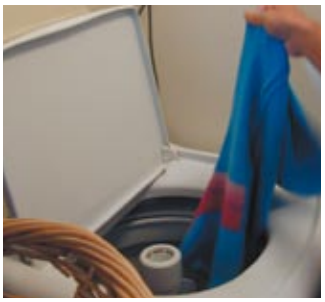
NSW GUIDELINES FOR

GREYWATER REUSE IN SEWERED, SINGLE HOUSEHOLD RESIDENTIAL PREMISES



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DEPARTMENT OF ENERGY, UTILITIES AND SUSTAINABILITY
NEW SOUTH WALES GOVERNMENT

Water for Life
A water plan from the NSW GOVERNMENT

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PART A
INTRODUCTION

1 INTRODUCTION

1.1 Overview

These guidelines provide direction on the use of greywater diversion devices (GDDs) in single households, and have been developed to specify the conditions for exemption from prior approval by councils for greywater diversion. *The Local Government (General) Amendment (Domestic Greywater Diversion) Regulation 2006* allows an exemption from prior approval by councils if certain practices are implemented and conditions are met. The main purpose of these guidelines is to specify those practices and conditions. Following these guidelines is mandatory for exemption (**Part B** of this document).

The secondary purpose of the guidelines is to provide additional advisory information to the owners and/or occupiers of sewered residential premises on greywater treatment systems and manual bucketing of greywater. This information is contained in **Part C** of this document.

Part C also contains guidance on the use of greywater treatment systems (GTSs). However, it is important to note that greywater treatment systems continue to require prior approval from the relevant local government authority for installation, and operation of the system (Item C6, Section 68, *Local Government Act 1993*). **There are no exemptions from this requirement**. A council must not approve the installation of a GTS unless the system has been accredited by the NSW Department of Health (Clause 41(1) of the *Local Government (General) Regulation 2005*).

These guidelines do not provide detailed information on the responsibilities of plumbers, installers or manufacturers of systems. Specific local, state and federal requirements exist for plumbers, installers and manufacturers of systems, including the NSW Plumbing Code of Practice and the *Trade Practices Act* that should be considered as primary sources of information.

These guidelines provide comprehensive information for the reuse of greywater on residential premises in sewered areas of NSW. These guidelines replace the NSW Health document 'Greywater Reuse in Sewered Single Domestic Premises' (April 2000).

This document has been prepared by the Department of Energy, Utilities and Sustainability (DEUS) on behalf of the NSW Government with input from other agencies, including the Department of Health, Department of Local Government, Sydney Water, and the Metro Water Directorate of The Cabinet Office.

1.2 Why Use Greywater?

Recent widespread drought in Australia, combined with the continued growth of cities and the need to provide for environmental flows in our river systems, has resulted in increasing pressure on drinking water supplies in most large cities and many regional areas of Australia.

Greywater from residential premises (single households) is a resource and can be reused on-site for garden and lawn irrigation or, if treated appropriately, for toilet flushing and laundry use (washing machine only). Substituting greywater for drinking water for these end uses will not only reduce the demand on drinking water supplies, but will also reduce the amount of sewage wastewater discharged to the environment.

1.3 What Type of System Should be Used?

There are three ways of reusing greywater that can be implemented for sewered residential premises in NSW:

- greywater diversion, which diverts greywater generated by a premises to the garden or lawn for use in sub-surface irrigation;
- greywater treatment, which treats greywater for other reuse, such as toilet flushing, washing machine and surface irrigation; and
- manual bucketing, which involves the reuse of relatively small quantities of greywater for irrigation.

1.4 Structure of this Document

An overview of the structure of this document is provided in order to direct readers to the most appropriate section of the guidelines appropriate to their needs:

Part A – Introduction

- Section 1 – Introduction – an overview of the purpose of the document and its application, relevant to all readers.
- Section 2 – Greywater Characteristics – relevant to all readers.

Part B – Compliance with this Part is necessary to obtain an exemption for prior approval for greywater diversion devices

- Section 3 – Greywater Diversion Devices – mandatory conditions for meeting the exemption criteria.

Part C – Advisory information on the reuse of greywater

- Section 4 – Greywater Treatment Systems.
- Section 5 – Manual Bucketing of Greywater.

Appendix A – Greywater Decision Flow charts

Appendix B – Greywater Reuse Estimations

Appendix C – Best Practice Management Controls

Appendix D – Greywater Fact Sheets

2 GREYWATER CHARACTERISTICS

2.1 Definitions

Greywater: For the purpose of these guidelines, greywater means waste water from washing machines, laundry tubs, showers, hand basins and baths from a greywater diversion device or by manual bucketing. It does not include waste water from a kitchen, toilet, urinal or bidet.

For the purpose of these guidelines, it also means waste water from washing machines, laundry tubs, showers, hand basins, baths and ***kitchens*** from a greywater treatment system. It does not include waste water from a toilet, urinal or bidet.

Residential Premises: Refers to a single, detached household residential premises. It does not include premises comprising more than one dwelling.

2.2 Where Does Greywater Come From?

Greywater is generated by every residential household that is occupied, and can be reused to provide a reliable source of water for those final uses that do not require drinking water (including irrigation, toilet flushing and washing machine use).

The characteristics of greywater produced by a household will vary according to the number, age, lifestyle, health status and water usage patterns of the occupants.

There are essentially two different greywater streams:

1. **Bathroom greywater (bath, basin, and shower)** – contributes about 59 per cent of the total usable greywater volume in a typical household (Loh & Coghlan, 2003). Bathroom greywater can be contaminated with hair, soaps, shampoos, hair dyes, toothpaste, lint, nutrients, body fats, oils and cleaning products. It may also contain some faecal contamination (and the associated pathogens) through body washing.

2. **Laundry greywater** – contributes about 41 per cent of total usable greywater volume in a typical household (Loh & Coghlan, 2003). Wastewater from the laundry varies in quality from wash water to rinse water to second rinse water. Laundry greywater can be contaminated with lint, oils, greases, laundry detergents, chemicals, soaps, nutrients and other compounds. It may also contain some faecal contamination (and the associated pathogens) through washing contaminated clothes. Greywater generated from the laundry is often the easier source of greywater to access, although it is usually more contaminated than bathroom greywater (Jeppesen and Solley, 1994; Christova-Boal et al., 1996).

Kitchen wastewater is sometimes considered as a greywater stream; however, for the reuse of greywater by greywater diversion devices (GDDs) it is not appropriate to include kitchen wastewater due to the amount of contaminants (food particles, oil and grease). Kitchen wastewater can be treated for reuse by greywater treatment systems (GTSs).

Under the *NSW Code of Practice: Plumbing and Drainage 3rd Edition 2006*, only greywater from the bathroom and laundry can be reused by GDDs. Greywater from the kitchen must not be reused by GDDs.

2.3 Water Usage Volumes

The average single sewered household in Sydney (based on 3 persons per household) uses (unrestricted) 825 litres of water each day, or approximately 300,000 litres (300 kilolitres) per year (Sydney Water, 2005). This equates to approximately 339 litres of greywater per house per day. Of this, 198 litres is from baths and showers, and 141 litres is from the laundry (Table 2.1) (Loh & Coghlan, 2003; Sydney Water, 2005). Approximately 223 litres each day is used outdoors for garden and lawn irrigation, car washing, swimming pools etc. (Sydney Water, 2005). By reusing greywater for irrigation a household has the potential to save between 50,000 and 100,000 litres of drinking water per year.

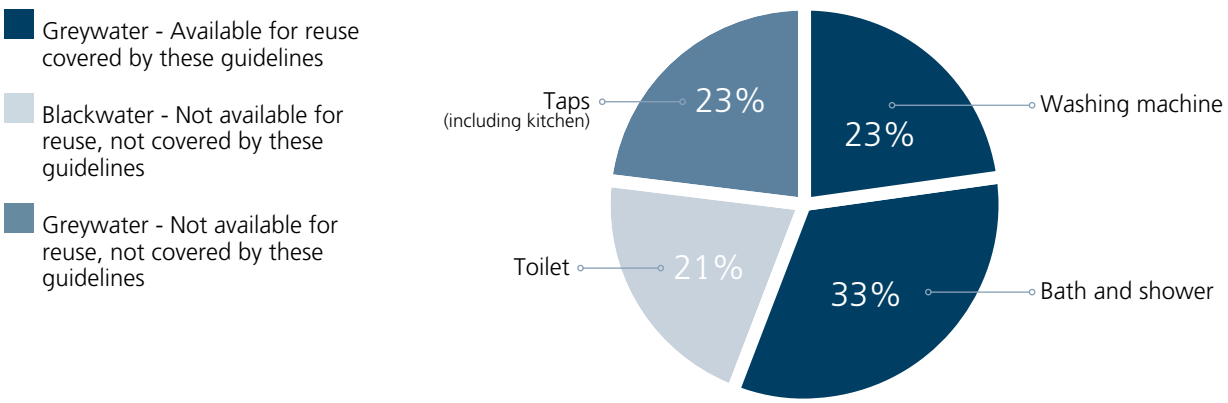
Table 2.1: Per Capita In-house Usage (Loh and Coghlan, 2003)

Appliance	Residential Premise (Single Household)	
	L/house/day*	L/person/day
Bath and shower	198	66
Washing machine	141	47
Sub-total Greywater	**339**	**113**
Toilet	124	41
Taps (includes kitchen)	140	47
Total in-house	**603**	**201**

* Based on 3 people per house.

Water usage will vary according to the practice of each household. Approximate percentages of water use volumes for in-house use are provided in Figure 2.1.

Figure 2.1: Proportion of In-house Usage Available for Reuse (Loh & Coghlan, 2003)



2.4 Composition of Greywater

2.4.1 Microbiological Quality

The thermotolerant coliform group of bacteria are used as an indicator of microbiological quality. Thermotolerant coliforms are also known as faecal coliforms and are a type of micro-organism which typically grow in the intestine of warm-blooded animals (including humans) and are shed in their millions in each gram of faeces. Occurrence of faecal coliform bacteria in water indicates a risk of human illness or infection through contact with the water.

In general, the number of faecal coliforms in greywater is low unless greywater is generated from washing nappies or clothes contaminated with faeces or vomit (Jeppesen and Solley, 1994). This suggests that the numbers of harmful pathogens are also low.

2.4.2 Chemical and Physical Quality

There is a high amount of variability in the chemical and physical quality of greywater produced by any household, due to factors such as the source of water, the water use efficiency of appliances and fixtures, individual habits, products used (e.g. detergents, shampoos, soaps etc.) and other site-specific characteristics.

The amount of salt (sodium, calcium, magnesium, potassium and other salt compounds), oils, greases, fats, nutrients and chemicals in greywater can largely be managed by the types of products used within a household. The ***Dos and Don'ts*** in Sections 3, 4 and 5 provide guidance on how to manage the chemical and physical quality of greywater. Appendix C also goes into further detail on the risks of using greywater and how to best manage these risks.

Nutrients

Phosphorus and nitrogen are nutrients necessary for plant growth. Greywater, containing nutrients generated from the bathroom and laundry, may be substituted for fertiliser and can provide phosphorus and nitrogen to the garden and lawn.

Table 2.2 shows the estimated amount of nutrients contained in greywater reused on a one square metre irrigation area of a residential household over a one year period, compared with the amount of nutrients applied by following recommended dosage rates over a one year period provided by manufacturers of typical lawn fertilisers.

Table 2.2: Nutrient Application Resulting from Greywater Reuse

Nutrient	Bathroom Greywater	Laundry Greywater	Fertiliser
	Range (grams/year/m^2)	Range (grams/year/m^2)	Average (grams/year/m^2)
Total Nitrogen (N)	3.22 – 24.0	0.7 – 48.0	17.6
Total Phosphorus (P)	0.08 – 2.16	0.04 – 50.4	11.3

Source: Based on the composition of five readily available lawn fertilisers – Brunnings, Hortico, Munns, Shirley's and Yates and greywater composition data from Christova-Boal et al. (1996).

