



Willow in third season

Photos © Feidhlim Harty

Cleaning Effluent with Plants

Féidhlim Harty explains how to clean up household effluent with willow in special percolation areas rather than wasting nutrients and polluting groundwater

By combining these two famous phrases, ‘We are surrounded by insurmountable opportunities’ and ‘Shit happens’, we have an opportunity in the form of abundant nutrients and biomass! On an individual level, compost toilets are the obvious way to recoup nutrients and biomass, but a quick look in most bathrooms will confirm that they’re not all that common. Most people seem to want to flush. All is not lost, however. We can make changes in wider society without everyone needing a compost toilet. There is an abundant reservoir of nutrients in existing percolation areas; ready and waiting to grow firewood, sequester carbon and generate biomass. All it takes is to plant willows in the right place and we can tap into this resource where once we had a septic tank pollution problem. This works on a municipal scale too, but for now let’s look at one-off houses.

Useful Willow

Willows absolutely love moist, nutrient-rich soils. They also grow at a phenomenal rate. The quicker growing hybrid biomass willows will rise to 6m (c.18ft) in three years in the right conditions. They are voracious feeders on nitrates and phosphates and can essentially vacuum it up out of the soil so that the pollution load can drop to an impressive zero impact on the local environment.

For new sites, a willow system can be carefully designed and built in a large plastic basin to ensure that no effluent leaves the system other than through the leaves into the air as evapotranspiration. However, I believe that the greatest potential for wide-scale use in society is in providing a low-cost, low-tech solution for use in existing percolation areas.

