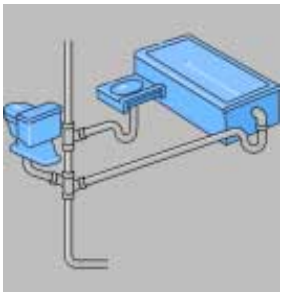
Water Sensitive Urban Design in the Sydney Region

PRACTICE NOTE 9

Wastewater reuse



On-site waste water treatment options include septic tanks, aerated wastewater treatment systems and composting toilets.

Water sensitive development involves simple design and management practices that take advantage of natural site features and minimise impacts on the water cycle. It is part of the contemporary trend towards more 'sustainable' solutions that protect the environment.

This Water Sensitive Practice Note gives a general introduction to the options available for on-site waste water treatment and re-use.

- **Septic tanks**
- **Aerated wastewater systems**
- **Greywater reuse systems**

Wastewater reuse

Introduction

The majority of water used for indoor domestic purposes is discharged after use as 'wastewater'. Wastewater can be collected by a reticulated sewage system and treated at a conventional wastewater treatment plant. Alternatively, it can be collected, treated and re-used on-site, thereby promoting more efficient water use. This has many significant economic and environmental benefits for the community. However, on-site reuse of domestic wastewater is subject to various restrictions due to concerns about effluent quality, maintenance and health issues.

Types of wastewater

There are two main types of domestic wastewater:

- blackwater - wastewater from the toilet
- greywater - all other domestic wastewater, including wastewater from bathrooms, kitchens and laundries.

A typical household discharges approximately 35 litres of blackwater, and 105 litres of greywater, per person per day. The potential for on-site treatment and reuse will depend on its quality. Greywater contributes about 65% of the volume of domestic wastewater, 70% of the phosphorus, and 63% of the BOD (biological oxygen demand), whilst blackwater contributes about 35% of the volume of wastewater, 61% of suspended solids, 82% of nitrogen and 37% of BOD.

The potential presence of pathogens in greywater is substantially lower than in blackwater. However, several authors have shown that greywater may contain pathogens. Thus, both greywater and blackwater require adequate treatment before on-site reuse.

On-site treatment and reuse options include septic tanks, aerated systems, and greywater reuse systems. These options are mainly applicable to rural and rural-residential locations.

Septic tanks

Septic tanks are widely used throughout Australia in areas without reticulated sewerage. About 12% of all households nationally rely on septic tanks. The conventional system involves the underground installation of a concrete tank and an absorption trench (see Figure 1).

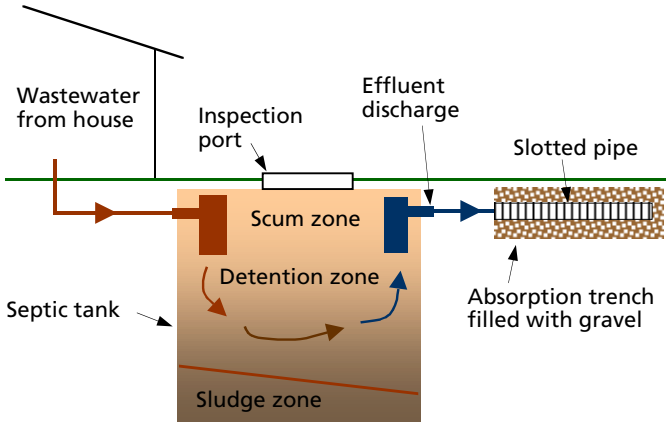


Figure 1: Septic tank & absorption trench

Wastewater is partially treated in the septic tank by anaerobic processes. These remove about 30% of phosphorus, 20% of nitrogen, 60% of suspended solids, 50% of BOD, and reduce the concentration of biological contaminants. Final treatment occurs via an absorption trench. The effluent then percolates to the soil where it is subject to further contaminant removal processes by soil organisms before reaching surface or ground waters.

Guidance for the design of septic tanks and the disposal of effluent from on-site wastewater treatment systems is provided in Australian Standards AS1546 and AS1547 respectively. Installation of a septic tank requires approval from the local council. Ongoing operation also requires council approval and regular inspection.

About 40% of septic systems have been found to be not operating correctly, thereby contributing nutrients to waterways and causing significant water management problems. Common reasons for failure of septic tank and absorption trench systems are:

Wastewater reuse

- the volume of wastewater discharged to the septic tank is greater than its design volume
- failure to periodically remove sludge from the septic tank
- insufficient area of absorption trench to accept effluent from the septic tank
- inappropriate soil type for absorption of effluent.