Excessive nutrient loads should be avoided to prevent damage to soil, plants, groundwater and off-site waterways. However, it is apparent from Table 2.2 that the typical nutrient loads that are applied to the soil by irrigating with greywater are similar to those that are applied by following the directions on common fertiliser packages. The upper limits of ranges can be managed by the selection of appropriate laundry detergents (and similar products) that are low in nitrogen and phosphorus. The reuse of greywater, therefore, has the potential to significantly reduce the need for fertiliser application on gardens and lawns. The application of nutrients through the irrigation process is also preferred, as the nutrients will be applied more gradually and will reduce the risk of nutrients being washed away during rain events.

The variability in the nutrient loadings is influenced by the use of different washing detergents, personal hygiene products (soaps, shampoos), and cleaning agents. The amount of nutrients in the products being used by the household has a direct relationship with the amount of nutrients that are present in the greywater when it is reused for irrigation. By managing the type and amount of washing detergents, personal hygiene products and cleaning agents that are used, the amount of nutrients in greywater can be managed.

Further information regarding the management of nutrients in greywater and managing vegetation that is irrigated by greywater can be found in Appendix C and in the **Greywater Fact Sheets.**

2.4.3 Salts

Salts in greywater originate from washing detergents and are commonly in the form of sodium, magnesium and calcium compounds (Patterson, 2006).

The application of greywater to land introduces to the soil quantities of many salts that cannot be drained from the root zone under normal rainfall. Increases in salt concentration in soil will depend upon the unique combination of soil type, greywater composition and drainage (Patterson, 2006).

The major risks of salts contained in greywater are the accumulation of salts in the soil structure leading to a loss of soil permeability (ability to absorb water) which can cause degradation to vegetation. Sodium salts are always very soluble, many times more soluble than calcium or magnesium salts, and soil sodicity (soil degradation due to sodium salts) presents particular problems to soil and vegetation, including soil permeability and plant growth (Patterson, 2006).

The salts originate from washing detergents, which vary in their salt content. Reducing the quantity of salts, particularly sodium, is the most effective method to reduce the risk to soil and vegetation due to salts, and especially soil sodicity. Generally, powdered detergents contain the most salt as it is used in washing powders as filler. Concentrated powders generally contain less salt than normal powdered detergents, and liquid detergents contain the least salt of all washing detergents (Table 2.3).

Table 2.3: Sodium Adsorption Ratio (Patterson, 2006)

Greywater Type	Sodium Adsorption Ratio (SAR)		
	Min	Mean	Max
Laundry (powder detergents)	1.2	9.2	52.1
Laundry (liquid detergents)	0.02	1	4

The sodium adsorption ratio (SAR) measures the relationship of the concentration of sodium cations (positive ions) in the water compared to the concentration of other cations in the water. Water with a SAR of greater than 6 is likely to raise the risk of sodicity in non-sodic soils, whilst a SAR of less than 3 may lower that risk in sodic soils. Table 2.3 clearly shows that if liquid detergents are used, greywater has a SAR with a maximum of 4, well within the acceptable SAR. Thus using liquid detergents instead of powder detergents will generally result in greywater with a reduced risk of causing soil degradation.

In addition to choosing washing detergents that are low in salts, and in particular sodium salts, there are other ways of managing a household's soil to reduce the risks caused by salt application. These include incorporating organic matter into the soil by mulching, and the addition of lime or gypsum to already sodic soils.

PART B
GREYWATER DIVERSION DEVICES

Section 3

Greywater Diversion Devices
- Mandatory conditions for gaining exemption

Compliance with this Part is necessary to satisfy the conditions for an exemption from prior approval for greywater diversion devices.

3 GREYWATER DIVERSION DEVICES

This section outlines the guidelines specifically pertaining to the use of greywater diversion devices at residential premises in sewered areas of NSW.

Compliance with this section is necessary to satisfy the conditions for an exemption from prior approval for the operation of greywater diversion devices.

3.1 Overview

A greywater diversion device (GDD) is a hand-activated switch that diverts untreated greywater by gravity or pump directly to a sub-surface irrigation system.

A diversion system incorporates the following features:

- a hand-activated valve
- a switch or tap which is fitted to the outlet of the waste pipe of the plumbing fixture (e.g. a washing machine)
- a coarse filter for screening out solids and oils/greases
- non-storage surge attenuation
- an overflow device
- a garden irrigation or distribution system.

Greywater from a diversion device is untreated and must only be reused for sub-surface irrigation.

Greywater diversion is for the productive reuse, not easy disposal, of wastewater. It is important for owners and residents to recognise that a diverter must be treated as a garden tap. The diverter should only be turned on when the garden needs watering, at all other times it must be turned off. If the diverter is turned on all the time, over-watering has the potential to significantly damage plants and soil as well as increase the risk to residents' health. Any greywater that can not be immediately reused for sub-surface irrigation at the residential premises must be diverted to sewer.

Reuse of greywater through a GDD at a residential household is considered to be a low risk activity if the requirements of these guidelines are met. By reusing only greywater produced within the household for sub-surface irrigation, the health risks associated with pathogen exposure are reduced, since those residing in the house are likely to have been exposed to the majority of the pathogens in the greywater, through contact with the other residents at the household. The main form of exposure for pathogens is through personal contact.

The reuse of greywater by a GDD where more than one dwelling is located on a block, including groups of town houses, villas and multi-unit dwellings, is not permitted. This is due to the fact that other residences will not have been exposed to the pathogens through personal contact, therefore increasing the risk of spreading disease through the community. A town house occupant using only that residence greywater on the garden within the premises is permitted. Use on common property gardens is not permitted.

Appendix A outlines the process for choosing and installing a greywater diversion device.

3.2 Conditions of Approval

The Local Government (General) Regulation 2005 under the ***Local Government Act 1993*** requires prior council approval of greywater diversion. However, under Clause 75A of the Regulation, greywater diversion at residential premises may be carried out without the prior approval of the council if the requirements of the ***NSW Code of Practice: Plumbing and Drainage 3rd Edition 2006*** for the reuse of greywater by a GDD are met.

To obtain exemption from obtaining council approval the following conditions must be satisfied:

- the proposed site for installation is not located in an area registered as environmentally sensitive. Areas registered as environmentally sensitive are listed on the Department of Energy, Utilities and Sustainability web site (www.deus.nsw.gov.au);
- wastewater is not diverted from kitchen or toilet plumbing;
- an on-site sewage management facility is not in place;

- the property is not serviced by a dual reticulation system;
- greywater is not stored in any way, or treated other than primary screening or filtration;
- a washing machine standpipe, or WaterMark licensed diversion device, delivers the greywater to a sub-surface irrigation system;
- the standpipe or diversion device has a switching or selection facility so that greywater can be easily diverted back to sewer;
- any diversion device connected to, or modifying, the existing plumbing system is a WaterMark licensed device (previously a Plumbing Safety licence), and must be installed by a licensed plumber;
- any diversion other than by gravity is only via a licensed non-storage surge tank and pump system installed by a licensed plumber;
- some form of non-storage surge attenuation is installed as part of the diversion system ***(non-storage surge attenuation can be in the form of a tank system, a mulch basin or similar)***;
- the local water utility is notified in writing by the installing plumber that a greywater diversion device is in place;
- diversion devices installed prior to the fixture trap must have provision to automatically maintain the water seal in the trap; and
- the landowner complies with these guidelines and any others issued by the Director General of the Department of Energy, Utilities and Sustainability.

It is the responsibility of the household owners to engage a licensed plumber to install the GDD and associated non-storage surge attenuation.

It is the responsibility of the installing licensed plumber to install the GDD and non-storage surge attenuation to meet the requirements of the ***NSW Code of Practice: Plumbing and Drainage 3rd Edition 2006***. The plumber must ensure that controls to prevent the incidence of cross connection are implemented and that the local water utility is notified in writing that a diversion device is in place at the household. Written confirmation shall be in the form of a certificate of compliance and "as completed plans" (e.g. an amended sewer service diagram) or other documentation as required by the local water utility.

Where a GDD is to be installed at a residence, the property owner should check with their local water utility, prior to installation, that their property is serviced by a meter with an integral dual check valve to ensure backflow protection of the water supply.

The sub-surface irrigation system connected to the GDD does not require installation by a licensed plumber, but must meet the requirements of Section 5.6 and 5.7 and the performance standards in Clause 75A of the Regulation (reproduced in Appendix C of this Guideline). Also, where relevant, the installation of the sub-surface irrigation system must follow the manufacturer's recommendations or design.

A GDD, unlike a GTS, does not require approval to operate the system.

3.3 Best Practice Management Control Measures

It is important that greywater diversion is undertaken sensibly to ensure that public health and the environment are protected at all times. The control measures, presented in a list of ***'Dos and Don'ts'***, have been compiled to provide owners and residents with a guideline of how to best manage their reuse of greywater. The list will assist owners to ensure that the reuse of greywater achieves the performance standards required for exemption from the prior approval of council. Each of these control measures is explained in further detail in Appendix C of these guidelines.

The control measures (***Dos and Don'ts***) for the GDD are a necessity as they reduce the risks associated with reuse, whilst providing a water source that has the potential to improve the health and appearance of soil and plants at the household.

When undertaking diversion of greywater, **DO**:

- ✓ **DO** check with the DEUS web site (www.deus.nsw.gov.au) to make sure your property is not registered in an area that is deemed to be environmentally sensitive.
- ✓ **DO** install a greywater diversion device that has a WaterMark licence (previously a Plumbing Safety licence) and is listed by NSW Health.
- ✓ **DO** reuse diverted untreated greywater only for sub-surface irrigation (at least 100 mm below the surface of soil or mulch).
- ✓ **DO** install a greywater diversion device that incorporates some form of non-storage surge attenuation.
- ✓ **DO** ensure the greywater diversion device is switched back after irrigation periods so that greywater is diverted to sewer.
- ✓ **DO** undertake a water balance (refer to Appendix B3) to estimate the amount of water that can be reused by the household.
- ✓ **DO** select garden-friendly detergents that are biodegradable and low in phosphorus, sodium, boron and chloride.
- ✓ **DO** select washing detergents that are low in salt – consider using a powder concentrate, or a liquid washing detergent (refer to fact sheets for further information).
- ✓ **DO** monitor plant and soil response to greywater irrigation.
- ✓ **DO** occasionally irrigate with drinking water to disperse salts from the soil (only necessary during extended periods of zero rainfall).
- ✓ **DO** consider applying a soil rewetting agent every six months.
- ✓ **DO** use a filter to screen solids when using a diversion device.
- ✓ **DO** ensure that regular maintenance is undertaken, including cleaning out the greywater diversion device filter weekly and maintaining the sub-surface irrigation system.
- ✓ **DO** consider using irrigation drippers with large openings.
- ✓ **DO** mark and label all pipes and use signs to indicate greywater reuse (refer to Section 3.7).

When undertaking diversion of greywater, **DON'T**:

- ✘ **DON'T** leave a diversion device on all the time. Treat it like a garden tap and only reuse greywater when the garden needs watering. Greywater is for reuse, not disposal.
- ✘ **DON'T** reuse toilet or kitchen wastewater.
- ✘ **DON'T** reuse greywater during rain.
- ✘ **DON'T** reuse greywater from the washing of nappies or contaminated clothing.
- ✘ **DON'T** reuse greywater when a resident is sick, e.g. has diarrhoea.
- ✘ **DON'T** reuse greywater generated by cleaning in the laundry or bathroom, or when using hair dye or other chemicals.

- ✘ **DON'T** reuse greywater generated by washing rags used for painting or for maintaining machinery and vehicles.
- ✘ **DON'T** reuse greywater to top up rainwater tanks or swimming pools.
- ✘ **DON'T** store untreated greywater.
- ✘ **DON'T** over-water.
- ✘ **DON'T** irrigate with greywater if the household is located on an aquifer that is used for drinking water (refer to the DEUS website for locations where greywater reuse is not acceptable).
- ✘ **DON'T** reuse greywater on plants that will be eaten raw or where fruit has fallen to the ground and could be eaten.
- ✘ **DON'T** use greywater to wash paths, driveways or cars.
- ✘ **DON'T** allow direct contact or ingestion of the greywater.
- ✘ **DON'T** use greywater to irrigate on dune sand or shallow rocky soil unless the soil has been enriched to a minimum 300mm in depth.
- ✘ **DON'T** reuse greywater so that it flows into the streets or down stormwater drains.
- ✘ **DON'T** install drippers of a sub-surface irrigation system within one metre of boundary lines, inground pools and inground potable water tanks and buildings.
- ✘ **DON'T** let greywater go beyond the property boundary and cause a nuisance to neighbours.
- ✘ **DON'T** use greywater in households where immuno-suppressed occupants are present.

