Design Guidance and Permitting Requirements

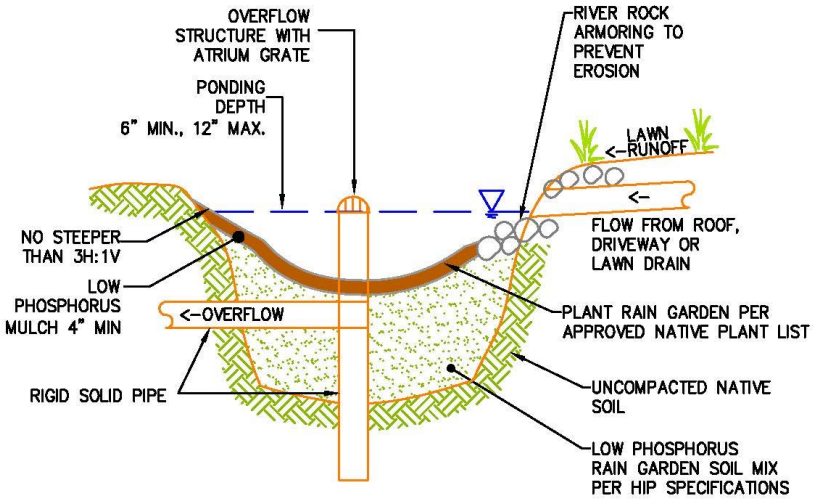
Lake Whatcom Rain Garden

DESCRIPTION

A hybrid underground/surface drainage facility, consisting of special soil mixes and vegetation and constructed with a flat bottom, intended to capture and infiltrate runoff from impervious and pervious surfaces.

METHOD OF PHOSPHORUS REDUCTION

Treatment via infiltration through native soils. Runoff entering the rain garden is detained and allowed to slowly pass through imported and native soil mixes, where phosphorus is bound by, captured within, and recycled into the soil matrix. Plants in the facility attenuate flows through evapotranspiration and reduce nutrient loading by uptake and binding in the vegetative biomass.



SECTION VIEW

Photo source: Stewardship Partners

Photo source: Stewardship Partners

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All rain gardens must meet these minimum requirements in order to be approved for construction under these Design Standards:

DESIGN

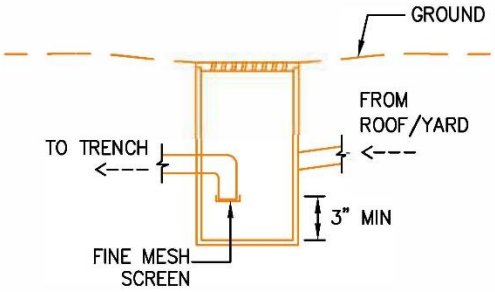
- At least 18" of rain garden soil throughout ponding area
- Total slope of bottom surface less than 2%
- Side slopes 3:1 Horizontal to Vertical or flatter, measured from top of soil mix
- Bottom of soil mix (media) must be more than 1' from groundwater or bedrock
- Low-P mulches from approved list cover all soils with at least 4" deep
- Includes a mix of approved rain garden plants at a minimum density
- Ponding depth cannot exceed 12" or occupy more than half of the side slope area

LOCATION

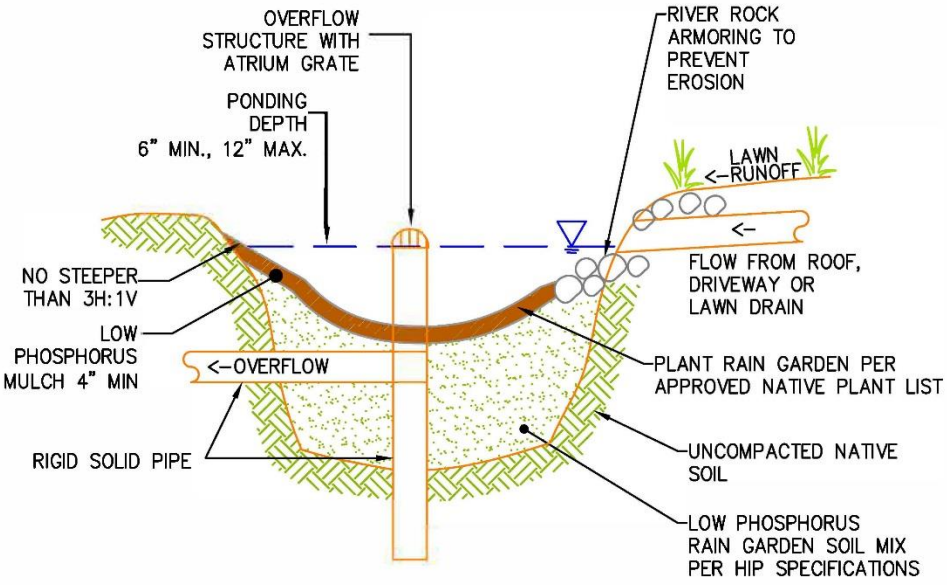
- **Critical Areas:** Setback requirements near critical areas (wetlands, shorelines, or creeks) and their buffers will vary depending on site specifics. Consult with the HIP Coordinator for requirements pertaining to each unique site.
- **Slopes:** unless approved by a licensed geotechnical engineer, rain gardens cannot be placed on slopes >10% and must be at least 10' upgradient from slopes >15% and 50' upgradient from slopes steeper than 35%
- **Separation:** at a minimum, all wetted areas must be at least: 25' from shorelines or creeks 5' from known public and private utilities, 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space. Septic tanks must be protected by placing the rain garden at least 5' from tanks, and 10' upgradient and 30' downgradient from drain fields and drain field reserve areas
- **Property Lines:** rain gardens cannot be located in public rights-of-way and placed at least 10' from neighboring property lines except in some specific cases. Consult with the HIP Coordinator to determine site-specific setback requirements.

