$



Note: Stormwater is considered managed by pervious pavers only if the pervious pavers replace existing impervious cover



INSTALLATION

STEP 1:

Prepare the site. Remove any existing walkway, driveway or patio material. Excavate to Depth to Dig calculated above where pavers will be installed. Ensure the bottom of the trench is slightly sloped away from any structures.

STEP 2:

Install a layer of landscaping weed fabric.

STEP 3:

Fill the bottom of the trench with at least 4" crushed stone.

STEP 4:

Add 6" of pea gravel

STEP 5:

Lay the pavers with appropriate spacing. Use a level to make sure they are installed uniformly. The manufacturer will provide recommendations depending on the paver type. Most pervious pavers have tabs on the edges to create proper spacing between them.

STEP 6:

Once the pavers are installed, spread more pea gravel over the top and use a push broom to work the pea stone into the space between the pavers.

MAINTENANCE

Inspect: Seasonally and after large storms, look for signs of clogging such as ponding at the surface or accumulated sediment.

Clean Out: If clogging occurs, remove and wash or replace pea stone and fabric. Remove any vegetation growing on the steps if not included in the design. Refer to manufacturer's instructions for power washing or vacuuming.

DESIGN REFERENCE

- New Hampshire Homeowner's Guide to Stormwater Management 2016
- Vermont Guide to Stormwater for Homeowners 2018

RAIN BARREL

A rain barrel captures stormwater from your roof to reduce runoff from your property and provide water for lawns and gardens in dry weather.



SIZING AND DESIGN

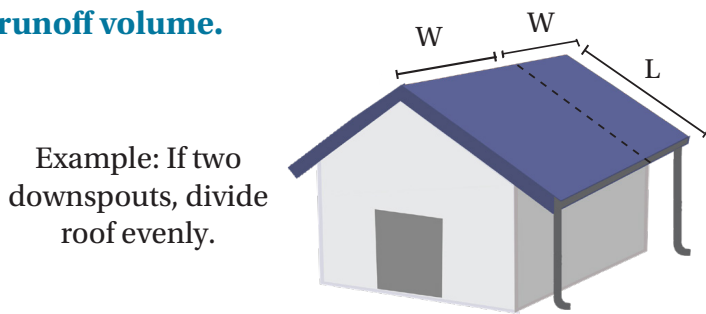
STEP 1:

Observe your roof runoff. Note where you have existing roof gutter downspouts, roof valleys, or edges that drain large amounts of water.

STEP 2:

Calculate the runoff volume. To determine how many rain barrels you need and whether you should designate an area to direct the rain barrel overflow, you need to know the volume of water the barrels will receive during a typical rain storm.

Complete steps a. through d. to calculate runoff volume.



- a. Calculate the square footage of the drainage area:

$$\text{Drainage Area Length (ft)} \times \text{Drainage Area Width (ft)} = \text{Drainage Area (ft}^2\text{)}$$

- b. If more than one surface will drain to the rain barrel, calculate the square footage of each area and add them together.

EQUIPMENT AND MATERIALS

- Purchased or home-made rain barrel (food-grade)
- Downspout diverter (purchased or made)
- Shovel
- Elevated base (e.g. with cinder blocks or wood)
- Level

OPTIONAL

- Soaker hose
- Crushed stone
- Mulch
- Splash guard

- c. Find the volume of stormwater from the drainage area for a 2-inch storm by dividing the drainage area by 6 to convert the inch to feet:

$$\text{Total Drainage Area (ft}^2\text{)} \div 6 = \text{Stormwater Volume (ft}^3\text{)}$$

- d. Most rain barrels give the holding capacity in gallons. Convert the cubic feet to gallons by multiplying by 7.48.

$$\text{Stormwater Volume (ft}^3\text{)} \times 7.48 \text{ Gallons} = \text{Stormwater Volume (gallons)}$$

