



Iowa Rain Garden Design & Installation Guide

Third Edition



Developed by **The Iowa Stormwater Education Partnership**

Iowa Rain Garden Design & Installation Guide

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The *Iowa Rain Garden Design and Installation Guide* was developed by ISWEP in cooperation with the following partners:



IOWA DEPARTMENT OF
AGRICULTURE &
LAND STEWARDSHIP





Smooth Blue Aster

Symphyotrichum laeve



PLANT NOTES

Common throughout Iowa. Blooms in the fall. Stems are usually 20"-60" long. Flowers are about 1" across with 15 to 30 petals. Yellow center that turns reddish with age. A beautiful addition to any rain garden and landscape.

Photos: Shutterstock



Introduction

What is a Rain Garden?



Capturing Stormwater Runoff

A rain garden is a type of **stormwater best management practice (BMP)** used to capture **stormwater runoff**.

Stormwater runoff is generated from **impervious** surfaces such as rooftops and driveways. Stormwater BMPs collect rain and snowmelt. They remove pollutants that accumulate on impervious surfaces and lawns.

Rain gardens and other stormwater BMPs such as rain barrels, soil quality restoration, and native landscaping are also referred to as **Rainscaping** practices. These practices are landscaping features used to manage stormwater runoff on residential and commercial properties.

Rain gardens are designed as shallow, landscaped depressions. They promote infiltration of rainwater into the landscape, rather than it running off into a storm drain. Runoff that enters the rain garden is temporarily ponded so that the rain can soak into underlying soils and be cleansed.

Homeowners can add value to their property and improve local water quality through the installation of a rain garden. Many rain gardens utilize native plants, which provide excellent habitat for birds, bees, and butterflies. Native plants provide added benefit because once they are established, they require less maintenance over the long term.

Photo: Sustainable Landscape Solutions



Residential rain garden in eastern Iowa.



Terms to Know

Stormwater BMP: Landscaping practice that is designed to temporarily impound and treat stormwater runoff.

Stormwater Runoff: Rainfall and snowmelt that drains off impervious surfaces and is not absorbed into the landscape.

Rainscaping: Landscaping method that promotes the use of infiltration-based stormwater management practices in Iowa.

Impervious: Surfaces (such as roofs, driveways, and streets) that are unable to absorb rainfall and thus contribute to stormwater runoff.

▼ Why Install a Rain Garden?

When Iowa was covered by prairie and forests in the early 1900s, rainfall was able to slowly infiltrate into soils. This allowed streams to be recharged naturally via

groundwater flow. Before these ecosystems were altered and eliminated, waterways had clean water, stable levels, and minimal flooding.

The tallgrass prairie ecosystem was dominated by grasses and flowering plants, or forbs, that had deep, fibrous root systems. Annually, as a part of the root system died off and decayed, organic matter was formed to create deep, rich, and porous soils.

These two features – high **organic matter** and high **porosity** – gave prairie landscapes the ability to infiltrate most rainfall into the soil. Forests also had deep-rooted trees and plants that helped build healthy soils that could intercept and infiltrate rainfall.

As Iowa landscapes became more altered, soils were either replaced by impervious surfaces or were so heavily disturbed that they lost significant amounts of organic matter and pore space. The result is increased stormwater runoff.

Rain gardens are attractive landscape features that homeowners can use to restore the natural function of landscapes. Homeowners that manage stormwater on their property help reduce the amount of stormwater runoff that can degrade local streams.

Photo: USFWS



Native prairie at Neal Smith Wildlife Refuge in Iowa.

Terms to Know

Organic Matter: Fraction of soil that consists of decomposed plant or animal material that acts like a sponge to hold water and provide nutrients to plants.

Porosity: The amount of pores or open space in soil, expressed as a percentage of the total volume of the soil material.

Did you know? You can get money to help build your rain garden!

Some communities and Soil and Water Conservation Districts (SWCDs) in Iowa have cost share programs to help homeowners pay for installing a rain garden. The goal of cost share programs is to encourage homeowners to incorporate stormwater practices on their property. This helps to improve local water quality and reduce localized flash flooding. Learn more at www.bit.ly/IowaCostShare.



Overview of the Design to Install Process

This guide will assist homeowners and contractors with the design and installation of rain gardens. The following is an overview of the step-by-step process that will be detailed in subsequent chapters.

CHAPTER

1

Locating a Rain Garden

This chapter will address the best locations for rain gardens. Factors include direction of rainwater drainage across the landscape, locations of utilities and trees, clay content of soils, natural and hardscape features, and personal preferences. Rain gardens will perform well when located properly.

CHAPTER

2

Evaluating Soil Conditions

Conduct soil color, ribbon, and percolation tests to determine how the soils drain at the project site. Adequate drainage is a crucial component when designing an effective rain garden. This is perhaps the most important step in the process!

CHAPTER

3

Choosing the Type of Rain Garden

In this step, the type of rain garden will be chosen. This guide details two types, basic and enhanced rain gardens. Simple soil tests and site conditions play a role in the type of rain garden installed. Basic rain gardens can be used in areas with good percolation rates while enhanced rain gardens, which feature a subdrain, are recommended where soils drain slower.

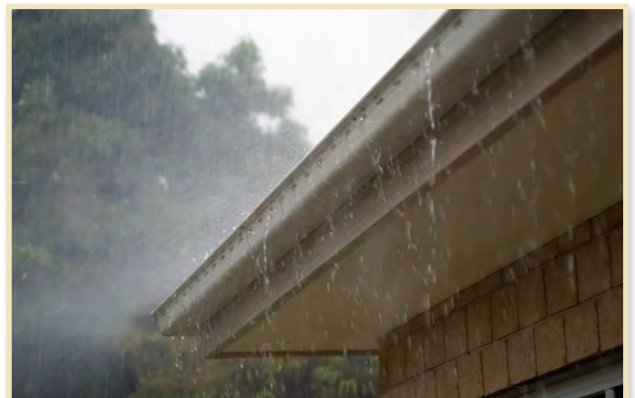
CHAPTER

4

Designing a Rain Garden

This guide provides instructions for determining the appropriate size, depth, and layout of basic and enhanced rain gardens. Rain garden design also includes considerations for subsurface drainage, overflow devices, inlets and outlets, berms, and retaining walls. It also includes methods for directing rainwater to the rain garden.

Photo: Pixabay



Most rain gardens receive rainwater from roof gutters.

CHAPTER

5

Estimating Materials

Once the size and depth of the garden are determined, an estimate of the amount of materials required for the project can be made. This might include sand, topsoil, compost, mulch, rock aggregate, a subdrain, or hardscape features. Instructions are provided in this chapter for purchasing by the bag or in bulk.

CHAPTER

6

Constructing a Rain Garden

When weather permits, the site will need to be prepped, excavated, and graded before any plants can be put into the ground. This step also calls for excavation of the depression, installation of inlets and outlets, overflow features, and construction of berms and retaining walls. If constructing an enhanced rain garden, an aggregate layer and subdrain are also installed at this time. Soil amendments and mulching are completed prior to planting.

Photo: Polk SWCD



Rain garden under construction.

CHAPTER

7

Planting Vegetation

Add some color! Select plants from sample layouts or design your own. Select plants suited to sunlight availability, soil conditions, and homeowner preferences. Clumping species and simplifying the design can make weeding easier. Need some inspiration? Check out the following page for examples of beautiful rain gardens.

Photo: Shutterstock



Harebell is a plant native to Iowa.

CHAPTER

8

Maintaining a Rain Garden

Keep an eye on your rain garden and periodically inspect it using the checklist included in this guide. Routine inspections and subsequent maintenance prevent additional costs and protect the landscaping investment. Taking good care of a rain garden ensures that it functions properly and looks great.

Photo: ISWEP



Pruning mature vegetation in the fall.



1. A basic rain garden in a residential backyard after a rain storm. *Photo: Polk SWCD*



2. Rainwater temporarily ponded in a residential rain garden located downslope from the home. *Photo: Polk SWCD*



3. Rainfall is moved to this small, circular rain garden through a rocky channel connected to one of the home's downspouts. *Photo: Blackhawk SWCD*

4. A large, oblong rain garden is carved into a steep hill featuring boulders for soil stabilization. The newly established garden has young native plant plugs. *Photo: Polk SWCD*

5. This multi-cell rain garden captures stormwater runoff from a nearby street. *Photo: Forever Green Garden Center*



Woodland Phlox

Phlox divaricata



PLANT NOTES

Prefers shady areas and spreads over time; "divaricata" means "with a spreading and straggling habitat." Drought tolerant once established, but does best in medium moisture and well-drained soils. Violet-blue to pink flowers bloom in late May and stand between 1 and 2 feet tall.

Photos: Shutterstock



Chapter 1

Locating a Rain Garden



Location is Critical

The first step in planning a rain garden is to determine sources generating runoff (like a rooftop) and then determining how rainfall is flowing across the property. This can be done by walking the site during a rainfall event. A rain garden must be located so that runoff moves to it.

Start by using a grid sheet to create a sketch of the site. First draw existing buildings, driveways, sidewalks, trees, and other **hardscape** and natural features. Next, identify locations of utilities. Last, identify downspouts and draw in lines where water flows across the property. Mark where water ponds, if applicable. A blank grid sheet can be found in Appendix I. Keep these tips in mind when locating the site of a rain garden:

- **Digging to depths where public and private utilities are buried may occur during the installation of a rain garden.** Contact Iowa One Call to locate buried utility lines on a property. Avoid locating a rain garden above or directly adjacent to marked utilities.
- **Identify all drainage to the proposed rain garden area.** Rain gardens are designed to manage runoff generated from small areas, usually a rooftop downspout and some lawn area. They are not meant to manage runoff from multiple buildings or large drainage areas. A general rule of thumb is to limit the drainage area to no more than 11,000 square feet (or about 1/4 acre).
- **Identify drainage easements.** Rain gardens placed in a **drainage easement** or backyard swale may easily become overwhelmed, even if designed correctly. These locations are not ideal because the drainage area is typically too large for stormwater to be effectively managed by a rain garden.



Terms to Know

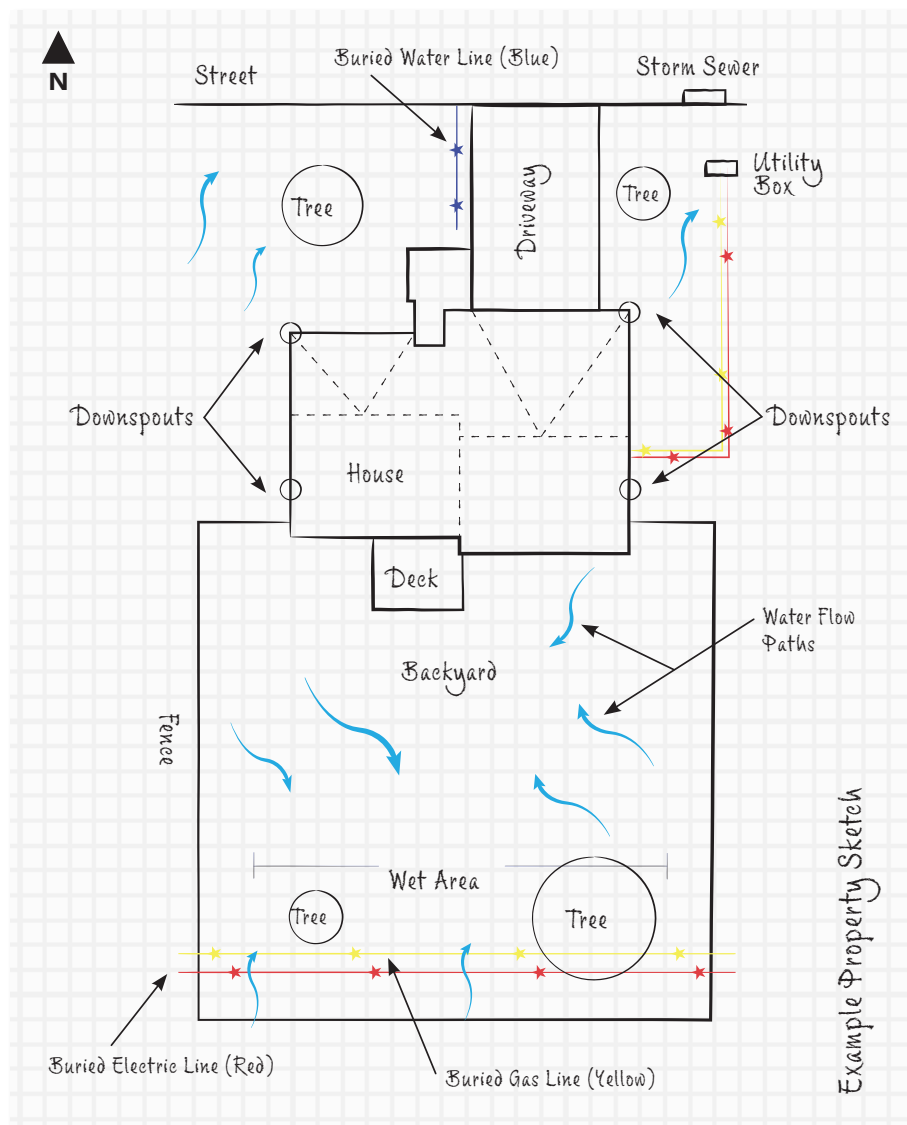
Hardscape: Landscaping features built with “hard” materials, such as paved roads, patios, and driveways. Hardscapes typically increase impervious surface area and stormwater runoff.

