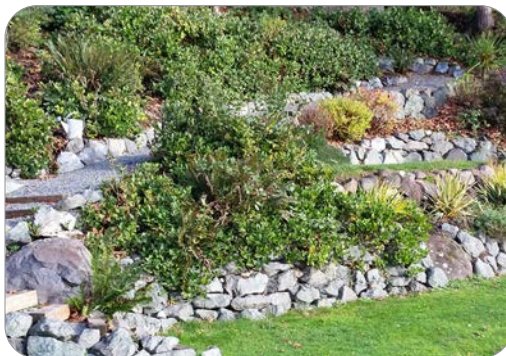


# RETAINING WALLS & TERRACING

## ▶ USES: SLOPED AREAS



Retaining walls can be an effective solution to create level areas for planting while protecting steep soil excavations from erosion.



Terraces create relatively level 'steps' on slopes for plantings and landscaping to **SLOW** rainwater down.

A retaining wall holds back soil to stabilize a slope and reduce erosion. Installing more than one retaining wall across a slope is known as a terrace. The use of a retaining wall or terrace creates a flat or gentler sloping area that is easy to plant, walk on, and enjoy. This flat or gentler slope helps to **SLOW** the flow of rainwater runoff so it can **SINK** into soils. Planting the area helps to further stabilize soil and capture and use the rainwater.

While retaining walls and terraces can be highly effective, they must be carefully designed and are not appropriate in all situations. If improperly installed or inappropriately used, they can pose a serious threat to life and property.

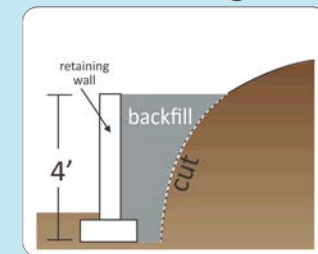
Consult with a qualified professional before designing or installing a retaining wall. A licensed landscape architect or civil or geotechnical engineer can assist with planning retaining wall projects and applying for permits.

A building permit with an engineering plan may be required (see sidebar). Depending on the size of your project and if it is in or near a critical area, you may also need a Land Disturbing Activity (LDA) permit. Always use proper sediment control measures when working on a slope. Further details are included in Section 2: Evaluate Your Site.

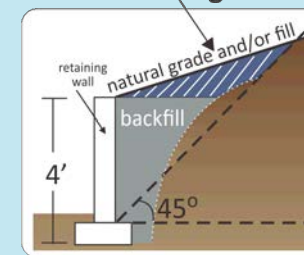
## BUILDING PERMITS

Building permits and engineered plans are required for any retaining wall that exceeds 4 feet in total height (including the buried portion of the wall). Building permits are also required for any wall which supports a surcharge above or behind the wall. A surcharge is any additional load placed on or against the wall, such as fill material (see images). For more information, contact Snohomish County Planning and Development Services (PDS) [Ask Permit Tech](#) program or call 425-388-3311. Refer to the PDS [assistance bulletin](#) on Retaining Walls.

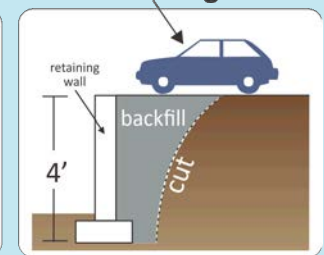
### No Surcharge



### Surcharge



### Surcharge



## RETAINING WALL DESIGN

Retaining walls may be constructed with a variety of materials include modular blocks, angular boulders, gabion baskets, or poured concrete. There are numerous types of retaining walls, each with a different purpose, so always check with a qualified design professional before embarking on a wall project.

Most soil retaining structures lean slightly into the hillslope, although paved concrete walls can be vertical. The base of the wall should be embedded below the soil surface. Many walls are built on a structural foundation. Typically, this foundation is a 6-inch layer of level and compacted crushed rock. The top of the foundation is often buried a minimum of 12 inches below the ground surface.

