



In this practice note:

- Septic tanks
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- Greywater reuse systems
- Regulations and guidelines

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 state and local government regulations due to concerns about effluent quality, maintenance and health issues. A number of state and national guidelines are also available to guide sustainable use of waste water.

This WaterSmart Practice Note gives a general introduction to the options avail-

able for on-site waste water treatment and re-use.



TYPES OF WASTEWATER

Covers:

- Blackwater, greywater and sewage
- Quantity of wastewater discharged by a typical household

There are two main types of domestic wastewater:

- blackwater - wastewater from the toilet, that is human sewage; and
- greywater - all other domestic wastewater, including wastewater from bathrooms, kitchens and laundries.

Blackwater, or blackwater combined with greywater, is called "sewage" and is traditionally disposed of to the "sewerage system" or "sewer system" — a system of pipes that lead to a sewerage treatment plant and outfall. In the absence of a sewer system, the most common methods of treatment and disposal were on-site septic tanks or pump outs.

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.

Whilst the level of pathogens in greywater is substantially lower than in blackwater, they remain sufficiently high that both greywater and blackwater require adequate treatment before on-site storage and reuse.

On-site treatment and reuse options include septic tanks, aerated systems (also called advanced wastewater treatment systems, AWTS) and greywater reuse systems.

SEPTIC TANKS (SEWAGE TREATMENT)

Covers:

- How septic tanks operate
- Installation of a septic tank
- Septic tank malfunction

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 under-

ground installation of a concrete tank and an absorption trench (see Figure 1).

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 con-

taminant removal processes by soil organisms before reaching surface or ground waters. However, as absorption trenches are constructed below the biologically most active zone — the topsoil, these biological processes have limited influence.

Guidance for the design of septic tanks and the disposal of effluent from on-site wastewater treatment systems is provided in Australian Standards AS/NZS 1546.1:1998 and AS/NZS1547:2000 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:

- 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.

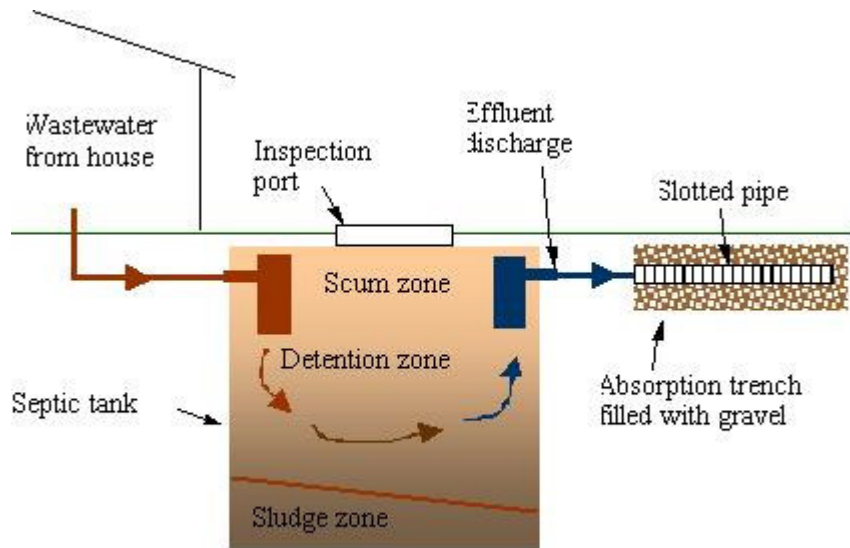


Figure 1: Septic tank & absorption trench

AERATED SYSTEMS (SEWAGE TREATMENT)

Covers:

- Benefits of an aerated wastewater system

There are a number of different aerated wastewater treatment systems (AWTS) 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).

As with greywater systems, sewerage management facilities need to be accredited by NSW Health (see References section). As at May 2007, 15 such systems were accredited.

