Drainage, Slopes and Retaining Walls

How would I know if I have a drainage problem?

Leading indicators of drainage problems at your planting sites are standing water 24 hours after a hard rain, yellowing plants, a smell of stagnant water, mud deposits on hardscape, piles of debris that accumulate after a rain like leaves, trash and twigs, water stains on fences or buildings and salts extruded on bricks.

When is the ideal time of year to assess drainage?

Late November to April is best time to assess drainage.

How do I assess drainage?

Do test borings from your site that are from 3-5 feet deep during the wet season. Take these borings at the highest elevation on the plot, in depressions, and at the bottom of abrupt slope changes. If you see obvious ponded or spongy areas take borings in these areas as well.

What does soil with good drainage look like?

A soil with good internal drainage has a high proportion of sand or gravel, will NOT have distinct layers but will show a gradual color change from dark to light at a three foot depth.

What does soil with bad drainage look like?

A soil profile with abrupt color changes and mottling within three feet of the surface indicates a badly drained area. Soil will look densely packed and is often blue or gray in color. There may be dark surface soil with an abrupt change to light gray or brown mottling 6-8” deep: this indicates saturation at or near the surface for a long time which may be due to excess runoff from roofs or pavement. If you dig a test hole in a wet season, the hole rapidly fills with water and may not dry until late summer.

How can I tell if I need surface drainage or subsurface drainage?

Walk into a puddle: if it is firm under foot, the problem is surface drainage. If you sink in to your ankle, you have a subsurface issue that may require subsurface drainage. Subsurface drainage problems may stem from a number of problems such as a high water table, or a subsurface compaction issue from a botched renovation that has created a perched water table on top of a compacted layer. You can also do a test boring: if water infiltrates from the sides it’s a surface drainage problem.

I am trying to select an area to build or develop. What plants indicate poor drainage?

Large populations of sedges, willows, alders, and red maples indicate very wet conditions.

I have poor drainage which is affecting the health of the plants in the area. What can I do?

Build raised beds for ornamentals, 8-16 inches high for annuals, 2 feet for shrubs, 3 feet for trees.

Can’t I just bring in fill or soil from a different area to solve drainage problems?
NO! This will NOT solve drainage problems and often makes them much worse or shifts the issue to an adjacent area.

**I want to install drain tiles for poor drainage in a lawn. How deep should they go?**

Tiles in tile drainage systems for landscape should be placed 18-24 inches below the surface, then back fill ditch with coarse sand or gravel to within 8” of the lawn surface, top with topsoil. The water collected should go to a sump with the capacity of 300 gallons/hour.

**What are some general tips on drainage design?**

On rolling areas, drain tiles should be located in low areas along the base of slopes to gather seepage water. There should be a slope of at least 1% throughout the entire drainage system.

**What is a catch basin?**

An underlying drain tile system connected to surface drain tile is the basic principle of a catch basin and these are best for promoting proper drainage of terraces on a slope.

**Will slope have any effect on drip irrigation in beds and groundcovers?**

Yes. In order to maintain uniform pressures on slopes greater than 5% it is often necessary to install compensating equipment right with your drip system.

**I need to stabilize a slope that keeps eroding. Any advice?**

Identify soil types to determine if angle of slope must be changed: for example, sandy soil is difficult to stabilize unless slope is reduced to a one foot rise in 5 feet or more of horizontal distance. A silt loam slope will remain stable if the slope has a one foot rise for every 2.5-3 feet of horizontal distance.

**What do I need to build a successful retaining wall?**

The wall base must be below frost line to prevent heaving. There must be a way to remove water that collects behind the walls or the wall will fail. This means enough weep holes to let out water pressure. Increase drainage by backfilling with coarse gravel and providing weep holes through the wall located several inches above ground level on the lower side, and you also can use 4” drain tiles set at 10 foot intervals along the length of the wall.