CONSTRUCTION METHOD/ CRITICAL PATH

1. Install erosion controls
2. Excavate soil and reuse on site or dispose
3. Gently scarify subgrade
4. Install overflow riser and pipe
5. Install 75% of rain garden mix on first lift
6. Connect overflow pipe to downstream drainage system
7. Install drains and conveyance into rain garden from site surfaces
8. Install river rock for energy dissipation at inlet
9. Install second lift of rain garden mix (25%) to final surface grade
10. Place 75% of mulch over all soil surfaces
11. Install plants
12. Place remaining 25% of mulch
13. Stabilize disturbed soils
14. Remove erosion controls



JUNCTION BOX



SECTION VIEW

LAKE WHATCOM RAIN GARDEN
HIP BMP "E" TYPICAL NTS

Construction Criteria for Infiltration Facilities

Initial basin excavation should be conducted to within 1-foot of the final elevation of the basin floor. Excavate infiltration trenches and basins to final grade only after all disturbed areas in the upgradient project drainage area have been permanently stabilized. The final phase of excavation should remove all accumulation of silt in the infiltration facility before putting it in service. After construction is completed, prevent sediment from entering the infiltration facility by first conveying the runoff water through an appropriate pretreatment system such as a pre-settling basin, wet pond, or sand filter.

Infiltration facilities should generally not be used as temporary sediment traps during construction. If an infiltration facility is to be used as a sediment trap, it must not be excavated to final grade until after the upgradient drainage area has been stabilized. Any accumulation of silt in the basin must be removed before putting it in service.

Traffic Control Relatively light-tracked equipment is recommended for this operation to avoid compaction of the basin floor. The use of draglines and trackhoes should be considered for constructing infiltration basins. The infiltration area should be flagged or marked to keep heavy equipment away.

Design Submittal

Lake Whatcom Rain Garden

Section I: System and Sizing Summary

☐	I have provided a site plan and facility cross-section. I have defined the area that will drain into the rain garden, by piping or sheet flow.
	The drainage area is_____ft² of impervious surface and/or _____ft² of lawn/landscape
☐	I have sized the system using approved methodology (HIP Sizing Calculator or stormwater hydrological modeling software) and attached that data.
	The ponding area of the rain garden will be at least _____ft² in size.
☐	I have calculated the number of plants needed for the total rain garden area (square feet of ponding area divided by 16) and completed a plant list.
	I will need to install at least _____ native plants in my rain garden.
☐	I have calculated the amount of lake-friendly mulch (area divided by 80) I will need. I have chosen mulch from the HIP-approved mulch list.
	My rain garden plan requires _____ cubic yards of approved mulch.

Section II: Site-Specific Planning

☐	I have determined that the ponding area is at least 5' from known utilities.
☐	I have determined that the ponding area is at least 10' from structures or property lines.
☐	I have determined that the rain garden is not on a slope >10% or within 10' upgradient of a slope >15% or within 50' upgradient of a slope >35%.
☐	I have developed an erosion control plan for the excavation of the rain garden and completed a site-specific SWPP that is included with this application.

Sizing Calculator

Lake Whatcom Rain Garden

How to Use Sizing Calculator:
Input project-specific data into the table below to calculate the size of the ponding area of the rain garden facility. Choose soil type based on test results in Step 1. Insert amount of hard surface (roof, pavement, gravel) in square feet and amount of lawn and/or landscape area in square feet. Determine multipliers by using the table below and calculate required ponding area.