Drainage Easement: Land areas used to control stormwater runoff. Easement allows another party to access land in emergency situations. Rain gardens may be prohibited within drainage easements.

Steep Slopes: A steep slope is defined as greater than 10 percent.



- **Locate the rain garden downslope from structures.** Runoff going into the rain garden must be at an elevation higher than where water would be leaving the garden. However, avoid siting a rain garden near **steep slopes**. Stormwater should always move away from structures.
- **Look for low spots.** Where does water flow on the property? Are there areas where water typically ponds? Rain gardens can be used in some situations to address drainage issues. Use caution in placing rain gardens in low spots. There may be poorly drained soils or too much drainage for a basic rain garden to handle. An enhanced rain garden may be needed in some of these situations.
- **Rain gardens can be easily incorporated into existing landscaping or new projects.** As long as soils are suitable, rain gardens work great in areas where there might be traditional landscaping. They can be used along property or fence lines, near a driveway or walkway leading to a front door, or around the perimeter of a fire pit or patio area.





Runoff, Structures, and Drainage Considerations

Stormwater runoff needs to reach the rain garden. It is often easiest to locate a rain garden close to downspouts. Runoff can be directed to a downslope location using **subsurface drainage** or a **vegetated swale**. In some cases, downspouts can be rehung or redirected.

Rain gardens should be sited in flat areas. Installing a rain garden will be more challenging if steep slopes exist. To minimize erosion or scouring, avoid placing rain gardens on slopes steeper than ten percent. **Saturated soils** on steep slopes can also become very unstable. Retaining walls are usually needed to create a level depression for a rain garden on steep slopes. Work with a landscaping professional in this case.

During large rainfall events, rain gardens may overflow because the soils become temporarily saturated. It is important to route the overflow to a **stabilized area**. Overflow drainage should always be directed away from structures and neighboring properties.

To prevent adverse impacts to your property or other structures, maintain the following minimum distances:

- 10 feet downslope from a basement, 30-40 feet is preferred
- 10 feet from a foundation/slab
- 2 feet from a sidewalk
- 100 feet downslope from a septic system drainfield or private well
- 200 feet downslope from a public well
- Near public and private utilities (refer to page 15)

Check with the local jurisdiction to confirm any additional requirements such as minimum separation distances between neighboring properties and if a rain garden can be placed in the right-of-way space between the street curb and sidewalk (see photo to the right).



Terms to Know

Subsurface Drainage: Method of moving excess rainwater via a buried pipe, either to remove excess rainwater or transfer rainwater to the rain garden.

Vegetated Swale: Sloped depressions used for above-ground rainwater conveyance. May feature a rock bed with vegetation.

Saturated Soils: A soil condition in which the pore space between soil particles is completely filled with water.

Stabilized Area: Any area of land (i.e. garden, lawn) that is fully vegetated and bare soil is absent.

Photo: Linn SWCD



Grassed right-of-way space between the street curb and sidewalk.

Locating a rain garden also depends on various natural conditions that determine drainage patterns. To ensure adequate drainage, avoid the following areas:

- **Areas where seasonal groundwater is less than two feet from the bottom of the proposed rain garden.** Shallow groundwater may potentially be discovered during excavation or a soil percolation test. Be aware that if a percolation test is completed during drought conditions, groundwater may not be visible. Shallow groundwater may also be verified by looking at the color of the soil. Gray soil and soil with orange stains may be too wet.
- **Wet areas discovered during a site assessment.** Unless an enhanced rain garden is used, rain gardens should be sited away from areas where soils take longer than 24 hours to drain. Heavy soil compaction and/or shallow groundwater may prohibit adequate infiltration and percolation.
- **Areas where bedrock is less than two feet from the bottom of the proposed rain garden.** Soil survey information from the United States Department of Agriculture's (USDA) online Web Soil Survey may indicate whether high water tables exist or where shallow bedrock might exist. Probing the soil can confirm the existence of both.
- **Areas that have been contaminated by heavy metals or other pollutants.** Do not install a rain garden on a contaminated site. These soils are typically found in ultra-urban areas.
- **Be cautious of tree locations.** Avoid locations near or under trees to prevent harming the root structure of trees.

Photo: Shutterstock



Wet areas likely will not have adequate drainage to support a rain garden.

Be Careful With Sump Pump Discharges

In some situations, it may be possible to utilize a rain garden to manage discharge from a sump pump. To prevent continuous recycling of groundwater between the rain garden and a home's foundation, consider the following recommendation:

Never permanently "connect" your sump pump to the rain garden. Continuously saturated soils, the presence of algae, and dead plants are indications that the sump pump is providing too much water to the rain garden. Disconnect the sump pump connection if this is the case and reroute the discharge to a stabilized area. Contact local officials for more guidance.



Working Within Existing Site Conditions

Avoid areas where utilities are located. Call “Iowa One Call” at 811 or (800) 292-8989 to locate utilities before any digging begins. Iowa One Call requests can also be completed online. Be sure there are no phone lines, gas lines, or other infrastructure where digging will occur. Call at least 48 hours in advance of digging. Be aware that Iowa One Call will not mark utilities such as electric dog fences, water lines, and electric or gas lines that were installed privately.

Rain gardens should only be installed when surrounding landscapes are stabilized and not subject to erosion. If a rain garden will be installed in conjunction with other landscaping or as part of new home construction, install the rain garden after construction is completed and the surrounding area is fully vegetated. Sediment entering a rain garden will create a plugged surface that will limit the infiltration of rainwater.

Photo: Iowa One Call / Facebook



Finally, avoid locating rain gardens under trees. Excavation under the drip line of a tree canopy will cause damage to the tree's roots. There is a much wider selection of plant species suitable for sunny conditions as well.

Understanding Utility Markings

The following colors are used nationwide to mark the locations of buried utilities. Homeowners typically use white flags or white spray paint to denote the proposed area of excavation.

	Electric Power Lines, Cables, Conduit, and Lighting Cables
	Gas, Oil, Steam, Petroleum, or Gaseous Material
	Communication, Alarm or Signal Lines, Cables, or Conduit
	Potable Water
	Sewers and Drain Lines

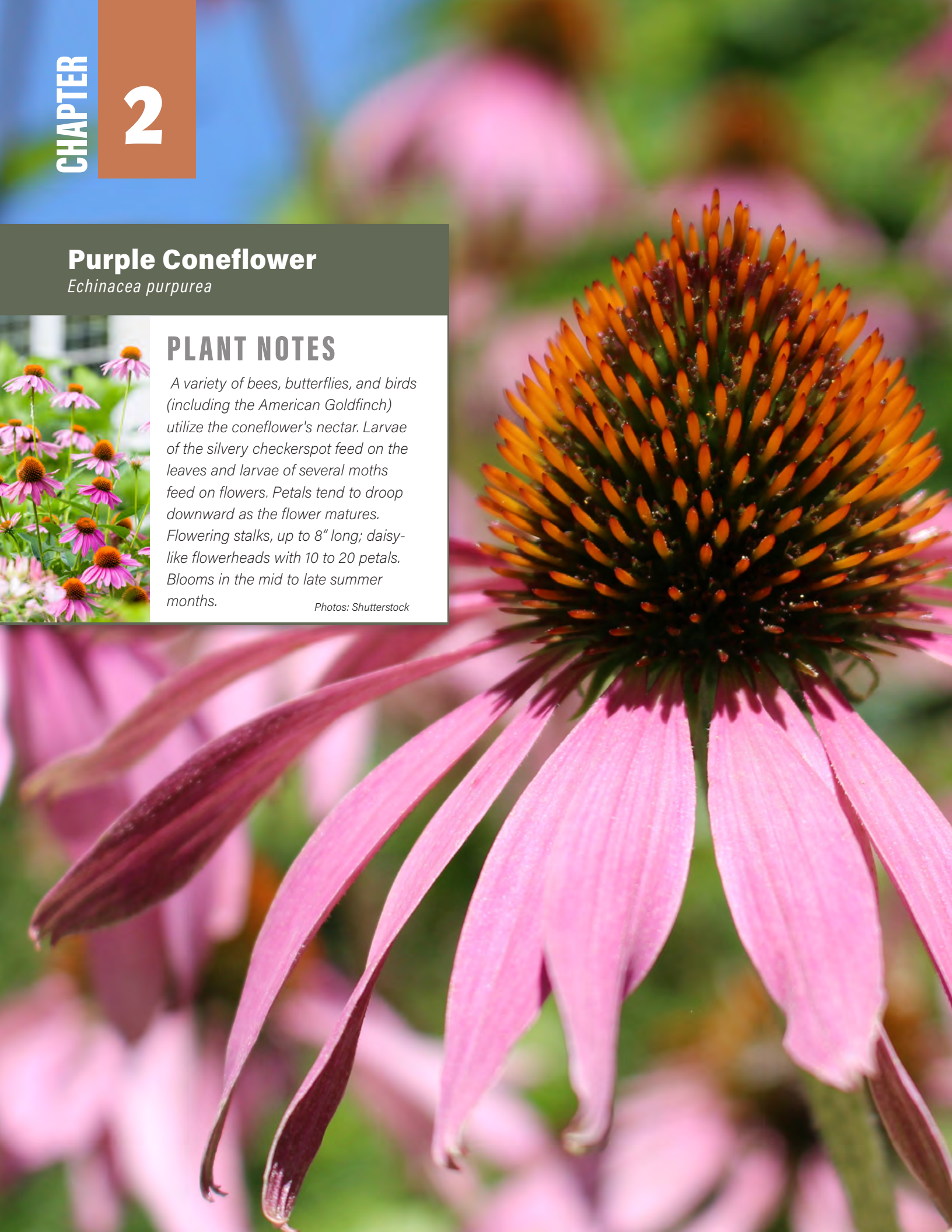
Purple Coneflower

Echinacea purpurea

PLANT NOTES

A variety of bees, butterflies, and birds (including the American Goldfinch) utilize the coneflower's nectar. Larvae of the silvery checkerspot feed on the leaves and larvae of several moths feed on flowers. Petals tend to droop downward as the flower matures. Flowering stalks, up to 8" long; daisy-like flowerheads with 10 to 20 petals. Blooms in the mid to late summer months.

Photos: Shutterstock



Chapter 2

Evaluating Soil Conditions

▼ The Importance of Good Soils

Healthy soils have good pore space, minimal compaction, high organic matter and microbial activity, and a sufficient supply of nutrients. These characteristics factor into a soil's ability to drain water. Rain gardens rely on good soils for this reason.

Rain gardens typically hold water for 12 hours or less. For example, if it rains in the afternoon, a rain garden should not have standing water by morning. Standing water for a long period of time in a rain garden can create low oxygen conditions in the subsurface soils. This can lead to a variety of issues, including plant death and odor problems.

There are three soil tests that should be done at the proposed rain garden location. The first test is simply to view the color of the subsurface soils. The second test is a soil ribbon test and the third is a **percolation** test. These three tests help determine if soils have adequate drainage for the installation of a rain garden.

While the soil tests may appear conclusive regarding the soil type and drainage patterns of an area, seasonal variations such as soil moisture content and temperature can change the testing outcomes. Seek technical assistance from a local Soil and Water Conservation District (SWCD) office if there are questions about the suitability of the soil at a proposed rain garden site.



Terms to Know

Percolation: The movement of water through the soil. Percolation rate is the rate that water moves downward through the pores in the soil profile, and is measured in inches per hour. Sandy soils tend to have high percolation rates and clay soils tend to have slower rates.

Water Table: In subsurface soils, it is the top level below which the pore spaces in soil are saturated with water.

Photo: Polk SWCD



Healthy soils allowed for a basic rain garden to be installed at this residence.



Soil Color Test

Various soil colors are indicators of drainage conditions. Soils that are too wet can have a gray color. Reddish dots of color indicate that there may be a seasonally high **water table**. This typically is an unsuitable location for a rain garden. The soil color test can be completed when excavating soils for the soil ribbon and percolation tests.

Photo: MN Pollution Control Agency



Gray color indicating high levels of moisture in the soil.



Soil Ribbon Test

The soil ribbon test estimates the amount of clay in the soil, which indicates how quickly rainfall will percolate through the soil. Follow these steps to complete a soil ribbon test:

1. Select three locations within the proposed rain garden area. Try to pick the center of the rain garden and upslope and downslope locations. These holes will also be used for the soil percolation test.
2. Once all underground utilities have been marked, use a soil probe, shovel, or clamshell posthole digger to dig three holes within the proposed rain garden location. The upslope hole should be about three feet deep, the downslope hole about 1.5 feet deep, and the center hole in between those depths. You may have to pre-wet the area if the soil is dry by slowly pouring a bucketful of water on the area and allowing the water to soak into the soil.
3. At every half foot increment in depth, grab a handful of soil and roll it into the shape of a cigar with your hands.
4. Squeeze the soil between your thumb and forefinger into a flat ribbon. Measure the approximate length of soil that ribbons out before breaking.
5. Refer to "How to Interpret Soil Ribbon Test Results" on the following page.