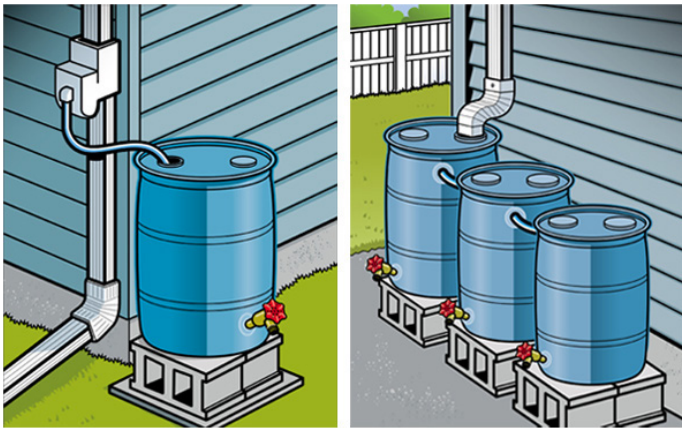
STEP 3:

Determine how many rain barrels are needed.

Attempt to capture the volume from a two-inch storm, if yard space is available.

$$\text{Stormwater Volume (gallons)} \div \text{Rain Barrel Storage Capacity (gallons)} = \text{Number of Rain Barrels Needed}$$

TIP: You are not limited to one rain barrel. Rain barrels can be linked together so that the overflow from one goes into the next.



STEP 4:

Address the overflow. Be sure to note where the overflow will go during larger storms. Avoid directing the overflow next to building foundations. Plan to use a splash guard, install a soaker hose, or build a slight swale to direct overflow away from your home and into an area where it can be absorbed, such as a naturally vegetated area, a rain garden, or dry well.

Calculating Volume of Stormwater Managed

$$\text{Number of Rain Barrels} \times \text{Rain Barrel Capacity (gallons)} \div 7.48 = \text{Cubic Feet Managed}$$

INSTALLATION

STEP 1:

Level the area. Once you have determined where you want your rain barrels to go, level the ground surface. You can use crushed stone or mulch to stabilize the ground.

STEP 2:

Install blocks or stand.

Elevating the rain barrel is necessary to allow room for a watering can, bucket, or hose attachment under the spigot. Elevating the barrels will also create stronger water pressure. Place the blocks or other materials to create a stand on the leveled ground and recheck for level. Adjust as needed to achieve level.

TIP: Your rain barrel **must** be secured on a firm, level surface. A full, 55-gallon rain barrel weighs over 400 pounds.

STEP 3:

Connect the downspout to the rain barrel.

Downspout diverters allow you to easily direct flow from your gutter downspout into your rain barrel during warm seasons. They can be closed during winter month, which allows your gutter to operate normally. To install the diverter, temporarily place the rain barrel on the blocks to mark where the diverter needs to be installed. Cut the gutter with a hand saw and install the diverter per the manufacturer's instructions, at a height that allows the water to flow from the diverter into the barrel. If not using a flow diverter, the gutter downspout can be directed or connected directly to the barrel.

STEP 4:

Install the rain barrel.

- Place the rain barrel on the blocks or stand.
- Direct flow from gutter downspout or diverter into the barrel.
- Cover the open top of the rain barrel with screen to prevent mosquitoes from breeding in the standing water and to reduce the amount of debris entering the barrel. Most rain barrels that you purchase pre-made will come with a screened cover.
- Direct the overflow hose from the rain barrel to a vegetated area or another stormwater practice, where it can soak into the ground.

MAINTENANCE

Inspect: Check after storms to determine how soon you need to empty the barrel. Remember that a rain barrel only works if it has space to contain more water.

Empty: Empty the rain barrel between storms or, at a minimum, when full. The water can be used on perennial gardens, house plants, and other non-potable or non-drinking water needs. Carefully consider what you water with your rain barrel. This water has the potential to contain pollutants from your roof that you may not want to come in contact with vegetables or other edible crops.

Clean: Keep the screen clear of debris and clean with a soft brush as needed. Periodically clean out the inside of the barrel if debris has collected. Keep gutters and downspouts clean and clear to prevent debris, such as leaves and pine needles from entering the rain barrel.