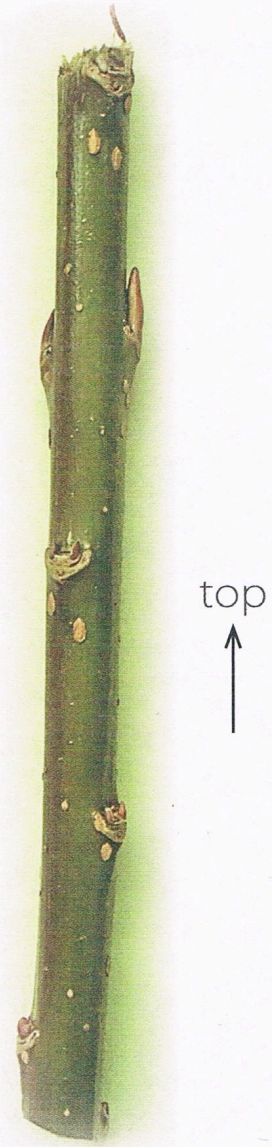
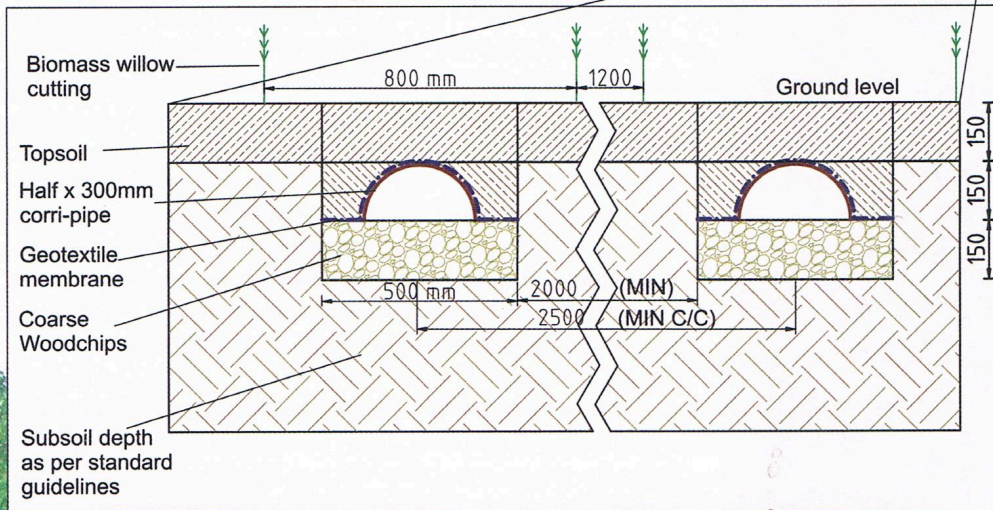
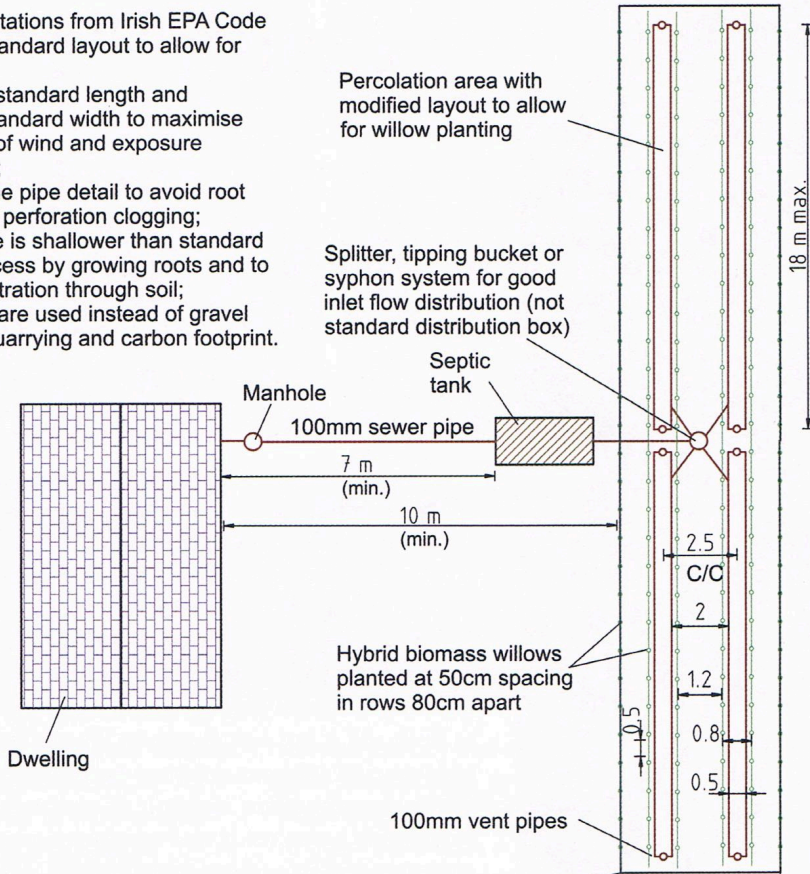
Percolation

So, can I just plant 100 willow cuttings and return in three years for my firewood? Not necessarily. Percolation piping is typically 100mmØ (4in) perforated PVC pipe laid in a gravel trench. Producing lots of biomass is thirsty and hungry work, so if you plant your willows over a standard percolation trench the roots will find their way to the food and water, and probably clog the pipe perforations over time. To avoid this, use a modified pipe layout for new projects or upgrades. For existing systems plant the willows along the

Plan and section of layout of septic tank and willow planted percolation area based on EPA Code of Practice Figure 7.1 with modifications for willow use

Primary adaptations from Irish EPA Code of Practice standard layout to allow for willow use:

- >Double the standard length and halve the standard width to maximise throughput of wind and exposure to sunshine;
- >Amended the pipe detail to avoid root ingress and perforation clogging;
- >Trench base is shallower than standard for easy access by growing roots and to maximise filtration through soil;
- >Woodchips are used instead of gravel to reduce quarrying and carbon footprint.



ABOVE Plant this way up

BELOW Coppicing in alternate years stretches the willows out like a clothesline



contour of the land downhill of the percolation area. This works well for soils over heavy clay or impermeable rock where the effluent has to migrate laterally to find a way back into the wider catchment. It is not so effective for quick draining sands or gravelly soils because the effluent escapes directly down into the ground.