3.4 Greywater Reuse Estimations

To estimate a household's greywater requirements, a water balance can be undertaken to consider both the amount of greywater that has the potential to be reused, and the amount of greywater that can be generated to meet the needs of the household. This is important because a typical metropolitan household can potentially generate much more water than is needed for use on the garden.

All of the information and calculations to undertake a water balance are provided in Appendix B: Greywater Reuse Estimations and included in the online Self Assessment Form and Tool, available online at www.deus.nsw.gov.au. A water balance provides guidance for managing greywater to protect public health and the environment. It is a requirement that owners or residents complete the Self Assessment Form in order to meet the conditions for exemption from council approval.

3.5 Choosing a Greywater Diversion Device

Greywater diversion devices (GDDs) are evaluated to the Australian Technical Specification ATS 5200.460-2005. Certification to the technical specification for plumbing and drainage products is obtained by the manufacturer by way of a WaterMark licence (previously a Plumbing Safety licence).

Diversion devices are only exempt from requiring approval from council if they are licensed with a WaterMark licence (previously a Plumbing Safety licence).

Figure 3.1: WaterMark Certification

(source: http://www.saiglobal.com/assuranceservices/certification/ProductCertification/)

There are a number of certified GDDs available for installation at residential premises.

The Greywater Diversion Devices Register, which is a list of licensed greywater diversion devices maintained by NSW Health, can be accessed online at www.health.nsw.gov.au/public-health/ehb/general/wastewater register_grey_diversion.pdf.

3.6 Sub-surface Irrigation

Greywater generated by a GDD must only be reused for sub-surface irrigation, at a depth of 100 mm or more below the surface. Distribution pipes and fittings must be at least one metre from a boundary, and delivery pipes will generally need to be underground.

The sub-surface irrigation should be installed in such a manner that it will not discharge into any watercourse or cause run-off to neighbouring properties.

The irrigation system connected to the GDD does not require installation by a licensed plumber, but must follow the manufacturer's recommendations or design where relevant, and must meet the performance standards in Clause 75A of the Regulation (reproduced in Appendix C of these guidelines).

Additional information on recommended sub-surface irrigation design, maintenance and management can be found in the greywater fact sheets listed in Appendix D.

3.7 Marking, Labelling and Signage

In accordance with the ***NSW Code of Practice for Plumbing and Drainage 3rd Edition 2006***, the GDD and associated sub-surface irrigation system must be marked, labelled and signed.

External connections shall have signs that are marked "WARNING DO NOT DRINK" in accordance with the Australian Standard AS 1319.

All pipes or pipe sleeves and identification tapes (including those on pressurised irrigation systems) shall be coloured purple as per the Australian Standard AS 2700 and marked with the following in accordance with the Australian Standard AS 1345 "WARNING RECYCLED/RECLAIMED WATER – DO NOT DRINK" at intervals not exceeding 0.5 m.

All below ground pipes (including those used for sub-surface irrigation) shall have an identification tape, marked in accordance with the Australian/New Zealand Standard AS/NZS 3500.1 Clause 9.5.4.1, installed on top of the greywater pipeline, running longitudinally, and fastened to the pipe at not more than 3 m intervals.

3.8 Maintenance

Once a GDD is installed it is the owner's responsibility to ensure it is maintained for the life of the installation.

GDDs and their associated sub-surface irrigation distribution systems require regular maintenance, such as cleaning and replacing of filters and periodic de-sludging of the surge tank, regular though infrequent inspection of the sub-surface distribution system, and soil condition evaluation (Table 3.1).

Table 3.1 Recommended Maintenance for Greywater Diversion Devices

GDD Component	Maintenance Required	Frequency
Filter	Clean filter – filter should be removed and cleaned, removing physical contaminants (sand, lint, hair, etc.)	Weekly
	Replace filter	As recommended by manufacturer or as required (usually every 6 – 12 months)
Surge tank	Clean out sludge from surge tank	Every 6 months
Sub-surface irrigation distribution system	Check that water is dispersing – regularly monitor soil to ensure all areas are wet after an irrigation period.	Weekly
Soil condition	Check that soil is healthy. Signs of unhealthy soil include: – damp and boggy ground hours after irrigation – surface ponding and run-off of irrigated water – poor vegetation growth – unusual odours – clumping of soil – fine sheet of clay covering surface	Monthly

This maintenance work itself has inherent health risks, just like managing a worm farm or compost bin. Rubber gloves and a mask should be worn and thorough washing of hands and clothes should take place immediately afterwards.

3.9 Responsibilities

Table 3.2 Responsibilities for Greywater Diversion Devices

Action	Responsibility		
	Owner	Plumber	Other
Evaluate conditions for exemption from the prior approval by council and ensure overall compliance	✓		
Undertake a water balance to determine water demand requirements	✓		
Check with the local water utility that the property is serviced by a meter with an integral dual check valve to ensure backflow protection of the water supply	✓		
Engage a licensed plumber to install the GDD and associated non-storage surge attenuation	✓		
Ensure GDD and non-storage surge attenuation meets the requirements of the *NSW Code of Practice: Plumbing and Drainage 3rd Edition 2006*		✓	
Install sub-surface irrigation system to distribute greywater	✓		
Notify the local water utility that a GDD has been installed at the property		✓	
Undertake regular maintenance of the GDD in accordance with the manufacturer's recommendations and these guidelines	✓		

3.10 Offences and Penalties

There is an onus of responsibility on the owner of residential premises where a greywater diversion device (GDD) is installed to ensure that the GDD is maintained and does not compromise public health or the environment.

The best practice management control measures identified in this guideline provide guidance on how to maintain and operate a GDD correctly, to protect public health and the environment. If the owners of premises comply in full with these guidelines, then they are exempt from council approval. If a person carries out the activity of greywater diversion without council approval and does not comply with the requirements in the Regulation, the NSW Code of Practice, and these guidelines, the exemption from approval is invalid. Under s. 626(3) of the ***Local Government Act 1993***, the maximum penalty for carrying out an activity without prior council approval is $2200, or council can issue an on the spot fine of $220.

Under the ***Protection of the Environment Operations Act 1997*** the reuse of greywater that has the potential to pollute or pollutes a council's stormwater system and/or waterways carries a maximum penalty of $1,500 to the operator of the offending system, or council can issue an on the spot fine of $150.

If a neighbour or member of the public reports a nuisance or greywater crossing boundary lines with the potential to cause a public health or environmental impact, council has the ability to follow up the complaint and issue fines or directions.

PART C
ADVISORY INFORMATION ON THE REUSE OF GREYWATER

Section 4 – Greywater Treatment Systems

Section 5 – Manual Bucketing of Greywater

4 GREYWATER TREATMENT SYSTEMS

4.1 Overview

A greywater treatment system (GTS) collects, stores, treats, and may disinfect, greywater to the standards specified in the NSW Health ***Domestic Greywater Treatment Systems Accreditation Guidelines (February 2005***). They can be installed in residential premises in sewered areas to provide treated greywater for reuse for irrigation (including surface irrigation), toilet flushing and washing machine use.

Appendix A outlines the process for choosing and installing a greywater treatment system.

4.2 Accreditation

NSW Health is responsible for administering the requirements of Clause 41 of the ***Local Government (General) Regulation 2005*** in accrediting GTSs and circulating accreditation notices to Public Health Units and councils.

GTSs are accredited by the Director-General of the Department of Health (NSW Health) following the process and standards specified in the Domestic Greywater Treatment Systems Accreditation Guidelines (February 2005).

A council must not approve the installation of a GTS, unless the GTS has been accredited by NSW Health. There are some instances where a GTS may be exempt from accreditation by the Director-General of the NSW Health Department. The criteria for exemption are explained on the NSW Health web page at http://www.health.nsw.gov.au/public-health/ehb/general/wastewater/adnote1.pdf.

The irrigation system associated with the GTS does not require accreditation by NSW Health but requires prior approval of the council.

4.3 Approvals

A GTS is defined as a waste treatment device and therefore the owner of the premises must obtain prior approval from the council for installation, and operation, under Item C6 of Section 68 of the ***Local Government Act 1993*** and Part 2, Division 4 ***Local Government (General) Regulation 2005***. There are no exemptions to this requirement. A council must not approve the installation of a GTS unless they have been accredited by the NSW Department of Health (Clause 41(1) of the ***Local Government (General) Regulation 2005)***.

Council may grant approval to construct and install a GTS at a particular site in accordance with Item C5, Section 68, ***Local Government Act, 1993***. A GTS and the associated reuse distribution system/s (e.g. irrigation system, reticulation for toilet flushing) also require approval to operate from council. Approval to operate should ideally be obtained from the local council at the same time as approval for the installation of the GTS and associated distribution system.

It is the responsibility of the owner of the premises to engage a licensed plumber to install the GTS and any associated distribution system (e.g. irrigation system, third pipe for toilet flushing).

It is the responsibility of the installing licensed plumber to install the GTS to meet the requirements of the ***NSW Code of Practice: Plumbing and Drainage 3rd Edition 2006***. The plumber must ensure that controls to prevent the incidence of cross-connection in addition to overflow and backflow protection (in the form of a backflow containment device) are implemented and that the local water utility is notified in writing that a GTS is in place at the premises. Written notification shall be in the form of "as completed plans" (e.g. an amended sewer service diagram) or other documentation as required by the local water utility.

Where a GTS is connected to internal fixtures for toilet flushing and washing machine use, a back-up water supply will be required to ensure a constant water supply to all fixtures should the GTS fail.

4.4 Best Practice Management Control Measures

It is important that greywater treatment is undertaken sensibly to ensure that public health and the environment are protected. The control measures, presented here as a list of '***Dos and Don'ts***', have been compiled to provide owners and residents with a guideline of how to best manage their reuse of treated greywater and ensuring the reuse of greywater achieves the performance standards required by the approval granted by council. Each of these control measures is explained in further detail in Appendix C of these guidelines.

These are minimum requirements for greywater treatment systems, council may have other requirements and conditions when the approval is given.

When reusing greywater treated by a greywater treatment system, **DO**:

- ✓ **DO** get council approval and install a greywater treatment system (GTS) that has been accredited by NSW Health.
- ✓ **DO** reuse treated greywater (from a GTS) only for irrigation (including surface irrigation), toilet flushing and washing machine use.
- ✓ **DO** undertake a water balance before installing a GTS to calculate the amount of water that can be reused by the household.
- ✓ **DO** select garden-friendly detergents that are biodegradable and low in phosphorus, sodium, boron and chloride.
- ✓ **DO** select washing detergents that are low in salt – consider using a powder concentrate, or a liquid washing detergent.
- ✓ **DO** monitor plant and soil response to greywater irrigation.
- ✓ **DO** occasionally irrigate with drinking water to disperse salts from the soil (only appropriate during extended periods of zero rainfall).
- ✓ **DO** consider applying a soil rewetting agent every six months.
- ✓ **DO** ensure that regular maintenance of the greywater system is undertaken.
- ✓ **DO** consider using irrigation drippers with large openings.
- ✓ **DO** mark and label all pipes and use signs to indicate greywater reuse (see section 4.6).

When reusing greywater treated by a greywater treatment system, **DON'T**:

- ✗ **DON'T** irrigate with greywater during rain.
- ✗ **DON'T** reuse greywater generated by cleaning in the laundry or bathroom, or when using hair dye or other chemicals.
- ✗ **DON'T** reuse greywater generated by washing rags used for painting or for maintaining machinery.
- ✗ **DON'T** reuse greywater to top up rainwater tanks or swimming pools.
- ✗ **DON'T** over-water.
- ✗ **DON'T** irrigate with greywater if the household is located on an aquifer that is used for drinking water.
- ✗ **DON'T** reuse greywater on plants that will be eaten raw or where fruit has fallen to the ground.
- ✗ **DON'T** use greywater to wash paths, driveways or cars.
- ✗ **DON'T** reuse greywater so that it flows into the streets or down stormwater drains.
- ✗ **DON'T** install drippers of an irrigation system within one metre of boundary lines, inground pools, and inground potable water tanks and buildings.
- ✗ **DON'T** let greywater go beyond the property boundary and cause a nuisance to neighbours.