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 for accredited systems, for 90% of samples, should be

less than 30 mg/l total suspended solids (TSS), 20 mg/l BOD₅, between 0.5 & 2.0 mg/l free residual chlorine and less than 30 cfu (colony forming units) per 100 ml for faecal coliforms. Higher values must also be met for all samples. Effluent can then be disposed of by surface or underground irrigation. A minimum irrigation area of 200 m² is usually required.

On-site AWT Systems can also be accredited for use in environmentally sensitive areas where they can demonstrate higher effluent standards.

In addition to AWTS, two bio-filtration systems are accredited by NSW Health that offer equal or greater advantages (see 'Useful Websites').

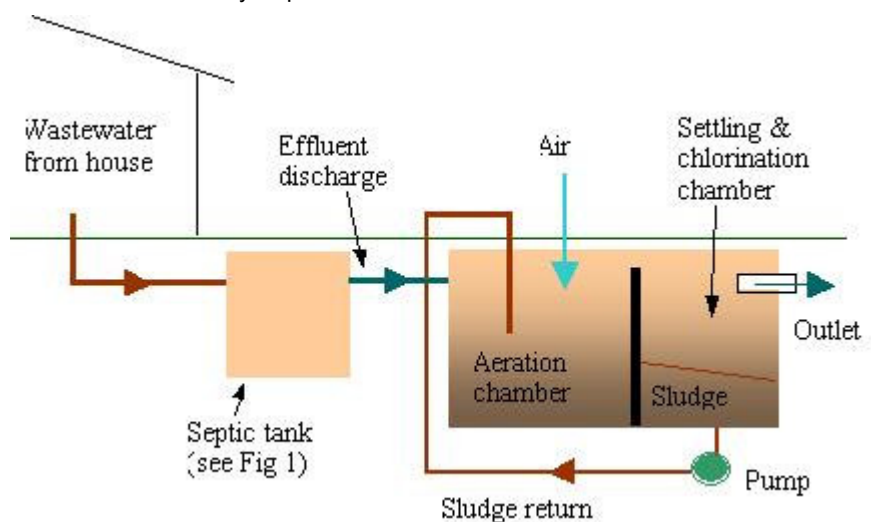


Figure 2: Aerated wastewater treatment system

GREYWATER REUSE SYSTEMS

Covers:

- Differences between diversion and treatment greywater treatment systems.

There are two main types of domestic greywater treatment systems (DGTS); diversion and treatment systems. In diversion systems, untreated greywater is collected and distributed by gravity or a pump for underground lawn and garden watering (see Figure 3). It is not permissible to store untreated greywater, other than to balance pump operation, and uses are limited (by regulation) to external reuse only.

Greywater treatment systems generally incorporate one or more tanks for treatment and storage. The treated effluent can be stored and used for non-potable internal uses, such as toilet flushing, and/or outdoor use for garden irrigation (see Figure 4). Local government regulations in some areas may restrict irrigation to underground systems.

With, or without treatment, 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 on the Lanfax website (see 'useful websites'). As untreated greywater may contain harmful bacteria, it should not be applied directly to vegetables.