Photo: ISWEP



Accessing subsoils using a soil probe.

How To Interpret Soil Ribbon Test Results



If the soil won't ribbon outward and breaks off as you squeeze it, the soils have a low clay content and good percolation rates.



If the soil extends out between one and two inches before breaking off, the clay content should still be low enough for adequate percolation rates.



If the soil ribbons out two inches or more before breaking off, the clay content is too high. Percolation rates will likely be too slow for a rain garden to adequately drain.

How To Determine Soil Type With a Soil Ribbon Test

Low Clay Content

If the soil does not form a ribbon or forms a ribbon less than one inch, the soil is **sandy** or **loamy**. These types of soils are best suited for rain gardens because they have high percolation rates.

Photo: Polk SWCD



Medium Clay Content

If you are able to form a ribbon that is between one and two inches before it breaks off, you likely have a **clay loam** type soil. These soils have moderate percolation rates and may still work for rain gardens.

Photo: Design With Natives



High Clay Content

If you are able to form a ribbon that is longer than two inches before it breaks off, the soil has a high **clay** content. These types of soils have slow percolation rates. Select an alternative site or consider installing a bioretention cell.

Photo: RainscapingIowa



Refer to Appendix C for more information on infiltration rates in natural soil types that mimic percolation rates.

While medium to high clay content is not preferable for rain gardens, it is not impossible to overcome. Native plants, once established, grow deep roots that have the ability to open pore space. The rain garden may need to be designed with additional amounts of amended soils and a subsurface perforated subdrain to ensure adequate drainage and for vegetation to succeed.

✓ Soil Percolation Test

A percolation test indicates whether water will drain fast enough through the soils beneath the rain garden. Follow these steps to conduct the percolation test:

1. Use the same areas where you did the ribbon test to conduct the percolation test. If you used a soil probe to do the ribbon test, you will need to dig the holes larger with a shovel or clamshell posthole digger.
2. If dry soil conditions exist, slowly pre-wet (pour water) the areas with a pail of water. Wait a couple of hours for the water to drain through the soil.
3. Have a tape measure on hand for measuring water depths. Fill each hole with 12 inches of water.
4. Measure how far the water drops in height (inches) after 12 and 24 hours.
5. Calculate how many inches of water have percolated after 12 and 24 hours.
6. Calculate the average percolation rate by adding the rates together and dividing by two.
7. After 24 hours, fill each hole with another 12 inches of water and repeat the percolation test to validate the results from the first test.

Photo: ISWEP



Using a clamshell posthole digger to create a hole for the perc test.

Use the "How To Interpret Percolation Test Results" table on the following page to determine if there is adequate drainage for a rain garden. Generally, a basic rain garden can be installed when percolation rates are greater than one-half inch per hour. Ideally, rain gardens are most suitable where soils percolate water at a rate greater than 1 inch per hour. Jot down the measured percolation rate as it will be utilized when designing the size and depth of your rain garden in Chapter 4.

How To Interpret Percolation Test Results



If water drains completely from the hole within 12 hours for both tests, percolation rates should be **greater than 1 inch per hour**. This is a good percolation rate for a basic rain garden installation.



If water drains completely from the hole within 24 hours for both tests, percolation rates should be **between 0.5 and 1.0 inches per hour**. This is an acceptable percolation rate for both basic and enhanced rain garden installations.



If water does not completely drain from the hole within 24 hours for either test, percolation rates are **less than 0.5 inches per hour**. This percolation rate is too slow for a basic rain garden and likely an enhanced rain garden as well. Consider installing a bioretention cell or other stormwater practice, such as a native plant garden or soil quality restoration.

Example Percolation Test

In this example, water height was measured at 4 inches (8 inches drained) after 12 hours and at 1 inch (11 inches drained) after 24 hours. The average percolation rate among the measured rates is 0.57 inches per hour. This site is suitable for a basic rain garden.

$$8'' / 12 \text{ hours} = 0.67'' / \text{hour}$$

$$11'' / 24 \text{ hours} = 0.46'' / \text{hour}$$

$$(0.66'' + 0.46'') / 2$$

$$= 0.57'' / \text{hour}$$

Photo: Polk SWCD



Photo: Polk SWCD



Butterfly Milkweed

Asclepias tuberosa

PLANT NOTES

Late summer bloomer that commonly occurs throughout Iowa. Provides nectar for many insects and hummingbirds and larval food for monarchs. The plant can take on a bushy appearance from multiple stems and branches. Single stem when young, multiple stems when mature. Dome-shaped with 8 to 25 flowers, 2" to 5" across.

Photos: Shutterstock



Chapter 3

Choosing a Rain Garden Type



Two Types of Rain Gardens

There are two types of rain gardens covered in this guide, a basic rain garden and an enhanced rain garden. Selecting the type of rain garden suitable for your property will depend on a variety of factors such as soil type, percolation rate, compaction, age of home, and space constraints.

Basic rain gardens are suitable for well drained soils that can percolate water at a rate greater than one-half inch per hour. Many homes built in the 1970s or earlier will have yards that can support a basic rain garden. Basic rain gardens also provide more flexibility in their design when there is no place to outlet a subdrain. A subdrain is a feature of an enhanced rain garden.

Photo: Polk SWCD



Native and non-native plants in a basic rain garden.

Photo: Polk SWCD



Enhanced rain garden with a vertical overflow structure.

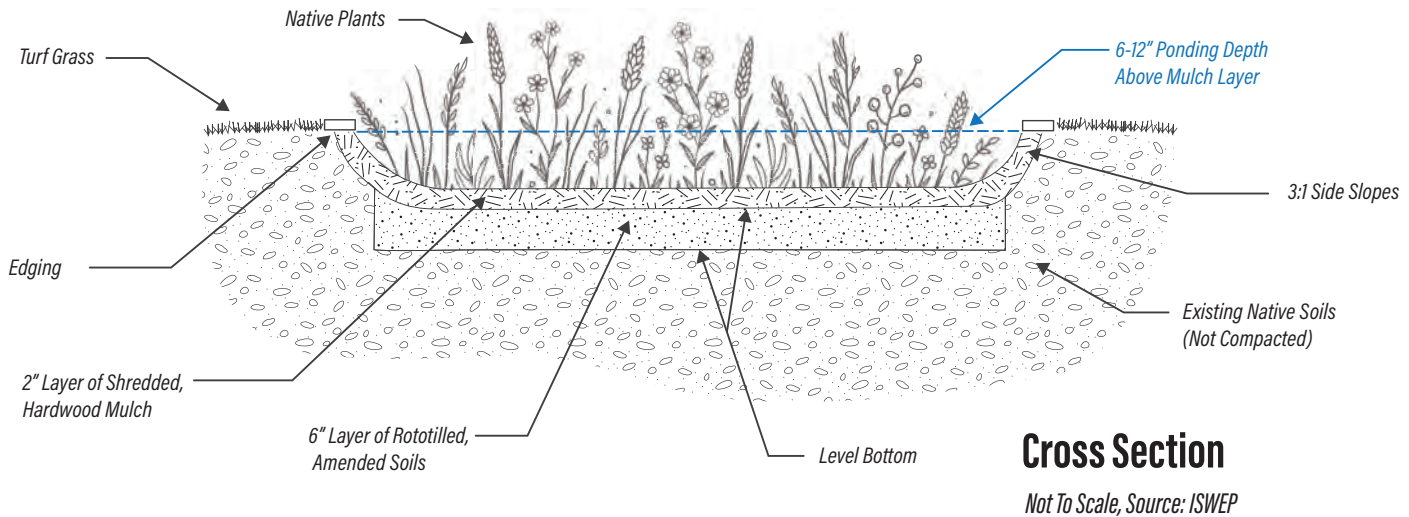
Enhanced rain gardens are often suitable for sites in newer developments where soils are compacted and have poor drainage. Some homeowners opt for an enhanced rain garden when space is limited, or a smaller footprint is desired.

Although basic rain gardens and enhanced rain gardens may appear similar above ground, they are designed differently underground. Enhanced rain gardens are used in poorly drained soils and feature a subsurface perforated subdrain buried in aggregate. They also have an overflow structure for large rainfall events.



Basic Rain Gardens

If site conditions and percolation rates are suitable, a basic rain garden is a simple solution for treating and managing stormwater runoff. Basic rain gardens feature four major components as detailed below. Both basic and enhanced rain gardens are designed to impound a specified amount of rainfall. This is known as the ponding depth and is typically between 6 and 12 inches above the mulch layer.

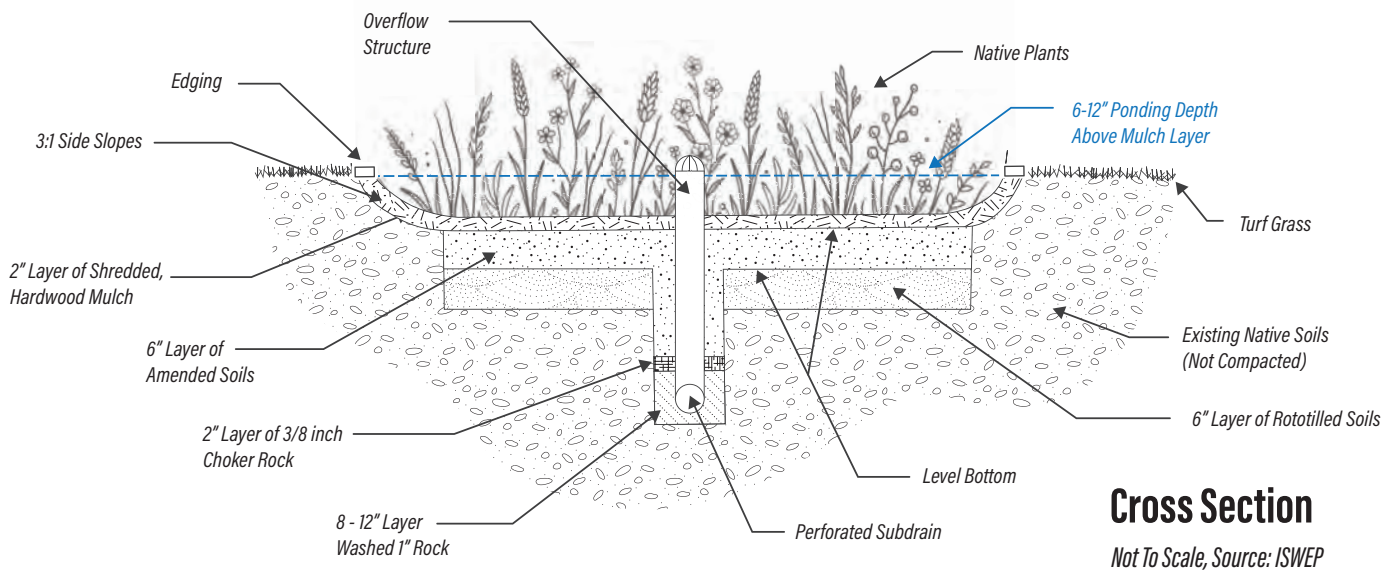


Basic Rain Garden Components

1. **Amended Soils.** Many rain gardens have amended soils in the base of the garden, especially if percolation rates range from $\frac{1}{2}$ - 1.0 inch per hour. A recommended starting point is to amend with 2 inches of purchased topsoil, $3\frac{1}{2}$ inches of washed concrete sand, and $\frac{1}{2}$ inch of compost for a total depth of 6 inches. If you have healthy soils, topsoil that is loose and uncompacted with good percolation rates, it may not be necessary to amend the soils.
2. **Shredded Hardwood Mulch.** A two-inch layer of shredded hardwood mulch is added above the amended soils for weed suppression and moisture retention. Shredded hardwood is used since it is less likely to float when the rain garden has ponded water.
3. **Native and/or Non-Native Plants.** The use of native Iowa plants in rain gardens is recommended. Native plants are hardy and adapted to Iowa's fluctuations in seasonal temperatures, rainfall, and soils.
4. **Edging.** Many rain gardens have defined edges using paver blocks, landscape edging, or mulched trenches. This makes mowing around the rain garden easier and prevents encroachment from roots of the surrounding turf grass.

Enhanced Rain Gardens

An enhanced rain garden can be installed in areas where soils drain slowly or where space is limited. The use of a subdrain, overflow structure, amended soil, and rock layers are the primary differences between the two types of rain gardens. Due to a more complicated installation, most homeowners hire a landscaping contractor to install this type of rain garden.



