THE OREGON Rain Garden Guide

A STEP-BY-STEP GUIDE TO
Landscaping FOR Clean Water AND Healthy Streams

Sea Grant
Oregon

The Oregon Rain Garden Guide: Landscaping for Clean Water and Healthy Streams

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Cover artwork: "Rain Garden" painted by John C. Pitcher © Good Nature Publishing 2009. www.goodnaturepublishing.com 800-631-3086

This project has been funded in part by the United States Environmental Protection Agency under assistance agreement CP-00451O5 to the Oregon Department of Environmental Quality. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Many thanks to those who reviewed this document, plant lists, and sample planting designs for accuracy and appropriateness. Special thanks to those who made contributions of photos or text.

This report was prepared by Oregon Sea Grant under award number NA06OAR4170010 (project number E/BET-02-PD) from the National Oceanic and Atmospheric Administration's National Sea Grant College Program, U.S. Department of Commerce, and by appropriations made by the Oregon State legislature. The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of these funders.

The production of this guide was part of Stormwater Solutions, a collective public education effort involving several partners. Partners responsible for the production of this guide include the following:

Oregon Sea Grant, Corvallis, Oregon ORESU-H-10-001

Contents

Introduction

The purpose of this guide

The *Oregon Rain Garden Guide* was written to help Oregonians learn how to design and build rain gardens to treat the stormwater runoff from their own homes or businesses. Rain gardens are "gardens with a purpose"; they help reduce the amount of excess water and associated pollutants reaching local lakes, streams, and bays. Ultimately this results in healthier waterways, fish, other wildlife, and people.

This how-to guide provides information specific to Oregon's conditions, including the rainfall and appropriate plants for your site. You don't have to be a stormwater, garden, or landscape professional to use this guide. It provides the necessary information to safely build and maintain a rain garden, along with references for more detailed guidance for special conditions. You may also contact the authors and partners directly for more information.

What is a rain garden?

A rain garden is a sunken, generally flat-bottomed garden bed that collects and treats stormwater runoff from rooftops, driveways, sidewalks, parking lots, and streets. Rain gardens help mimic natural forest, meadow, or prairie conditions by infiltrating stormwater from hard surfaces. A variety of planting plans are included in this manual for your reference.

Rain gardens keep our watersheds healthy by...

- reducing flooding by absorbing rain water from hard surfaces
- filtering oil, grease, and toxic materials before they can pollute streams, lakes, and bays
- recharging groundwater aquifers by allowing water to soak into the ground
- providing beneficial wildlife habitat

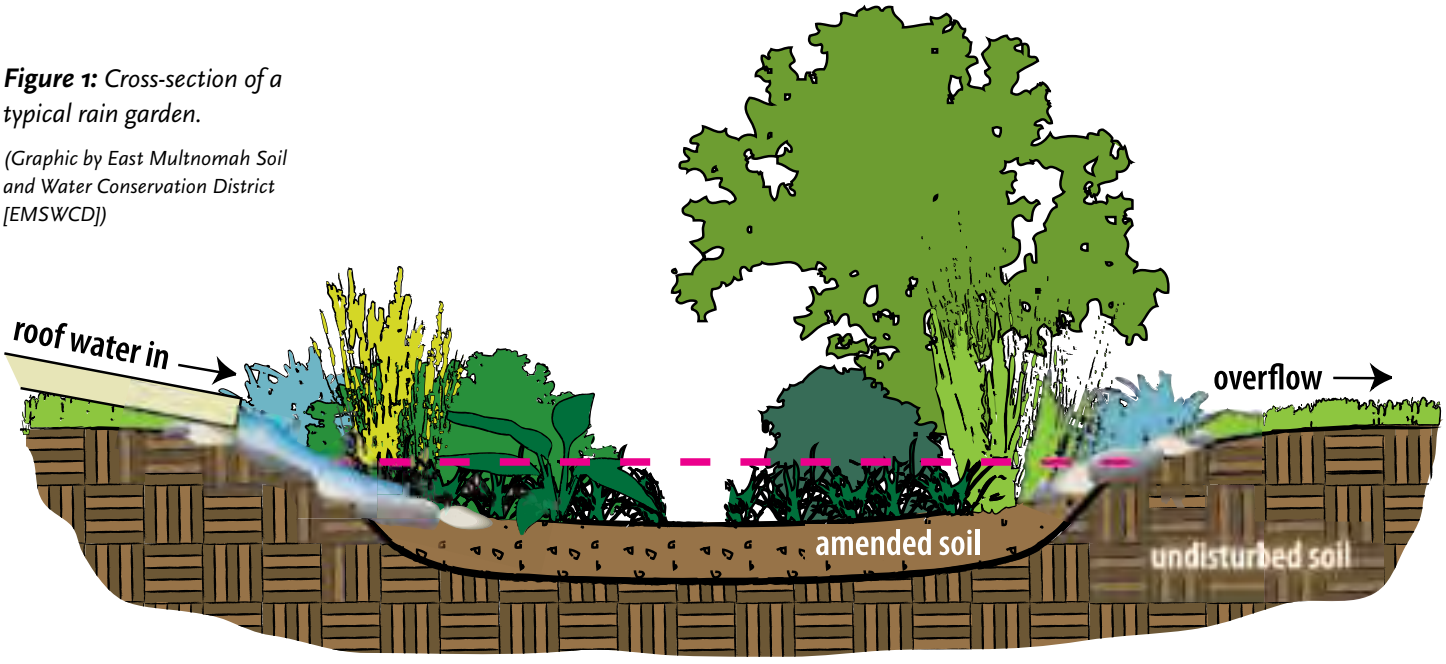


Figure 1: *Cross-section of a typical rain garden.*

(Graphic by East Multnomah Soil and Water Conservation District [EMSWCD])

RAIN GARDEN DICTIONARY:

Impervious surfaces are areas that do not allow rain or snowmelt to infiltrate or soak into the soil below the surface (for example, roofs, driveways, roads, sidewalks, and patios). Some ground areas that have been severely compacted from heavy equipment or foot traffic may also be considered impervious if most of the water runs off the surface when it rains.

Why build a rain garden?

When the Pacific Northwest was covered with forests and prairies, rainfall slowly dripped through branches and vegetation, seeped through duff, and sank into the ground as it slowly percolated to nearby water bodies. As parts of our landscapes became more developed, the rainfall that lands on hard surfaces was routed into pipes, ditches, and storm drains. Much of that runoff is routed directly to streams or into the sewer system. The result? Too much water flowing in a short amount of time, carrying pollutants that negatively affect the health of our streams, lakes, and estuaries. Today, managing stormwater runoff by infiltrating it into the ground is one of the simplest ways to actively protect our streams. Rain gardens help us restore the natural water cycle in the landscape, which is critical to ensure healthy streams in both small towns and large cities.

Do rain gardens attract or breed mosquitoes?

No. For reproduction, mosquito larvae require a number of days in standing water. Most urban mosquitoes breed in places like junk piles where there are old tires or tin cans. In a well-designed rain garden, water is rarely standing long enough for mosquito reproduction. Ideally, a rain garden should drain so that water won't be standing in it for more than 48 hours. For more information, see "Mosquitoes" at entomology.oregonstate.edu/urbanent/.

Robert Emanuel, OSU

Candace Stoughton, EMSWCD

Robert Emanuel, OSU

Figure 2 (top): *A newly installed rain garden in Tillamook County, Oregon.*

Figure 3 (middle): *An established rain garden in Portland, Oregon (by Blossom Earthworks).*

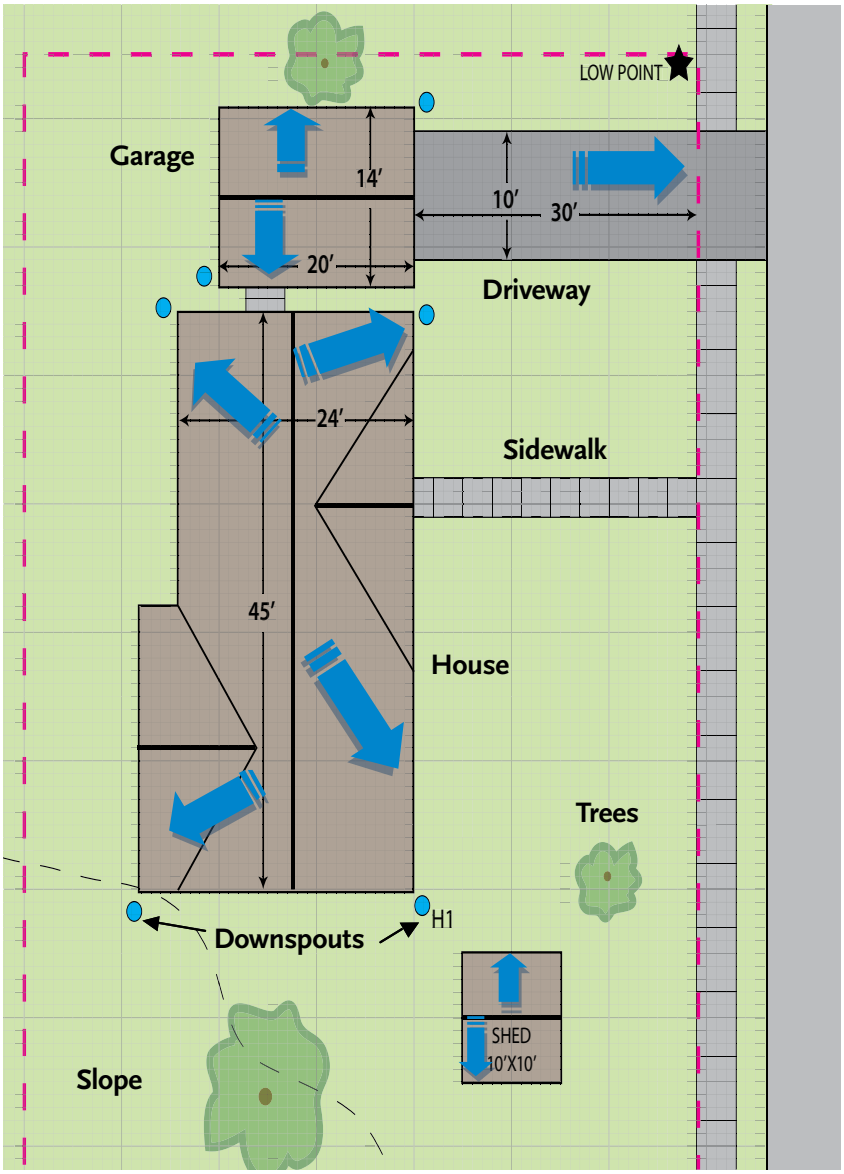
Figure 4 (bottom): *Streams in the Pacific Northwest are normally buffered from pollution and sudden flashes of water by their surrounding forests and grasslands. In an urban environment, water from roofs and streets is often piped directly into streams, delivering pulses of polluted, damaging water and sometimes causing localized flooding.*

Building a Rain Garden: A Step-by-Step Approach

The following steps will help you assess the characteristics of your site so you can design your garden to capture and treat water safely and effectively, build it correctly, and maintain it to be a healthy and beautiful addition to your landscape.

STEP 1: Observe and map your site

The first step is to assess how water flows across your property. We suggest you create a map of your site that includes the measurements of all structures, with arrows to indicate where the water flows after the rain lands on these surfaces. See Figure 5.



1. Walk through your yard and note any obvious slopes or low spots.
2. Note areas where water might drain to your neighbors' or public property.
3. Site your potential rain garden where water flowing into the garden will be higher than where water will naturally exit the garden.
4. Look for areas nearby where overflow from a rain garden can be absorbed or safely directed into an approved stormwater collection point (such as a streetside gutter and storm drain).

Determine how much area the rain garden will treat

Next, decide which impervious surfaces you'd like to manage using a rain garden. Measure the width and length of these surfaces and multiply them together to give you the square feet of surface area to be treated. See Figure 6 for an example. The rain falling on the part of the roof outlined in red drains into downspout H1 and could be directed into a rain garden.

Width of Surface Area x Length of Surface Area = Area (square feet)

An example: roof area draining to downspout H1 is 30 feet x 12 feet = 360 square feet of roof area

STEP 2: Determine the location of the rain garden

Go with the flow

The easiest place to build a rain garden is relatively close to a gutter downspout. If you want to build only one rain garden, consider using the downspout that captures the largest portion of the roof. If necessary, you can route water from several downspouts to one location. It is also possible to re-hang your gutters to move the downspout to a more appropriate spot.

Figure 5: *Map of home site indicating measurements of structures that shed water and the direction the water flows.* *(Graphic: EMSWCD)*

Note: a rain garden **should not** be constructed in a location that stays wet throughout the rainy season, since this is an indication of poorly drained soils.