4.5 Greywater Reuse Estimations

To estimate a household's greywater requirements a water balance can be undertaken to consider both the amount of greywater that has the potential to be reused, and the amount of greywater that can be generated to meet the needs of the household. This is important because a typical metropolitan household can potentially generate much more water than is needed for use by the household.

All of the information and calculations to undertake a water balance are provided in Appendix B: Greywater Reuse Estimations and are included in the online Self Assessment Form and Tool, available online at www.deus.nsw.gov.au. Appendix C provides guidance for managing greywater to protect public health and the environment.

4.6 Marking, Labelling and Signage

The marking, labelling and signage of the GTS and associated sub-surface irrigation system must be in accordance with the ***NSW Code of Practice for Plumbing and Drainage 3rd Edition 2006***.

Greywater outlets (connections, taps, appliances) shall have signs that are marked "WARNING DO NOT DRINK" in accordance with the Australian Standard AS 1319.

All pipes or pipe sleeves and identification tapes (including those on pressurised irrigation systems) shall be coloured purple as per the Australian Standard AS 2700 and marked with the following in accordance with the Australian Standard AS 1345 "WARNING RECYCLED/RECLAIMED WATER – DO NOT DRINK" at intervals not exceeding 0.5 metres.

All below ground pipes (including those used for sub-surface irrigation) shall have an identification tape, marked in accordance with the Australian/New Zealand Standard AS/NZS 3500.1 Clause 9.5.4.1, installed on top of the greywater pipeline, running longitudinally, and fastened to the pipe at not more than 3 m intervals.

4.7 Irrigation

The irrigation system connected to the GTS does not require installation by a licensed plumber, but must follow the manufacturer's recommendations or design where relevant.

Greywater generated by a GTS may be reused for surface or sub-surface irrigation. Distribution pipes and fittings must be at least 1 metre from a boundary, inground pool or inground potable water tank, and pipes will generally need to be underground.

4.8 Maintenance

Once a GTS is installed it is the owner's responsibility to ensure it is maintained for the life of the installation.

The maintenance procedures provided by the manufacturer, and any conditions of approval from the council, must be carried out as specified.

4.9 Responsibilities

Table 4.1 Responsibilities for Greywater Treatment Systems

Action	Responsibility		
	Owner	Plumber	Other
Undertake a water balance to determine water demand requirements	✓		
Ensure GTS meets the requirements of the *NSW Code of Practice: Plumbing and Drainage 3rd Edition 2006*		✓	
Apply for and obtain approval to install and approval to operate the GTS and associated irrigation from the local council	✓		
Engage a licensed plumber to install the GTS		✓	
Install sub-soil, sub-surface or surface irrigation system to distribute greywater	✓		
Notify the local water utility that a GTS has been installed at the property		✓	
Undertake regular maintenance of the GTS in accordance with the manufacturer's recommendations and these guidelines	✓		
Undertake annual testing of backflow protection device			✓[a]

a It is the responsibility of the owner to organise annual testing of the backflow protection device by an accredited tester

4.10 Offences and Penalties

There is an onus of responsibility on the owner of residential premises where a greywater treatment system (GTS) is installed, to ensure that council has approved the installation and the operation of the system and that it is maintained and does not compromise public health or the environment.

Failure to obtain approval from council for the installation of a greywater treatment system, as well as failure to obtain approval to operate a greywater treatment system, are offences under section 626(3) of the ***Local Government Act 1993***. The maximum penalty is $2200.

Councils can issue an on the spot fine of $330 for operating a greywater treatment system without approval. Failure to comply with the conditions of approval issued by council is also an offence under section 627(3) of the ***Local Government Act 1993***. The maximum penalty is $2200. Councils can issue an on the spot fine of $330 for failing to comply with the conditions of approval for operating a greywater treatment system.

Under the Protection of the ***Environment Operations Act 1997*** the reuse of greywater that may have the potential to pollute or pollutes council's stormwater system and/or waterways carries a maximum penalty of $1,500 to the operator of the offending system, or Council can issue an on the spot fine of $150.

5 MANUAL BUCKETING OF GREYWATER

This section outlines the conditions of approval and the '***Dos and Don'ts***' for manual bucketing of greywater at residential premises in sewered areas of NSW.

5.1 Overview

Manually irrigating with greywater using a bucket (e.g. collecting shower and laundry water for reuse) can reuse small quantities of greywater, potentially saving drinking water.

Bucketed greywater can be reused for irrigation of gardens, lawns and outdoor pot plants.

Manual bucketing is considered to be a low risk activity for the following reasons:

- Manual bucketing reuses low volumes of greywater. Accordingly, only low quantities of contaminants will be applied to the soil and there is a limited ability for runoff to neighbouring properties or waterways.
- It is unlikely that manual bucketing will occur during wet weather, reducing the risk of over-watering or runoff.

5.2 Conditions of Approval

Manual bucketing for residential premises in sewered areas of NSW does not require prior approval from council.

5.3 Best Practice Management Control Measures

It is important that manual bucketing is undertaken sensibly to ensure that public health and the environment are protected. The following best practice management control measures, presented in a list of '***Dos and Don'ts***', have been compiled to provide owners and residents with a guideline of how to best manage their reuse of greywater by manual bucketing. Each of these control measures is explained in further detail in Appendix C of these Guidelines.

The best practice management control measures (***Dos and Don'ts***) for manual bucketing are a necessity as they reduce the risks associated with reuse, whilst providing a water source that has the potential to improve the health and appearance of soil and plants.

When undertaking manual bucketing of greywater, **DO**:

✓ **DO** be careful lifting and carrying buckets of greywater, particularly over slippery surfaces and on stairs or steps.

✓ **DO** select garden-friendly detergents that are biodegradable and low in phosphorus, sodium, boron and chloride.

✓ **DO** select washing detergents that are low in salt – consider using a powder concentrate, or a liquid washing detergent.

✓ **DO** reuse greywater in the garden in several locations.

✓ **DO** monitor plant and soil response to greywater irrigation.

✓ **DO** consider applying a soil rewetting agent every six months.

✓ **DO** wash your hands after reusing greywater.

When undertaking manual bucketing of greywater, **DON'T**:

- ✘ **DON'T** reuse toilet or kitchen wastewater.
- ✘ **DON'T** reuse greywater for irrigation during rain.
- ✘ **DON'T** apply greywater in areas that are readily accessible to children, people with a low immune system or pets.
- ✘ **DON'T** reuse greywater generated from the washing of nappies or soiled clothing.
- ✘ **DON'T** reuse greywater when a resident is sick, e.g. has diarrhoea.
- ✘ **DON'T** reuse greywater generated by cleaning in the laundry or bathroom, or when using hair dye or other chemicals.
- ✘ **DON'T** reuse greywater generated by washing rags used for painting or for maintaining machinery and vehicles.
- ✘ **DON'T** reuse greywater to top up rainwater tanks or swimming pools.
- ✘ **DON'T** store untreated greywater.
- ✘ **DON'T** over-water.
- ✘ **DON'T** reuse greywater on plants that will be eaten raw or where fruit has fallen to the ground and could be eaten.
- ✘ **DON'T** use greywater to wash paths, driveways or cars.
- ✘ **DON'T** reuse greywater so that it flows into the streets or down stormwater drains.
- ✘ **DON'T** let greywater go beyond the property boundary and cause a nuisance to neighbours.

GLOSSARY OF TERMS

aquifer	A porous soil or rock formation which holds water.
council	Statutory corporation constituted under the *Local Government Act 1993* for an area of NSW.
drinking water	Water suitable for human consumption, used for drinking, food preparation, personal hygiene, and the removal of human wastes.
dual reticulation	Two separate and distinct piping systems, one of which is used to transport drinking water, and the other for non-potable water for final uses that do not require drinking water.
fixture trap	U-shaped pipe below plumbing fixtures that provides a water seal to prevent sewer odours and gases from entering habitable areas.
greywater	For the purposes of these guidelines, means waste water from washing machines, laundry tubs, showers, hand basins and baths, but does not include waste water from a kitchen, toilet, urinal or bidet.
greywater diversion	The installation and operation of a method for diverting greywater generated by a household to sub-surface irrigation of a garden or lawn at that same premises.
greywater diversion device (GDD)	A device that diverts greywater generated by a household for sub-surface irrigation reuse.
greywater treatment system (GTS)	A system that collects, treats, and disinfects greywater generated by a household, for reuse for one or more of the following end uses: toilet and urinal flushing; washing machine; and surface or sub-surface irrigation.
groundwater	Water beneath the surface held in, or moving through, saturated layers of soil, sediment or rock.
local water authority	The organisation, agency or company that has responsibility and authority for treating and/or supplying water and wastewater services to a local government area.
non-potable water	Water suitable for purposes other than drinking water use.
non-storage surge attenuation	Allows the temporary containment of greywater to be released to an irrigation system at a constant rate via gravity or pump. Methods of non-storage surge attenuation include: a non-storage surge attenuation tank; attenuation incorporated into the GDD system itself; or a mulch pit.
nutrients	Chemical elements essential for sustained plant or animal growth. The major nutrients essential for plant growth are nitrogen, phosphorus and potassium.
pathogen	Organism that is capable of causing disease in humans and animals.
percolation	The descent of water through the soil.
residential premises	A single household in a sewered residential area; does not include a premises comprising more than one dwelling.

GLOSSARY OF TERMS continued

reticulation	A network of water pipes, which delivers water supply to customers.
risk	The likelihood of a hazard causing harm in exposed populations in a specified timeframe, including the magnitude of that harm (EPHC-NRMMC, 2005).
salinity (irrigation salinity)	The increasing build-up of salts in irrigated soils. It results from raised water table levels that bring soil salts into the upper levels of the soil profile.
sewage management facility	A human waste storage facility or a waste treatment device intended to process sewage. Also includes a drain connected to such a facility or device. As defined in Section 68A of the ***Local Government Act 1993***.
sub-surface irrigation	Irrigation at a depth of at least 100 mm below surface level of soil or mulch.
surface irrigation	Water applied to the ground surface from above surface level.
surface water	All water naturally open to the atmosphere (e.g. rivers, streams, lakes and reservoirs).
surge attenuation	A tank or similar to cope with sudden influxes of greywater (e.g. from a washing machine cycle) for distribution to a land application system.
thermotolerant coliforms	An indicator of microbiological quality. A type of micro-organism which typically grows in the intestine of warm-blooded animals (including humans) and are shed in their millions in each gram of faeces.
wastewater	Water that has been contaminated by some activity. Includes greywater and sewage.

REFERENCES

Christova-Boal, D., Eden, R. E. and McFarlane, S. (1996). 'An investigation into greywater use for urban residential properties'. ***Desalination*** 106 (1996) 391-397.

DEC NSW (2004). ***Environmental Guidelines: Use of wastewater by irrigation***. NSW Department of Environment and Conservation. Sydney, Australia.

Jeppesen, B. and Solley, D. (1994). ***Domestic greywater reuse: Overseas practice and its applicability to Australia.*** Research Report No. 73. Urban Water Research Association of Australia. Brisbane, Australia.

Loh, M. and Coghlan, P. (2003). ***Domestic water use study: In Perth, Western Australia 1998-2001***. Water Corporation. Perth, Australia.

NSW Health (2005). ***Domestic Greywater Treatment Systems Accreditation Guidelines February 2005***. NSW Department of Health. Sydney, Australia.

NSW Health (2000). ***Greywater reuse in sewered single domestic premises***. April 2000. NSW Department of Health. Sydney, Australia.

Patterson, R.A. (2006). ***Consideration of soil sodicity when assessing land application of wastewater or greywater***. Septic Safe Environmental Health and Protection Guidelines. Technical Sheet Reference 01/7. Department of Local Government and Lanfax Laboratories.

Sydney Water Corporation (2005). ***Water Conservation & Recycling Implementation Report 2004-2005***. Sydney Water Corporation. Sydney, Australia.

BIBLIOGRAPHY

ACT Government (2004). ***Greywater Use: Guidelines for residential properties in Canberra***. ACT Government. Canberra, Australia.

Australian Standards. ***AS 1319-1994 Safety signs for the occupational environment***.