Winter Storage: It is recommended that you completely empty your rain barrel and store it indoors through the freezing winter months. When the rain barrel is removed for the season, the gutters and downspouts should be returned to their normal function to drain the roof during winter storms. This can be done by closing or removing the diverter and extending the downspout back to the ground.

BUILD YOUR OWN RAIN BARREL

Pre-made rain barrels are available in many sizes and styles. They range in price from \$50 to over \$200. To save money, you can make your own rain barrel out of a food grade drum and plumbing parts that you can find at most hardware stores. An internet search of “*How do I make a rain barrel*” will result in a long list of how-to sites and videos, similar to this one <http://www.instructables.com/id/Rainwater-harvesting-Rain-Barrel-DIY>

Whichever instructions you follow, a food grade drum is preferable. We recommend avoiding trash barrels, which may not stand up to the pressure of being full of water.

DESIGN REFERENCE

- New Hampshire Homeowner’s Guide to Stormwater Management 2016
- Vermont Guide to Stormwater for Homeowners 2018

RAIN GARDEN

A rain garden is a sunken, flat-bottomed garden that uses soil and plants to capture and absorb stormwater. This helps to reduce street flooding and recharges groundwater.



SIZING

Use the following steps to determine the dimensions of the rain garden.

STEP 1

Total drainage area. Identify the impervious surface(s) that will drain to the rain garden. Multiply the length by the width to get the drainage area in square feet.

$$\text{Drainage Area Length (ft)} \times \text{Drainage Area Width (ft)} = \text{Drainage Area (ft}^2\text{)}$$

If more than one surface will contribute runoff to the rain garden, add them together. For example, if a roof drains onto a driveway and flow from the driveway will drain to the rain garden add the roof area and the driveway area together.

STEP 2:

Rain Garden Area. A typical rain garden is 6" deep. Use Table 1 to determine the corresponding footprint of the rain garden.

The long side of the rain garden should be perpendicular to the slope of the drainage area. Overall a rain garden works best when it is twice as long as it is wide. This allows the rain garden to capture as much stormwater as possible. Curved shapes are the most

EQUIPMENT AND MATERIALS

- Calculator
 - Measuring tape
 - Spray paint
 - Yard stick
 - 6-12 Stakes
 - 2-4 long stakes (4')
 - String
 - Shovels
 - Carpenter's level
 - String level
- Rakes
 - Compost/ Wood chips
 - Mulch
 - Crushed stone
 - Flat stones or pavers
 - Tarp(s)
 - Wheel Barrow(s)
 - Plants

Table 1: Surface area (ft²)

Drainage Area	Rain Garden Recommended Footprint
100	33
200	67
300	100
400	133
500	167
600	200
700	233
800	267
900	300
1,000	333

effective, just be sure to approximate the required area from the table. Depending upon your property, it may be easier to break up stormwater flows to create multiple, smaller rain gardens rather than one larger one.

STEP 3:

Determine depth to dig. A working rain garden needs a 6" to 12"-deep planting bed. A 2"-thick hardwood mulch layer is also recommended to retain moisture and prevent weeds.

$$6'' \text{ Ponding Depth} + 6'' \text{ to } 12'' \text{ Planting Bed Depth} + 2'' \text{ Mulch Layer Depth} = \text{Total Depth to Dig}$$

Calculating Volume of Stormwater Managed

$$\begin{aligned} &\text{Rain Garden Footprint (ft}^2\text{)} \times \text{Ponding Depth (in)} \\ &\div 12 + \text{Rain Garden Footprint (ft}^2\text{)} \\ &\times \text{Planting Bed Depth (in)} \div 12 \times 0.33 \text{ void ratio} \\ &= \text{Cubic Feet Managed} \end{aligned}$$

DESIGN

STEP 1:

Design the berm. A berm is needed on the downslope side of the rain garden to hold water in the garden. The berm should be the same height as the upslope edge of the garden to make the entire perimeter of the garden level. This creates the ponding area. The berm should be no more than 12" high in order to blend with the surrounding landscape and to be easier to maintain.