Enhanced Rain Garden Components

1. **Amended Soils.** Amended soils consist of a mixture of washed concrete sand (75-90%), topsoil (0-25%), and compost (0-10%). They promote rainwater percolation and create a suitable planting bed for young plants. After rototilling, a six-inch layer is placed in the excavated depression.
2. **Perforated Subdrain.** The subdrain is placed horizontally within a trench filled with 8 to 12-inches of washed rock. There are typically two inches of rock below the subdrain.
3. **Overflow Structure.** The overflow riser is a solid pipe that extends vertically above the ponding depth. There are openings on the cap of the riser that are used for drainage overflow generated from large rainfall events.
4. **Washed Rock.** An 8 to 12 inch layer of washed one-inch rock surrounds the perforated subdrain pipe.
5. **Choker Rock.** A two-inch layer of 3/8-inch washed rock is placed above the washed rock layer to prevent the amended soil from entering the subsurface rock and subdrain.

Wild Geranium

Geranium maculatum



PLANT NOTES

Common throughout Iowa, but more prevalent in eastern counties. Prefers partial shade and slightly damp sandy or loamy soils. When not flowering, Wild Geranium leaves may be mistaken for Canada Anemone. Flower is 1 1/4" diameter with upward facing saucer-shaped petals with rounded tips. Foliage remains all season. Blooms in the summer to early fall.

Photos: Shutterstock



Chapter 4

Designing a Rain Garden

▼ Determining Drainage Areas

The first step in designing a rain garden is to determine what areas flow to the rain garden. Typically, rain gardens manage rainfall from roofs and lawns. The plan is to direct one or several of the home's downspouts to the rain garden and determine the specific area of the roof that drains to each downspout.

An easy way to determine the **surface area** of a roof is to place a tape measure on the ground and mimic the outline of the roof. Measure the length and width of the roof. Another option is to use Google Maps on the Internet. Locate the property and use the "Measure Distance" tool by right-clicking on the map. Draw the outline of each roof section and note the area. Add the roof sections together to find the **impervious drainage area** in square feet.

All surface area calculations should be measured in "plan view", which is the two-dimensional area of the roof. When measuring the roof, be sure to include overhangs, eaves, and all roof areas contributing to each gutter.

Next, measure the approximate lawn area that will contribute runoff to the rain garden. This area is known as the **pervious drainage area**. Some rainfall that falls on pervious areas will soak into the ground and not contribute runoff to the rain garden. Therefore, the entire pervious area may not need to be included in the **total drainage area**. The pervious area can be entirely eliminated from the total drainage area if soil quality restoration (SQR) has been completed. SQR is a combination



Terms to Know

Surface Area: Measure of the total area occupied by the surface of an object.

Impervious Drainage Area: Part of the drainage area that includes roofs, pavement, and other hardscapes.

Pervious Drainage Area: Part of the drainage area that includes lawn areas, planting beds, and other natural features.

Total Drainage Area: The sum of all impervious and pervious areas draining to the rain garden.

Photo: Google Maps



Plan view of a roof section and calculated surface area in Google Maps.

of deep tine aeration and the addition of compost to the lawn surface. If SQR has not been performed on the lawn, the pervious drainage area is divided in half to account for some of the runoff being infiltrated into the lawn.



Calculating Size and Selecting a Shape

The majority, 90 percent, of rainfall events in Iowa generate less than 1.25 inches of rainfall in 24 hours. Design calculations will ensure that rain gardens handle runoff from 1.25 inches of rain. This amount of rainfall is called the Water Quality Volume (WQv). In order to effectively manage the WQv, a rain garden must have enough surface area and be deep enough for stormwater to be stored without overtopping. Follow the instructions on page 30 to determine the appropriate size and depth for the rain garden. The instructions will yield the square feet of rain garden surface

area needed to impound the WQv. Rain gardens can be built with a surface area greater than what is required by the WQv to manage more rainfall.

Next, determine the appropriate depth for the rain garden. This guide offers three options: six, nine, and 12 inches. Most residential rain gardens in Iowa have a six-inch or nine-inch depth. The 12-inch option is only recommended for large sites, such as commercial areas or parks, as it may be too deep for a small residential application. A common rule of thumb is to use a six-inch ponding depth if the rain garden is estimated to be less than 200 square feet.

A key design and installation decision is determining the rain garden's correct elevation in the landscape. Rain gardens in flat areas can be created with a ponding depth below the surrounding area that overflows into the yard. Selecting a shape that conforms to the existing landscape, and at the ideal elevation, can help avoid unnecessary labor and material costs. An ideal elevation for a rain garden is where either the upslope or downslope side of the rain garden is level with the nearby landscape. A rain

garden may require the use of a berm to create ponding depth. Retaining walls can be used on steeper slopes.

Once the surface area is determined, consider various dimensions (lengths and widths) that yield the required square footage. Long and narrow rain gardens are often preferred so installation and maintenance can be done from the side of the garden. Common rain garden shapes are rectangular, kidney, oblong, and L-shaped.

Photo: Polk SWCD

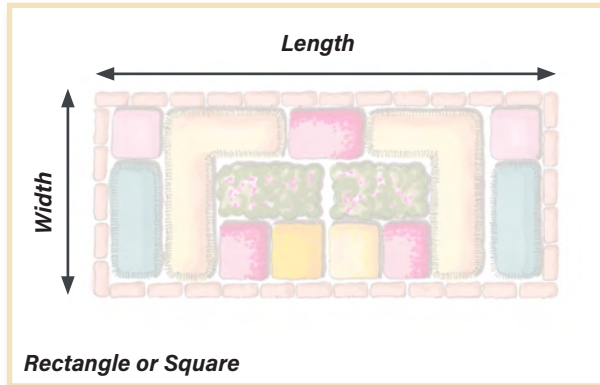


This rain garden was built below the yard surface with no berms. The water overflows onto the existing grass and flows away from the house.

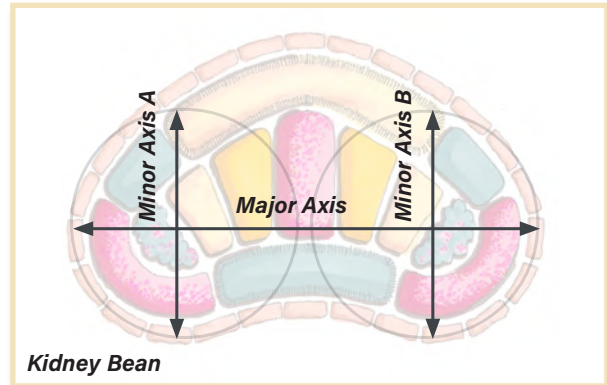
Photo: Polk SWCD



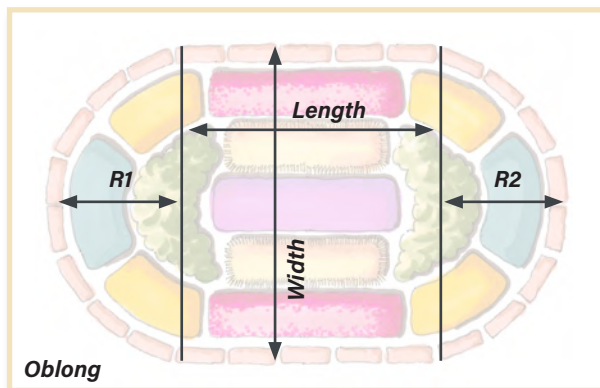
In order to achieve a ponding depth in the rain garden, this sloped site requires berms and/or retaining walls.



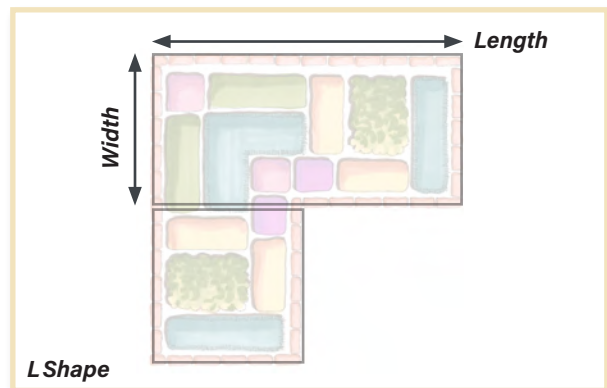
$$\text{Area} = \text{Length} \times \text{Width}$$



$$\text{Area} = (\text{Minor Axis A} + \text{Minor Axis B}) \times \text{Major Axis} \times 0.45$$



$$\text{Area} = R1 \times R2 \times 3.14 + (\text{Length} \times \text{Width})$$



$$\text{Area} = \text{Length} \times \text{Width of Square} + \text{Length} \times \text{Width of Rectangle}$$

✓ Directing Rainwater to the Rain Garden

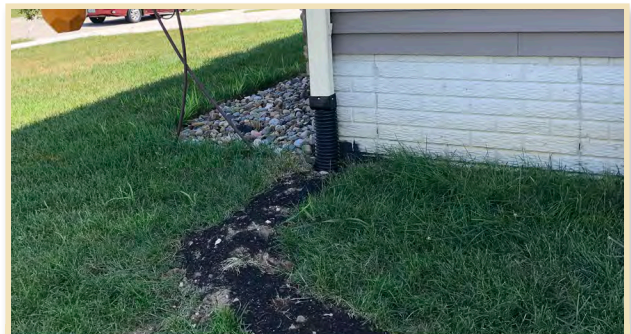
After calculating the depth and dimensions of the rain garden, the next step is to determine a method or combination of methods for getting rainwater to the rain garden. Consider the options shown below. Whichever method(s) is selected, ensure there is an adequate slope to allow gravity to move rainwater to the rain garden.

Photo: ISWEP



Gutter extension added to downspout to move rainwater to rain garden.

Photo: Polk SWCD



Buried drain pipe connected to downspout that discharges to the surface of a garden.

How To Calculate the Size of Basic and Enhanced Rain Gardens

Step 1: Estimate Impervious Drainage Area	Estimate the impervious drainage area in square feet of the contributing roof section(s). If applicable, add the total area of other impervious surfaces that would contribute runoff (e.g. driveway, sidewalk, patio). <i>The result of this step is total impervious surface area in square feet.</i>
Step 2: Estimate Pervious Drainage Area	Estimate the pervious drainage area of lawn that would contribute runoff to the rain garden. Refer to the site drawing to determine the areas of the lawn that will shed runoff to the rain garden. <i>The result of this step is total pervious surface area in square feet.</i>
Step 3: Calculate the Total Drainage Area	On lawns that have not had SQR completed: Total Drainage Area = Impervious Drainage Area + ½ the Pervious Drainage Area. For lawns that have completed SQR: Total Drainage Area = Impervious Drainage Area. <i>The result of this step is the total drainage area required for the rain garden to manage the Water Quality Volume (WQv).</i>
Step 4: Select Footprint Area Percentage	Select desired ponding depth of 6, 9, or 12 inches. Refer to the Rain Garden Sizing Guidelines table on page 31 to determine the required footprint area percentage, which is based on the selected ponding depth and the calculated percolation rate in Chapter 2.
Step 5: Calculate Footprint of Rain Garden Area	Using the following formula, calculate the required footprint of the rain garden: Rain Garden Footprint = (Total Drainage Area) x (Footprint Area Percentage from the table on page 31). <i>The result of this step is the surface area of the proposed rain garden in square feet.</i>
Step 6: Select Shape and Calculate Surface Area Dimensions	Select a basic shape for the rain garden based on site constraints and preferences. Determine the length(s) and width(s) of the rain garden that is roughly equal to or slightly larger than the area calculated in Step 5.

Rain Garden Sizing Guidelines

Percolation Rate	Appropriate BMP for Site and Ponding Depths for Rain Gardens	Footprint Area Percentage
> 0.5 inches per hour	Enhanced Rain Garden	5%
> 1.0 inch per hour	Basic Rain Garden with 6" Ponding Depth ¹	10%
	Basic Rain Garden with 9" Ponding Depth ¹	7%
	Basic Rain Garden with 12" Ponding Depth ²	5%
0.5 - 1.0 inch per hour	Basic Rain Garden with 6" Ponding Depth ¹	21%
	Basic Rain Garden with 9" Ponding Depth ¹	14%
	Basic Rain Garden with 12" Ponding Depth ²	10%
< 0.5 inch per hour	Bioretention Cell ³	~3% - 4% ⁴

¹ Appropriate for drainage from one home. Not applicable for managing runoff from numerous sites.

² For use on large sites only.

³ Where soils drain less than 0.5 inches per hour, it is recommended that a bioretention cell be installed rather than an enhanced rain garden. Bioretention cells are typically installed in parking lots or along roadways. They typically treat runoff from large watershed areas and are often used in tandem with pre-treatment practices to provide added sediment capture. Refer to Chapter 5, Section 4 of the Iowa Stormwater Management Manual (ISWMM) for full design guidelines. The ISWMM can be accessed online via the Iowa DNR's website.

⁴ General rule of thumb. Actual square footage must be calculated using the bioretention cell calculation in the ISWMM.