Respect the flow

Rain gardens must be designed to carefully capture and treat stormwater on-site and send the excess overflow during a large rainstorm off-site, without damaging structures and other property.

To prevent slumping and failing of the following structures, make sure the outer edge of your rain garden is at least:

- three feet from a sidewalk
- six feet from a basement
- two feet from a crawl space or slab
- ten feet from a retaining wall

To prevent landslides and surface erosion, do not place rain gardens on slopes steeper than 10 percent. If the property does not have adequate flat areas and you are still interested in building a rain garden, contact a licensed landscape professional or engineer for design modifications to safely store and route water off-site without damage.

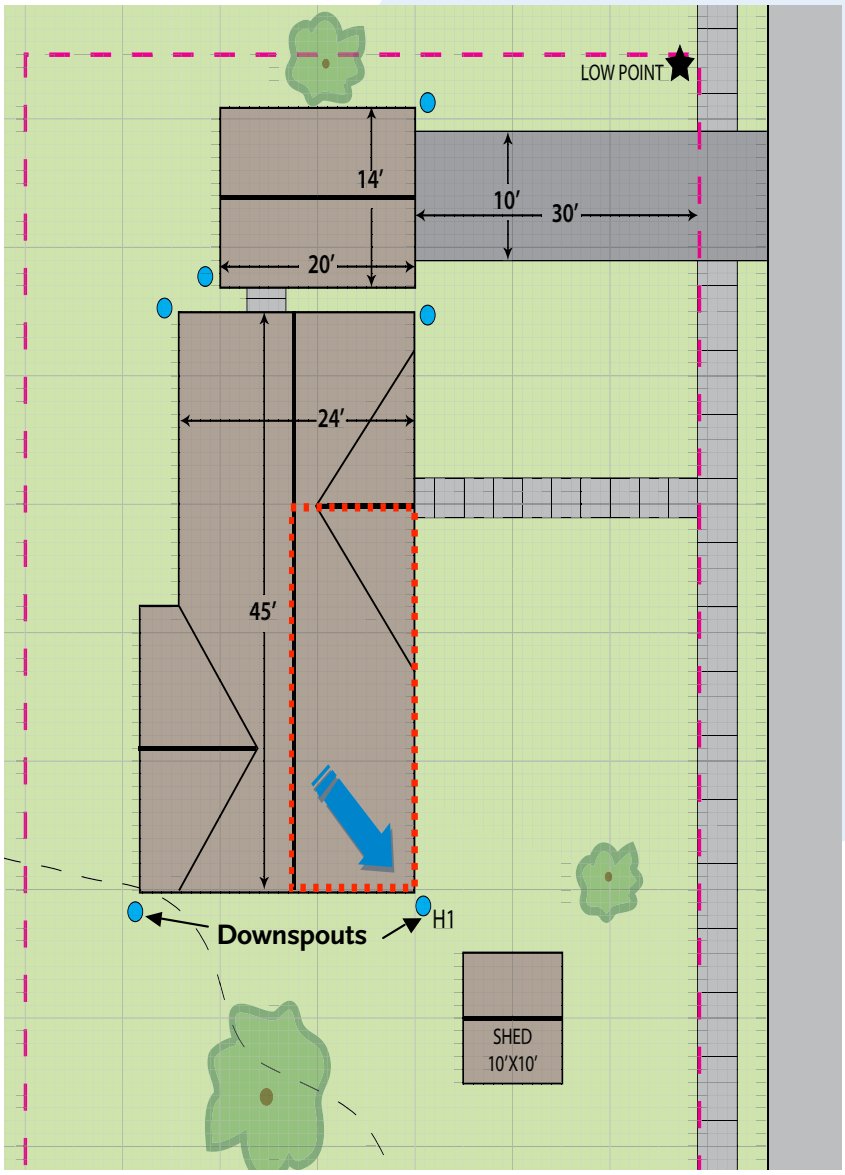
Divert the flow

Rain gardens are designed to drain water to the soil layers below the garden for treatment. To ensure adequate drainage and treatment while not polluting groundwater, rain gardens should not be placed in the following areas:

- on top of a septic drain field. When uphill of a septic system, provide at least 50 feet between a rain garden and the septic system.
- where a seasonal groundwater table is within three feet of the bottom of the rain garden (about four to five feet below ground surface)
- areas that stay wet during the rainy season, such as wetlands, natural springs, or seeps
- in soils that don't have good drainage (minimum of 1/2 inch/hour infiltration) or on bedrock
- in soils that have been contaminated by chemicals or other toxic substances
- under or immediately adjacent to trees, if digging will disturb their roots

During very large storms, rain gardens will overflow because the soil becomes saturated and cannot hold all of the water. Special precautions should always be used to route the overflow to a safe location, away from structures, steep slopes, and neighbors' property. Your rain garden should be at least five feet away from property lines, and the overflow should not be routed to the neighbor's property unless it is an approved location, such as a ditch or swale in a right of way.

Figure 6: *Map of home site indicating surface area and direction of water flow to downspout H1.* *(Graphic: EMSWCD)*



Regulations, permits, and design modifications

Some cities and counties have specific regulations regarding disconnecting downspouts, routing or piping water off-site, and setbacks to structures, steep slopes, and property lines. They may also require a permit. Always check with your city's building or planning department if you live within city limits; otherwise, check with your county government.

Rain gardens may be designed with impermeable liners, rock trenches, and piping to safely route water away from structures and off-site. These designs would allow you to build rain gardens closer to structures, on steep slopes, in soils that don't drain well, and in other challenging situations. However, these designs are beyond the scope of this guide. We recommend that you contact a licensed landscape professional or engineer for assistance with these alternative designs.

Measure the slope

Tools needed:

- Two stakes
- Survey line or string
- Line level
- Measuring tape
- Calculator

Steps:

Measure and calculate the slope of the site to assess how water will be routed to and from your rain garden. It is critical to make sure your property has a slope of less than 10 percent before constructing a rain garden there.

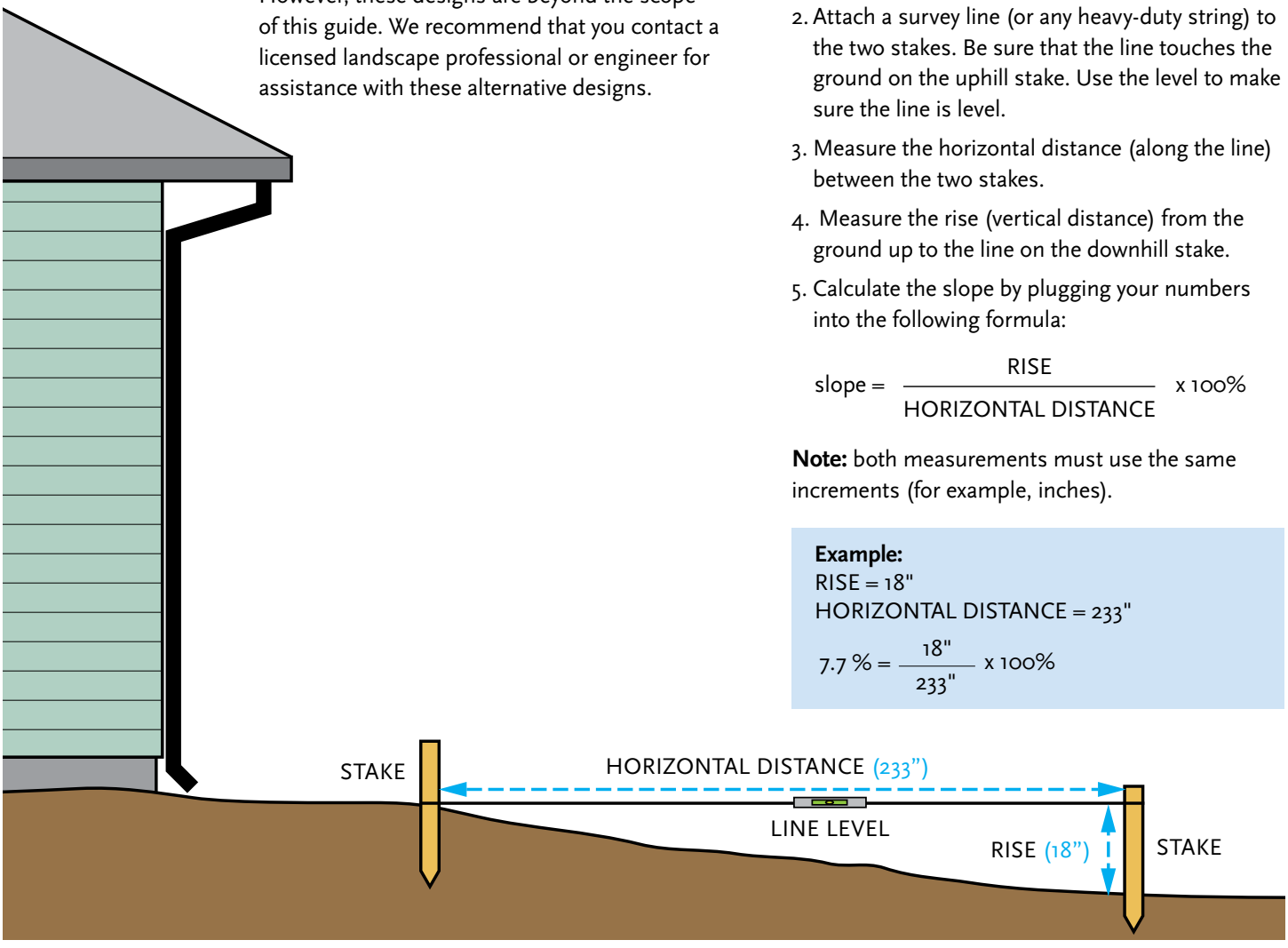
1. Place stakes in the ground at the top and bottom of the slope to be calculated.
2. Attach a survey line (or any heavy-duty string) to the two stakes. Be sure that the line touches the ground on the uphill stake. Use the level to make sure the line is level.
3. Measure the horizontal distance (along the line) between the two stakes.
4. Measure the rise (vertical distance) from the ground up to the line on the downhill stake.
5. Calculate the slope by plugging your numbers into the following formula:

$$\text{slope} = \frac{\text{RISE}}{\text{HORIZONTAL DISTANCE}} \times 100\%$$

Note: both measurements must use the same increments (for example, inches).

Example:
RISE = 18"
HORIZONTAL DISTANCE = 233"

$$7.7\,\% = \frac{18"}{233"} \times 100\%$$



Graphic: EMSWCD

STEP 3: Assess soil

The ability of soil to drain water is one of the most important considerations for understanding the site and properly sizing a rain garden. An infiltration and texture test will help you determine the soil's capacity to absorb and percolate water down into the lower layers.

Testing infiltration

1. Dig a test hole in the area where the rain garden will be built. Try to site the hole in the middle of the planned rain garden. Dig a hole to the expected depth of the rain garden (from grade to the top of the rain garden's base). Note that ideally, this test should be done when soils are not frozen and when groundwater levels may be highest, such as in the spring.
2. Fill the hole with water to just below the rim. This should be the same depth of water expected if the rain garden filled to the rim. Record the exact time you stop filling the hole and the time it takes to drain completely.
3. Refill the hole again and repeat step 2 two more times. The third test will give you the best measure of how quickly your soil absorbs water when it is fully saturated, as it would be during a rainy period of the year or during a series of storms that deliver a lot of rainfall in a short period of time. Building a rain garden to handle these conditions is a way to be sure you will not cause damage to your own or a neighbor's property.
4. Divide the distance that the water dropped by the amount of time it took for it to drop. For example, if the water dropped 6 inches in 12 hours, then 6 divided by 12 equals 1/2 inch per hour of infiltration. If the slowest infiltration rate measured of the three trials is less than 1/2 inch per hour, then you should dig another 3 to 6 inches deeper and repeat the above steps. Repeat this process at various depths down to 2 feet, or until you have at least 1/2 inch per hour infiltration.

Note: Soils with drainage of less than 1/2 inch per hour are not appropriate for rain gardens without significant modifications in design. Consult a licensed landscape professional or engineer for assistance in these circumstances.