Australian Standards. ***AS 2700 AS 2700-1996 Colour Standards for general purposes.***

Australian Standards. ***AS/NZS 3500.1:2003 Plumbing and drainage - Water services***

Committee on Uniformity of Plumbing and Drainage Regulation in NSW (2006). ***New South Wales Code of Practice Plumbing and Drainage 3rd Edition***. Department of Energy Utilities and Sustainability. Sydney, New South Wales.

Local Government Act 1993 (NSW)

Local Government (General) Regulation 1995 (NSW)

NSW Government (1998). ***Environment & Health Protection Guidelines: On-site and Decentralised Sewage Management***. NSW Government. Sydney, Australia.

Patterson, R.A. (2005). ***Consideration of soil sodicity when assessing land application of wastewater***. Septic Safe Technical Sheet 01/7. Department of Local Government and Lanfax Laboratories. Armidale, Australia.

Protection of the Environment Operations Act 1997 (NSW)

SAI Global Assurance Services. ***Australian Technical Specification 5200.460 – 2005.***

Shaw, R.J. (1999). ***Soil Salinity – Electrical Conductivity and Chloride in Soil Analysis: an interpretation manual***. Edited by Peverill, K.I., Sparrow, L.A. and Reuter, D.J. CSIRO. Canberra, Australia.

Water Corporation, Department of Environment (WA) and Department of Health (WA) (2005). ***Code of Practice for the Reuse of Greywater in Western Australia***. Water Corporation. Perth, Western Australia.

APPENDICES

Appendix A
Greywater Decision Flow Charts

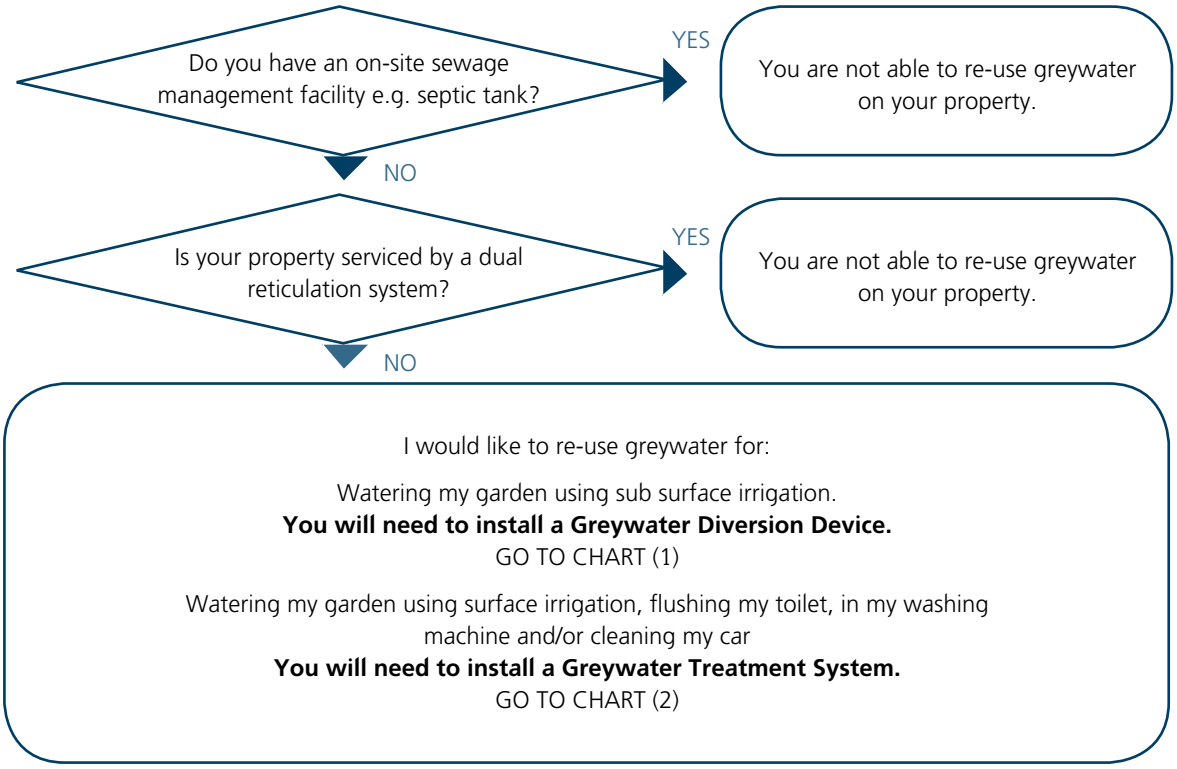
Appendix B
Greywater Reuse Estimations

Appendix C
Management of Greywater

Appendix D
Fact Sheets

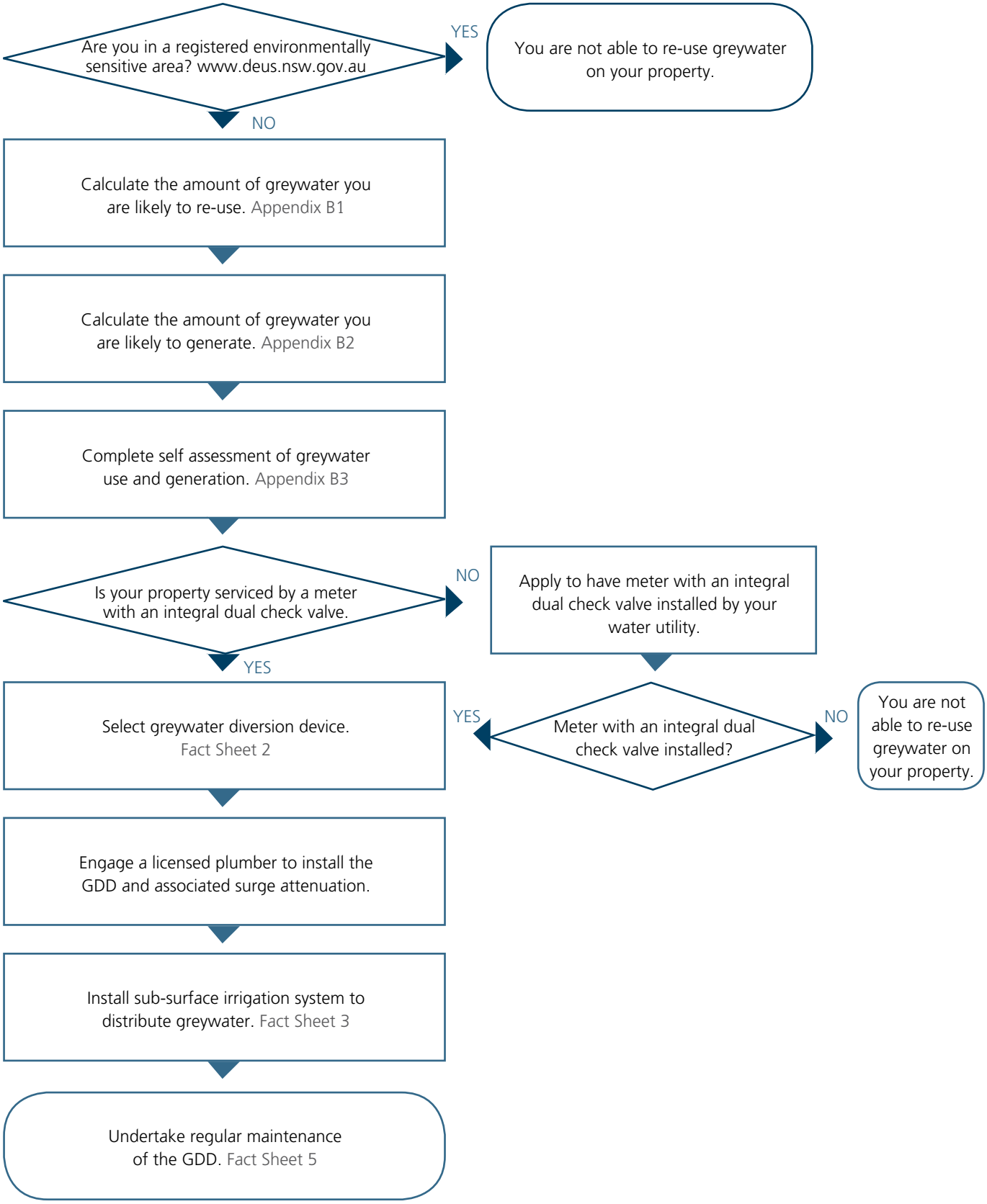
APPENDIX A – GREYWATER DECISION FLOW CHARTS

Process Flow Chart



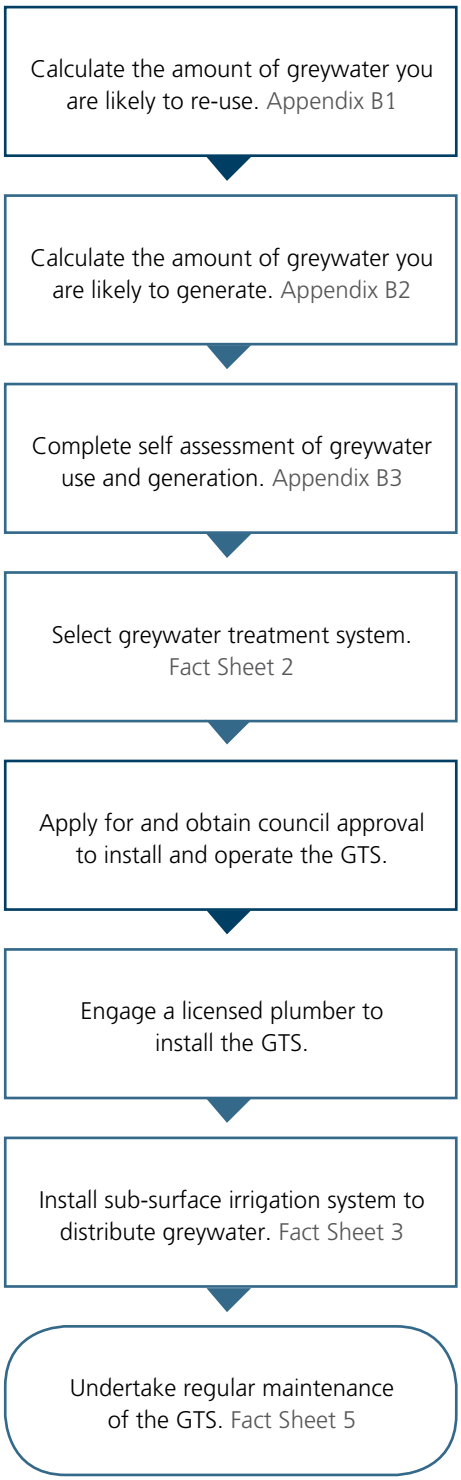
APPENDIX A – GREYWATER DECISION FLOW CHARTS

Chart 1 Greywater Diversion Device



APPENDIX A – GREYWATER DECISION FLOW CHARTS

Chart 2 Greywater Treatment System



APPENDIX B – GREYWATER REUSE ESTIMATIONS

To estimate a premises' greywater requirements, a water balance can be undertaken to consider both the amount of greywater that has the potential to be reused, and the amount of greywater that can be generated to meet the needs of the premises.

All of the information and the calculations explained here are included in the online Self Assessment Form and Tool, available online at www.deus.nsw.gov.au. The Self Assessment Form and Tool allows owners and residents to determine:

- how they can most appropriately reuse greywater on their premises;
- how to calculate how much greywater they have the potential to reuse;
- how to calculate how much greywater can be generated; and
- the nutrient balance of their premises.

It is essential that owners and residents complete the Self Assessment Form when they plan to install a GDD. The 'water for life' site also provides guidance for managing greywater to protect public health and the environment.

B1 Potential for Reuse

To determine the potential of a household to reuse greywater, the end uses of greywater need to be identified. There are several end uses available for greywater reuse, depending on the reuse method and level of treatment (Table A1).

Table B1 Greywater Reuse Methods and Applications

Reuse Method	Greywater Reuse Application
Manual bucketing	• Limited irrigation
Greywater diversion device (GDD)	• Sub-surface irrigation (at least 100 mm below surface)
Greywater treatment system (GTS)	• Surface or sub-surface irrigation • Toilet flushing • Washing machines

The potential amount of greywater that can be reused for residential premises can be estimated by considering the irrigation potential of the premises.