Rain Garden Sizing Example

Step 1: Estimate Impervious Drainage Area

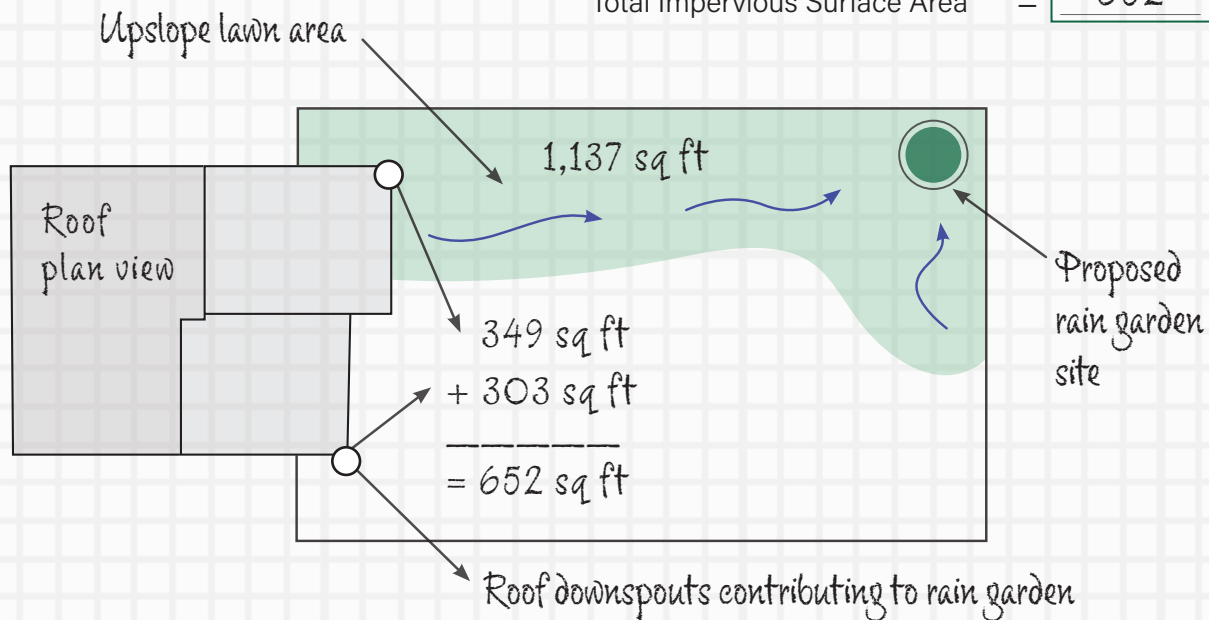
What is the total surface area of the contributing roof section(s)?

652 ft²

What is the total surface area of the contributing driveway, sidewalk, patio, or other impervious area?

+ 0 ft²

Total Impervious Surface Area = 652 ft²



Step 2: Estimate Pervious Drainage Area

What is the contributing area of lawn upslope of the rain garden?

Total Pervious Surface Area = 1,137 ft²

Step 3: Calculate the Total Drainage Area

In this example, soil quality restoration (SQR) has not been completed. Soil organic matter content of site soils is less than 5 percent.

Impervious Drainage Area + (0.5 x Pervious Drainage Area) = Total Drainage Area

$$\begin{array}{rcl} \text{Step 1} & & \text{Step 2} \\ \underline{652} & \text{ft}^2 + (& \underline{0.5} \times \underline{1,137} \text{ ft}^2) = \underline{1,221} \text{ ft}^2 \end{array}$$

Step 4: Select Ponding Depth

Previous percolation tests determined an average percolation rate of 0.8 inches per hour. The homeowner selects a ponding depth of 6 inches. This allows them to build a rain garden that has a larger footprint that doesn't appear too deep and provides more space to plant grasses and flowers.

Percolation Rate = 0.8 inches /hour

Desired Ponding Depth = 6" or 9" or 12"

Percent of Total Drainage Area (Per Sizing Guidelines Table on Page 31) = 21%

Step 5: Calculate Footprint of Rain Garden Area

$$(\text{Step 3 } 1,221 \text{ ft}^2) \times (\text{Step 4 } 0.21) = \boxed{256 \text{ ft}^2}$$

(Total Drainage Area) x (% of Total Drainage Area) = Footprint of Rain Garden

Step 3

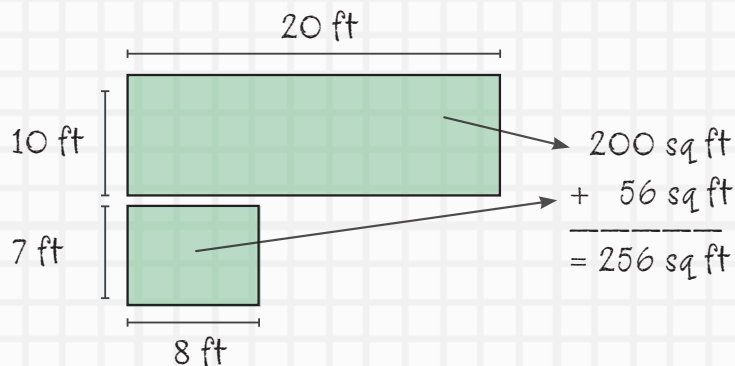
Step 4

Step 6: Select Shape and Calculate Surface Area Dimensions

The homeowner selected an "L"-shaped rain garden, which was based on site constraints and preference. The total surface area of the "L"-shape should be approximately 256 square feet.

$$(\text{Step 6 } 8 \text{ ft} \times 7 \text{ ft of Square}) + (\text{Step 6 } 20 \text{ ft} \times 10 \text{ ft of Rectangle}) = \boxed{256 \text{ ft}^2}$$

(Length x Width of Square) + (Length x Width of Rectangle) = Surface Area of "L"-shaped Rain Garden



Disconnecting Downspouts from the Storm Sewer

In some cases, a home's gutter system and downspouts will be directly connected to the storm sewer system. If rainwater will discharge directly to a rain garden via one or multiple downspouts and the home's system is tied directly to the storm sewer, check with the local community to find out if there are any disconnection requirements.

▼ Inlets and Outlets

Rainwater typically enters the rain garden from a downspout, subdrain, or swale. The inlet is the opening where most of the rainwater enters the rain garden. Keep in mind that water comes from impervious and pervious areas and may enter the rain garden from a variety of places.

Photo: ISWEP



Rainwater enters the rain garden through a rock channel.

To prevent scour and erosion of soil in the bottom of the rain garden, armor the inlets and outlets with washed, three to four-inch diameter rocks, flagstones, or other protective products. Optionally, place landscaping fabric over the soil before placing rock so erosion does not occur right below the rocks. *This is the only location in the rain garden where limited use of landscaping fabric may be used.*

Rain gardens also need a designated outlet to allow excess water to leave the rain garden safely without causing damage to the garden. Outlets typically are notched out areas in a berm where excess rainwater can pass through. They should be reinforced with vegetation or rock. The outlet should be level to prevent scour at the discharge point.

Photo: ISWEP



An outlet from a rain garden reinforced with rock.

If installing an enhanced rain garden, an overflow pipe is often used in combination with the notched out area in a berm. The height of the overflow pipe is set at six, nine, or 12 inches (the ponding depth) above the base of the rain garden. The notch in the berm can be set at the same elevation as the overflow pipe or a little higher as a backup in case the overflow cannot handle all the water. Make sure

that where the base of the overflow pipe daylights back onto the lawn, water is conveyed in a manner that does not damage downslope property or infrastructure.



Berms and Retaining Walls

Rain gardens must be level from end to end and side to side. One option to create a level bottom in sloped areas is to use berms and/or retaining walls. Berms can provide a natural edge for the rain garden and allow for rainwater to pond and soak into the soil.

If berms are used, ensure that the berm located on the downslope edge of the rain garden is higher than the upslope berm. The back slope of the berm should be gradual. A 5:1 slope is recommended and means that for every one foot of vertical height, the berm should extend out five feet horizontally. This will allow water during larger rainfall events to flow slowly to an area stabilized with vegetation, rocks, or other types of stabilization. If the site is flat, berms are not always necessary. Simply excavate to get to the designed ponding depth.

If steep slopes exist at the site of a proposed rain garden, a retaining wall may be needed. A retaining wall can be built up to create a level depression on a sloping site. An alternative is to cut into a slope to create a level depression and have the retaining wall as a backdrop that holds the cut slope soil in place. Retaining walls can be used for decorative purposes even if there are no steep slopes.



Pre-Treatment Areas

Some rain gardens, primarily enhanced rain gardens designed to manage larger drainage areas, feature pre-treatment areas. These areas are used to filter out debris and sediment before stormwater runoff reaches the rain garden. Pre-treatment areas can extend the longevity of the stormwater BMP and reduce annual maintenance.

Rain gardens located along streets or driveways typically include a curb cut to allow stormwater runoff to enter into the rain garden. A grass filter strip between the curb and rain garden is a simple pre-treatment practice that could be used in this scenario. Sod should be placed two inches lower than the inlet to accommodate sediment deposition. Another option for pre-treatment could be stone steps.

Photo: Central Ohio Rain Gardens



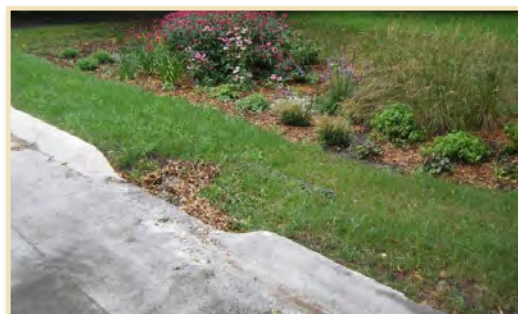
Upslope retaining wall around an oblong rain garden with a mulch berm on the downslope side.

Photo: Ramsey Wash. Metro Watershed



Rock retaining wall is cut into the slope to create a level bottom.

Photo: Wayne Petersen



Pre-treatment grass filter strip used for a rain garden receiving street runoff.

Little Bluestem

Schizachyrium scoparium



PLANT NOTES

Perennial bunchgrass that forms dense mounds up to 2 feet tall. Vegetation color remains year-round and turns from greenish-blue to reddish-white in the fall. Is drought tolerant and thrives in full to partial sun. Hearty grass commonly used in rain gardens.

Photos: Shutterstock

Chapter 5

Estimating Materials



Creating a Materials List

Once the rain garden has been designed, the next step is to create a materials list and determine the approximate amount of materials needed for installation.

- **Concrete Sand.** Ensure the sand is washed and graded. Many commercial concrete sands may simply say “All Purpose Sand”. Do not use masonry sand. In enhanced rain gardens, concrete sand and should account for between 75 and 90 percent of the amended soil mixture.
- **Compost.** Compost is typically composed of decayed plant and tree materials. High-quality compost should be black to dark brown in color, be loose, and have a musty or earthy smell. Look for STA (Seal of Testing Assurance) certification by the US Composting Council. In enhanced rain gardens, compost should account for up to ten percent of the amended soil mixture.
- **Topsoil.** Ensure excavated or purchased topsoil is free of small rocks, roots, and debris. It should have a dark brown to black color, be loose (not sticky), and granular. In enhanced rain gardens, topsoil should account for up to 25 percent of the amended soil mixture.

Photo: ISWEP



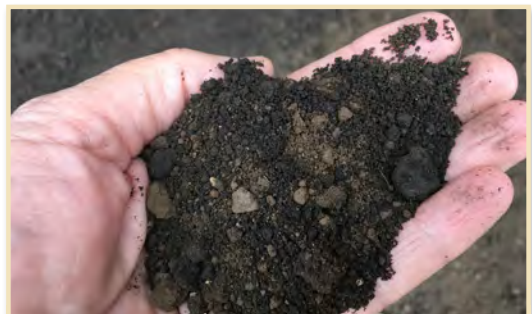
Concrete sand is added to rain gardens to enhance percolation.

Photo: ISWEP



Compost is added to increase organic matter.

Photo: ISWEP



Topsoil provides nutrients needed for plants to survive.

- **Shredded Hardwood Mulch.** Long strand, shredded hardwood mulch is used to retain soil moisture for plants. It also helps suppress weeds. Shredded hardwood mulch is recommended because it is less likely to float or wash away when the rain garden has ponded water.
- **Potted Plants and Plugs.** Vegetation can be purchased as potted plants, typically in quart or gallon pots, or as plugs, which are seedlings sold in trays. Plugs are more economical but potted plants provide more immediate aesthetics. Once plants for the rain garden are selected (see Chapter 7), jot down the spacing recommendations for each plant species. Calculate the average spacing recommendations from your plant list. Most plants are placed at one plant per square foot for an average spacing of 12 inches. Spacing recommendations are measured “on-center”, or from the center of one plant to the center of the neighboring plant.
- **Inlet and Outlet Rock.** Two-inch to five-inch river rock can be used to prevent scouring at the inlets and outlets of a rain garden. Larger decorative flagstones can be used alone or in combination with the rock at these locations.
- **Edging.** Edging is used around the perimeter of the rain garden. It prevents turfgrass encroachment and makes mowing around the rain garden easier. Landscaping pavers, a mulch trench, cedar wood, and plastic or metal edging can be used.

Photo: ISWEP



Long-strand, shredded hardwood mulch.

Photo: ISWEP



Plant plugs ready to be planted in a rain garden.

Photo: ISWEP



Two to five-inch rock provides scour protection at inlets and outlets.