**We have had retaining walls fail after several years. What is the secret to a lasting retaining wall?**

In addition to sufficient weep holes, any wall over 3 feet must be reinforced and should have construction modifications that allow for joint expansion and contraction. Footings must extend below frost depth and thus will vary greatly from one part of the country to the other. Pressure treated timber walls, with tie backs every third layer, can be built without deep excavation for footings.

If you are building a dry stone wall, you need to backfill and firm the soil behind the wall as each layer is finished. Use one part organic matter in your back fill mix to improve soil structure and drainage. You can use this mix between stone layers as a four inch layer of icing. Slope walls slightly back into bank with a pitch of 1-2 inches for every foot in height if you are using flat stones and 3-5 inches if using round stones. In this kind of system you don’t necessarily need weep holes or footings, just a toe stone layer 6-8 inches below grade. Dry stone walls can also be used as crevice gardens in sunny spots for herbs or rock garden plants. Avoid inserting plants too deeply or shallowly into these pockets.
How can I build a retaining wall around a tree without killing it?

The tree may die no matter what you do, but if you must, build a stone retaining wall that leaves at least 3 feet between the tree trunk and the wall plus install 4 or more tile lines that fan out radially from the wall for a distance equal to the outer branches of the tree. These tiles should be in a graded bed sloping away from the tree. Do NOT add soil over the roots of the tree.

What should I do if I have water collecting in a wet spot that is draining down from a higher place on a slope?

If water is seeping from a higher elevation a big mistake is to run a drain through the middle of the wet spot. You want to install a drain on a grade ACROSS the slope above the wet area and at a depth which will intercept the water before it appears on the surface. Therefore the drain should be at least 2 feet deep. Back fill with coarse sand, gravel to 6 inches of the surface, make sure it leads to an acceptable outlet or else the difficulty will be shifted to another spot.

What level of slope spells trouble for mowing or other maintenance?

Any area with a drop of one or more feet every four feet of horizontal width (25%) spells trouble for mowing and other maintenance. A crest that is not rounded off will also guarantee scalping with each pass of the mower.

What things should I do to make grass establishment and maintenance on a slope easier?

If you are going to sod a slope, place strips horizontally in staggered lengths to provide the best chance of rapid rooting with minimal erosion. Strips can be pegged into place with small wooden dowels. If seeding, try an erosion blanket which seed can come up through, or a spray mulch and seed combination. When mowing slopes, mow across rather than up and down to avoid tearing and make sure you wear shoes that give a firm grip because slippery turf clippings and be a cause of grief.

What are some recommendations for various slopes and their uses?

<table>
<thead>
<tr>
<th>slope</th>
<th>Pitch</th>
<th>recommendation</th>
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</thead>
<tbody>
<tr>
<td>negligible</td>
<td>1%</td>
<td>Minimum for paved areas</td>
</tr>
<tr>
<td>slight</td>
<td>2%</td>
<td>Minimum for good lawn drainage</td>
</tr>
<tr>
<td>slight</td>
<td>5%</td>
<td>Maximum for lawn games and parking</td>
</tr>
<tr>
<td>moderate</td>
<td>10%</td>
<td>Maximum for most driveways and gardens</td>
</tr>
<tr>
<td>steep</td>
<td>20%</td>
<td>Optimal for a split level building</td>
</tr>
<tr>
<td>steep</td>
<td>33%</td>
<td>Absolute maximum for lawn maintenance</td>
</tr>
<tr>
<td>very steep</td>
<td>&lt;33%</td>
<td>MUST be stabilized</td>
</tr>
</tbody>
</table>
How can I change the slope without creating disaster?

The site is some cases can be subgraded to improve a slope’s pitch. Use a rear mounted blade on a landscape tractor. Subgrading involves the movement and stockpiling of top soil, the realignment of the layer beneath the topsoil (don’t compact it) and then replacing stockpiles of top soil. A minimum grade of 1-2% to a street or sub-surface drain sloping away from any building is suggested. Remember, too, that subgrading around trees is iffy: always maintain the original grade around trees or you can expect them to die. Avoid also depressions in the soil where water can accumulate.