STEP 2:

Plan the inlet and outlet.

a. Inlet. The location where runoff enters a rain garden is called the inlet. The inlet might be a gutter downspout, a trench, or from sheet flow. It is important to protect the inlet from erosion and scouring during rain storms. To reduce erosion and scouring, the inlet should be reinforced with stone or gravel. A flat rock or paver can also be placed at the inlet, directly under where runoff enters the garden to help spread out the flow.

b. Outlet. The location where water exits or overflows from a rain garden is called the outlet. This is the lowest part of the berm and must be below the inlet for the rain garden to work properly. While the rain garden is designed to contain most rain storms, the outlet provides a safe and controlled place for water to overflow during storms that produce a lot of rain. An outlet can also be created along a portion of the berm on the downslope side of a rain garden. An outlet is created by lowering a 1' to 2' wide section of the berm a couple of inches. Similar to the inlet, the outlet needs to be protected against erosion and scour and needs to be reinforced with stone or directed toward a City storm drain or the street.

STEP 3:

Create your planting plan. Select appropriate plant species for the rain garden from the [Rhode Island Coastal Plant Guide](#). Set the Rain Gardens filter to "+" and the Native Status to "+". A good planting plan includes at least three plant species and a mix of shrubs and grasses. See Figure 1 below for an example plan, but feel free to create your own.

The Coastal Plant Guide also indicates which local nurseries may stock these plants, but calling ahead is recommended.

- Hoogendorn Nurseries, 408 Turner Road, Middletown, RI, 401-847-3405
- The Farmer's Daughter, 716 Mooresfield Road (Rt 138), Wakefield, RI, 401-792-1340
- The Rhode Island Nurseries, Inc., 736 East Main Road, Middletown, RI, 401-846-0721

STEP 4:

Determine materials needed. Based on the area and depth to dig of your rain garden, follow Table 2 to approximate the amount of soil, compost, mulch and other materials that you may need. If needed, convert cubic feet to cubic yards by dividing cubic feet by 27.

Table 2: Material Thickness and Coverage

Material Thickness (inches)	Area Covered (in ft ₂) per Cubic Yard (yd ₃) of Material
1"	324 ft ₂
2"	162 ft ₂
3"	108 ft ₂
4"	81 ft ₂
5"	67 ft ₂
6"	54 ft ₂
7"	47 ft ₂
8"	40 ft ₂
9"	36 ft ₂
10"	33 ft ₂
11"	30 ft ₂
12"	27 ft ₂

A working rain garden needs a 6" to 12"-inch deep planting bed. A 2"-thick hardwood mulch layer is also recommended to retain moisture and prevent weeds. Softwood mulches are not recommended because it is more prone to floating away in a rainstorm.

$$\text{Rain Garden Area} \div \text{Area Covered per Cubic Yard} = \text{Cubic Yards of Material Needed}$$

STONE: About a half of a cubic yard of crushed stone is useful for securing the inlet and outlet and achieving the pitch of the inlet pipe from a downspout. Two or more 1-ft₂ or larger flat stones or pavers are useful for placing at the inlet. The outlet can also be reinforced with stones that you find as you dig out the rain garden area.