1

2

3

Photos: Robert Emanuel, OSU

Figure 7a: *Conducting a soil feel test by making a ball with the moistened soil, to see how easily it falls apart as well as what texture it has (sticky, silky, or gritty).* *(Photo: Gina Emanuel)*

Figure 7b: *Using a soil ribbon to test soil for clay, loam, or sand content. The longer and firmer the ribbon, the more clay content in the soil.* *(Photo: Gina Emanuel)*

Determining soil texture

1. Take a handful of the soil you have excavated from your infiltration test. Pulverize it in your hand and remove any bits of organic matter or obvious rocks.
2. Wet it with a small amount of water and rub it between your thumb and index finger. Don't saturate it until it is runny mud. You might feel stickiness, grittiness, or smoothness. The grittier the feel, the more sand is present in your soil. The slicker the soil, the more clay in it. Smooth soils are sometimes an indicator of a fine silt or loam. Discard the soil.
3. Next, take another sample in your hand. Wet it until it has the consistency of dough. You should be able to form a ball that holds together with the soil in your palm. If you cannot get the ball to form, then your soil is very sandy. In most soils, however, you should be able to create a rough ball.
4. Knead the soil together between your thumb and fingers and attempt to form a ribbon. As you build the ribbon, it will either hold together or break off. If the soil breaks quickly in the process, then it likely has a high sand content. If the ribbon forms quickly and stays strong, it has more clay.

- If the soil forms a ribbon less than 1 inch in length before it breaks, the soil is sandy or silty.
- If the soil makes a ribbon 1 to 2 inches in length before it breaks, the soil is clayey.
- If the soil makes a ribbon greater than 2 inches before it breaks, it may not be suitable for a rain garden constructed without professional help, depending on how fast the soil drains during the infiltration test.

Interpreting the infiltration test

Drainage rate	Recommendation
Less than 1/2 inch per hour	Do not build a rain garden on this site without professional assistance.
Between 1/2 and 1 inch/hour	Low infiltration for a rain garden. Homeowners may want to build a larger or deeper garden, or likewise plan for additional overflow during high-rainfall storms.
Between 1 and 1 1/2 inches/hour	Adequate infiltration for a rain garden. Plan for sufficient overflow during high-rainfall storms.
Between 1 1/2 and 2 inches/hour	Adequate infiltration for a rain garden. Plan for sufficient overflow during high-rainfall storms.
Faster than 2 inches/hour	High infiltration for a rain garden. Design should feature fewer moisture-loving and more drought-tolerant plants. The rain garden may also be sized to hold smaller amounts of water, have a deeper mulch layer, or have denser plantings.

Building a better soil

Amending with compost is recommended to improve initial plant and microbial health. If your soil has high clay content, soil amendments may be needed to improve conditions for good plant health. Sites with very high clay content and low drainage are usually inappropriate for the types of rain gardens described in this guide, without significantly altering the design for better drainage (such as adding subsurface drain pipes and drain rock).

If you plan to amend the soil, a typical soil mixture contains 20 to 40 percent organic material (compost); 30 to 50 percent clean, coarse sand; and 20 to 30 percent top soil.

Note: do not add sand to a highly clayey soil. Soils are commonly amended to a depth of 18–24 inches.

STEP 4: Determine the size of the rain garden

Always check with your local planning department, public works, or stormwater utility before designing your rain garden. If your local jurisdiction does not have a recommended size calculation for a rain garden, then we recommend the size of the rain garden be **at least 10 percent** of the impervious surface draining to the garden. Rain gardens should ideally be between 6 and 24 inches deep.

To use this number, your soil should drain at least 1/2 inch per hour or greater. Compare the result of your soil infiltration test with the table above, for a good idea of how your soil influences the size of the rain garden. Rain gardens of 10 percent and 1/2 inch minimum infiltration rate should treat a large majority of storms in Oregon.

Using the area of impervious surface that you calculated in Step 1, multiply this by 0.10 (or 10 percent). The result will be the area of the rain garden in square feet. The calculation is:

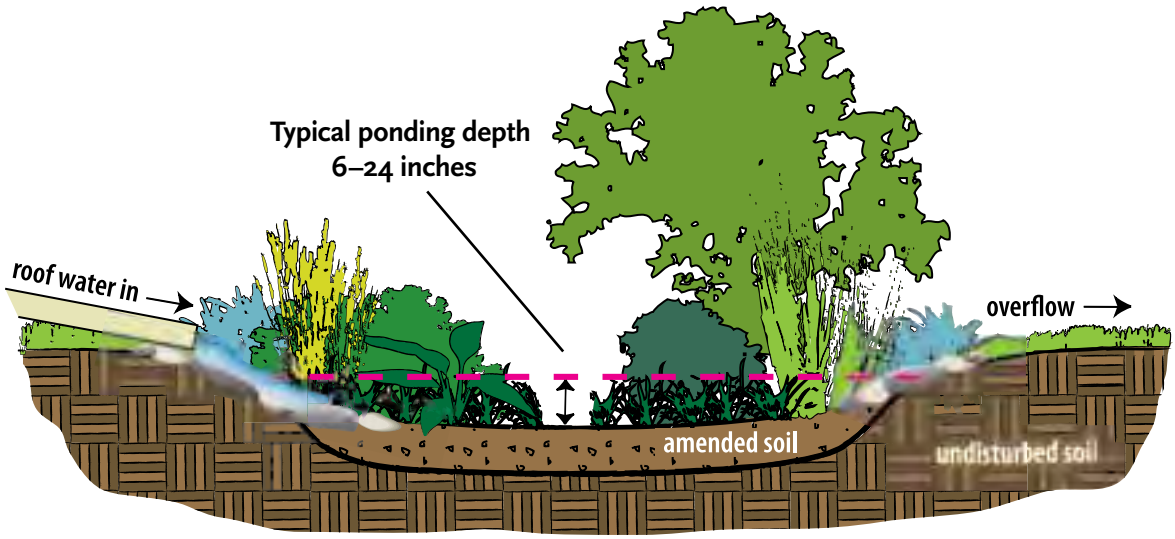


Figure 8: *Ponding surface is denoted by the dotted line.*
(Graphic: EMSWCD)

(Length of surface area x Width of surface area) x .10 = total rain garden area

An example: 30 feet x 12 feet = 360 square feet x .10 = 36 square feet of rain garden

The more impervious area you want to treat, the bigger your garden. The size of your rain garden will also depend on the space available and your budget. If you don't have enough space, you can build multiple rain gardens or build a smaller one and plan for it to overflow more often.

Note: Rain gardens should be a minimum of five feet wide to accommodate gentle side slopes that will host plants and minimize soil erosion.

Rain garden depth

Most rain gardens should be between 6 and 24 inches in ponding depth with 2–4 inches of additional depth for safety. This means that rain gardens range from 8 to 28 inches in depth. The table below is a general guide for rain garden ponding depths based on different drainage rates. Add depth where overall size is restricted by setbacks, structures, vegetation, or other obstacles.

Note: remember to account for the addition of mulch when you plan for your finished depth (see "Mulching" on page 23). For example, if you are adding 3 inches of mulch to your final planted garden and it needs to be at least 12 inches deep, you must excavate to a depth of 15 inches from grade.

RAIN GARDEN DICTIONARY:

The **size** of a rain garden refers to the volume of water it can hold before the water overflows at the exit point. This volume is described in terms of ponding depth and square feet of surface area (depth x width x length).
Ponding depth is the depth at which the water can pond before it flows out of the rain garden (see Figure 8). It is measured from the surface of the rain garden at its lowest point to the elevation of the outlet. Rain gardens generally should range between 6 and 24 inches in ponding depth, adding 2–4 inches of extra depth below the outflow for safety.

Drainage rate	Suggested rain garden ponding depth
Between 1/2 and 1 inch/hour	12–24 inches
Between 1 and 2 inches/hour	6–8 inches
Faster than 2 inches/hour	6 inches

Dig safely!

It's the law in the state of Oregon to call the Utility Notification Center by dialing 811 or 1-800-332-2344 before beginning any excavation. The service is free and convenient for homeowners, contractors, excavators, landscapers, etc. Anyone planning to dig must contact the Center at least *two business days prior to digging,* in order for the underground utilities to be located and accurately marked using color-coded paint. For more information on digging safely, visit the OUNC Web site: www.digsafelyoregon.com.

Delineate the rain garden

Use a garden hose, string, stakes, or marking paint to delineate the boundary of the rain garden on the site. Before you dig, be sure to note any existing utilities or vegetation that might be damaged by digging (see note above).

Getting water to the rain garden

Your garden will not actually be managing storm-water if it does not collect rain water from your home's impervious surfaces. That means you must find ways to get water from your collection points to your garden, sometimes by digging trenches, running gutter extenders, or even building artificial streams that run only when the rain falls. The water may be routed using a pipe, rock tiles, or other hard surfaces, or a small swale (ditch) lined with rock (3/4-inch diameter, washed drain rock or pea-sized gravel). If using a pipe, we recommend a 4-inch diameter ABS.

If not using a rock-lined trench, the outlet of the routed water and inlet of the rain garden should be lined with rock (again, 3/4-inch diameter, washed drain rock or pea-sized gravel) to prevent erosion. In addition, a 4-inch-wide strip of grass could be used to filter and settle sediment from your rain water before it enters the rain garden.

Figures 9a and b: *Delineating rain garden boundaries with a garden hose (top) and marking paint (above).* *(Photos by Robert Emanuel, OSU)*

Photo: Portland Bureau of Environmental Services

Figure 10: *Moving water from a gutter to a garden can be as simple as a piece of buried 4-inch drain pipe. Note that the pipe is buried at least 12" below the surface as required by Oregon's plumbing code. See note on page 19.*

Figure 11: *Using a rock-lined trench to convey water across a walkway (Photo: Portland Bureau of Environmental Services [BES])*

Figure 12: *Trench drain through a sidewalk at a building in Portland. (Photo: Derek Godwin, OSU)*

Figure 13 (right): *A "dry" stream bed conveys water across a surface before it enters a rain garden. (Photo: Judy Scott, OSU)*

Disconnecting downspouts

Disconnecting downspouts is an important part of rain garden construction. Avoid creating safety and structural problems when disconnecting any downspouts from your storm sewer by following these safety guidelines:

- Don't disconnect a downspout in an area that is too small to drain the water properly.
- Disconnected downspouts must be extended to discharge water at least 6 feet from a structure with a basement or 2 feet from a crawl space or slab foundation.
- Direct water away from your structure, a retaining wall (by at least 10 feet), a septic drain field, or an underground storage tank.
- The end of the downspout extension must be at least 5 feet away from a neighboring property and 3 feet from a public sidewalk. Do not direct water toward a neighboring property, especially on a steep slope.

Steps for disconnecting:

1. Measure the existing downspout from the top of the standpipe, and mark it at least 9 inches above the standpipe. A standpipe is the pipe leading into the below-ground storm sewer.
2. Cut the existing downspout with a hacksaw at the mark. Remove the cut piece.
3. Plug or cap the standpipe. Do not use concrete or another permanent sealant.
4. Attach an elbow to the newly cut downspout by inserting the elbow over the downspout. Then use at least two sheet-metal screws to secure the two pieces.
5. Measure and cut the downspout extension so that when it is attached, you will be following the safety guideline above. Fit the extension over the elbow and attach it with sheet-metal screws.
6. If the extension does not connect directly to a below-ground pipe or lead into a rain garden, use a splash block or gravel to prevent soil erosion.
7. Remember that each section should funnel into the one below it. All parts should be securely fastened together with sheet-metal screws.

Be sure to maintain your gutter system. Inspect it regularly for leaks, sagging, holes, or other problems. It is a good idea to annually inspect and clear debris from gutters, elbows, and other connections before the rains arrive.

This material is condensed from "How to Manage Stormwater: Downspout Disconnection," City of Portland Bureau of Environmental Services publication BS 07011. It is used here with permission of the City of Portland, BES. The full document can be found at www.portlandonline.com/bes/index.cfm?c=46962&a=188637.

Figure 14. *Downspout connected to downspout extension that directs flow away from a building's foundation. Note sheet-metal screws.*
(Photo: Robert Emanuel, OSU)

Designing for overflow

When properly sized, a rain garden is designed to handle roughly 80–90 percent of the water that falls on a given impervious surface. Therefore, extreme events should be considered when designing your garden. For this reason, it is critical to include plans for overflow. This should be a notch or a pipe in the berm, at least 2 inches lower than the berm. The overflow could lead to one of several options:

Figure 15: *Curb-cut inlet for a parking lot and an overflow device (pipe and screen) for a parking lot in Gresham, Oregon.* *(Photo: Derek Godwin, OSU)*

Figure 16: *PVC pipe outflow from a coastal Oregon rain garden. The rocks, mulch, and gravel help protect the area from erosion.* *(Photo: Robert Emanuel, OSU)*

- a flat area in your home landscape where water can be safely absorbed,
- another rain garden,
- a French drain or rock-filled soakage trench,
- a swale or drainage ditch, or
- return stormwater to its original destination before the rain garden was built (such as a public sewer, street gutter, storm drain, or pipes and catch basin).

Be sure to discuss your plans for overflow with your local planning department. They typically have specific, approved locations for draining the overflow off-site. They may also require a permit for a rain garden.

Figure 17: *A rain garden in Gresham, Oregon, fills with rain. Note the use of rocks at the outflow point near top.* *(Photo: City of Gresham)*

Note: For smaller gardens, or gardens in high rainfall areas with soils with low infiltration rates, you will need to take extra care in routing the overflow away from the garden in a safe manner.