Soil Type	Impervious Surface (square feet)		Hard Surface Multiplier (Varies)*		Lawn/Landscape (square feet)		Lawn/LS Multiplier (Varies)*		Ponding Area Minimum (square feet)**
Good	[	×	]	+	[	×	]	=	
Moderate	[	×	]	+	[	×	]	=	
Marginal	[	×	]	+	[	×	]	=	
Poor	Infiltration Not Recommended. Use Treatment, Dispersion, or Native Landscaping BMPs								

*Use multiplier reference table below.

** The ponding area is defined as the area that will be flooded before the system overflows. All rain gardens will have side slopes extending at least 18" from the top of this ponding area in all directions. See Design Guidance for more details and examples.

MULTIPLIER REFERENCE TABLE
RAIN GARDEN SIZING

	Multiplier by Soil Type		
	Good	Moderate	Marginal
Hard Surface Area			
Less than 5,000 sf	0.09	0.12	0.15
More than 5,000 sf	0.07	0.09	0.12
Lawn/Landscape Area			
Less than 2,000 sf	0.05	0.07	0.10
Between 2,000-10,000 sf	0.04	0.06	0.08
Between 10,000 - 40,000 sf	0.03	0.05	0.07
More than 40,000 sf	0.02	0.04	0.06

Soil Characterization Sheet

Step 1. Review available soil data and recommend on-site soil testing

To be completed by HIP Coordinator

Off-site test pit data. Review map provided by HIP. If one test pit is within 100' of any property line, list only that data. Otherwise, please list three representative test pits, preferably within ¼ mile of the site.

Test Pit Number	Soil Type/ Infiltration Rate	Depth to Groundwater	Depth to Bedrock

Based on this information, the recommended soil investigation procedure to follow in Step 2 is (determined by HIP Coordinator):

_____

Step 2. On-site testing procedure to determine soil type

To be completed by HIP Coordinator or the project designer

Follow the soil testing methods and instructions for infiltration BMPs, found in the HIP Design Manual (Infiltration Trench and Lake Whatcom Rain Garden).

Note: If designing for infiltration facilities in multiple locations, it is suggested that each location be checked for factors that might affect design considerations. Consult with the HIP Coordinator to determine the number of additional investigations recommended for each unique site.

I completed an on-site soil investigation using (check boxes of all completed tests):

☐ Soil Drainage Test

I used the Rain Garden Manual

After one wet season (or three dry season) tests I have determined that my soil drainage rate is _____in/hr.

I've characterized my soil as:

- ☐ Good
- ☐ Moderate
- ☐ Marginal
- ☐ Poor

☐ Simple Investigation

I dug to a depth of 3' below ground surface and found:

- ☐ Groundwater
- ☐ Bedrock
- ☐ Other: _____
  _____
  _____
- ☐ None of the above

☐ Soil Texture Test

I used this test method to determine soil type (circle one):

Clay	Clayey Silt
Silt/Loam	Sandy Loam/Sand

I've characterized my soil as:

- ☐ Good
- ☐ Moderate
- ☐ Marginal
- ☐ Poor

"SOIL DRAINAGE TEST" INSTRUCTIONS

Modified for HIP from procedures found in the Rain Garden Handbook for Western Washington Homeowners

After identifying the location of a potential infiltration system (HIP Infiltration Trench BMP or HIP Lake Whatcom Rain Garden BMP), the next step is to test the soil in that location. You will be evaluating the "infiltration rate", defined as the amount of time it takes water to soak into the ground. Determining an infiltration rate will allow you to use the HIP Standard Calculator to size the system for maximum water quality benefit and free permits through HIP.

1 LOCATE UTILITIES

Call 8-1-1 and mark with white paint the location of your proposed test hole or other potential underground features. The Call-Before-You-Dig professionals will arrive, from the various utilities, over the next week or so to mark the location of public utilities on your property.

Make sure you identify any potential private utilities (such as septic system drain fields and/or private electrical conduit) that would not be part of the public utility marking. You may need to do shallow, careful, excavations (pot-holing) to confirm some utilities.

2 DIG TEST HOLE

Dig a small hole at least 2 feet deep and at least 18 inches in diameter.

3 DETERMINE DRAINAGE RATE

Fill the hole with 12 inches of water. Secure a yard stick or a self-made gauge in the hole for measuring the drainage rate. The self-made gauge can be a board or pipe with markings every half inch from the bottom.

Time how long it takes for the water to drain out completely. By the way, this can take a while, so start in the morning and check back regularly throughout the day. If there is still water in the hole after 12 hours, record how many inches have gone down since you started the test. Divide total inches by total hours to calculate the soil drainage rate.