Irrigation

The method described in this section can be used for estimating the potential amount of greywater that can be used for sub-surface irrigation (GDD or GTS greywater) or surface irrigation (greywater treated by a GTS only).

To estimate the amount of greywater that can be reused for irrigation, a number of factors need to be considered including the soil irrigation rate, size of the area to be irrigated and seasonal variations in irrigation requirements.

The irrigation volume is the amount of water that the soil can absorb per square metre of garden or lawn that will be irrigated. The irrigation volume adopted for NSW is 20 L/m2 for each event (equivalent to 20 mm/m2 of rainfall). The frequency of an irrigation volume is dependant on the soil's capacity to hold water; this will be considered later in the estimations.

The sub-surface irrigation area can be calculated by determining the total size of all of the garden beds or lawn area that will be served by the irrigation system. The sub-surface irrigation area can then be multiplied with the irrigation volume to determine the total volume of greywater that can be reused per irrigation event. A number of example volumes have been calculated and are presented in Table A2.

Table B2 Examples of the Volume of Greywater Reused per Irrigation Event

Volume of Greywater Reused per Irrigation Event (L)				
1 m^2	5 m^2	10 m^2	25 m^2	50 m^2
20	100	200	500	1000

It is important that GDDs are only turned on when the garden needs watering. Leaving a GDD turned on at all times has the potential to lead to over-watering. Just as a resident would not leave a drinking water tap turned on watering the garden at all times, the GDD should be used as a tap that is typically turned off (diverted to sewer). When the tap is turned on it is to meet the needs of the irrigation event determined above (from Table A2). Similarly, treated greywater produced by a GTS should not be continuously supplied for irrigation, and should only be used when irrigation is required.

The frequency of an irrigation event is dependant on the season. During the summer months plants require irrigation more frequently than in the winter months. The recommended frequency of irrigation events for the year is provided in Table A3.

Table B3 Recommended Seasonal Irrigation Frequency

Location - NSW	Frequency of irrigation event			
	Summer	Autumn	Winter	Spring
Coastal Region	Every 7 days	Every 13 days	Every 20 days	Every 9 days
Inland – East of the Great Dividing Range	Every 5 days	Every 8 days	Every 12 days	Every 7 days
Inland – West of the Great Dividing Range	Every 4 days	Every 10 days	Every 14 days	Every 6 days

Rainfall must also be considered as an irrigation event. For every 1 mm of rainfall, owners and residents need to adjust their irrigation volume by 1 litre per square metre (1 L/m2). So if in the first week of January there is a rainfall event of 20 mm in a coastal area, there will be no need to irrigate with greywater (or any other water source) for seven days.

Toilet Flushing

The method described in this section can be used for estimating the potential amount of greywater that can be used for toilet flushing. Only greywater treated by a GTS can be used for toilet flushing.

To estimate the amount of greywater that can potentially be reused for toilet flushing in the premises, the number of residents and the type of toilet/s installed at the premises needs to be determined.

Toilets are either full flush (one button) or dual flush (two buttons). Full flush toilets use 11 litres per flush, and dual flush toilets use between 3.0 and 5.5 litres per flush on average (assuming a ratio of four half flushes to every one full flush) (AS 1172.2-1999; AS/NZS 6400:2005). Table A4 can be used to estimate the amount of water used at the premises for toilet flushing, and therefore the potential for reuse by replacing drinking water with greywater for toilet flushing.

Table B4 Potential for Greywater Reuse – Toilet Flushing

Number of residents	Potential for Reuse - Toilet Flushing (L/week)	
	Full Flush	Dual Flush
1	308	101
2	616	202
3	924	302
4	1232	403
5	1540	504
6	1848	605
7	2156	706

Assumptions: Full flush: 11 litres per flush Half flush: 3.0 – 5.5 litres per flush. Ratio of four half flushes to every one full flush. Assumed 4 total flushes per resident per day. Sources: AS 1172.2-1999; AS/NZS 6400:2005

Washing Machine

The method described in this section can be used for estimating the potential amount of greywater that can be used in washing machines. Only greywater treated by a GTS can be used in washing machines.

To estimate the amount of greywater that can potentially be used by the washing machine, the number of residents (or the number of washes per week) and the type of washing machine needs to be determined.

Washing machines can be front loading or top loading and can be small (up to 5.5 kg), medium (6 – 7 kg), or large (over 7.5 kg). In general, front loading washing machines are more water-efficient than top loading washing machines, based on washing machines available for domestic use over the last five years. The average front loading washing machines are medium in size and have a 4-Star rating under the Water Efficiency Labelling and Standards (WELS) Scheme. The average top loading washing machines are large in size and have a 2-Star rating under the Water Efficiency Labelling and Standards (WELS) Scheme. The size of the washing machine can be found in the manufacturer's user manual or written on the machine itself. Alternatively, owners and residents can assume that a front loading washing machine is medium in size and a top loading washing machine is large.

Table A5 can be used to estimate the amount of water used by a washing machine per week. The number of residents or the number of washes per week can be matched with the type of washing machine, to give the estimated amount of greywater that can be reused by the washing machine.

Table B5 Potential for Greywater Reuse – Washing Machines

Number of residents	Number of washes per week	Potential for Reuse – Washing Machine (L/week)					
		Front Loading Washing Machine			Top Loading Washing Machine		
		Small (up to 5.5 kg)	Medium (6 – 7 kg)	Large (over 7.5 kg)	Small (up to 5.5 kg)	Medium (6 – 7 kg)	Large (over 7.5 kg)
1	2	103	**133**	164	210	273	**336**
2	3	154	**200**	246	315	410	**504**
3	4	205	**267**	328	420	546	**672**
4	6	308	**400**	492	630	819	**1008**
5	7	359	**466**	574	735	956	**1176**
6	8	410	**533**	656	840	1092	**1344**
7	9	461	**600**	738	945	1229	**1512**

Assumptions: Top loading: average machine is large (over 7.5 kg) with a 2-Star WELS rating. Front loading: average machine is medium (6 - 7 kg) with a 4-Star WELS rating. Sources: AS/NZS 6400:2005; Choice Magazine 2003

B2 Greywater Generation

The potential water usage volume for a greywater generating appliance is equivalent to the volume of greywater generated by an appliance.

The data in Table 2.1 (Section 2.1.1) can be used to calculate the amount of greywater you can generate from your bathroom, laundry or both, depending on how many people live in the house.

It is appropriate to use the data in Table 2.1. However, as has been previously discussed, there is a high amount of variability associated with the generation of greywater. The figures for residential premises water use given in Section 2.1.1 in Table 2.1 are average values and may not represent a particular premises' water usage accurately. To best estimate the amount of greywater generated by a household, it is most accurate to determine the potential for greywater generation by the household appliances at individual residential premises.

The household fixtures or appliances that can potentially be used to generate greywater are:

- Shower
- Bath
- Basin taps
- Washing machine
- Laundry taps.

Shower

To estimate the amount of greywater that is generated by the shower, the number of residents at the premises and the type of shower head installed in the house need to be determined.

Shower heads are given a rating of 1-Star to 6-Stars under the Water Efficiency Labelling and Standards (WELS) Scheme depending on the amount of water they use. Only 1-Star to 3-Star shower heads are currently available. For those owners and residents that are unsure of the type of shower head they have installed, Table A6 provides a general explanation.

Table B6 Shower Head WELS Star Rating and Water Use

Installation Date	Shower Head Star Rating (WELS)	Water Flow (L/min)
As part of WaterFix (Sydney Water) or a similar water efficiency program	**3-Star**	9
Within the last 15 years	**2-Star**	12
More than 15 years ago	**1-Star**	16

Source: AS/NZS 6400:2005

Once the number of residents and the shower head type is known, using Table A7 the amount of greywater generated by the premises' shower(s) can be determined by matching the number of residents row with the shower head type column. It is assumed that the average shower length is seven minutes (Loh and Coughlan, 2003) and that every resident has one shower per day.

Table B7 Greywater Generation – Shower (and Bath)

Number of Residents	Greywater Generation – Shower (and Bath) (L/week)		
	Shower Head 1-Star	Shower Head 2-Star	Shower Head 3-Star
1	784	588	441
2	1568	1176	882
3	2352	1764	1323
4	3136	2352	1764
5	3920	2940	2205
6	4704	3528	2646
7	5488	4116	3087

Assumptions: Average shower: 7 minutes (Source: Loh and Coughlan, 2003). Every resident showers (or bathes) once per day (7 times/week).

Baths

The amount of greywater generated by a bath is between 60 and 300 litres depending on the size of the bath and the level that the bath is filled to. An average bath size is 260 litres when full. However, the majority of baths are for children and will be filled to between a quarter to a half of the full bath level, generating 60 to 130 litres of greywater per bath. This is the equivalent of one seven-minute shower, so the estimation for the amount of water generated by the shower can be used to estimate the amount of water generated by the bath (Table A7). Assume that each resident showers or bathes once per day (7 times/week); for children that share a bath treat them as one resident for the purposes of the bath estimation only.

Basin Taps

To estimate the amount of greywater that is generated by bathroom basin taps, the number of residents at the premises needs to be determined.

It is estimated that each person uses 4 litres of water from the bathroom hand basin per day (face washing, teeth brushing, hand washing). This assumption is used to estimate the greywater generation from basin taps in Table A8, by matching the number of residents to the amount of greywater generated.

Table B8 Greywater Generation – Basin Taps

Number of Residents	Greywater Generation – Basin Taps (L/week)
1	28
2	56
3	84
4	112
5	140
6	168
7	193

Washing Machines

To estimate the amount of greywater that is generated by the use of washing machines, the number of residents at the premises (or the number of washes per week) and the type of washing machine need to be determined.

It is appropriate to reuse washing machine wastewater as greywater in both diversion systems and greywater treatment.

Washing machines can be front loading or top loading and can be small (up to 5.5 kg), medium (6 – 7 kg), or large (over 7.5 kg). In general, front loading washing machines are more water efficient than top loading washing machines, based on washing machines available for domestic use over the last five years (***Choice Magazine***, 2003). The average front loading washing machines are medium in size and have a 4-Star rating under the Water Efficiency Labelling and Standards (WELS) Scheme. The average top loading washing machines are large in size and have a 2-Star rating under the WELS Scheme. The size of the washing machine can be found in the manufacturer's user manual or written on the machine itself; alternatively owners and residents can assume that a front loading washing machine is medium in size and a top loading washing machine is large.

Table A9 can be used to estimate the amount of water generated by a washing machine per week. The number of residents or the number of washes per week can be matched with the type of washing machine, to give the estimated greywater generated by the washing machine.

Table B9 Greywater Generation – Washing Machines

Number of residents	Number of washes per week	Greywater Generation – Washing Machine (L/week)					
		Front Loading Washing Machine			Top Loading Washing Machine		
		Small (up to 5.5 kg)	Medium (6 – 7 kg)	Large (over 7.5 kg)	Small (up to 5.5 kg)	Medium (6 – 7 kg)	Large (over 7.5 kg)
1	2	103	133	164	210	273	336
2	3	154	200	246	315	410	504
3	4	205	267	328	420	546	672
4	6	308	400	492	630	819	1008
5	7	359	466	574	735	956	1176
6	8	410	533	656	840	1092	1344
7	9	461	600	738	945	1229	1512

Assumptions: Top loading: average machine is large (over 7.5 kg) with a 2-Star WELS rating Front loading: average machine is medium (6 - 7 kg) with a 4-Star WELS rating.

Sources: AS/NZS 6400:2005; ***Choice Magazine***, 2003

Laundry Taps

Laundry taps are generally used for soaking clothes and hand washing delicates.

Water that has been used to wash nappies or soiled clothing must not be diverted as greywater due to the high pathogen load of the wastewater generated.

It is estimated that a residential premises with three or less residents uses the equivalent of half a laundry tub of water per week (an average laundry tub has a capacity full to the brim of 50 litres), and a residential premises with four or more residents uses the equivalent of one full laundry tub of water per week.

The amount of greywater generated by premises from laundry taps has been estimated in Table A10.

