Fall is almost always a limiting factor for collection plumbing and gravity distribution plumbing (see Squander No Fall, Chapter 4).

If you're fortunate enough to have a 1' *(25 cm)* contour map of your site, use it to check elevations. (A contour map has lines on it showing where the land surface is at the same elevation. On a 1' map, there are lines for each foot. For an example, see Figure 12.1.) If you don't have such a map, measure the elevations where the system is going to be installed. You can do this with a $3,000 transit, but a $5 water level works well enough (see Appendix B: Measuring Elevation and Slope).

Note these elevations on your site map. From slope measurements, you can determine which sources can water which plants. Remember that you actually need a bit more than 2% slope from end to end, to allow for obstacles and other "fall eaters." Particularly for a Branched Drain system with little slope, it is helpful to make a drawing showing the elevations in section view from one end to the other of the system's flattest branch.

Check the Soil Perk

You should have at least an idea of the perk rate for any system. Quantitative measurement is necessary if a lot of greywater is going into a small area, or the perk appears to be low, or the soil is clayey.

The rate at which water absorbs into the soil—the percolation or "perk" rate—is an important variable in greywater system design. High clay content generally means slow perk, which can get dramatically slower if you add salt-laden greywater. Rock can have slow or no perk. Very slow perk can lead to standing water and noxious smells.

Sand is high perk, gravel more so. Very fast perk can lead to groundwater contamination, though this is unlikely if there is a dense network of plant roots.

Fissured limestone and lava tubes can be very problematic for wastewater management, as they form natural pipes that enable wastewater to bypass soil purification and flow directly into the groundwater at warp speed.

It is vital to know about the perk where the greywater is going before committing to a design. I once embarrassed myself by building a system for a neighbor, based on an assumption from my prior experience that the soil around here is very free-draining. Well, the *soil* is free-draining, but where I dug the infiltration basin turned out to be *subsoil* from the house's excavation, and it hardly drained at all.

If you're putting a small amount of greywater in a big area, the only perk issue would be a really, really slow perk rate. If you have enough experience with your soil—digging holes to various depths, perhaps filling them with water, observing how water absorbs into the ground—to know it perks reasonably fast, you don't need a perk test.

But if you are applying a large amount of greywater, or have a small area, or are applying greywater subsurface, a perk test is critical. Based on the result, you might change the size of the system by a factor of 4 or more, or even decide that a greywater system is infeasible.

A professional (read: expensive) perk test is required for installing most septic systems. These tests are usually done with a truck-mounted borer to a depth that is irrelevant to greywater systems. If you already have one of these tests in hand and it shows that the perk rate is okay several feet down, it is surely fine at greywater depth. But a shallow, do-it-yourself perk test that takes an hour gives you more relevant information (see sidebar).

How to Measure Perk

Measuring perk

Dig holes to greywater discharge depth (usually 6–12", 15–30 cm), in the locations you wish to discharge it. Place stakes into the bottoms firmly. Mark reference elevations on the stakes and fill the holes with water two to four times, measuring each time how far the water drops in a given number of minutes. When it drops the same amount in the same amount of time, a couple of times in a row, that's your perk measurement (dry soil perks much faster—saturated perk is what matters for sizing the system). Convert the numbers to perk rate in min/in or cm (3" in 60 min is 20 min/in, for example), then see Table 2.3 to see how much area you need to treat that much water.

If it takes hours for the water to drop at all, or the water vanishes as fast as you can fill the hole, or if the holes fill with water by themselves, you've got a problem! If the perk is super slow, consider a Constructed Wetland. If it is super fast, add compost, mulch, and plants that will develop a dense network of roots to help purify greywater on its short journey through the soil.