Keys to success

Permits and design modifications:
Check with your local government (city or county planning department) to

- find out whether you can legally build a rain garden (and whether you need a permit)
- get information on disconnecting downspouts or routing water off the site
- learn about any design requirements or setbacks

You may decide that you need the help of a licensed landscape professional or engineer.

Be kind to trees:
It's a good idea to avoid placing a rain garden beneath the drip line of large trees. The tree roots will be damaged by the excavation and may also be overwhelmed by the amount of water that pools beneath them.

When is the best time to build?
The following schedule is recommended to prevent soil compaction, maintain the soil's ability to infiltrate stormwater, and minimize the need for watering the plants:

- Conduct site assessments and design the garden in the fall, winter, and spring when the soil is wet but not frozen;
- Excavate and build the garden when the soil is dry enough to work with easily; and
- Plant vegetation in the fall and as early as possible the following spring.

STEP 5: Constructing a rain garden

Excavation, grading, and berms

Plan to place the spoils to the outside edge of the garden and away from the inflow point. Use the spoils and any excess soil amendments to form the berm that bounds the rain garden on one or more sides, depending on the terrain. Berms should be built to have at least 2 inches of height above the elevation of the outlet.

Whether digging by hand or machine, excavate the soil from the outer edge of the rain garden to minimize soil compaction.

We recommend that the slope on the rain garden berm be at least 18 inches of horizontal length to 6 inches of vertical height (3:1) or flatter on both sides of the berm. If the rain garden is 12 inches in depth, you will need to have 36 inches of slope on either side of the berm.

Figure 18: *Excavator is located outside of the rain garden in order to make sure the machine does not compact soil in the rain garden.*
(Photo: Robert Emanuel, OSU)

Grading

The rain garden sizing process assumes the bottom of the garden is level and the sides are graded to a 3:1 slope. Even if the rain garden is constructed on a slight slope, the bottom of the garden should be approximately level to allow water to be distributed evenly throughout. We recommend you use a line level, stakes, and measuring tape to ensure that the total surface area and depth (storage volume) are built as designed in Step 3. Do this by placing a string across the surface and hanging a line-level on it. Then measure the distance from the string to the soil surface at frequent intervals. You should do this throughout the garden's ponding surface (see Figure 19, below).

Figure 19: *Grading is made simpler by using four stakes, one at the inflow point and three at the opposite or lower end of the rain garden—including, most importantly, the outflow point.* *(Photo: Robert Emanuel, OSU)*

Figure 20: *Using a combination of a line level and a measuring tape allows you to grade the base of the garden so that water will not pool in a particular location but will spread across the entire surface as evenly as possible.* *(Photo: Robert Emanuel, OSU)*

Figure 21: *Four-inch ABS storm-drain pipe connects smoothly to a downspout from a roof to a rain garden in Pacific City, Oregon.* *(Photo: Robert Emanuel, OSU)*

Plumbing the rain garden

The overflow point—either a swale or a pipe—should be at least 2 inches below the top of the berm on the downhill side. Similar to the inlet, you place some rock, tile, or other hard materials around this point and at the pipe outfall to minimize erosion. Plants can also be used to reduce soil erosion.

Where pipes are used for inflow and outflow, grading is important to keep erosion at the exit point to a minimum and to keep water from backing up toward your home or other built structure. A good rule of thumb is to grade your pipes to drop about 1 inch for every 10 feet.

Note: Oregon State Plumbing Code requires that any buried utility pipe should be at least 12″ below the soil level starting at the downspout. It also requires underground plumbing to be a durable material such as Schedule 40 ABS or PVC. While corrugated plastic pipes are frequently found in rain gardens (including some photographed in this guide), these materials may not last, especially in colder climates. If using an inflow pipe buried 12 inches deep, a rain garden's finished depth will need to be between 14 and 18 inches.

To amend or not to amend?

Rain gardens depend on healthy plants and soils to capture, clean, and filter the stormwater runoff. As mentioned in Step 1, your soils may need to be amended to ensure strong plant survival and microbial health. Where possible, your existing soil should be tilled to 18 to 24 inches deep if amending with compost, topsoil, or sand. See note on page 20.

Figure 22: *Four-inch ABS pipes here will convey water from this building into a rain garden. Pipes like these must be graded to drop about 1 inch for every 10 feet so water flows away from the building but does not build up too much velocity by the time is arrives in the rain garden.* *(Photo: Robert Emanuel, OSU)*

Figure 23: *The point where water enters a rain garden should be well armored with rock and plants (beach strawberries here) to prevent erosion.* *(Photo: Robert Emanuel, OSU)*

Figure 24: *An outflow notch in a Portland, Oregon, rain garden, protected by rock to prevent soil erosion.* *(Photo: Robert Emanuel, OSU)*

STEP 6: Choose the "right plant for the right place"

Fertilizers and pesticides often contribute to stormwater pollution in streams and lakes. Since rain gardens are designed to treat stormwater runoff, it is very important to choose plants that can survive and thrive without chemical inputs. It is also good practice to choose plants and design your garden to require minimal to no extra water.

Planting zones and plant selection

Plants vary in their tolerance of certain conditions, such as shade, flooding, moisture, and cold temperatures, while maintaining their ability to survive and grow. Rain gardens have zones that vary in wet and dry conditions and possibly sunlight and shade; therefore, plants need to be selected based on their tolerance to these conditions and placed in the corresponding zone to survive and thrive. Furthermore, plants need to be chosen based on their ability to survive in the climate relative to the region in Oregon in which they are planted (that is, Willamette Valley, coast, southwest, central, and east). Rain gardens are generally meant to be low maintenance.

Figure 25: *Rock, gravel, and sedges protect the inflow point in a rain garden.*
(Photo: Chris LaBelle, OSU)

Compost

Compost helps the soil hold moisture, increase microbial activity, improve its ability to filter and adsorb pollutants, and increase plant survival in the first few years as it slowly biodegrades. Be sure to use weed-free mixes.

! Note: Rain garden plants do not have to be wetland or water plants. In fact, they should be able to tolerate drying out for long periods with little to no supplemental irrigation, depending on where you live in Oregon and how long the plants have been established.

Rain gardens can be divided into three zones, relative to their wet and dry conditions: moist, moderate, and dry. If you select plants from the lists provided in this guide, be sure to pay attention to their designation as tolerant of "moist," "moderate," and "dry" soil conditions. Use plants that are designated as doing best in "moderate" and "dry" conditions only on the slopes or otherwise dry parts of the garden. Do not put a plant that cannot tolerate "wet feet" in the bottom or wettest part of your garden, because it could drown during rainy periods.

Soil type will also influence the plants and the size of different moisture zones. For example, rain gardens built in high-clay or slow-draining soils should be planted with more plants that tolerate "wet feet," while rain gardens in sandy or fast-draining soil can be planted with more dry-adapted plants (listed here with "moderate" or "dry" designations). In fast-draining rain gardens, group your moisture-loving plants within a few feet of the inflow points.

RAIN GARDEN DICTIONARY:

Zones of wet and dry conditions

- **Moist:** plant prefers moist soil and tolerates dry soil other times of the year.
- **Moderate:** plant can tolerate moist and dry soils equally.
- **Dry:** plant tolerates and even thrives in dry soil during most of the year.

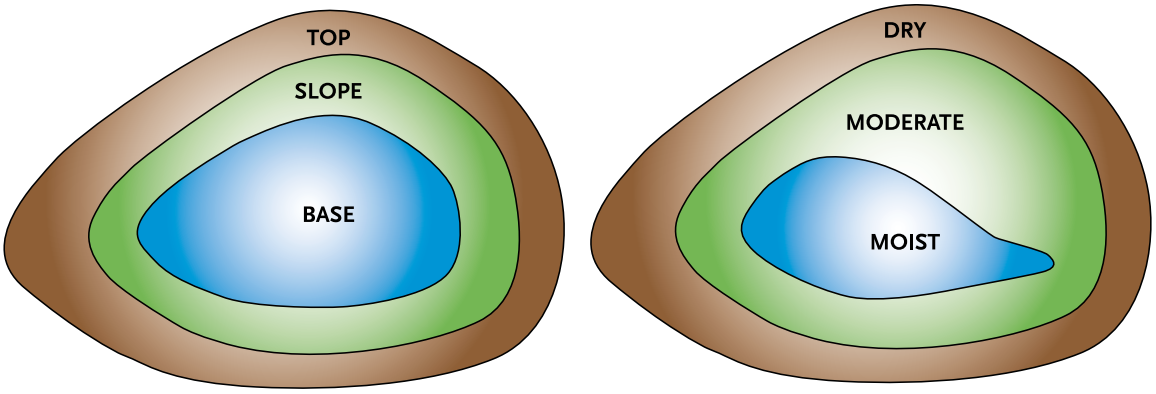


Figure 26: *Planting zones reflect the areas where the garden will have the most and least water when flooded, as well as during the dry season. The graphic on the left illustrates the topographic zones of the rain garden, the graphic on the right illustrates zones of high and low soil moisture during the dry season.*
(Graphic: Robert Emanuel, OSU)

- Filling up the rain garden and watching it drain several times will help you visualize where water pools and where it drains quickly. This will help you choose the "right plant for the right place."
- Visit local examples of rain gardens to get ideas of what plants thrive and how the design works in your local area.

Because this guide was written with most of Oregon in mind, we recommend that gardeners use the lists and designs provided here as suggestions, not as ironclad rules to follow. Be creative, and be prepared to experiment with the garden; garden areas and conditions are always variable, and no design is fail-safe.

- Remember that plants can do some of the work to make a rain garden easier to maintain. Some especially tough plants, such as sedges or bunch grasses, should be grouped around features like inflow and outflow points, to slow down water as it enters the rain garden. Use groundcovers on berms and other areas where erosion is a concern. Several designs are suggested on pages 28–35.

! The area around your inflow will retain the most moisture in your rain garden, meaning that what you plant there must be the most tolerant of moist soil.

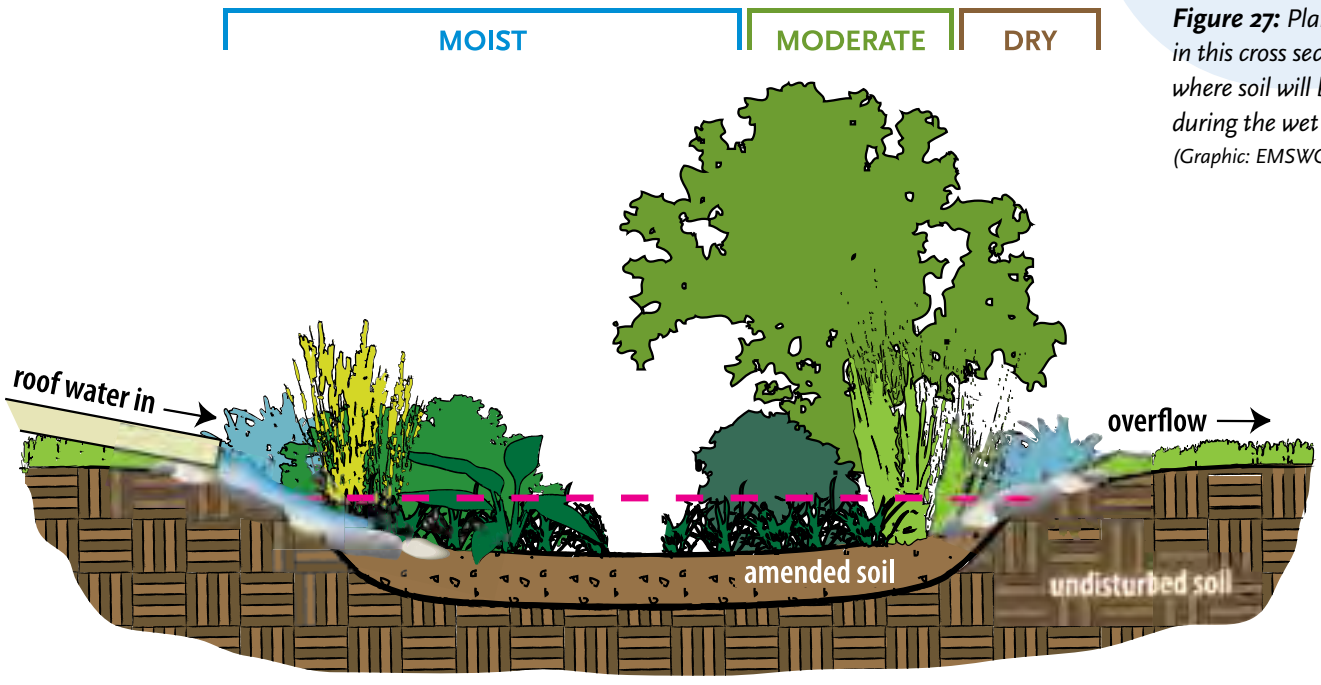


Figure 27: *Planting zones in this cross section illustrate where soil will be moist during the wet season.*
(Graphic: EMSWCD)

Key plant characteristics

Other plant characteristics and plant selection
While rain gardeners should focus on selecting and placing plants that may tolerate more or less water, there are other characteristics to note. Remember, rain gardens can and should be attractive features in your landscape, rather than just places to treat stormwater. Other characteristics to consider include:

- What is the plant's height and width?
- Does the plant have attractive foliage, flowers, or fruit?
- Does it attract beneficial insects and wildlife?
- Does it look good with neighboring plants and landscape?
- Seasonality
- Shade tolerance
- Temperature requirements

! Remember that plants grow! This simple fact should keep you from overplanting your rain garden or placing plants too close together. Respect their ultimate size requirements and keep in mind that these vary throughout Oregon.