Table B10 Greywater Generation – Laundry Taps

Number of Residents	Greywater Generation – Basin Taps (L/week)
3 or less	25
4 or more	50

Assumptions: An average laundry tub has a capacity (full to the brim) of 50 litres

B3 Water Balance

The total volume of greywater that has the potential to be reused (Section 4.4.1) can be compared with the total amount of greywater that can be generated to meet the needs of the premises (Section 4.4.2) to determine the water balance for the premises.

A water balance will allow the owner or resident to determine whether they generate enough greywater to supply their potential demand, whether one source (e.g. only the shower or only the washing machine) of greywater is sufficient to meet their needs, or whether they will need both greywater and drinking water to fulfil their demand.

The easiest way for owners or residents to determine their water balance is to write the volume of water that can potentially be reused and generated by the premises in a table form (similar to the Table in the example below), so that all volumes are clearly identified.

Example Water Balance – Greywater Diversion Device

The Smith family of four live in sewered residential premises and want to use greywater for irrigating the gardens in their backyard.

The Smith family can use a greywater diversion device (GDD) to divert greywater for sub-surface irrigation only, without prior approval from council, providing they meet the self-assessable conditions and follow the best practice management control measures stated in these guidelines.

Garden size: Two garden beds, both 2.5 m x 5 m (12.5 m^2) in size, so a total area of 25 m^2

Number of residents: 4

Potential for Reuse

Irrigation potential reuse volume: From Table A2, with 25 m^2 irrigation area, there is potential to reuse **500** litres per irrigation event

Greywater Generation

Shower and bath: The shower head was installed less than 15 years ago; from Table A6, shower head has a 2-Star rating

From Table A7, with 4 residents the premises generates **2,352** litres per week

Basin taps: From Table A8, with 4 residents the premises generates **112** litres per week

Washing machines: Medium sized top loading washing machine

From Table A9, with 4 residents the premises generates **819** litres per week

Laundry taps: From table A10, with 4 residents the premises generates 50 litres per week

Water Balance

Use / Appliance	Potential for Reuse (L/week)	Greywater Generated (L/week)
Irrigation	500	
Shower and bath		2,352
Basin taps		112
Washing machine		819
Laundry taps		50
Total	500	3,333
Water Balance = Total Greywater Generated - Total Potential for Reuse		
Water Balance = 3,333 – 500 = 2,833 L/week		

The water balance for greywater at the premises can be determined by deducting the total greywater requirement from the total greywater generated:

Total Greywater Generated – Total Greywater Requirement = Water Balance

From the previous examples and the Table: **3,333 – 500 = 2,833 L/week**

The Table also allows an easy understanding of where greywater could be generated to meet the requirements of one or more end uses.

For example, the volume of greywater generated by the washing machine could be used to meet the requirements for irrigation over one week. However, considering the shower generating 2,833 litres per week of greywater, or the equivalent of 405 litres per day, the irrigation event demand could be met in one day of shower greywater reuse.

There is no need in this example to connect both the shower and the washing machine to a GDD. It is likely that the decision regarding which appliance to fit the GDD to would be based on which appliance allowed for the easiest access.

Example Water Balance – Greywater Treatment System

The Jones family of four live in sewered residential premises and want to use greywater for toilet flushing, their washing machine, and irrigating the gardens in their backyard.

The Jones family can use a greywater treatment system (GTS) to treat greywater generated at the premises for toilet flushing, washing machine reuse, and surface irrigation of their gardens. The Jones family must receive approval to install and operate their GTS from their local council and the GTS must be accredited by NSW Health.

Garden size: Two garden beds, both 2.5 m x 5 m (12.5 m^2) in size, so a total area of 25 m^2

Number of residents: 4

Potential for Reuse

Irrigation potential reuse volume: From Table A2, with 25 m^2 irrigation area, there is potential to reuse **500** litres per irrigation event

Toilet flushing potential reuse volume: The Jones family have a full flush toilet; from Table A4, the toilet has the potential to reuse **1,232** litres per week

Greywater Generation

Shower and bath: The shower head was installed less than 15 years ago; from Table A6, shower head has a 2-Star rating

From Table A7, with 4 residents, generates **2,352** litres per week

Basin taps: From Table A8, with 4 residents, generates **112** litres per week

Washing machines: Medium sized top loading washing machine
From Table A9, with 4 residents, generates **819** litres per week

Laundry taps: From Table A10, with 4 residents, generates **50** litres per week

Water Balance

Use / Appliance	Potential for Reuse (L/week)	Greywater Generated (L/week)
Irrigation	500	
Toilet Flushing	1,232	
Shower and bath		2,352
Basin taps		112
Washing machine	819	819
Laundry taps		50
Total	2,551	3,333
Water Balance = Total Greywater Generated - Total Potential for Reuse		
Water Balance = 3,333 – 2551 = 782 L/week		

The water balance for greywater at the premises can be determined by deducting the total greywater requirement from the total greywater generated:

Total Greywater Generated – Total Greywater Requirement = Water Balance

From the previous examples and the Table: **3,333 – 2,551 = 782 L/week**

The Table also allows an easy understanding of where greywater could be generated to meet the requirements of one or more end uses.

For example, the volume of greywater generated by the washing machine could be used to meet the requirements for irrigation (or reused in the washing machine).

The amount of greywater generated by the shower over a period of a week (2,551 L) is sufficient to meet that required for toilet flushing and the washing machine combined (2,051 L).

APPENDIX C – MANAGEMENT OF GREYWATER

The reuse of greywater can potentially pose human health and environmental risks if not managed appropriately. A risk assessment has been undertaken to identify the potential risks, and control measures identified to manage these risks.

This generic risk assessment has been used as a basis for the Self Assessment Form that must be completed for each residential premises proposing to reuse greywater. The Self Assessment Form allows homeowners to determine whether greywater is a suitable water source for their premises and to identify the appropriate management measures that can be implemented to reduce the human health and environmental risks associated with greywater reuse.

The requirement of cl.75A of the ***Local Government (General) Regulation 2005*** for carrying out greywater diversion, and of the ***Local Government Act 1993***, to install and operate a greywater diversion system (GDD), is that a number of performance standards are achieved:

(i) the prevention of the spread of disease by micro-organisms

(ii) the prevention of the spread of foul odours

(iii) the prevention of the contamination of water

(iv) the prevention of degradation of soil and vegetation

(v) the discouragement of insects and vermin

(vi) ensuring that persons do not come into contact with untreated sewage or wastewater in their ordinary activities on the premises concerned

(vii) the minimisation of any adverse impacts on the amenity of the premises concerned and surrounding lands.

The management controls identified in this section, when implemented, will meet the performance standards required. The management controls also include practices that are required in the ***NSW Code of Practice: Plumbing and Drainage 3rd Edition 2006*** for carrying out greywater diversion and installing and operating a GTS.

By following the management controls identified in this guideline greywater diversion may be carried out without the approval of council, provided the conditions described in Section 4.2 are met. Greywater treatment systems continue to require prior approval from council.

C1 Risk Management Approach

A risk management approach involves identifying and managing risks in a proactive way, rather than simply reacting when problems arise. The application of the approach can be considered in three steps:

1. **Hazard Identification** – Identify all the hazards in the greywater that could potentially affect human or environmental health (i.e. what might happen and how).
2. **Risk Assessment** – Assess the risk from each hazard by estimating the likelihood that the event will occur and the consequence if it did (i.e. how likely is it that something will happen and how serious will it be if it does).
3. **Controls** – Ensure that preventive measures in place are sufficient to control the identified hazards, and to improve such measures or add new measures, if necessary.

The objective of the risk management approach is to identify and manage the risks associated with greywater reuse, ensuring that sufficient barriers or control points are in place to minimise risks, and meeting the performance standards.

C2 Hazard Identification

The hazard identification step of the risk management process considers potential biological, chemical and physical hazards that could be associated with the reuse of greywater to residential premises and that could potentially affect human or environmental health. The objective is to identify the hazard, the source, the potential hazardous event that may cause contamination or another impact, and, the receiving environment or receptor.

The following hazards were identified for greywater reuse in residential premises:

- **Biological**
  - Pathogens (such as bacteria, viruses, protozoa, helminths).
- **Chemical**
  - Nutrients
  - Salts
  - Chemicals.
- **Physical**
  - Physical contaminants
  - Water volume.

Sources of potential hazards include:

- Washing machine (pathogens, nutrients, salts, chemicals, water volume, physical contaminants)
- Washing detergents – especially during the wash cycle (nutrients, salts)
- Shower and hand basin (pathogens, salts, chemicals, water volume, physical contaminants)
- Bleaches (chemicals)
- Cleaning chemicals (chemicals, physical contaminants)
- Paints (chemicals)
- Wet weather – periods of high rainfall (water volume).

The receiving environment and receptors for a residential premises environment include: humans, animals (pets, native and feral animals), plants, soil, and the irrigation or other distribution system. The receiving environment may also extend to beyond the boundaries of the residential premises generating greywater and to neighbouring properties.

C3 Risk Assessment

Risk is the product of the likelihood of a hazard occurring and the consequence of that hazard occurring. A risk assessment was carried out for greywater reuse at residential premises.

An explanation of the risk events associated with each of the hazards identified is discussed below.

Pathogens

The health status of residents of premises is usually reflected in the wastewater produced. However, residents enjoying good health will still excrete micro-organisms which are part of the normal flora of the gut. Greywater may be contaminated with disease-causing micro-organisms (pathogens) such as bacteria, viruses, protozoa and helminths. It is these pathogens that present a health concern associated with greywater reuse.

People vary in their susceptibility to disease. The young, elderly and immuno-compromised are more susceptible than the general population.

Disease transmission is principally through the faecal-oral route, where the greywater, contaminated with pathogens, may be directly ingested through contact with contaminated land, or indirectly ingested through contact with contaminated items such as grass, soil, toys, garden implements, irrigation equipment and treatment plants while they are being serviced. Transmission may also occur through inhalation of irrigation spray, by penetration through broken skin, and by insects such as flies and cockroaches.

All forms of wastewater when stored will turn septic unless the wastewater is treated to a high standard. When greywater is stored it will turn septic, giving rise to offensive odours and providing conditions for pathogens to multiply.

Nutrients

Phosphorus and nitrogen are nutrients necessary for plant growth. Greywater containing nutrients generated from the bathroom and laundry can be substituted for fertiliser and provide phosphorus and nitrogen to the garden and lawn. Excessive phosphorus can be toxic to native plants, and runoff of nutrients in stormwater may create environmental problems in our rivers and lakes.

Salts

Washing detergents vary in their salt content. Generally, powdered detergents contain the most salt as it is included in washing powders as filler. Concentrated powders generally contain less salt than normal powdered detergents, and liquid detergents contain the least salt of all washing detergents.

The major risks of salts contained in greywater are the accumulation of salts in the soil structure leading to soil salinity and soil crusting which can cause degradation of the soil structure and damage to vegetation. Sodium salts are of particular concern to vegetation.

Chemicals

Greywater contaminated with bleaches (such as hair dyes and nappy wash), disinfectants (including eucalyptus and tea tree oil) and germicides can detrimentally affect the health of the soil by killing soil organisms.

Chemicals may also kill beneficial micro-organisms used in a GTS, reducing the effectiveness of the treatment process.

Physical Contaminants

In untreated greywater systems (those carrying out greywater diversion), physical contaminants such as hair, lint, and dirt and sand from the shower, washing machine and sinks, have the potential to cause blockages to irrigation pipes, hoses, and/or drippers. Blockages of the irrigation system can lead to pooling of water. Solids present in unfiltered greywater may also adversely impact on the drainage properties of the soil, blocking drainage paths, also leading to pooling of water and ineffectual water distribution.

Greywater contaminated with fats generated from soaps and fabric softeners can make soil water-repellent. When this happens, water just runs off instead of soaking into the soil, reducing the water available to plants. Fats in greywater may also cause offensive odours where greywater is allowed to pool and turn septic.

Water Volume

Excessive watering with greywater, or watering during wet weather, will cause surface runoff or seepage to neighbouring properties and/or stormwater drainage which ultimately finds its way to a natural watercourse. Nutrients (phosphorus and nitrogen) contained in greywater may promote the growth of algal blooms in natural watercourses.

If greywater is continuously applied to soil, chemical contaminants may cause damage to the soil structure and clogging of the soil's pore structure. Healthy plant growth will not be promoted under these conditions.