4 REPEAT IN DRY SEASON

If it's the wet season (December through April), do this soil drainage test once. If you must test during the dry season, do the test three times (with each test performed immediately after completion of the last). Use the third test as your drainage rate (measured in inches per hour). Testing three times during the dry season provides a better estimate of wetter conditions present in the winter when the system is doing the most work.

5 CHARACTERIZE YOUR SOIL

- If your calculated drainage rate is greater than two inches per hour (2"/hr), **use the "good" designation** on the soil characterization sheet in the design packet. This soil is likely sand.
- If your calculated drainage rate is between a half-inch per hour (1/2"/hr) and two inches per hour (2"/hr), **use the "moderate" designation** on the soil characterization sheet in the design packet. This soil is likely silty sand.
- If your calculated drainage rate is between an eighth-inch per hour (1/8"/hr) and a half-inch per hour (1/2"/hr), **use the "marginal" designation** on the soil characterization sheet in the design packet. This soil is likely a silt or loamy material.
- If your calculated drainage rate is less than an eighth-inch per hour (1/8"/hr), **use the "poor" designation** on the soil characterization sheet in the design packet. This soil is likely clay.

"SIMPLE INVESTIGATION TEST" INSTRUCTIONS

Modified for HIP from procedures found in the Rain Garden Handbook for Western Washington Homeowners

Avoid locating your infiltration system in an area with high groundwater or shallow bedrock by performing a simple investigation test. It's best to figure out the groundwater level during the rainy winter months, December through April, and you can search for bedrock at the same time.

1 LOCATE UTILITIES

Call 8-1-1 and mark with white paint the location of your proposed test hole or other potential underground features. The Call-Before-You-Dig professionals will arrive, from the various utilities, over the next week or so to mark the location of public utilities on your property.

Make sure you identify any potential private utilities (such as septic system drain fields and/or private electrical conduit) that would not be part of the public utility marking. You may need to do shallow, careful, excavations (pot-holing) to confirm some utilities.

2 DIG INVESTIGATION HOLE

Dig down 36 inches below the ground surface, if possible. You can use a post-hole digger or hand operated auger to reach the desired depth.

If you are digging in groundwater (i.e. the hole is filling with water faster than you can remove it) or hitting rock that prohibits any additional digging, you can stop the test as this location is not conducive to infiltration.

3 LOOK INTO THE HOLE

If you see water seeping in from the bottom or sides, or hit an impenetrable layer of rock or clay, find another location for your infiltration facility or choose a treatment BMP (such as the HIP Media Filter Drain or Dispersion BMPs).

"SOIL TEXTURE TEST" INSTRUCTIONS

Modified for HIP from procedures found in the Rain Garden Handbook for Western Washington Homeowners

Avoid locating your infiltration system in an area with high groundwater or shallow bedrock by performing a simple investigation test. It's best to figure out the groundwater level during the rainy winter months, December through April, and you can search for bedrock at the same time.

1 LOCATE UTILITIES

Call 8-1-1 and mark with white paint the location of your proposed test hole or other potential underground features. The Call-Before-You-Dig professionals will arrive, from the various utilities, over the next week or so to mark the location of public utilities on your property.

Make sure you identify any potential private utilities (such as septic system drain fields and/or private electrical conduit) that would not be part of the public utility marking. You may need to do shallow, careful, excavations (pot-holing) to confirm some utilities.

2 DIG TEST HOLE

Dig a small hole at least 18 inches deep and at least 6 inches in diameter. A post-hole digger or small hand auger is the perfect tool for this job.

3 EVALUATE SOIL TEXTURE

When you reach a depth of at least 18", take a scoop of soil from the bottom of the hole and use the procedure below to characterize its soil type.

Prepare the soil: put some soil in the palm of your hand and try to squeeze it into a ball. If the soil is dry, add water a few drops at a time, break down the chunks to work the water into the soil, and then perform the soil texture test.

Characterize the soil texture:

- If the soil is light in color, feels gritty, and will not stick together at all when wet **use the "good" designation** on the soil characterization sheet in the design packet. This soil is likely sand.
- If the soil is dark in color, feels gritty, and falls apart easily when worked, **use the "moderate" designation** on the soil characterization sheet in the design packet. This soil is likely silty sand.
- If the soil feels smooth, and breaks apart into chunks when worked but stays together in a ball when held, **use the "marginal" designation** on the soil characterization sheet in the design packet. This soil is likely a silt or loamy material.

- If the soil is very sticky and forms a dense ball that can't be easily broken apart, **use the "poor" designation** on the soil characterization sheet in the design packet. This soil is likely clay.