

Reed-beds & Wetlands

By Dr Rick Hudson, Cress Water Solutions

In off-mains drainage locations, and wherever the ground is unsuitable for a septic tank and soakaway drains, a choice has to be made between two options on how to clean the effluent to a suitable quality for discharge to the natural water environment. One is to use a package mechanical sewage treatment plant (PSTP); the other is to use a reed-bed / wetland system. In some cases a combination of the two may be required.

Reed-beds, willow beds, ponds and wetlands are all natural ecological systems that harness the normal mechanisms that take place in nature to break down the organic polluting matter in sewage and waste water. They are also used to treat leachate, agricultural wastewaters and a host of industrial and commercial effluents. Often installed in combination with self contained ponds and wetlands they can, as well, solve surface water drainage and discharge problems. Their numerous advantages over PSTP's include their capacity to cope with widely varying loading conditions, their ability to produce a high quality treated effluent and remove of ammonia, and being ecologically friendly and sustainable with low maintenance requirements. In gravity driven systems they have no need for a power supply.

Over the last 25 years or so two different kinds of reed-beds have been developed and used largely for the treatment of domestic sewage for populations ranging in size from those of a single household, visitor centres and hotels up to village sized communities. These are the **horizontal flow reed-bed**, and the **vertical flow reed-bed** which, when used in combination, create highly effective treatment systems for the secondary and tertiary treatment of strong polluting wastewaters.

In a typical gravity driven combination reed-bed system, installed on a slope, all black and gray wastewaters from the premises drain into a large septic tank where the solids settle out. The settled effluent flowing from the tank is then dosed automatically, by means of a passive dosing siphon, onto the surface of the first stage vertical flow reed-bed. A network of pipes on the surface of the bed ensure an even distribution of the effluent. As the effluent percolates slowly down through the roots of the reeds and the different layers of sand and gravel in the bed it comes into contact with a thin film of bacteria growing on the surfaces of everything. The bacteria feed on the organic matter in the effluent and convert it into harmless substances, cleaning the water in the process. After a relatively short while all the effluent in the dose will have drained to the bottom of the bed and flowed away to the next stage in the treatment chain. As a result the spaces between the particles fill up with air again and an oxygen rich environment is maintained, aided by the roots of the reeds. It is this oxygen rich environment in vertical flow reed-beds which allows them to nitrify effluents, converting ammonia into nitrites and nitrates, and eliminate rather than create unpleasant smells.

In combination system the effluent flows next into a horizontal flow reed-bed of which there are several different types. Here the effluent enters a bed

which remains full of water the whole time and a different group of bacteria grow. In the poor oxygen conditions that exist the nitrites and nitrates are reduced to gaseous nitrogen, which escapes to the atmosphere, by a process known as denitrification.

Horizontal reed-beds alone work particularly well for low strength effluents, or effluents that have undergone some form of pre-treatment. As such they play an invaluable role in tertiary treatment and the polishing of effluents. A typical application would be to treat the discharge from a PSTP which is not meeting the discharge consent standard required.

Combination reed-bed systems in conjunction with wetlands and ponds can produce near river quality discharges substantially reducing the release of ammonia, phosphates, nitrites and nitrates from reaching the water environment. The whole process depends on providing the right conditions for groups of different bacteria which do just about all the work. The reeds and other plants enhance the bacteria activity, maintain the integrity of the gravel beds and create a robust and diverse ecology attractive to wildlife. Taking up a relatively small area at 2.5-4 sq.m/person equivalent, properly designed reed-bed and wetland systems provide an ideal, low-energy, sustainable solutions with a small carbon footprint for the treatment of a wide range of polluting wastewaters.