Photo: ISWEP



Plastic landscape edging along the perimeter of a rain garden.

In addition to the previous materials, the following items are needed for *enhanced rain gardens*.

- **1-inch Rock.** One-inch clean field rock or limestone surrounds the subdrain in an enhanced rain garden. The rock should be washed and adhere to DOT Section 4115, Gradation No. 3, Class 2, or ASTM D 448, #57.
- **3/8-inch Aggregate.** 3/8-inch aggregate is used in enhanced rain gardens as a choker layer that separates the amended soil from the 1-inch rock above the subdrain. Ensure aggregate selection is washed and does not have a wide range of particle sizes. Seek aggregate meeting ASTM #8 specifications and avoid road stone.
- **Subdrain Pipe.** It is recommended that a 4- or 6-inch high-density polyethylene (HDPE) perforated drainpipe be used as the subdrain in enhanced rain gardens. HDPE is resistant to corrosion, durable, and lightweight for easier installation. Pipe is typically sold in lengths of 10, 50, or 100 feet. Measure from the outlet of the pipe to the edge of the enhanced rain garden farthest away from the outlet. Add 10 percent extra to the rain garden length to ensure enough pipe is purchased. If you plan to route rainwater underground from a downspout, the same type of HDPE pipe can be used. However, it should be solid pipe and not perforated. Do not buy pipe that is smaller in diameter than the downspout. This can back water up the downspout. Ensure a water-tight seal, which may require an adapter. The outlet of the subdrain into the rain garden should be capped with a grate to prevent animals from nesting inside the pipe.
- **Overflow Structure and Grate Cover.** A solid, four or six-inch PVC pipe can be used for the riser overflow structure. PVC provides a more rigid, firm pipe that will not bend over time and will stay vertical at the correct

Photo: ISWEP / Gravelstop



1-inch washed field rock and crushed limestone rock.

Photo: ISWEP



3/8-inch aggregate.

Photo: Fairfield Elementary School



HDPE subdrain pipe in an enhanced rain garden.

Photo: Polk SWCD



Overflow structure extending to the top of the ponding depth.

angle. Make a plan on how you will connect the overflow structure to the subdrain. This step may require an adapter or coupler to create a water-tight seal. A grated inlet cover rests on top of this pipe. The grated device is located at the height of the ponding depth to drain ponded water that exceeds the design depth. Beehive (dome-shaped), square, or circular grates are common and can be purchased at a local home improvement retailer. Ensure that the diameter of the overflow pipe matches the diameter of the grate opening.



Creating a Budget

The cost of installing a rain garden will vary based upon the footprint area, ponding depth, amount of plants, type of edging, and if subsurface drainage is used. Enhanced rain gardens will be more expensive than basic rain gardens and are typically designed and installed by a contractor. The following are simple cost ranges for estimating the total project cost of a "Do-It-Yourself" installation. Estimated ranges reflect material costs in 2021.

Photo: Shutterstock



Individual bags of long-strand, shredded hardwood mulch.

Basic Rain Gardens = \$4 - \$10 per square foot

(assumes a rain garden less than 400 square feet, 6" ponding depth, 12" plant spacing, edging)

Enhanced Rain Gardens = \$10 - \$20 per square foot

(assumes an enhanced rain garden less than 400 square feet, 6" ponding depth, 12" plant spacing, subdrain infrastructure, and edging)

Use the tables on pages 41 and 42 to develop a more accurate estimate of the materials needed and potential costs.

Depending on the size of your rain garden, buying materials in bulk may be more cost-effective than purchasing individual bags. Bulk delivery of materials typically includes a delivery fee.

Photo: Shutterstock



Bulk delivery of long-strand, shredded hardwood mulch.

In addition to buying in bulk, out-of-pocket costs can be reduced by utilizing a local stormwater BMP cost-share program. Cost-share programs are offered by many cities and SWCDs in Iowa.

Common programs fund fifty percent of the

project cost, usually up to a specified dollar amount. Cities encourage residents to adopt stormwater practices on their property to help improve local water quality and reduce flash flooding. A complete list of participating communities and organizations can be found at www.bit.ly/IowaCostShare.

Estimated Cost Ranges for Rain Garden Materials

Item	Purchased in Bulk	Bulk Cost Range	Purchased as Individual Bags	Cost Range
Topsoil	1 Cubic Yard	\$20 - \$55	0.75 Cubic Ft.	\$2 - \$5
Compost	1 Cubic Yard	\$15 - \$45	0.75 Cubic Ft.	\$2 - \$5
Concrete Sand	1 Cubic Yard	\$30 - \$40	0.5 Cubic Ft.	\$3 - \$8
Shredded Hardwood Mulch	1 Cubic Yard	\$18 - \$35	2.0 Cubic Ft.	\$3 - \$6
1" Rock	1 Cubic Yard	\$30 - \$40	0.5 Cubic Ft.	\$3 - \$6
3/8" Aggregate	1 Cubic Yard	\$40 - \$55	50 Lbs. Bag	\$4 - \$8

Refer to Appendix D for calculating soil amendments.

List of Communities that Sell Compost, Topsoil, or Mulch

Some municipalities in Iowa have facilities that convert yard waste to mulch or compost. This is an environmentally friendly way of diverting biomass from the landfill and reusing organic materials. It's also a more cost-effective solution for homeowners and contractors, materials are typically cheaper than buying commercially. Some cities even offer free materials to residents. The following is a list of facilities in Iowa that are STA certified by the US Composting Council.

Region	Location	Agency	Materials
Eastern	Cedar Rapids	Solid Waste Agency	Compost, Mulch
Eastern	Davenport	City of Davenport	Compost, Garden Soil, Potting Soil, Mulch
Central	Des Moines	Metro Waste Authority	Compost

Are amended soils always necessary?

Basic Rain Gardens

Soils in newer developments are often heavily disturbed. Typically, it is desirable to amend the soils in the base of the garden, especially if percolation rates range from ½ - 1.0 inch per hour. Amendments include topsoil, washed concrete sand, and compost. A recommended starting point is to amend with 2 inches of purchased topsoil, 3½ inches of washed concrete sand, and ½ inch of compost for a total depth of 6 inches of amended soils. Compost is naturally high in nutrients such as nitrogen and phosphorus. Use no more than a ½ inch of compost at any time to prevent contamination of groundwater from excess nutrients. The amount of sand can be adjusted based on native soils. If there is more clay present, use more sand. Over excavate the bottom of the rain garden to account for the soil amendments to make sure that the design ponding depth is achieved. Rototill to create a uniform blend of topsoil, sand, and compost. If you have healthy soils, topsoil that is loose and uncompacted with good percolation rates, it may not be necessary to amend the soils in the base of the rain garden.

Enhanced Rain Gardens

Amended soils are used in enhanced rain gardens. Follow recommendations in the Iowa Stormwater Management Manual (ISWMM) for bioretention cells. The amended soils consist of a mixture of washed concrete sand (75-90%), topsoil (0-25%), and compost (0-10%).

Other Estimated Costs for Basic and Enhanced Rain Gardens

Item	Details	Cost Range
Plant Plugs	Native/Non-Native Species, Sold as Flats	\$1 - \$5 per plant
Potted Plants (Quart)	Native/Non-Native Species, Sold Individually	\$3 - \$10
Potted Plants (Gallon)	Native/Non-Native Species, Sold Individually	\$5 - \$45
HDPE Perforated Pipe	4-inch Diameter by 100 foot Length	\$35 - \$45
PVC Non-Perforated Pipe	4-inch Diameter by 10 foot Length	\$8 - \$15
Drain Grate	4-inch Round, Square, Beehive, or Atrium	\$5 - \$15
Pipe Adapters	Varies by Brand and Material	\$5 - \$15

Example Materials List

Continuing with the example provided in Chapter 4, the homeowner intends to install a basic rain garden with a footprint of 256 square feet and a ponding depth of 6 inches. The homeowner has chosen to amend the soils based on the recommendations on page 42. Always round up to make sure you purchase enough materials.

Topsoil (2" Depth or 33% of Amended Soil Mixture)

$$256 \text{ ft}^2 \times 0.17 \text{ (topsoil depth)} = 43.5 \text{ ft}^3$$

$$43.5 \text{ cubic ft} / 27 = 1.6 \text{ cubic yards}$$

Compost (1/2" Depth or 8% of Amended Soil Mixture)

$$256 \text{ ft}^2 \times 0.04 \text{ (compost depth)} = 10.2 \text{ ft}^3$$

$$10.2 \text{ cubic ft} / 27 = 0.4 \text{ cubic yards}$$

Concrete Sand (3 1/2" Depth or 58% of Amended Soil Mixture)

$$256 \text{ ft}^2 \times 0.29 \text{ (concrete sand depth)} = 74.2 \text{ ft}^3$$

$$74.2 \text{ cubic ft} / 27 = 2.8 \text{ cubic yards}$$

Hardwood Mulch (2" Depth)

$$256 \text{ ft}^2 \times 0.17 \text{ ft (mulch depth)} = 43.5 \text{ cubic feet} / 27 = 1.6 \text{ cubic yards}$$

Plants (Plugs)

The rain garden square footage only accounts for the flat bottom of the rain garden. If plants are desired for the side slopes and berms, measure the total square footage of the area to calculate needed plants. Spacing options include 1 plant per square foot, 1.5 square feet per plant, and 2 square feet per plant.

$$256 \text{ ft}^2 / 1.0 \text{ ft}^2 = 256 \text{ total plugs} \quad 256 \text{ ft}^2 / 1.50 \text{ ft}^2 = 171 \text{ total plugs}$$

$$256 \text{ ft}^2 / 2.0 \text{ ft}^2 = 128 \text{ total plugs}$$

Jacob's Ladder

Polemonium reptans



PLANT NOTES

A shorter (up to 1 foot tall) perennial providing vibrant shades of blue in April to May. Jacob's Ladder prefers shady areas but can withstand full sun if moisture conditions are sufficient. Cup-shaped blooms provide nectar to a host of pollinators. "Reptans", meaning "creeping", gives this spring ephemeral a sprawling aesthetic.

Photos: Shutterstock



Chapter 6

Constructing a Rain Garden

▼ "Do-It-Yourself" Installation

Be aware that rain gardens require a significant amount of excavation. For rain gardens with a ponding depth of six inches, be prepared to excavate at least 14 inches (six-inch ponding depth, two-inch mulch layer, six inches of amended soils) for the entire footprint. Increasing the ponding depth will add more excavation.

The first construction step is to remove or kill-off existing turfgrass or other vegetation at the site. If turfgrass is not removed properly, it will compete with rain garden plants. Turfgrass removal can be completed in one of three ways after mowing the grass as short as possible.

- Place plastic sheeting or cardboard to cover the rain garden area and weigh it down with rocks or other heavy items. This method should suppress existing vegetation within a few weeks.
- Rent a sod cutter or remove it using a shovel. The sod could be used to fill in bare areas outside of the rain garden or elsewhere on the property.
- An herbicide like Roundup® can be used to kill off existing vegetation. Grass should be killed off within a few weeks of application.

Use a garden hose, rope, or spray paint to layout the rain garden area. Don't forget to include additional space to achieve a minimum of 3:1 side slopes on the rain garden.

See "Ensuring 3:1 Slopes" above for guidance on how much space to include based on the ponding depth. Additional space will be needed if the rain garden side slopes are flatter than 3:1. If the subsoil is not being repurposed for a berm or elsewhere on the property, create a plan for disposal.



Equipment List

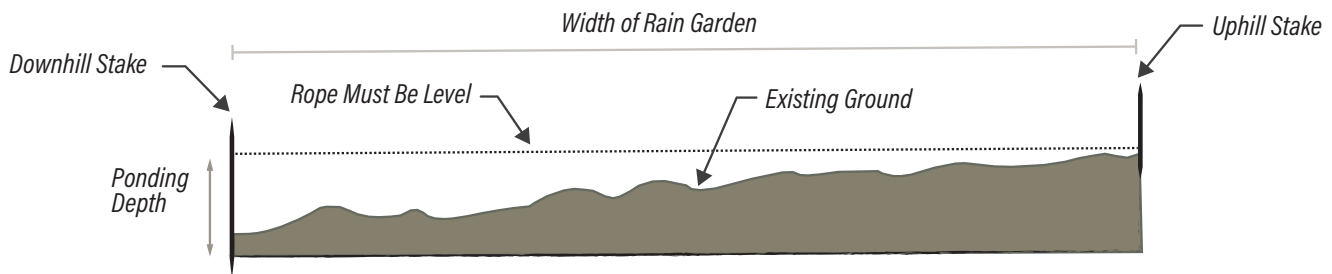
- Carpenter's Level
- 2" x 4" Board, 6' Length
- Rubber Mallet
- Shovel
- Spade
- 2-4 Wooden Stakes
- Rope, Garden Hose, Flags
- Wheelbarrow
- Tape Measure
- Rake
- Rototiller
- Spray Paint (optional)

Ensuring 3:1 Slopes

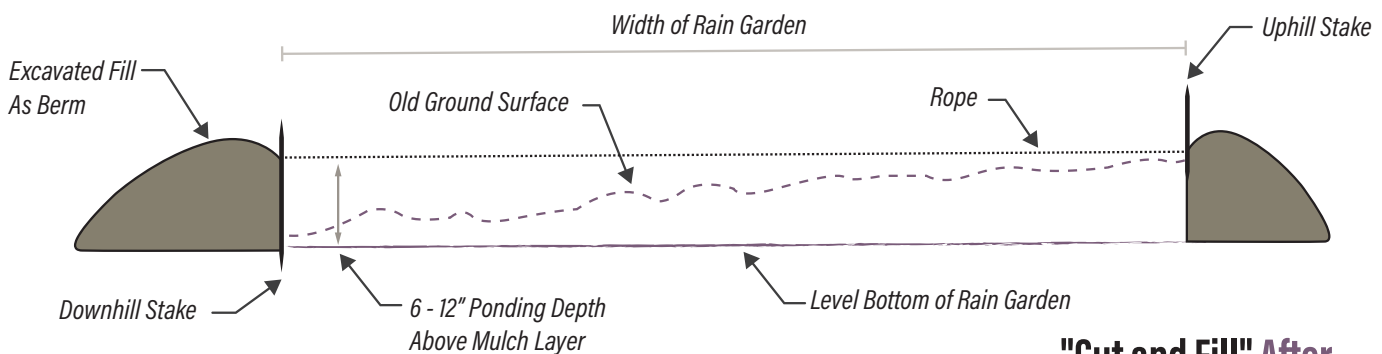
Add the following distances to the perimeter of the calculated rain garden area.