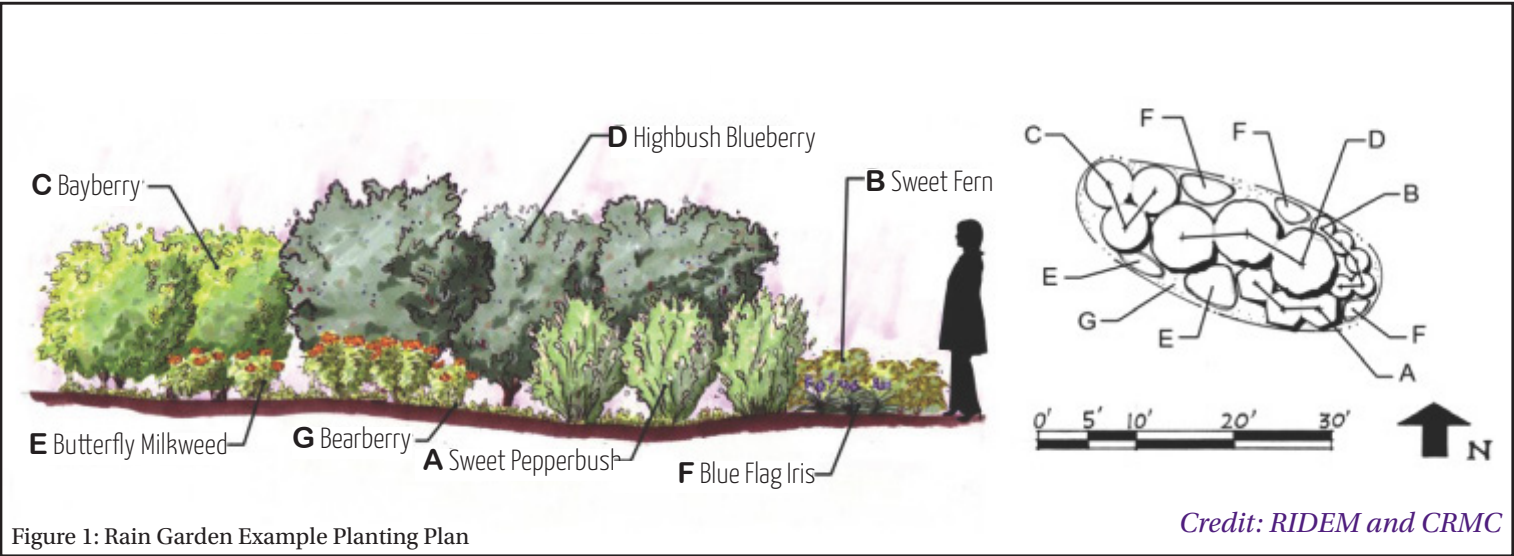
INSTALLATION

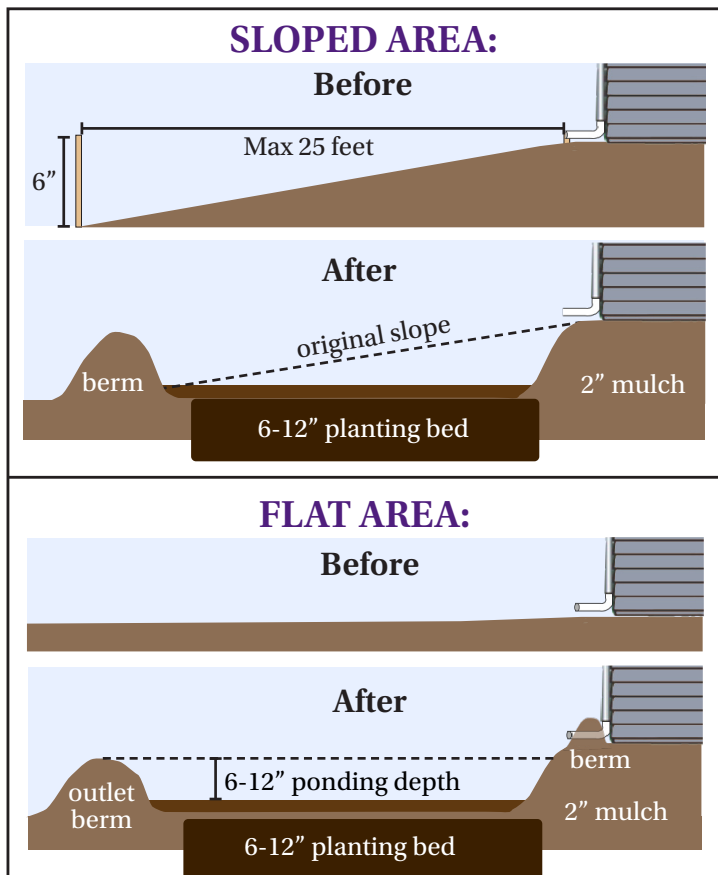
STEP 1:

Define Borders. Use string or spray paint to outline the shape of the rain garden. The berm, if needed, will be built outside of the outline.