Planting tips

When planting, be sure to dig a planting hole at least as big as the pot, if the soil has been amended. If you are planting into unamended soil, dig a hole that is at least twice the diameter but the same depth as the pot. Most native and nonnative plants need to be planted at the same depth as they were growing in their pots. Leave some compost and soil mixture mounded at the bottom, as appropriate, to keep your plant at the same level as it was in its original container.

Carefully remove the plant from its container. If the plant roots have formed a solid mass around the outside of the pot, gently loosen them or carefully score the outside layer with a sharp knife. Lower the root ball into the planting hole slowly, to prevent cracking or breaking of the soil around the roots. If the root ball was opened up, spread some of the roots over the mound in the center of your hole.

Backfill your hole with well-drained soil rich in compost, being careful to make sure you do not cover the crown of the plant if it was exposed in the original container. Be sure to firm the soil around the plant and water well with a slow stream of water or soaker attachment.

A note about invasive species

Invasive plants such as English Ivy, Japanese knotweed, spurge laurel, or butterfly bush cost Oregonians millions of dollars in control, prevention, and direct economic losses. An invasive plant is one that escapes cultivation and multiplies in other habitats, to the near exclusion of species that would occur naturally.

Gardens and gardeners are among the most important pathways for invasive plants to move into new places. You can help stop the biological invasion by eliminating known invasive plants from your garden; preventing the introduction of new, aggressive plants; and replacing nonnative invaders with friendly native plants in your landscape.

For common invasive plants to avoid as well as some excellent alternatives, consult the publication *GardenSmart Oregon*, available at www.oregoninvasivespecieshotline.org and through your local Soil and Water Conservation District or OSU Extension Service office.

Mulching

Mulch is another important part of the rain garden. It will help shade the soil and keep it cool and may increase soil moisture during the dry summer and fall months. The right mulch can also help control weeds. More importantly, microbial activity in the mulch helps to break down some of the common pollutants in stormwater. For this reason, we recommend always applying mulch to new rain gardens and maintaining some mulch in established ones.

Double-shredded conifer bark mulch (also known as "bark dust") is probably the most commonly used in landscape plantings in the Pacific Northwest. Douglas-fir and hemlock are the most commonly sold barks, although pine bark is also available. Bark mulch is available in a range of grades, from fine through medium to large bark nuggets. We recommend using fine-grade bark mulch rather than nuggets, as the latter will float. We do not recommend using sawdust or grass clippings, as these materials will alter your soil chemistry and can affect the ability of the garden to support healthy plants.

Apply mulch at a rate of 2–3 inches evenly across the rain garden on the edges or slopes of your rain garden. If you choose not to use bark mulch in the lowest point of the garden, then be sure to apply a 2- to 3-inch depth of compost instead.

Rocks and gravel are often used at inflow and outflow areas to dissipate energy from water and prevent erosion. They will also make maintenance in the rain garden easier. Rock and gravel are important design elements that can add interest to the rain garden. Washed pea gravel is an attractive small-grade rock for use in the base of the rain garden.

Compost is another alternative for covering the base of the rain garden. It will not suppress weeds as well as wood chips or other materials, but it will succeed in adding fertility to the soil and in filtering pollutants. More finely textured compost is less likely to float in heavy rains. Apply compost at the same rate as indicated in the chart to the right.

How much mulch?

To calculate the total cubic yards of mulch needed for your rain garden project, follow these steps:

1. Multiply the length of your rain garden by the width to find the square footage.
2. Multiply that square footage by 0.25, which will equate to 3 inches of mulch.
3. Divide that value by 27 to yield cubic yards of mulch needed for your project.

The steps above can be used to quickly estimate the necessary amount of mulch to purchase based on various depths of mulch. Remember not to pile mulch alongside the stem of plants. Mulch is moist and can lead to rotting around the stem. Also, remember to break up any mulch that may be dry or clumped together as you spread it over your rain garden.

For more information on mulches, please consult: Bell, N., D. M. Sullivan, and T. Cook. 2009. Mulching Woody Ornamentals with Organic Materials. *EC 1629-E. extension.oregonstate.edu/catalog/pdf/ec/ec1629-e.pdf*

Cubic yards of mulch	Rain garden square feet and mulch coverage based on depth		
	1″	2″	3″
1	338 sq. ft.	158 sq. ft.	108 sq. ft.
2	676 sq. ft.	316 sq. ft.	216 sq. ft.
3	1,014 sq. ft.	474 sq. ft.	342 sq. ft.
4	1,352 sq. ft.	632 sq. ft.	432 sq. ft.
5	1,690 sq. ft.	790 sq. ft.	540 sq. ft.
6	2,028 sq. ft.	948 sq. ft.	648 sq. ft.
7	2,366 sq. ft.	1,106 sq. ft.	756 sq. ft.
8	2,704 sq. ft.	1,264 sq. ft.	864 sq. ft.
9	3,042 sq. ft.	1,422 sq. ft.	972 sq. ft.
10	3,380 sq. ft.	1,580 sq. ft.	1,080 sq. ft.

Figure 28: *A rain garden that is mulched with gravel rather than bark.* *(Photo: Portland BES)*

Figure 29: *Gravel, rocks, and even driftwood add to the interest in this rain garden. The pea gravel also acts as mulch, helping to retain soil moisture while at the same time minimizing erosion.* *(Photo: Robert Emanuel, OSU)*

Watering a rain garden

Even after you have chosen and carefully planted "the right plant in the right place" and mulched the garden, it is important to make sure new plants get sufficient water during their first and possibly second dry summer season, until they are fully established. This is especially true if the rain garden was planted in the spring or summer.

As with any watering regime, water deeply and slowly during the coolest time of the day (evenings if possible). Soaker attachments or soaker hoses are particularly useful for this purpose. Use a soil probe or stick to check whether moisture is present in the rain garden at a depth greater than 2–3 inches.

After the first or second dry season, depending upon how good the plants look and how hardy they are, you may be able to stop watering altogether and depend on rain entirely. Remember that the more native plants you use in your rain garden and landscape, the less supplemental water you'll need to apply during drought periods.

STEP 7: Maintenance

Weeding, pruning, and mulching

You will need to weed your rain garden during the first couple of years. Try to get out all the roots of the weedy plants. Weeds may not be a problem in the second season, depending on the variety and tenacity of weeds present. In the third year and beyond, the grasses, sedges, rushes, shrubs, trees, and wildflowers will begin to mature and should out-compete most of the weeds. Weeding isolated patches might still be necessary on occasion.

Be sure to maintain the rain garden plants in whatever fashion satisfies you the most—as a "wild"-looking garden, a more manicured space, or something in between. Plants may need to be pruned as appropriate for the look you desire in your garden.

Maintain the organic mulch layer in your rain garden by replenishing it when needed. Apply mulch

Figure 30 (above): *A newly established rain garden in Gresham, Oregon (Photo: City of Gresham).*

to a 2-inch depth on bare soil. If your rain garden receives any sediment or soil eroded from other locations in your landscape, you may need to clean this out on occasion. It is important also to keep exposed the rocks, tiles, or other hard surfaces you placed in the rain garden to slow water at the inflow and outflow points, so that they can continue to slow down water and prevent erosion.

Depending upon the local climate and plant choice, plants may need supplemental water during the summer. This is especially true in eastern, central, and southern Oregon. The use of native and drought-tolerant plants will help reduce the amount of supplemental irrigation during dry periods.

Figure 31 (right): *This Willamette Valley rain garden is planted with "Autumn Joy" Sedum* (Sedum telephium)*, slough sedge* (Carex obnupta)*, New Zealand sedge* (Carex testacea)*, yellow-eyed grass* (Sisyrinchium californicum) *and mallow* (Malva spp.). *(Photo: Chris LaBelle, OSU)*

Don't drown your plants!

Another consideration is to make sure your plants in the base don't drown in their first winter. Plants need air in the soil, so when the rain garden stays consistently flooded for long, wet winters, it may become necessary to notch the berm at the outlet to a lower elevation or add more notches to the berm. This will help the rain garden drain a little faster and give the plants a chance to establish healthy roots. After the first winter, fill in the notches and allow it to function normally. Some professionals and gardeners even advocate diverting stormwater from the rain garden for the first year or two while plants become established, especially in heavy soils.

Figure 32: *A rain garden in Portland, Oregon.* *(Photo: Portland BES)*

A note about Oregon's regions

Oregon is a much more geographically diverse state than most. Climates and soils can vary significantly between the coast, Willamette Valley, Cascades, eastern high desert, and southwestern mountains. Below are a few tips on region-specific items to be aware of in designing, building, or maintaining a rain garden.

Willamette Valley:

Most of the materials—including many of the plant selections in this guide—will help rain gardeners in the Willamette Valley. With its generally mild seasons, good soils, and mostly flat territory, the Willamette Valley presents few obstacles for rain gardeners. When planning your rain garden for the Willamette Valley, keep these things in mind:

- Summertime temperatures can occasionally exceed 90 degrees; thus, some plants in sunny locations with fast-draining soils will need supplemental irrigation—at least for the first two or three years while roots are becoming established.
- Wintertime temperatures in some locations can drop well below freezing and thus create problems for more tender or sensitive plants. It is important to choose plants adapted to both summer and winter conditions in your area.
- The Willamette Valley contains the state's biggest cities, each of which may have their own requirements for on-site stormwater management (and rain gardens). If you live in Salem, Eugene, Gresham, or Portland, contact your local government for more information.

Coastal Oregon:

With the influence of strong Pacific winds, abundant rainfall, and generally milder temperatures, the coast can be challenging for rain gardeners but also presents some great opportunities. When planning your rain garden on the coast, keep these things in mind:

- Strong winds can dry out and damage plants any time of the year, especially for gardens located near the beach. Provide for shelter, or plan your plant selections to take account of the wind damage. Additional water may be necessary during

Figure 33: *Rain garden at Astor Elementary School in Portland, OR.* *(Photo: Candace Stoughton, EMSWCD)*

the summer months, when drying winds can be most damaging for newly established rain garden plants.

- On the Oregon coast, rainfall is very abundant. Where coastal soils drain at less than 1 1/2 inches per hour, size the rain garden to at least 15 percent of the impervious surface. For example, a rain garden is designed to capture runoff from a 300-square-foot surface. Hence, the calculation is 300 x .15 = a 45-square-foot rain garden. Consult our online materials at extension.oregonstate.edu/watershed/rain-gardens for more information on using the "modeling method" to size your rain garden for your soil and precipitation.
- Some beach homes are built on fossilized sand dunes. Soils on and around these geologic features will drain extremely rapidly, often in excess of 2 inches per hour, making a rain garden unnecessary or impractical. Furthermore, the additional water from a rain garden built on a fossilized dune may cause it to slump or even collapse. We do not recommend constructing a rain garden under these conditions.

Southwestern, central, and eastern Oregon:

Gardening in southwestern, central, or eastern Oregon can be rewarding but has its own set of challenges. These arid and semi-desert regions are characterized by volcanic, rocky, or clay soils, and steep slopes. And if that isn't enough, many gardeners must balance these restrictions with hungry deer and the reality of living in a wildfire-prone area.