Before you begin construction, you must remove any soils that contain organic matter (decaying leaf litter, compost, roots, etc.) that will cause the wall to settle in the future around your retaining wall. These soils are typically dark brown or black in color and have an earthy aroma. While prized by gardeners, the organic matter in these soils can hold an enormous amount of water. The water's extra weight may cause your wall to fail. Simply move the organic rich soils to another part of your yard where it will benefit your plants. If located under your footing, the organic matter in these soils may decay over time and cause your wall to sag. To reduce the chance of sagging, remove at least a foot of the organic-rich soil and replace it with compacted, crushed rock before installing the footing.

A drainage system is a necessary component of retaining wall design. Walls can fail if water builds up within the soils behind it.

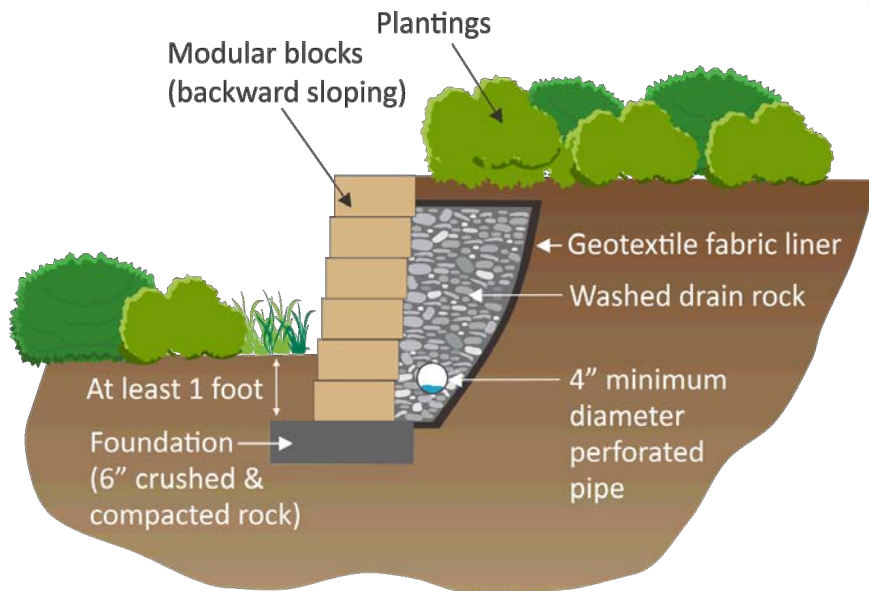
Consult a design professional to determine the type of features your drainage system will need for your site, as well as where to safely direct the water that it captures.

A critical aspect of your retaining wall's design is its backfill area. The backfill area is where the wall is supported, drainage is intercepted, and adjacent soil is stabilized. It is important to prevent fine particles in the adjacent soil from clogging the washed drain rock backfill. Prevent clogging by placing non-woven (felt-like) geotextile over the exposed soil to separate it from the drain rock.

As you build the wall, place, and tamp down layers of washed drain rock between the wall and the slope. The layer of drain rock should be at least one foot wide. Within the lowest layer of drain rock, install a perforated PVC pipe at least 4-inches in diameter. The pipe should be sloped slightly downward so water can flow by gravity to your drainage outlet. Continue to add layers of drain rock. The rock can extend to the surface, or you can stop within a foot of the surface, cover with non-woven drainage fabric and finish with topsoil and plantings.

## TERRACE DESIGN

A terrace is a relatively level 'step' constructed into the face of a slope and is typically a series of retaining walls. Terracing can provide benches of usable space for plantings and landscaping to **SLOW** rainwater down. However, terraces must be carefully planned to comply with regulations and protect your and neighboring properties from slope failures. In general, the width of terraced benches should be at least equal to the height of the lower wall supporting the flat surface. A certified landscape architect, or licensed civil or geotechnical engineer can assist with planning terracing projects and applying for permits.