New Projects

For new projects or upgrades it's easy to make some minor adjustments to the piping layout. The plan view of the trenches can stay pretty much the same as the standard layout; with a splitter box at one end and 4-5 runs of trench. However, instead of 100mm (4in) perforated PVC, use either a proprietary trench infiltrator unit (a big upside-down gutter resting on the base of the trench) or a DIY version made from 300mm (12in) twin walled corri-pipe (cut in two lengths to make two 150mm/6in high gutters). The latter option is lower cost but slightly narrower, so to make up the requisite 500mm (20in) of trench width you can lay 150mm (6in) of clean stone on the trench base before covering with the half pipe and backfilling with soil. This set-up will eliminate pipe perforations and thus avoid the clogging of same by willow roots.

The Size

Another consideration is the system size. All that is needed to achieve Code standards is to build (on suitable soils) the same sized system as a standard percolation area or drainage field. However, if you are aiming for full nutrient capture, note that biomass willows mop up c.8kg (17.6lbs) of P/ha/yr and c.40kg (88lbs) N/ha/yr. Thus for a typical household, a size of about 6 x 40m (18-120ft) gives a pretty good balance between area use and nutrient uptake. Remember that any willows (indeed any trees) will provide better nutrient capture and environmental protection than an unplanted percolation area. After that, the more trees, the greater the uptake, within reason.

The Shape

A third factor in the design is the system's shape. A long, thin stand of willows will have a higher evapotranspiration rate than a dense thicket. With a 6 x 40m (18-120in) layout the leaves of the trees are strung out like a clothes-line. Thus, the rate of moisture loss, and hence moisture and nutrient uptake from the soil, will be higher. Most percolation areas are laid out almost square, so take care to at least double the length and halve the width compared to standard layouts.

Getting a good spread of effluent is very important over this long distance. Typically a pump is used in zero discharge willow systems. However, to make use of gravity, a Ribbit splitter, syphon or Herr dosing box can work just as well.

Choosing a Variety

Finally, consider the willow varieties used. Just as you wouldn't plant an orchard with crab apples, you're best to use the correct willow cultivars too. Purpose-bred hybrids of *Salix viminalis* biomass willows are best. If you want a stand of basket willows or varieties for living willow sculpture work, then put those in at one end. But for the donkey work of mopping up pollution, the biomass varieties will do the best job in the smallest area.

Planting and Harvesting

Planting is usually set out as six rows of cuttings. Allow 80cm (2½ft) between rows and plant cuttings at 30-50cm (12-20in) spacing within each row. During the early establishment phase, willows can be mulched with a sheet of black plastic. Push the new cuttings through the plastic, then weigh down the plastic with soil or sand to prevent the wind lifting it over the cuttings and killing them.

Biomass willows are usually commercially planted as 200mm-long (8in) cuttings. However I prefer 300mm (12in) cuttings to give a bit of extra height over the groundcover plastics. After the first year of growth, all the willows should be coppiced and the plastic lifted off to let the soil breathe.

For nutrient uptake, willows are best harvested after three summers. This provides a good balance between growth rate for biomass generation and stem development for phosphorus uptake. To maximise your clothes-line effect, cut the three rows on the left of the system in one year; the three on the right in the next year; and a year without cutting after that. Then repeat the cycle. Thus in a given year, there will be a long, thin canopy of leaves, in full sun and wind to aid growth and nutrient uptake. Remember though, if you want wood for firewood, then a longer cutting interval will give thicker logs.

Willow stems can be burned as logs or chipped for compost as a way to return both nutrients and biomass to the soil. By looking holistically at the challenges around us we can often find solutions that bring two problems together to create a viable solution. This is just one of the many insurmountable opportunities that permaculture offers us as we move into a greener, more abundant future.

Féidhlim Harty is director of FH Wetland Systems Ltd., environmental consultancy and author of *Get Rid of Your Bin* (www.wetlandsystems.ie/shop.html), *Permaculture Guide to Reed Beds* and *Septic Tank Options and Alternatives*, both available from PM's online store: <https://shop.permaculture.co.uk> (and Féidhlim's website).