STEP 2:

Start Digging. Start digging. Remove the soil from within the rain garden area. Form a gentle slope along the edges as you dig. Lay out tarps to temporarily sort and store sod, top soil, and lower soil layers to use later in building the berm and preparing the soil planting bed.





STEP 3:

Set the berm height. Once you are close to having the entire garden area dug down to the “total depth to dig”, hammer stakes along the perimeter of the rain garden about 4-6 feet apart, starting with the highest edge, and working around the garden. Attach a string to the base of the highest stake. Use a string level to mark the leveled height on each stake around the perimeter of the garden. This will be your berm height. The berm height should be 6” to 12”.

STEP 4:

Level the bottom. The rain garden must have a level bottom to encourage the water to spread evenly throughout. Once all of your stakes are marked with the berm height, use a leveled string and a yard stick or measuring tape to measure the distance from the bottom of the rain garden to the string throughout the rain garden. You may find that you need to dig out additional material or rake it out to get rid of high or low spots.

STEP 5:

Prepare inlet. If your rain garden is capturing roof runoff from a gutter, you can dig a trench to bury your inlet pipe from the gutter downspout to the garden. Carefully remove the sod growing over the trench and set it aside to use as a cover, if desired, once the trench is complete. Be sure to pitch the trench toward the rain garden so that the water easily drains from the gutter to the garden and doesn’t back up. You can use a carpenter’s level to check the pitch.

Inside the rain garden, stabilize the inlet area with crushed stone to prevent erosion and scour of the inlet. Place one or more flat stones or pavers directly under the inlet pipe to further reduce erosion and to prevent a channel from forming in your rain garden.



Credit: UConn NEMO



Credit: Save the Bay

STEP 6:

Build berm and outlet. Using the marked stakes along the edge of the rain garden as a guide, use overturned sod and soil to build and shape the berm to the specified berm height. Designate a 1- to 2-foot section of the berm to be the outlet. The outlet should be a few inches lower than the rest of the berm height. After shaping the berm and the outlet, compact the soil. Reinforce the outlet with stone.

STEP 7:

Add planting bed materials. Before adding the planting bed materials into the rain garden, hammer tall stakes into the bottom of the rain garden and mark them with the planting bed depth, which should be between 6" to 12". Use this line as a guide as you evenly distribute a mix of native soil and other amendments, such as sand and yard waste, as needed to create a planting bed. Mix well and be sure to place some planting bed material up the sloped sides of the rain garden so that they may also be planted. Rake the bed level. To avoid compacting the planting bed, work from the center of the garden outward.

STEP 8:

Plant. Place plants while still in their pots into the garden according to the planting plan. Make adjustments for spacing as indicated in the Coastal Plant Guide. When you are ready to plant, remove one plant at a time from its pot and loosen the root ball with your fingers to encourage root growth. Plant to the same depth or slightly deeper than they were in the pot.

STEP 9:

Apply Mulch. Apply a 2" layer of mulch over the entire rain garden to help retain moisture in the soil and to prevent weeds.

STEP 10:

Water thoroughly. Water thoroughly immediately after planting. Give the plants an inch of water every week for the first growing season. Once the plants have been established, water only as needed during extended dry weather.

MAINTENANCE

Rain garden maintenance is similar to the maintenance of any perennial garden, with a few extra tasks:

Inspect: After storms to verify the inlet and outlet are stable, no channels have formed, that plants are healthy, and that it is draining. Adjust and repair if needed.

Plant Care: Weed and water as needed. Replace dead plants as needed. Cut back, prune, or divide plants when appropriate to encourage growth.

Clean: If the rain garden is receiving runoff that contains sand or debris, such as from a driveway, clean out and dispose of accumulated materials as needed.

DESIGN REFERENCE

- Rhode Island Stormwater Management Guidance for Single-Family Residential Lot Development 2013
- New Hampshire Homeowner's Guide to Stormwater Management 2016
- Vermont Guide to Stormwater for Homeowners 2018