When planning your rain garden for either region, keep these factors in mind:

- If you live in a fire-prone area, avoid using plants in your rain garden that are flammable. Plants with dry material (such as leaves or needles) and those with fine structure, aromatic leaves, loose bark, or resinous sap tend to be flammable. Consult the Extension publication *Fire-Resistant Plants for Oregon Home Landscapes* for more information and a list of fire-resistant plants (available online at extension.oregonstate.edu/emergency/FireResPlants.pdf or by visiting your local OSU Extension Service office).
- These semi-arid regions have long, dry summers with very little rainfall. Depending on your plant choice, it may be necessary to irrigate your rain garden two to three times each summer to keep the plants healthy, attractive, and fire-resistant.
- If deer plague your garden, use rain garden plants that are also deer-resistant. Although few plants are truly deer-resistant in every situation, most nurseries can provide a list of plants that deer tend to avoid.
- Central and eastern Oregon winters are longer and colder than in other areas of Oregon. Plants may not establish new roots well in frozen soils. Plan to construct and plant your garden early enough in the late summer to allow for plants to become established. Native plants that can handle the annual swings in temperature will survive best in a low-care rain garden.
- If you live in a location with fast-draining volcanic soils, you might want to make your rain garden shallower or smaller, depending on your space constraints or needs. Consult our online materials at extension.oregonstate.edu/watershed/rain-gardens for more information on using the "modeling method" to size your rain garden for your soil and precipitation.

Sample Rain Garden Layouts

These sample rain garden layouts use plants suitable for the state's different regions. Consider whether you want your garden to be formal, informal, round or square. Use these designs to give you ideas for how to incorporate different types of plants into the wetter and drier zones of your rain garden.

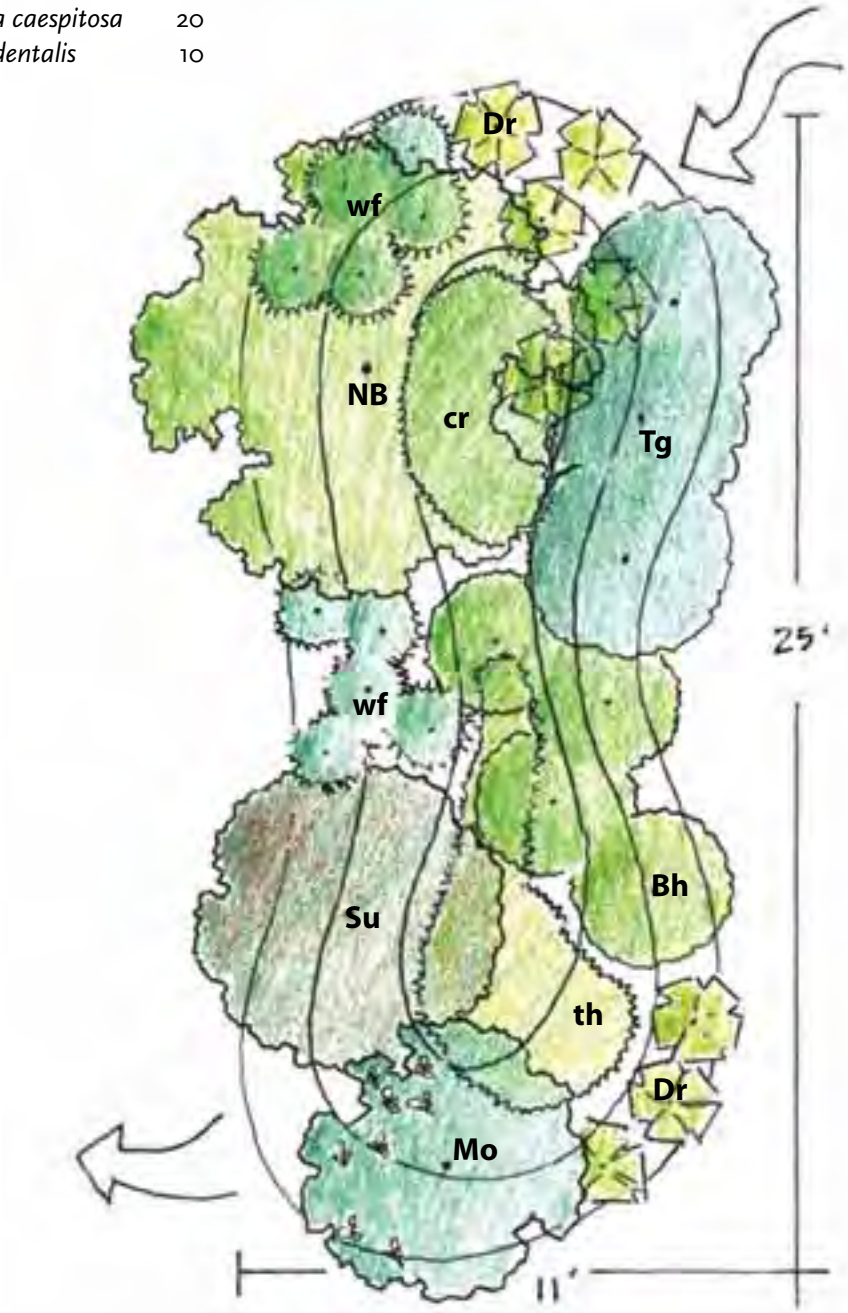
The abbreviations used will help you see at a glance which type of plant is being referenced. Two capital letters denote a tree; a capital and lower-case combination denotes a shrub; and two lower-case letters mean the plant is a perennial, rush, sedge, or grass.

CENTRAL OREGON SUN

Abbr.	Common name	*Scientific name*	Qty.
SS	Smooth sumac	*Rhus glabra*	1
Ds	Douglas spiraea	*Spiraea douglasii*	3
Dr	Dwarf redtwig dogwood	*Cornus sericea* Kelseyi	11
Gc	Golden currant	*Ribes aureum*	1
Os	Oceanspray	*Holodiscus discolor*	1
gr	Canada goldenrod	*Solidago canadensis*	13
cr	Common rush	*Juncus effusus var. pacificus*	22
dr	Dagger-leaf rush	*Juncus ensifolius*	13
lp	Large-leaf lupine	*Lupinus polyphyllus*	13
pc	Purple coneflower	*Echinacea purpurea*	6
yr	Yarrow	*Achillea millefolium*	9

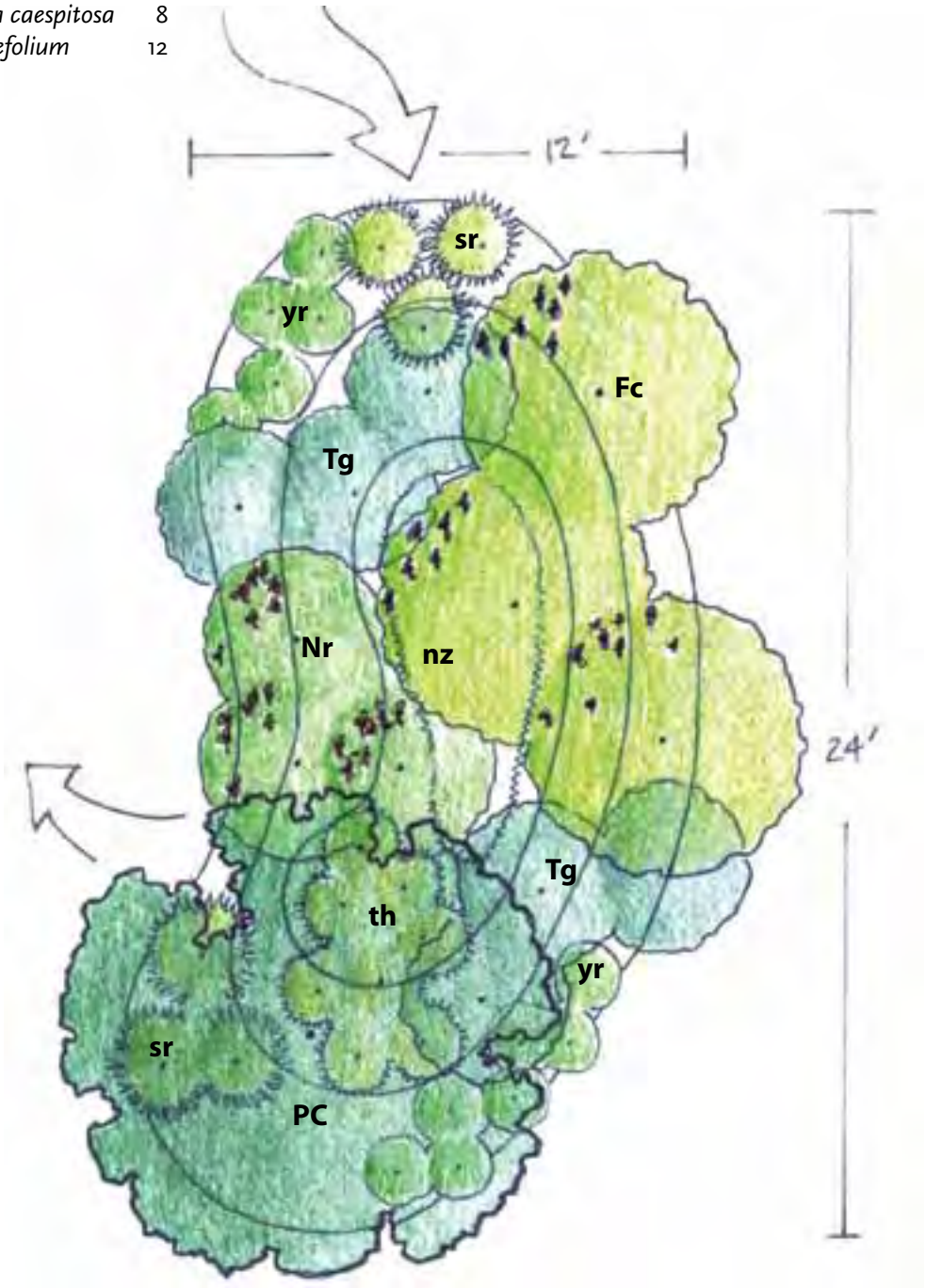
CENTRAL OREGON SHADE

Abbr.	Common name	*Scientific name*	Qty.
NB	Pacific ninebark	*Physocarpus capitatus*	1
Bh	Black huckleberry	*Gaylussacia baccata*	4
Dr	Dwarf redtwig dogwood	*Cornus sericea* Kelseyi	8
Su	Gro-low sumac	*Rhus aromatica* Gro Low	1
Mo	Mock orange	*Philadelphus lewisii*	1
Tg	Tall Oregon grape	*Mahonia aquifolium*	3
cr	Common rush	*Juncus effusus var. pacificus*	13
th	Tufted hairgrass	*Deschampsia caespitosa*	20
wf	Western fescue	*Festuca occidentalis*	10



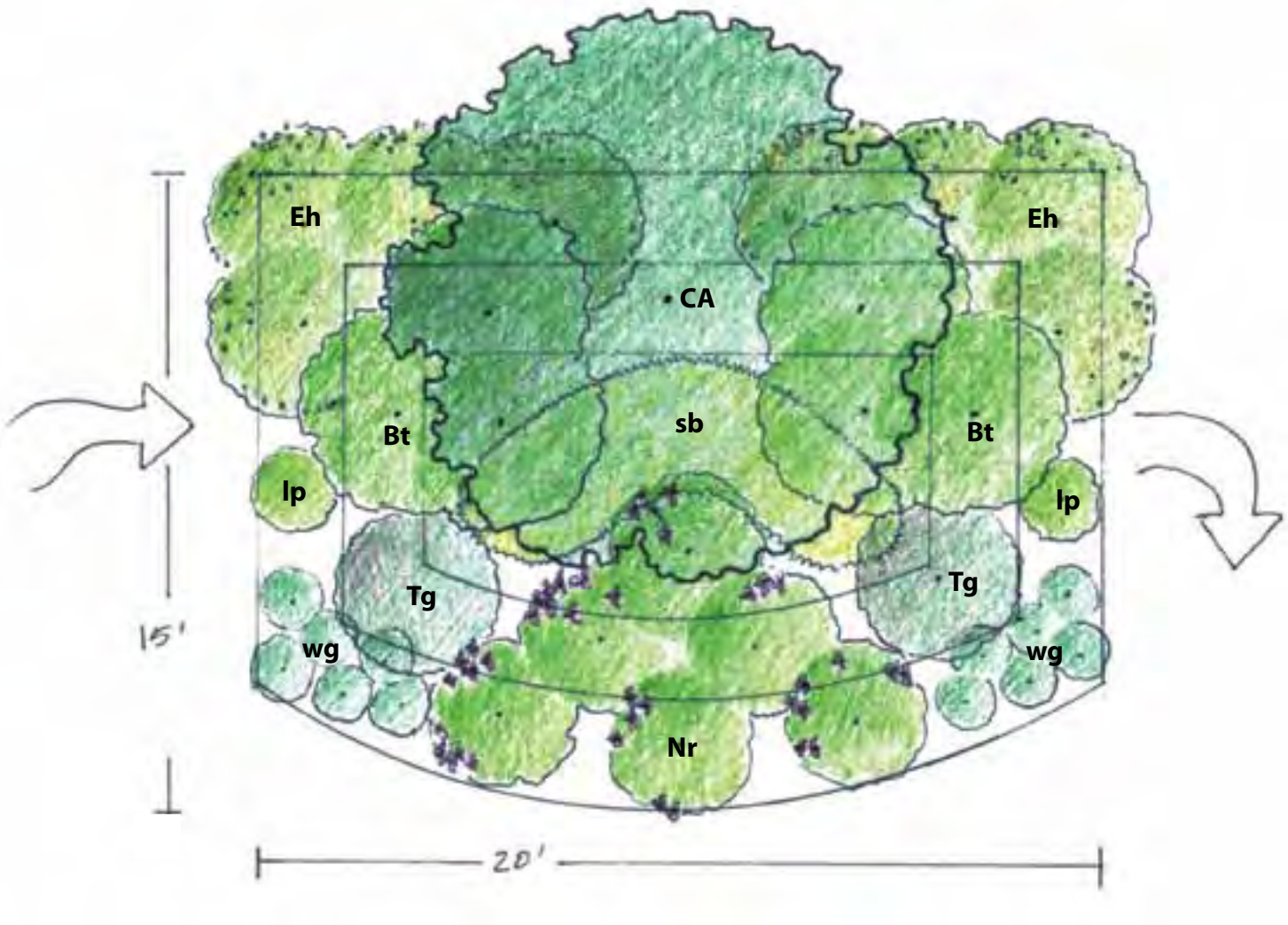
SOUTHWEST OREGON SUN

Abbr.	Common name	*Scientific name*	Qty.
PC	Pacific crabapple	*Malus fusca*	1
Fc	Flowering currant	*Ribes sanguineum*	3
Nr	Nootka rose	*Rosa nutkana*	3
Tg	Tall Oregon grape	*Mahonia aquifolium*	6
nz	New Zealand sedge	*Carex testacea*	14
sr	Spreading rush	*Juncus patens*	6
th	Tufted hairgrass	*Deschampsia caespitosa*	8
yr	Yarrow	*Achillea millefolium*	12