- 1.5' for 6" ponding depth
- 2.25' for 9" ponding depth
- 3' for 12" ponding depth

The most common installation approach for rain gardens is the "cut and fill" technique. This is because most rain garden sites have some degree of slope and rain gardens require a level bottom. With "cut and fill", a small berm is built on the downslope side of the rain garden using material excavated from the upper side of the rain garden. Once the rain garden has been excavated, refer to "Place Soil Amendments" on page 49 to continue basic rain garden installation.



"Cut and Fill" Before



"Cut and Fill" After

"Cut and Fill" Instructions

1. Layout the shape of the rain garden with a rope, garden hose, flags, or spray paint. Adjust the layout to make sure the rain garden fits into the landscape nicely and provides an aesthetic addition to the yard. If you adjust the layout in this step, make sure the footprint of the area is equal to the footprint area calculated in Chapter 4.
2. Place stakes at the upper edge of the rain garden and stakes at perpendicular angles on the lower edge of the rain garden. Tie a rope at the base of the upper stake. Then tie the rope to the top of the lower stake. Use a carpenter's level and 2"x4" board to ensure the rope is level.

Photo: Polk SWCD



"Cut and Fill" Instructions (Continued)

3. Measure the distance from the ground at the lower stake to the rope. Depending on the ponding depth selected in Chapter 4, raise or lower the rope to meet the desired depth. Adjust the upper stake to ensure the rope is level using a carpenter's level and a 2"x4" board.
4. If it is necessary to raise the rope to get the correct ponding depth, the area around the lower stake will need to be backfilled. Likewise, if you need to lower the rope to meet the correct ponding depth, excavate the area at the upper stake.
5. Once the rope is level and the lower stake is located at the correct ponding depth, excavate 8 inches deeper than the lower stake. If amended soil is used, fill 6 inches up to the bottom of the lower stake. A rototiller can be used to loosen the soil that can then be removed using a shovel. Fill the area with amended soil. Ensure a level bottom is achieved throughout.
6. Level the berm by raising or flattening the soil using the 2"x4" board. Place the carpenter's level on top of the board to verify levelness. For basic and enhanced rain gardens, notch out a designated outlet area on the berm to accommodate overflow from storms that exceed the capacity of the rain garden. Make sure the notch is set at or just above the ponding depth. Decorative rocks or stones can be placed on this area to prevent scour. The area beneath the berm where overflow will be discharged should be protected with vegetation (turf grass) or rock.
7. The upper edge of the rain garden, where rainwater from turf or other areas will flow into the rain garden, should be gently sloped backward (3:1 or flatter). It is recommended that for every 1 foot of height (depth of the cut slope), the slope should step back 3 feet. Place a layer of straw mulch or an erosion control blanket along this slope to protect it until vegetation is established (if seed is used). Sod can provide immediate protection.

Photo: Polk SWCD



Photo: Polk SWCD



Photo: Polk SWCD



Photo: Polk SWCD



Photo: Polk SWCD



Installation for Contractors

Contractors can be hired to construct both basic and enhanced rain gardens. The following instructions are provided to ensure that rain gardens are constructed properly, and soil compaction is avoided throughout the installation process.

Equipment List

- Spray Paint and/or Flags
- Laser Survey Equipment
- Excavator
- Rototiller
- Shovel
- Rake
- 2" x 4" Board, 6' Length
- Rubber Mallet
- 2-4 Wooden Stakes, Rope
- Wheelbarrow
- Rake
- Tape Measure

Step 1 - Layout. Use spray paint or place flags to layout the rain garden area. Extend the layout to accommodate for 3:1 side slopes (see page 45). If vertical sides are being used for the perimeter, there is no need to extend the layout. Ensure that the area surrounding the rain garden is stabilized prior to excavation of the garden area. Install erosion and sediment control practices upslope to protect the rain garden from eroded sediment.

Step 2 - Survey. Use survey equipment throughout the construction process to ensure that the base of the rain garden is level from front to back and side to side and to ensure downslope berms are high enough. Refer to “cut and fill” instructions (pages 46-47) for sloped areas.

Step 3 - Excavation. Excavate the rain garden area to the length, width, and depth specified in the contract design documents. Keep all equipment out of the garden

by working from the sides of the garden. This will prevent compaction of the soils. Use tooth buckets on small excavators that will not smear soils. Final grading may require using hand shovels to avoid compaction.

Step 4 - Construct Berm(s). Place excavated subsoil on the downslope side of the rain garden site. Use this to create a berm on the lower edge of the rain garden. Soil compaction is needed on the berm to prevent it from collapsing when water is ponded. Use a tamper to compact soil after each two-inch lift. This is the only soil material that should be compacted during construction. If installing an enhanced

rain garden, drainage infrastructure will need to be installed before backfilling with amended soils. This step is not required for basic rain gardens.

Step 5 - Place the Subdrain (Enhanced Rain Gardens Only).

Excavate the trench for the subdrain according to depths recommended for enhanced rain gardens (see page 25). Place first lift of aggregate then the perforated pipe at the elevation specified. The subdrain should extend the entire width of the longest side of the enhanced rain garden. Confirm local requirements if the subdrain

Photo: Polk SWCD



Rain garden berms under construction.

will be connected to the storm sewer system. If the subdrain is daylighted downslope of the rain garden, ensure the area is protected from scouring using rock, sod, or other erosion control products.

Step 6 - Add Overflow Pipe (Enhanced Rain Gardens Only).

Install the vertical overflow pipe at this time. Use a carpenter's level to make sure the pipe is standing at a 90-degree angle. Ensure all joints and connections are sealed tight. Backfill the trench with enough of the one-inch rock to cover the subdrain completely and to a depth of at least two inches above the subdrain. Next, place a two-inch layer of 3/8-inch aggregate rock into the trench. This creates a "choker" layer to prevent sediment from moving into the aggregate layer and subdrain.

Photo: Fairfield Elementary School



Placement of perforated subdrain.

Step 7 - Place Soil Amendments. Soil amendments are required for enhanced rain gardens. Depending on the native soils at the project site, soil amendments may also be used in basic rain gardens.

Add amended soil in two to three-inch lifts to the elevation specified in the contract documents. Overfill area with amended soil by five percent of the specified depth to allow for natural settlement. Avoid compaction by allowing time for natural settlement. If the project schedule does not allow for natural settlement of soil, enhance the settlement of the amended soil by soaking. Apply water to uniformly saturate the entire rain garden surface by spraying or sprinkling. Add amended soil as required to restore settled surface to finished elevation. Uniformly grade and rake the top of the amended soil layer to a flat and smooth surface.

Do not use landscaping fabric in a basic or enhanced rain garden for controlling weeds. Landscaping fabric will significantly limit rainwater infiltration. This will not allow the rain garden to function properly. Mulch is used to help control weeds.

Step 8 - Add Mulch. Place a two to three-inch layer of long-strand, hardwood mulch over the base and side slopes. If using plugs for vegetation, place the mulch then plant. Larger plants can be installed prior to placing mulch. Mulch should be level so that water infiltrates uniformly across the base of the rain garden.

Step 9 - Install Edging. The final step for both basic and enhanced rain gardens is to install edging if it is being used. Edging provides a barrier that prevents the roots of surrounding sod from creeping into the rain garden. It also makes mowing around the rain garden easier. Make sure that water can still flow into the rain garden over the edging. Mulch located in the rain garden along the perimeter should be lower than the installed edging. Common edging products include plastic, wood, or composite landscape edging, retaining wall blocks, and edging pavers.

Prairie Coreopsis

Coreopsis palmata

PLANT NOTES

Prairie coreopsis prefers full sun to partial shade in mesic to dry soils. Flowers are 1 1/2" - 2" across with 8 to 12 petals with rounded tips looking a bit ragged. Flowers earlier in the summer and blooms before the warm-season prairie grasses develop rapidly in response to hot summer weather.

Photos: Shutterstock



Chapter 7

Planting Vegetation



Selecting Species

Native plants are recommended for rain gardens for many reasons. They are adapted to the region's climate, soil, and moisture conditions. As native plants get established, their deep roots help break up the soil. This creates pore space that helps infiltrate and percolate water. Additionally, some of the native plant's roots decay adding more pore space and organic matter to the soils. Healthy plants with excellent root systems can make rain gardens more functional over time. Plants with deep roots also have the ability to reach further into the ground to find water during dry periods.

Many native plant species can tolerate temporary impoundment of water, which is the function of a rain garden. Native species are disease resistant and require less watering once established. They also don't require fertilization. Native species provide excellent habitat for pollinators, birds, and other wildlife.

Some rain gardens also feature species that are non-native to Iowa. While natives are recommended, some people may want to blend in their favorite horticultural cultivars. Select plants that meet your aesthetic values but consider the amount of inputs needed to keep non-native plants alive. This could include more water during periods of drought and the use of fertilizer.

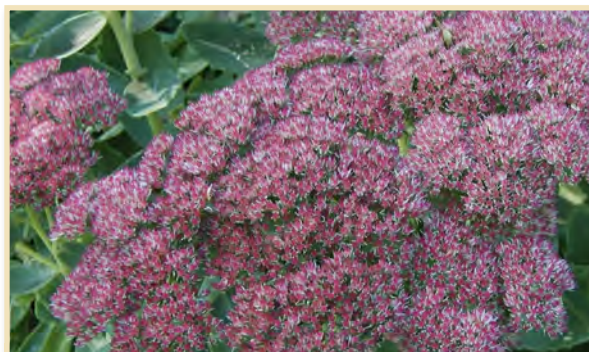
Plant selection should be based on sunlight, soil moisture, plant characteristics, and other site conditions. This guide provides a variety of plant layouts to assist in species selection. Layouts are based on sun conditions and the use of native and non-native plants. Refer to Appendix B for more information.

Photo: Katy Chayka, Bugwood.org



Prairie Blazing Star is a native prairie plant in Iowa.

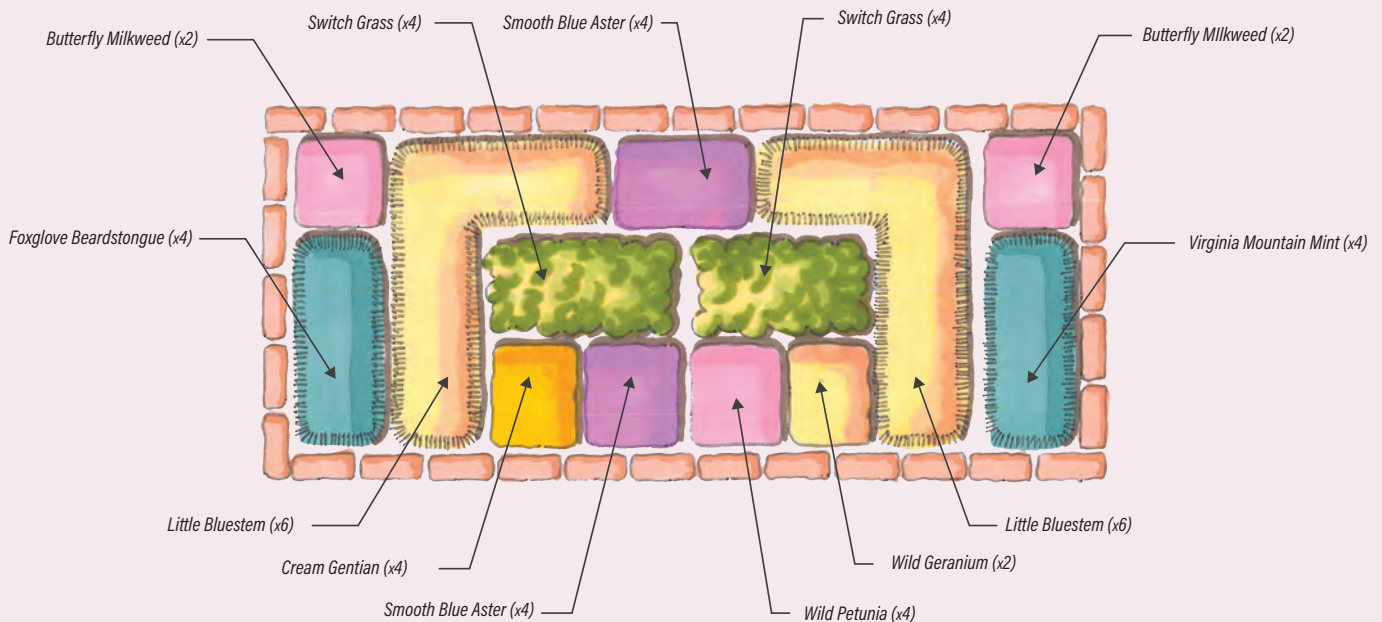
Photo: Dow Gardens



Autumn Joy Sedum is a non-native plant suitable for rain gardens in Iowa.