Aerated systems

There are a number of different aerated wastewater treatment systems available for on-site management and reuse of wastewater. These systems rely on mechanical devices to mix, aerate and pump the effluent, subjecting it to accelerated aerobic and anaerobic decomposition using one or two tanks (see Figure 2).

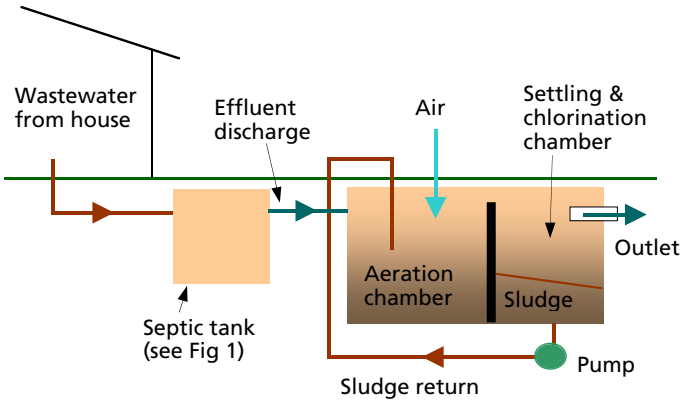


Fig 2: Aerated wastewater treatment system

Provided that the required management and maintenance regimes are adhered to, including periodic sludge removal, the effluent should be clear and odourless, and meet NSW Department of Health guidelines. Effluent quality should be better than 30 mg/l suspended solids concentration, 20 mg/l BOD_5, 0.5 mg/l free residual chlorine and 10 organisms per 100 ml for faecal coliforms. It can then be disposed of by surface or underground irrigation. A minimum irrigation area of 200 m^2 is usually required.

Greywater reuse systems

There are two main types of greywater reuse systems: primary and secondary systems In a primary system, greywater is collected and distributed by gravity or a pump for underground lawn and garden watering (see Figure 3).

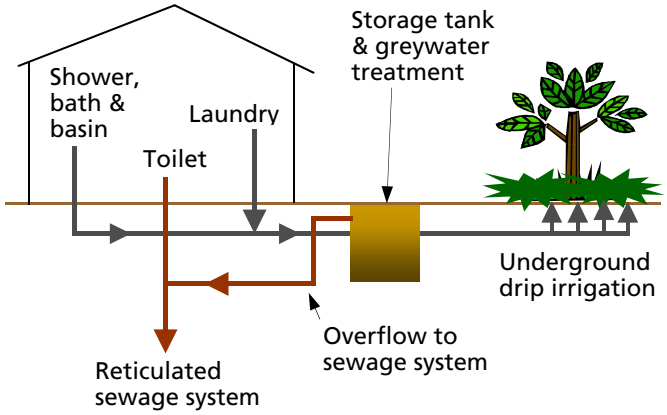


Fig 3: Primary greywater reuse system

Careful selection of detergents and washing products is required to minimise possible harmful impacts on plants or soil due to accumulation of salts, nutrients and trace metals. A guide to suitable detergents is provided by Mobbs (1998). As untreated greywater may contain harmful bacteria, it should not be applied directly to vegetables.

Secondary systems incorporate a storage tank for greywater treatment. This supplies greywater for toilet flushing and garden irrigation via a pump (see Figure 4). The system can also supply underground drip irrigation of garden areas.

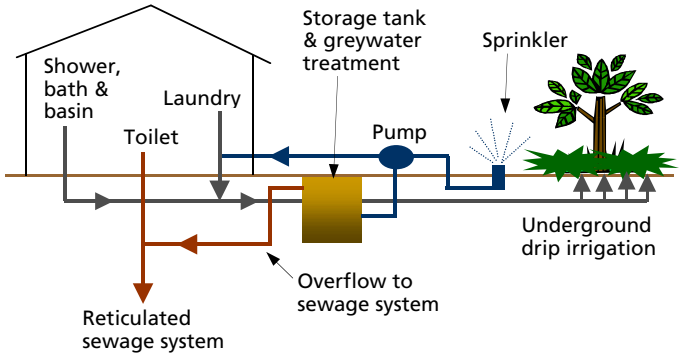


Fig 4: Secondary greywater reuse system

Wastewater reuse

Costs

Construction costs for wastewater systems can vary considerably. Palmer *et al* (2001) found that the average cost to install a septic system is $4,300, and the average cost of traditional reticulated sewage systems is $13,800 per allotment. The cost to install an aerated wastewater system is approximately $6,000-$8,000 with a maintenance cost of $260 per annum.

Useful contacts

CSIRO Urban Water Program: *www.dbce.csiro.au/urbanwater*

Michael Mobbs: *www.sustainablehouse.com.au*

BDP Environment Design Guide: The Royal Australian Institute of Architects

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