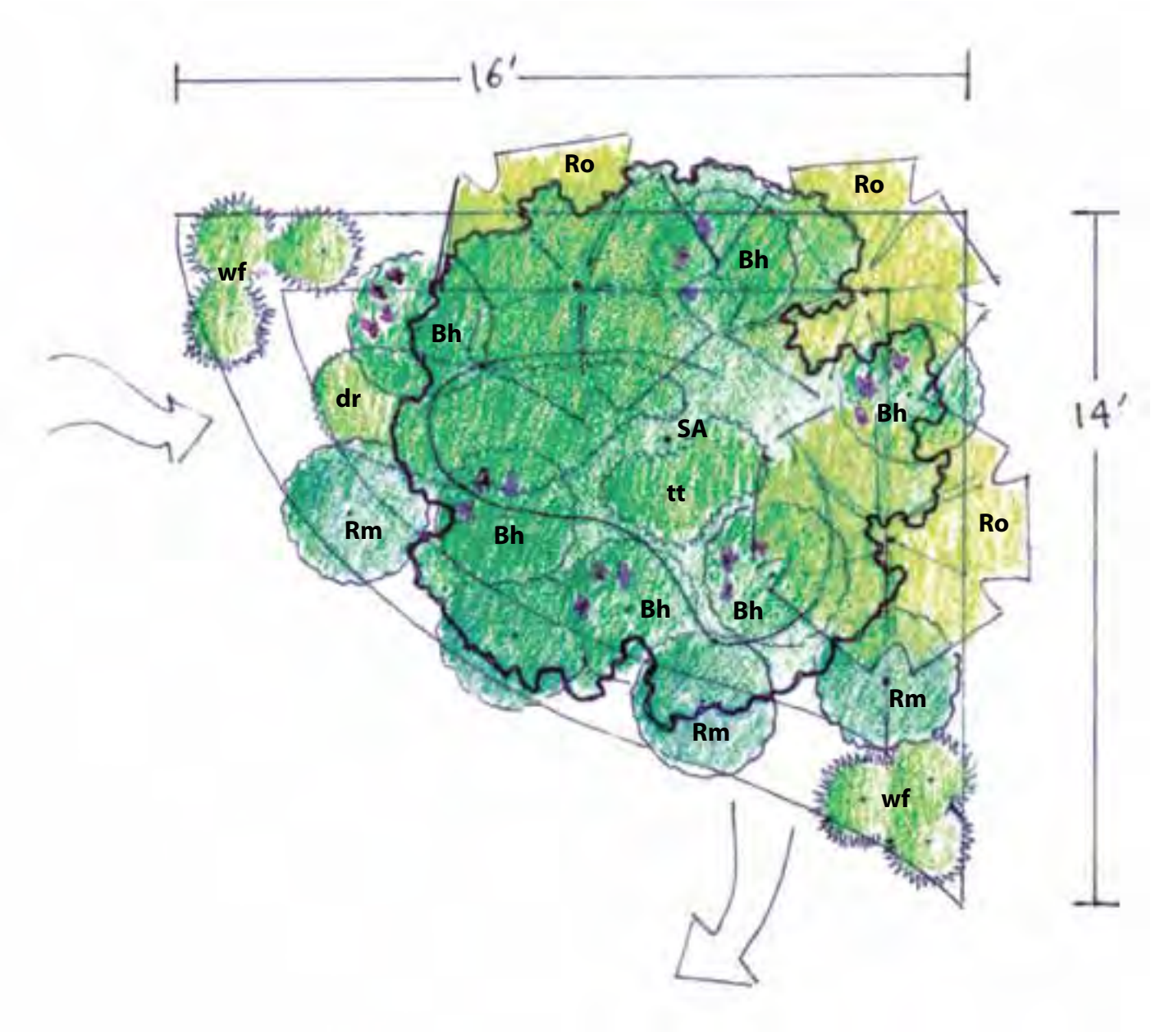
SOUTHWEST OREGON SHADE

Abbr.	Common name	*Scientific name*	Qty.
CA	Cascara	*Rhamnus purshiana*	1
Bt	Black twinberry	*Lonicera involucrata*	6
Eh	Evergreen huckleberry	*Vaccinium ovatum*	8
Nr	Nootka rose	*Rosa nutkana*	6
Tg	Tall Oregon grape	*Mahonia aquifolium*	2
lp	Large-leaf lupine	*Lupinus polyphyllus*	2
sb	Santa Barbara sedge	*Carex barbarae*	16
wg	Wild ginger	*Asarum caudatum*	12



WILLAMETTE VALLEY SUN

Abbr.	Common name	*Scientific name*	Qty.
SA	Sitka alder	*Alnus viridis ssp. sinuata*	1
Bh	Baldhip rose	*Rosa gymnocarpa*	6
Ro	Red osier dogwood	*Cornus sericea*	3
Rm	Rosemary	*Rosemarinus officianalis*	4
dr	Dagger-leaf rush	*Juncus ensifolius*	25
tt	Taper-tipped rush	*Juncus acuminatus*	10
wf	Western fescue	*Festuca occidentalis*	6

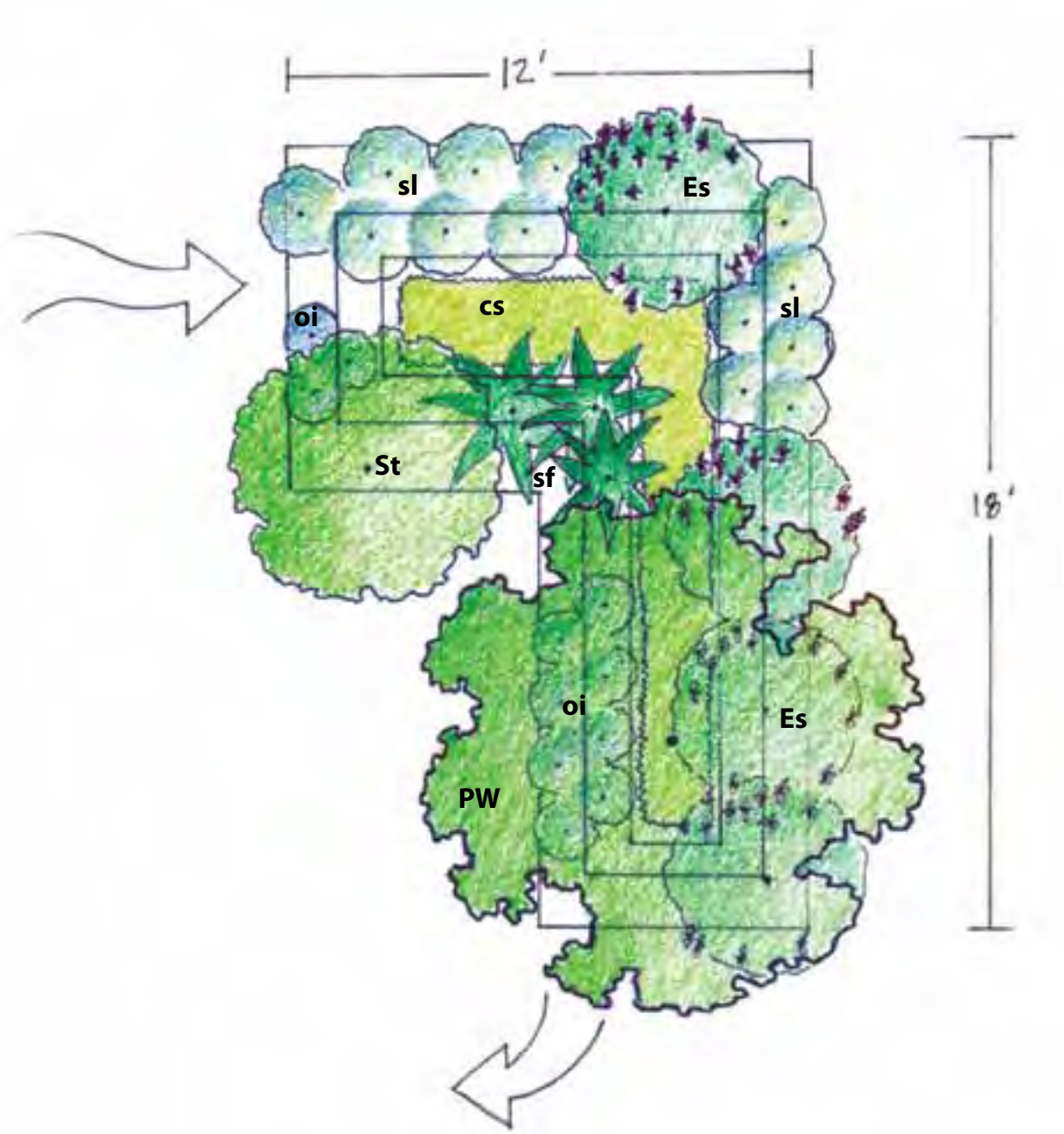


WILLAMETTE VALLEY SHADE

Abbr.	Common name	*Scientific name*	Qty.
VM	Vine maple	*Acer circinatum*	1
Dg	Dull Oregon grape	*Mahonia nervosa*	14
Dr	Dwarf redtwig dogwood	*Cornus sericea* Kelseyi	9
Sb	Snowberry	*Symphoricarpus alba*	3
ds	Dense sedge	*Carex densa*	13
br	Small-fruited bulrush	*Scirpus microcarpus*	11

OREGON COAST SUN

Abbr.	Common name	*Scientific name*	Qty.
PW	Pacific willow	*Salix lucida ssp. lasiandra*	1
Es	Dwarf escallonia	*Escallonia* Newport Dwarf	4
St	Silktassel	*Garrya elliptica*	1
cs	Curly sedge	*Carex rupestris*	32
oi	Oregon iris	*Iris tenax*	11
sl	Spanish lavender	*Lavandula stoechas*	13
sf	Sword fern	*Polystichum munitum*	3



OREGON COAST SHADE

Abbr.	Common name	*Scientific name*	Qty.
IP	Indian plum	*Oemleria cerasiformis*	1
Bb	Blue-ridge blueberry	*Vaccinium pallidum*	3
Cl	Common lilac	*Syringa vulgaris*	1
Dr	Dwarf redtwig dogwood	*Cornus sericea* Kelseyi	6
cr	Common rush	*Juncus effusus var. pacificus*	8
bh	Pacific bleeding heart	*Dicentra formosa*	13
ss	Slough sedge	*Carex obnupta*	13
sf	Sword fern	*Polystichum munitum*	6

Rain Garden Plant List: Trees and Shrubs

See page 20 for tips on choosing rain garden plants. Note that plant size will vary by location. Consult your nursery or OSU Extension Service office for locally accurate size information.