Example Plant Layout

In this example, a 5 foot by 10 foot (50 square foot) rain garden will be constructed. Native plants for full sun conditions will be planted in the garden. The desired plant spacing is 1 plant for every 1.0 square feet. Fifty plants will be planted. Species selected provide a variety of bloom colors and mature heights. More layouts are available in Appendix B.



Planting Process

First, gather the appropriate tools: a shovel, small hand tools, a rake, and a wheelbarrow. Try to minimize foot traffic within the rain garden when planting to minimize compaction of amended soils. Work from the side of the rain garden if possible. On larger, wider rain gardens a small bridge can be built by using two by four boards or an extension ladder and laying plywood over the top of the support boards.

Place a two to three-inch layer of shredded hardwood mulch across the entire surface area. Mulch suppresses weeds and helps conserve moisture needed especially for young plants during the first year. Mulch protects the rain garden from erosion.

Keep the soil in potted plants, shrubs, and trees moist before planting and keep them out of direct

Photo: Polk SWCD



Plants placed into position before installation.

sunlight until planting. When planting plugs, first place mulch. Then push aside mulch, dig a hole, bury the plant roots, and replace mulch. A dibble makes it easy to plant plugs. Push a hole into the ground with the dibble, plant then replace surrounding soil.

Depending on weather conditions, gently water plants every other day for the first few months after planting. As a rule of thumb, one inch of water per week is recommended. Watering in the early morning or evening hours will avoid water loss from evaporation. Target the base of plants rather than spraying broadly over the entire rain garden. New growth indicates that watering can be reduced to once weekly. Watering requirements will lessen as plants become fully established after the first year.

Photo: Polk SWCD



Using a soaker hose for watering in a new rain garden.

Soaker hoses or drip irrigation systems can be installed to provide water to the rain garden at set rates and times. A dedicated spigot is required for this option. Rain gardens can also be irrigated with a garden hose or watering can. Consider installing a rain barrel on your property to collect rainwater for watering plants. Rain barrels can also discharge water to rain gardens if they overflow.

Plant Selection Tips and Considerations

- Wetland plants will not survive in rain gardens. Since rain gardens drain down readily after a rain event, selected species must be adapted to drained soil conditions.
- Clump species together to express more dense natural plant communities. This makes the planting pattern more obvious.
- When shrubs and trees are used in enhanced rain gardens, the amended soil mix will likely need to be adjusted. Shrubs and trees will require more topsoil than sand.
- Use a layer of low-growing plants around the circumference to frame the plant palette. An example would be the use of some of the shorter native grasses such as blue grama and June grass.
- Consider a more natural approach that mimics a dense, layered plant arrangement that occurs in natural settings. This might include layers of low-growing ground cover, clumped species of taller plants, and at the tallest layer, shrubs and/or trees. A thick layer of more shade tolerant, low growing species can be grown under shrubs, trees, and taller plants. This ground cover can be thought of as a living mulch that protects soils from erosion, promotes vital soil microbes, and reduces weed pressure. Potential species might include sedges, short grasses, and flowers that spread easily. Non-native cultivars can be used if native plants are not available.

Prairie Blazing Star

Liatris pycnostachya

PLANT NOTES

A variety of bees, butterflies, moths, and skippers utilize the nectar. Upright, clump-forming plant. Distinct flowers open top to bottom on the spikes. 3/4" wide flower heads, typically numbering 5 to 60 appear on a dense spike. Blooms late summer to early fall months.

Photos: Shutterstock



Chapter 8

Maintaining a Rain Garden



Make a Plan for Maintenance

Routine inspection and maintenance are crucial for the lasting function and appearance of a rain garden. Maintenance protects the owner's financial investment of installing a rain garden and prevents costly rehabilitation.

Typical maintenance includes pulling weeds, pruning plants, replanting, mulching, and removing sediment and debris. This chapter includes guidance for important points of inspection and maintenance tasks that will need to be performed in order to keep the rain garden functioning properly and looking great. A maintenance checklist is provided in Appendix J of this guide. Consider the following quick tips:

Photo: Elizabeth Bella, AECOM



Quackgrass is a weed that can appear in rain gardens.

- **Get familiarized with your rain garden plants.** When plants are young, take photos and make your own plant ID book for your garden. Throughout the year, take photos at different points of maturity for reference so that you can easily distinguish your rain garden plants from weeds.
- **Monitor the rain garden for standing water after 24 hours of a rainfall event.** If rainwater is still standing after 24 hours, it may be an indicator that the rain garden is not functioning properly.
- **Supplement plantings as needed.** Be prepared to replant or replace some plants over the course of the first two to three years. Some species may not survive due to extreme weather conditions or may spread too rapidly.
- **Be prepared to manage leaves.** Excess leaves could clog the delivery of rainfall runoff to the garden, smother plants, and impact infiltration.
- **Gutters should be cleaned out regularly.** Any downspouts or drainpipes that deliver rainwater to the rain garden should be cleaned out to avoid backups.



Protecting Newly Established Plants

Rain gardens are designed to pond water for a short period of time. However, ponded water can be harmful to newly established plants after construction of the rain garden is complete. For that reason, some rain gardens are kept "offline", which means that rainwater is temporarily redirected away from the rain garden. Downspouts designed to direct rainwater to the rain garden are not connected to

the rain garden temporarily. If the rain garden is designed to take street runoff, cut curbs after plants are established.

Keeping rain gardens "offline" prevents young plants from receiving too much water if heavy rainstorms occur. However, during the first few months be prepared to water a rain garden if timely rainfall does not occur. Water at least once a week if it does not rain at least one inch per week. Monitor rainfall using a simple rain gauge and observe how much rainwater is reaching the rain garden during rainfall events.

In general, rain gardens featuring plants native to Iowa should not require extensive maintenance once plants are fully established. This typically takes three or four years. Reducing long-term maintenance can be minimized if weeds are diligently pulled during the first few years. This is because weeds will not compete well against vigorous, deep-rooted native species.

Photo: Polk SWCD



Downspout disconnected to temporarily have rain garden "offline".

Photo: Polk SWCD



This rain garden is online with downspouts connected to underground drain pipe.

"Is that a native plant or a weed?"

To assist homeowners with plant and weed identification for rain gardens installed with native species, the Iowa Stormwater Education Partnership (ISWEP) has created a pocket-size field guide for quick reference. Contact ISWEP to inquire about ordering hard copies. A free, complimentary mobile application is also available for download in the Google Play Store and the Apple App Store. Scan the QR code to download today! More detailed information can be found on www.iowaStormwater.org. Other mobile apps are available, too, that can identify a plant by taking a photo of it.





Inspection Points and Maintenance Tasks

Inlet and Pre-Treatment Area (If Installed).

Once a month during the growing season and after major storm events, inspect the area for excessive deposition of sediment and debris and signs of erosion and scouring. Checking these areas is especially important during the spring and fall.

- ☐ Remove litter, trash, debris, and sediment to prevent water from bypassing designated inlets and pre-treatment areas.
- ☐ Sod or native pre-vegetated mats can be installed on larger projects to prevent erosion in pre-treatment areas. They can also save on labor for weeding.

Base of Rain Garden. Check for ponded water 24 hours after a rainfall event. Ponded water for extended periods of time is an indicator that soils may have become plugged with sediment or heavily compacted due to human, animal, or vehicle traffic. This will prevent rainwater from effectively draining.

Check for fallen leaves and debris during the growing season and after major storms. Inspect distribution of mulch inside the rain garden and along slopes. Mulch and debris can smother plants and restrict growth if it becomes too concentrated.

- ☐ Remove litter, trash, leaves, and debris from the base of the rain garden.
- ☐ Spread shredded hardwood mulch evenly throughout the entire rain garden area. Mulch should be two to three inches thick.
- ☐ Clean out any debris and recheck drainage. If standing water is still present after 24 hours, the soils in the base of the garden may have to be replaced with amended soils. For this process, excavate and remove six or more inches of soil and replace with amended soil. In some cases, punching a few holes in the base of the rain garden with a post hole digger will suffice. Fill the holes with topsoil and cover with mulch.

Photo: ISWEP



Grass filter strip used for pre-treatment area.

Photo: Polk SWCD



Rain garden showing temporary ponding after a rainfall event.

Photo: Polk SWCD



Ensure rain gardens drain within 24 hours.

Newly Established / Young Plants and Trees. Young plants may be impacted if too much water or not enough water is entering the rain garden. Wilting of leaves is a good indicator of issues.

- ☐ Check for at least 75 percent vegetative cover upon establishment of new plants at the end of the first growing season. A healthy rain garden should have complete vegetative cover after the end of the third growing season.
- ☐ Remove dead vegetation during the spring or fall. Replant as needed to maintain desired vegetative cover in the rain garden. It is recommended during a fall cutback that some plants remain as winter habitat for pollinators. Some plants can also remain over winter based on personal aesthetic preferences.

Photo: Polk SWCD



Plugs recently planted in an enhanced rain garden.

- ☐ Pull weeds monthly during the first three years after installation. Reducing weed competition early and getting plants well established is needed to reduce maintenance over time.

Established / Mature Plants and Trees. Inspect older plants if they appear “leggy” or floppy or portions are dead. Inspect the base of mature plants and trees for undesired saplings.

Photo: Polk SWCD



Well established enhanced rain garden.

- ☐ Mature non-native plants may be “deadheaded”, which is the act of cutting off the old flower heads after a plant is done blooming. Deadheading can be used for most flowering plants and some perennials.
- ☐ Pruning of mature trees and shrubs should be completed in the fall or early winter. If plants are getting overgrown, some plants can be easily split and placed elsewhere in the rain garden to fill in bare spots. However, native plants have long roots, so transplanting may not be an option.

Photo: ISWEP



Removing unwanted tree saplings.

- ☐ Replace diseased or dead plants. Remove basal shoots, root suckers, and volunteer trees close to the ground. Herbicide treatment may also be necessary. If volunteer trees are a big problem, stump killer can be put on cut tree stumps to restrict growth.

Overflow Structure (Enhanced Rain Gardens Only). Inspect the overflow structure and grate for obstructions preventing flow into the pipe. Inspect where the structure daylight to ensure the animal guard is in place and clear of debris.

- ☐ Remove debris and trash from the grate or within the overflow pipe as needed.

Berm and Retaining Wall. Check on the notch in the downslope berm for overflow from large events. Look for evidence of scour there as well as on the discharge area. These areas may have to be revegetated or reinforced with rocks. Eroded sections of berms can also allow water to enter or exit the rain garden at unintended points that are not stabilized adequately.

- ☐ Rebuild and compact berms that have sunk from erosion or natural settling.
- ☐ For failing retaining walls, remove bricks or rock and level the trench area. Place bricks on paver sand or pea gravel and re-level. A drainage pipe may be needed behind taller retaining walls to prevent bricks from dislodging, which can be caused by drainage issues.

A Note on Wildlife

Just like a typical flower or vegetable garden, rain gardens can attract birds, deer, and rabbits. Plugs and small plants are especially vulnerable and will need protection until they mature. In the first few years after installation, a fence or other barrier may be needed to keep wildlife out of the rain garden. Where this may be a continuous issue, homeowners should consider selecting plants that aren't preferred by wildlife.



Final Considerations

The most common mistake identified by owners of rain gardens is insufficiently weeding the first year after installation. Annual weeds that are not pulled will re-seed rapidly, creating an unkept looking rain garden. In the end, rain gardens are a functional stormwater practice that also provides aesthetic appeal. If routine maintenance is an obstacle, a rain garden may not be the appropriate practice. Consider other practices such as soil quality restoration that has limited maintenance requirements.

The installation of one rain garden by one homeowner will not have major impacts on reducing hydrologic instability and water quality problems that are present in Iowa. However, the cumulative effect of individual actions can create tangible improvements in local water quality, localized flooding, and streambank stability.



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