## RETAINING WALL MATERIALS



MODULAR BLOCK WALLS

Pre-constructed modular blocks are made specifically for retaining walls. They have an interlocking design, with a lip on the lower back edge of each block that slips neatly over the block below. As each layer is laid, the structure will continue to slope backward ever so slightly which increases the wall stability. When constructing, ensure your crushed rock footing is packed and level. As you build your wall, verify that each layer is level before adding the next. Taller walls will require additional design features for stability.

Your qualified professional or engineering team can help you select the appropriate block and design for your wall. Purchase from landscaping supply companies or directly from modular block distributors. **Caution:** small modular blocks typically available at large home-improvement stores have limited applications. When using small modular blocks, the retaining wall must: be less than four feet in total height (including the buried blocks which act as a footing), not support a surcharge (see sidebar on first page of Retaining Walls & Terraces), and have adequate drainage.



ROCKERIES

Most rockeries are not true retaining walls. Instead, they tend to be a wall of boulders that cover freestanding soils. The soils may have been excavated to create a flat area below or behind them. The rockery face protects the exposed soil from eroding. In some cases, short rockeries may accommodate fill dirt placed behind them to create a relatively level terrace.

Rockeries are typically constructed with angular rocks 18 inches or larger in diameter. Rockeries must lean slightly back towards the slope for stability. Before setting any rock, place non-woven drainage fabric against the soil slope. A trench is typically dug along the toe of the slope and the largest boulders are placed in the trench. Subsequent rocks are laid with at least three bearing points on previously laid rocks. As the wall is built, fill cavities between and directly behind the boulders with angular rock that is 2 to 6 inches in diameter to help prevent erosion. Water can freely pass through the wall, so a drain pipe is not needed.



GABION BASKETS

Gabion baskets are cages made from heavy-duty wire and filled with rock. The rock must be larger than the openings of the cage and less than 18 inches in diameter. Gabion walls have the look of rockeries with the ease of installation offered by modular block walls. They are a good option for short walls. The design should include a gravel footing, drainage, and partial burial of the gabion basket.



*Photo: Rae Allen on Flickr*

POURED CONCRETE WALLS

Cast-in-place poured concrete walls are aesthetically pleasing and can be engineered to support tall, vertical faces. They must be reinforced by steel and require special design for their foundations and drainage. Consult with a design team including structural and geotechnical engineers.



WOOD RETAINING WALLS

Wood is NOT recommended for retaining walls. Toxic chemicals from creosote and treated wood can leach into the soil. Even treated wood decays over time when in contact with soil. Wood retaining walls do not provide long-term stability.



## ✓ Maintenance

At least once a year, conduct a thorough check of your retaining walls to observe their condition. Consult a geotechnical engineer if you see any buckling outward or sagging, or if cracks appear in the ground above the wall. These conditions are serious concerns and are indications of inadequate design or installation.



Short rockeries can be used to create relatively level terraces for plantings

## DO

- ✓ Provide adequate drainage behind retaining walls.
- ✓ Use a qualified professional, such as a licensed landscape architect or civil or geotechnical engineer, to design your wall.

## DO NOT

- ✗ Install without checking on permit requirements.
- ✗ Use wood for retaining walls.

## STRAW WATTLES

Straw wattles combined with hillside plantings that form deep roots can be a less expensive and more natural RainScaping solution to help prevent minor hillside erosion.

Wattles are long, straw-filled tubes that are fastened into the soil across a slope to help trap sediments. Wattles biodegrade, so their success depends on establishing plants at the location of the wattle that will form dense vegetation with strong root structure fairly quickly. Refer to the county's [native plants website](#) for plants best suited for hillside planting and for [local native plant nurseries](#).

Jute netting and/or mulch are often laid down in addition to the wattles to further reduce the risk of erosion and to suppress weeds while plantings establish. A list of local sources for wattles, jute matting, and mulch is available at [local suppliers of Mulch, Compost and Erosion Control Materials](#).