TREES AND SHRUBS

	Common Name *Scientific Name*	Oregon Native	Willamette Valley	Coast	Central/East	Southwest	Moisture Zone	Sun Requirements	Height	Width	Plant Characteristics
 Jim Pollock	**Vine maple** *Acer circinatum*	Y	X	X	X	X	moderate, dry	shade/ part	15–20'	15–20'	Small, multi-stemmed tree, red-orange fall color, excellent soil binder
 Brent Miller	**Sitka alder** *Alnus viridis ssp. sinuata*	Y	X	X	X		wet, moderate	full/ shade	3–15'	10–15'	Fixes nitrogen in soil
 Linda McMahan, OSU Extension	**Red osier dogwood** *Cornus sericea*	Y	X	X	X	X	wet, moderate, dry	full/part	4–8'	4–8'	Red twigs provide winter interest, white flowers in summer
 Teresa Huntsinger	**Dwarf redtwig dogwood** *Cornus sericea* Kelseyi	Y	X	X	X	X	wet, moderate, dry	shade/ full	2'	2'	Red twigs provide winter interest, white flowers in summer
 Rebecca Gebeshuber	**Dwarf escallonia** *Escallonia* Newport Dwarf	N	X	X		X	moderate, dry	part	3'	4'	Evergreen, flowers in late summer, fragrant
 Pete Veilleux	**Silktassel** *Garrya elliptica*	Y		X		X	dry	full	6–12'	6–12'	Evergreen, flowers in spring, berries attract wildlife
 Marielle Anzelone	**Black huckleberry** *Gaylussacia baccata*	N			X	X	wet, moderate, dry	shade/ full	1–3'	3'	Flowers in summer, edible berries, likes acidic soil

Trees and Shrubs

	Common Name *Scientific Name*	Oregon Native	Willamette Valley	Coast	Central/East	Southwest	Moisture Zone	Sun Requirements	Height	Width	Plant Characteristics
 Pete Veilleux	**Ocean spray** *Holodiscus discolor*	Y	X	X	X	X	moderate, dry	full/part	4–8'	3–6'	Flowers in summer, attractive to wildlife, good soil binder
 Mate Adamkovics	**Spanish lavendar** *Lavandula stoechas*	N	X	X		X	moderate, dry	full	1'	1–2'	Evergreen, pleasant fragrance, attractive summer flowers
 Pete Veilleux	**Black twinberry** *Lonicera involucrata*	Y	X	X	X	X	wet, moderate	part	7'	10'	Yellow flowers in summer, black berries with bright red bracts, attractive to hummingbirds
 M.S. Yamasaki	**Tall Oregon grape** *Mahonia aquifolium*	Y	X	X	X	X	moderate, dry	full/part	4'	4'	Evergreen, yellow flowers in spring, bronze fall color
 Edd Russell	**Dull Oregon grape** *Mahonia nervosa*	Y	X	X	X	X	moderate, dry	shade/ part	2'	2'	Evergreen, yellow flowers in spring, berries attract wildlife
 Karen Haard	**Pacific crabapple** *Malus fusca*	Y	X	X		X	wet, moderate	full/part	10–30'	10–30'	Flowers in spring, attractive to wildlife
 Steve Matson	**Indian plum** *Oemleria cerasiformis*	Y	X	X		X	wet, moderate, dry	part	10'	5'	Flowers very early spring, fragrant leaves, suckering habit
 arrowlakelass@flickr	**Mock orange** *Philadelphus lewisii*	Y	X	X	X	X	moderate, dry	part	5'	3'	Fragrant flowers attract birds, butterflies, and bees, prune to shape

Trees and Shrubs

	Common Name *Scientific Name*	Oregon Native	Willamette Valley	Coast	Central/East	Southwest	Moisture Zone	Sun Requirements	Height	Width	Plant Characteristics
 Pete Veilleux	**Pacific Ninebark** *Physocarpus capitatus*	Y	X	X	X	X	wet, moderate	full/part	6–13'	6–13'	Unique shredding bark, drought tolerant
 Portland Bureau of Environmental Services	**Cascara** *Rhamnus purshiana*	Y	X	X		X	moderate	shade/ full	to 20'	to 15'	Shrub or small tree, yellow fall color
 Karli Scott	**Gro–low sumac** *Rhus aromatica* Gro Low	N			X	X	moderate, dry	full/part	2'	6–8'	Fragrant, orange-red fall color
 John Hagstrom	**Smooth sumac** *Rhus glabra*	Y	X	X	X	X	dry	shade/ full	6–12'	10'	Orange-red fall color, suckering habit
 Doug Waylett	**Golden currant** *Ribes aureum*	Y			X	X	wet, moderate	full	6–8'	6–8'	Frangrant spring flowers, edible fruits
 Linda McMahan, OSU Extension	**Flowering currant** *Ribes sanguineum*	Y	X	X		X	wet, moderate, dry	full/part	10'	7'	Showy, pink flower clusters in spring, attractive to birds
 Pete Veilleux	**Baldhip rose** *Rosa gymnocarpa*	Y	X	X	X	X	wet, moderate, dry	full/part	2–3'	3'	Flowers in summer
 Linda McMahan, OSU Extension	**Nootka rose** *Rosa nutkana*	Y	X	X	X	X	wet, moderate, dry	shade/ full	5'	5'	Large, fragrant, showy flowers in late spring, beware of thorns

Trees and Shrubs

	Common Name / *Scientific Name*	Oregon Native	Willamette Valley	Coast	Central/East	Southwest	Moisture Zone	Sun Requirements	Height	Width	Plant Characteristics
 Victor Farinelli	**Rosemary** *Rosmarinus officianlis*	Y	X	X		X	dry	full	3'	3'	Evergreen, flowering begins in winter, fresh or dried leaves used in cooking
 Neal Kramer	**Pacific willow** *Salix lucida ssp. lasiandra*	Y	X	X	X	X	wet, moderate	full	13'	10'	Male and female catkins are borne on separate plants
 OSU Extension	**Douglas spirea/ hardhack** *Spirea douglasii*	Y	X	X	X	X	wet, moderate, dry	full/part	5'	5'	Pinkish flower clusters in summer
 Oregon Environmental Council	**Snowberry** *Symphoricarpus alba*	Y	X	X	X	X	moderate, dry	shade/ full	6'	4'	Flowers in spring, white berries provide winter interest, excellent soil binder
 New York Botanical Garden	**Common lilac** *Syringa vulgaris*	N	X	X		X	moderate, dry	full/part	15'	6–12'	Showy, fragrant lavender flowers in late spring
 OSU Extension	**Evergreen huckleberry** *Vaccinium ovatum*	Y	X	X		X	moderate, dry	part	to 9'	to 8'	Evergreen, edible berries in late summer, new growth emerges bronze in color, requires acidic soil, prune to shape
 Bruce M. Marshall	**Blue ridge blueberry** *Vaccinium pallidum*	N		X		X	moderate, dry	shade/ full	2–3'	2–3'	Edible berries

NOTES:

Rain Garden Plant List: Perennials

PERENNIALS

	Common Name *Scientific Name*	Oregon Native	Willamette Valley	Coast	Central/East	Southwest	Moisture Zone	Sun Requirements	Height	Width	Plant Characteristics
 OSU Extension	**Yarrow** *Achillea millefolium*	Y	X	X	X	X	moderate, dry	full	2'	2'	Summer flowers, spreads by rhizomes
 Michael G. Shepard	**Wild ginger** *Asarum caudatum*	Y	X	X	X	X	moderate	shade/ part	10"	spreading	Evergreen, pleasant fragrance
 Frans Schmit	**Pacific bleeding heart** *Dicentra formosa*	Y	X	X	X	X	moderate, dry	shade/ part	2'	2'	Delicate foliage with attractive spring flowers
 Jordan Meeter	**Purple coneflower** *Echinacea purpurea*	N	X	X	X	X	moderate, dry	full	3'	2'	Summer flowers, attractive to wildlife
 OSU Extension	**Oregon iris** *Iris tenax*	Y	X	X		X	wet, moderate, dry	full	1'	spreading	Evergreen, grassy foliage, showy spring flowers
 Jon Sullivan	**Large-leaved lupine** *Lupinus polyphyllus*	Y	X	X	X	X	moderate, dry	full/part	3'	2'	Showy spring flowers, fixes nitrogen
 Pete Veilleux	**Sword fern** *Polystichum munitum*	Y	X	X		X	moderate	shade/ full	3'	3'	Shiny, leathery, evergreen leaves

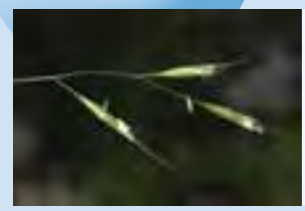
Perennials

	Common Name *Scientific Name*	Oregon Native	Willamette Valley	Coast	Central/East	Southwest	Moisture Zone	Sun Requirements	Height	Width	Plant Characteristics
 Patrick Standish	**Canada Goldenrod** *Solidago canadensis*	Y	X	X	X	X	moderate, dry	full	3'	2'	Pyramidal flower clusters in late summer

RUSHES, SEDGES, AND GRASSES

 Pete Veilleux	**Santa Barbara sedge** *Carex barbarae*	Y				X	wet, moderate	full/part	1–3'	spreading	Evergreen, flowers in summer
 Dr. Dean Wm. Taylor, Jepson Herbarium	**Dense sedge** *Carex densa*	Y	X	X		X	wet, moderate	shade/ full	2'	spreading	Evergreen, good for erosion control, trapping sediment and slowing the flow of water
 Pete Veilleux	**Slough sedge** *Carex obnupta*	Y	X	X	X	X	wet	full/part	2–5'	spreading	Excellent soil binder
 Martin Vavrik	**Curly sedge** *Carex rupestris*	N	X	X		X	wet	shade/ full	14"	spreading	Evergreen
 Claudia Vieira	**Orange New Zealand sedge** *Carex testacea*	N	X	X		X	wet, moderate	full	2–5'	1'	Light green leaves develop red/orange highlights
 Pete Veilleux	**Tufted hair grass** *Deschampsia caespitosa*	Y	X	X	X	X	wet, moderate	full/part	2'	3'	Attractive throughout winter

Rushes, Sedges, and Grasses

	Common Name *Scientific Name*	Oregon Native	Willamette Valley	Coast	Central/East	Southwest	Moisture Zone	Sun Requirements	Height	Width	Plant Characteristics
 Keir Morse	**Western fescue** *Festuca occidentalis*	Y	X	X	X	X	moderate, dry	part	1–3'	1–3'	Inconspicuous yellow flowers and brown seeds. Short-lived (20 years)
 Robert H. Mohlenbrock, USDA–NRCS	**Taper-tipped rush** *Juncus acuminatus*	Y	X	X	X	X	wet	full/part	3'	spreading	Drought tolerant
 Portland Bureau of Environmental Services	**Common rush** *Juncus effusus var. pacificus*	Y	X	X	X	X	wet, moderate	full/part	3–5'	spreading	Tolerant of polluted conditions. Note that European soft rush (*J. effusus var. effusus*) can be invasive. Please use the native Pacific variety.
 Steve Matson	**Dagger-leaf rush** *Juncus ensifolius*	Y	X	X	X	X	wet	full/part	2'	spreading	Flattened stems much like an iris
 Portland Bureau of Environmental Services	**Spreading rush** *Juncus patens*	Y	X	X	X	X	wet	full/part	2'	spreading	Bluish-green foliage
 Denis Bousquet	**Small-fruited bulrush** *Scirpus microcarpus*	Y	X	X	X	X	wet	full/part	4'	spreading	Good soil binder

NOTES:

Figure 34: *Rain garden using a grassy swale as the base.* *(Photo: Candace Stoughton, EMSWCD)*

For more information:

OSU Water and Watershed Education: extension.oregonstate.edu/watershed/rain-gardens

East Multnomah Soil and Water Conservation District: www.emswcd.org

Jackson Soil and Water Conservation District: www.jswcd.org

Oregon Environmental Council: www.oeconline.org/stormwater

Andreoletti, Jessica. 2008. *The Vermont Rain Garden Manual: Gardening to Absorb the Storm.* Winooski Natural Resources Conservation District. www.vacd.org/winooski/winooski_raingarden.shtml

Bannerman, Roger, and Ellen Considine. 2003. *Rain Gardens: A How-to Manual for Homeowners.* UWEX Publication GWQ037 1-06-5M-100-S. University of Wisconsin Extension. clean-water.uwex.edu/pubs/pdf/home.rgmanual.pdf

Dunnett, Nigel, and Andy Clayden. 2007. Rain Gardens: Sustainable Rainwater Management for the Garden and Designed Landscape. Timber Press.

Giacalone, Katie 2008. Rain Gardens: *A Rain Garden Manual for South Carolina*. Carolina CLEAR, Clemson University Public Service. www.clemson.edu/public/carolinaclear/

Hinman, Curtis. 2008. *Rain Garden Handbook for Western Washington Homeowners.* Washington State University Extension. www.pierce.wsu.edu/Water_Quality/LID/Raingarden_handbook.pdf

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