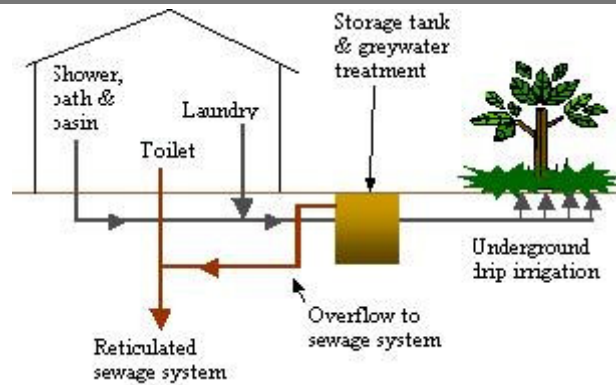


Fig 3: Primary greywater reuse system

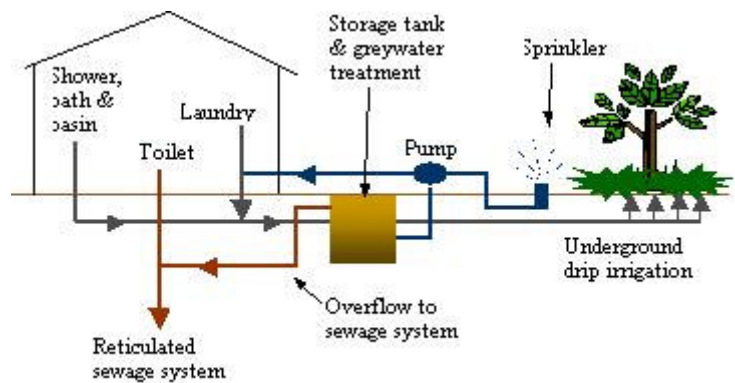


Fig 4: Secondary greywater reuse system

REGULATIONS AND GUIDELINES

Covers:

- Regulations applying to domestic greywater treatment systems

Under Item C6 of Section 68 of the Local Government Act 1993 and the Local Government (Approvals) Regulation, 1999 (specifically clause 43(1)) all DGTS in NSW must have prior council approval for installation and operation. All installations must be inspected regularly by the installing body, who must also submit

regular reports on effluent water quality tests conducted on a minimum percentage of installed systems. An explanation of the requirements is set out in the document "Greywater Reuse in Sewered Single Domestic Premises" (NSW Health, April 2000).

In 2005, NSW Health introduced a system of accrediting commercially available domestic greywater systems (see the references and links at the end of this practice note). As of early 2007, it had

accredited seven greywater treatment systems for domestic use (under the *Domestic Greywater Treatment Systems Accreditation Guidelines* NSW Health 2005) and nine diversion systems. Depending on the level of monitoring, accreditation increases the mandatory inspection time from every 3 to 4 months, to once every six months. Accredited suppliers must also comply with effluent monitoring schedules. Legislative requirements are summarised in the table below.

Legislative Process	Relevant Authority	Greywater Diversion Device	Greywater Treatment System	Land Application System
Carry Out Sewerage Works Approval *	Council	P	P	X
Installation Approval	Council	X	P	X
Accreditation	NSW Health	X	P	X
Operation Approval	Council	P	P	P
Materials Authorisation *	DECC	P	X	X

* not applicable within the Sydney Water Corporation or Hunter Water Corporation areas and land to which the Water Supply Authorities Act 1897 applies
DECC—Department of Energy & Climate Change

Source: NSW Health 2000

COST

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 allot-

ment. The cost to install an aerated wastewater system is approximately \$6,000-\$8,000 with maintenance costs in the order of \$260 per annum.

USEFUL WEBSITES

BDP Environment Design Guide: The Royal Australian Institute of Architects

Lanfax Laboratories (for WQ and soil testing, and information on detergents to use with greywater systems): www.lanfaxlabs.com.au

Michael Mobbs: www.sustainablehouse.com.au

NSW Health, On-site Single Domestic Wastewater Management: <http://www.health.nsw.gov.au/public-health/ehb/general/wastewater/wastewater.html>

Philip Geary, University of Newcastle: Phil.Geary@newcastle.edu.au

Septic Safe: www.dlg.nsw.gov.au/dlg/dlghome/dlg_InformationIndex.asp?areaindex=SEPTIC&index=150

Urbanwater info: www.urbanwater.info/engineering/BuiltEnvironment/GreywaterReuse.cfm

Technical information: www.urbanwater.info/engineering/BuiltEnvironment/BlackwaterReuse.cfm

NSW Health; Accredited domestic systems: www.health.nsw.gov.au/public-health/ehb/general/wastewater/wastewater.html

PRODUCT SUPPLIERS

Dowmus Resource Recovery: 1800 814 596

EnviroCycle: 1800 688 588

BioSeptic: 02 4629 6666 or 1300 658 111

Everhard Septic tanks: 13 1926

National Pumps and Irrigation: 02 4934 8699

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- No.9 Wastewater Reuse
- No.10 Groundwater
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