C4 Best Practice Management Controls

If the controls contained in these guidelines are implemented, greywater diversion can be carried out without approval from council. Greywater treatment systems (GTSs) continue to require prior approval, so the controls contained in these guidelines are the minimum and may be supplemented by council requirements. In both cases, the controls should enable owners and residents to manage their systems to protect public health and the environment.

The risks associated with reuse of greywater are generally not caused by the greywater itself, but by the contaminants of the greywater and the way greywater is reused. This means the homeowner and residents have the ability to manage risks by implementing controls that reduce the likelihood and/or consequence of a potential hazard, thus minimising the risk to human health and the environment.

Best practice management control measures have been identified to minimise the risks associated with greywater reuse for residential premises. It is mandatory that all of the management measures identified here are undertaken by the owners and residents, to ensure that the reuse of greywater occurs in a responsible and sustainable manner.

Measures are listed under the hazards they relate to, along with an explanation of the reasoning behind the control and a symbol indicating the reuse method that the control is specific to:

- greywater diversion device (GDD)
- greywater treatment system (GTS)
- manual bucketing.

Any conditions of approval imposed on a GTS by council or NSW Health must be implemented in preference to the controls recommended in these guidelines.

Fact sheets have been produced to accompany the guideline to provide easy to understand guidance to homeowners and residents regarding the appropriate management strategies to implement.

Pathogens

Control: Don't reuse toilet or kitchen wastewater

Wastewater from toilets, urinals or bidets is contaminated with pathogens and is not greywater, and must not be reused as greywater on-site.

Kitchen wastewater is heavily contaminated with oils and grease and is inappropriate for greywater reuse.

Control: Do implement a greywater diversion device that has a WaterMark licence (previously a Plumbing Safety licence) and is registered by NSW Health

Control: Do reuse diverted untreated greywater only for sub-surface irrigation (at least 100 mm below the surface of soil or mulch)

Untreated greywater from a licensed greywater diversion device must only be reused for sub-surface irrigation. This is a barrier approach, using the soil to separate greywater from the surface, and reduces the health risks associated with greywater reuse. Sub-surface irrigation places a barrier between the wastewater and humans and animals to prevent exposure. In this case the barrier is a minimum 100 mm of soil or mulch. If a mulch barrier is used, the mulch must be maintained to a minimum 100 mm thickness.

Control: Do install a greywater treatment system (GTS) that has been accredited by NSW Health

Control: Do reuse treated greywater (from a GTS) for irrigation (including surface irrigation), toilet flushing, and washing machine only

Greywater that has been treated by a NSW Health accredited GTS is designed to reduce pathogens and other contaminants to levels that allow it to be reused for irrigation (including surface irrigation), toilet flushing, and washing machines.

Control: Do wash your hands after manual bucketing

Untreated greywater contains pathogens. By washing your hands after using manual bucketing, you will minimise the potential health risk caused by these pathogens.

Control: Don't reuse greywater when a resident has diarrhoea or is sick

Greywater should be diverted to sewer when a resident has diarrhoea or is ill, to prevent pathogens from contaminating greywater, minimising exposure.

Control: Don't reuse greywater from the washing of nappies or soiled clothing

Greywater should be diverted to sewer when nappies, clothes or blankets contaminated with faecal matter or vomit are washed.

Control: Don't store untreated greywater

To prevent any increase in pathogen levels prior to reuse and to discourage insects, vermin, and odour generation, untreated greywater must not be stored in any way, other than temporarily in a bucket or similar container.

Control: Don't reuse manual bucketed greywater in areas that are readily accessible to children and pets
Manual bucketed greywater is untreated and should not be applied to areas that are readily accessible to children and pets to prevent exposure to pathogens and minimise the risk to health.

Control: Don't reuse untreated greywater on plants that will be eaten raw or where fruit has fallen to the ground and could be eaten

To prevent the ingestion of pathogens, greywater should not be diverted and used for sub-surface irrigation of food plants that have their edible parts underground or touching the ground. In addition, any fruit that has fallen to the ground in an untreated greywater irrigation area should not be consumed.

Control: Don't irrigate with greywater if the premises is located on an aquifer that is used for drinking water

If the premises is located on a drinking water aquifer there is a risk of greywater percolating to the aquifer and contaminating the drinking water supply.

Council can inform owners and residents as to whether premises are located on an aquifer that is used for drinking water.

Control: Do mark and label all pipes and use signs to indicate greywater reuse

By ensuring that the greywater system is appropriately signed, the likelihood of cross-connections, human contact or inappropriate use is minimised.

Control: Do ensure that regular maintenance is undertaken

Regular maintenance of a greywater system will ensure that the system is working effectively and will minimise any problems that may otherwise result from leakages, blockages or other technical problems.

Maintenance of diversion devices requires weekly cleaning of the coarse filter attached to the diversion device. Any wash water from the cleaning of a GDD should be disposed of directly to the sewer.

Maintenance of greywater treatment systems (GTSs) should be undertaken in accordance with the maintenance manual provided by the GTS manufacturer. Maintenance of the GTS will also include annual testing of the backflow prevention device by an authorised and accredited person. Following the testing a "Backflow Prevention Inspection Testing and Maintenance Report" and prescribed fee shall be provided to the local authority.

Control: Don't use greywater to top up swimming pools or rainwater tanks

Both treated and untreated greywater may still contain pathogens. Adding greywater to swimming pools or rainwater tanks will increase the potential for residents (and others) to come into contact with pathogens. In addition, greywater added to swimming pools and rainwater tanks would effectively be stored greywater, increasing the levels of pathogens, as well as causing odour and attracting vermin and insects.

Control: Don't reuse greywater to wash paths, driveways or cars

Both treated and untreated greywater may still contain pathogens. Allowing greywater to be reused to wash paths, driveways or cars would increase the likelihood of human contact with pathogens and the potential for pathogens and other contaminants to be released from the premises.

Control: Don't reuse greywater so that it flows into the streets or down stormwater drains

Both treated and untreated greywater may still contain pathogens. Greywater must be reused in such a way as to prevent greywater being discharged to streets or down stormwater drains. It is important to remember that greywater is for reuse and is not to be disposed of. Any greywater that cannot be used on the premises it is generated from must be diverted to sewer.

Nutrients

Control: Do select garden-friendly detergents that are biodegradable and low in phosphorus

Greywater can be substituted for fertiliser and provide nutrients to gardens and lawns. By choosing to use a washing detergent that is low in phosphorus, the phosphorus load of the greywater generated is reduced. This is particularly important for a garden that contains native plants as the reduced phosphorus content will reduce the risk of damage to native plants.

Control: Do monitor plant response to greywater irrigation

Native plants are sensitive to phosphorus and waterlogging of soils and need to be monitored when irrigated with greywater to ensure that the phosphorus content of the greywater does not cause damage.

Control: Don't irrigate if the premises is located on an aquifer that is used for drinking water

If premises are located on a drinking water aquifer, there is a risk of greywater percolating to the aquifer and contaminating the drinking water supply.

Fact Sheets

A fact sheet ***'Preventing Health and Environmental Impacts from Greywater Reuse***' has been produced to educate homeowners and residents in the 'dos and don'ts' for correct procedures and management techniques for maintaining a safe greywater water system that minimises health risks.

A fact sheet '***Selection of Household Detergents, Soaps and Cleaning Agents'*** has been produced to educate homeowners and residents about choosing the right personal and domestic cleaning products to maintain a greywater system that has a minimal impact on the environment.

Salts

Control: Do select garden-friendly detergents that are biodegradable and low in sodium, boron and chloride

Minimising the salt content (sodium, boron, chloride) of greywater is important to reduce any risks due to soil salinity.

Control: Do select liquid washing detergents, as they are comparatively low in salts

Minimising the salt content (low sodium and chloride) of greywater is important to reduce any risks due to soil salinity. It is included in washing powders as filler. Liquids generally have the lowest salt content of all types of washing detergents and as such should be used at any premises that carry out greywater reuse for irrigation.

Control: Don't reuse greywater for irrigation during rain

Diverting greywater intended for irrigation to sewer when it is raining and after recent rainfall will help ensure that over-watering, which can potentially lead to an increase of the watertable height and increased salinity, does not occur.

Control: Do undertake a water balance before installing a greywater reuse system to calculate the amount of water that can be reused by the household.

By understanding how much water can be reused by the household, the homeowner and the residents can ensure that over-watering, which can potentially lead to an increase of the watertable height, does not occur. Greywater should be diverted to sewer when it can not be appropriately used within the premises. It must be noted that greywater reuse should not be considered as a form of disposal.

Control: Do monitor plant response to greywater irrigation

Native plants, in particular, need to be monitored when irrigated with greywater to ensure that the nutrient content of the greywater does not cause damage.

Control: Do monitor soil response to greywater irrigation

Look for changes in soil characteristics that indicate salinity problems, including hard crusty soils which are a sign of sodicity. The soil will benefit from an addition of gypsum when sodicity is first identified, as it will help improve soil structure.

Control: Do occasionally irrigate with drinking water to disperse salts from the soil (only appropriate during periods of zero rainfall)

In many areas normal rainfall will flush any excess salts from greywater irrigated soils. In areas of low rainfall or during periods of drought it is appropriate for a garden or lawn to be irrigated with drinking water (within the limitations of any prevailing water restrictions) occasionally (e.g. six- weekly) to disperse salts from the soil.

Control: Do reuse greywater by manual bucketing at several locations rather than one single point

Reusing untreated bucketed greywater at several locations will prevent an accumulation of salts and other contaminates in the soil.

Chemicals

Control: Don't divert greywater for reuse when cleaning in the laundry or bathroom, or when using hair dye or other chemicals

Ensuring that greywater containing any kind of bleach, disinfectant or other chemical is diverted to sewer will reduce the risk of damage to the garden and lawn environment and of skin irritation arising from contact with chemicals.

Control: Don't reuse greywater generated by washing of rags used for painting or for maintaining machinery and vehicles

Paints, grease and oil products should not be washed down the sink or toilet. They should be disposed of in the bin or taken to a chemical collection point.

Ensuring that greywater generated from washing cloths or rags used for painting, or maintaining machinery and vehicles, is not reused for greywater will reduce the risk of damage to the garden and lawn environment and of skin irritation arising from contact with chemicals.

Control: Do reuse greywater by manual bucketing at several locations rather than one single point

Reusing untreated bucketed greywater at several locations will prevent an accumulation of chemicals and other contaminates in the soil.

Physical Contaminants

Control: Don't reuse kitchen wastewater

Kitchen wastewater is heavily contaminated with oils and grease and is inappropriate for greywater reuse.

Kitchen wastewater can be reused after treatment by a GTS.

Control: Do use a filter to screen solids when using a diversion device

The use of a filter to screen solids from greywater that has been diverted for sub-surface irrigation will prevent physical contaminants such as hair, lint, dirt and sand from causing blockages in the irrigation system.

Control: Do use irrigation drippers with large openings

A greywater irrigation system that has drippers with large openings will allow solids that have not been removed by the screening of solids to pass through the system without causing blockages and will prevent the pooling of water.

Control: Do ensure that regular maintenance is undertaken

Regular maintenance of a greywater system, including cleaning the filters of a diversion device system or appropriately maintaining a GTS, will ensure that the greywater systems are working effectively and will minimise any problems that may otherwise result from leakages, blockages or other technical problems.

Control: Do reuse greywater by manual bucketing at several locations rather than one single point

Reusing untreated bucketed greywater at several locations will prevent an accumulation of physical and other contaminants in the soil.

Control: Do consider applying a soil rewetting agent every six months

Soil irrigated with greywater will benefit from an application of a soil rewetting agent every six months, to prevent and manage water-repellent soils.

Control: Do enrich the soil if irrigating with greywater, especially if located on dune sand or shallow rocky soils

Enriching the soil with organic matter and mulch will improve the potential water storage of a soil. This is particularly important for dune sand and shallow rocky soils which have a low potential for water storage.

Water Volume

Control: Do undertake a water balance before installing a greywater reuse system to calculate the amount of water that can be reused by the household.

By understanding how much water can be reused by the household, the homeowner and the residents can ensure that over-watering, which can potentially lead to water logging of soils, odours, damage to the health of soils and plants and an increase of the watertable height, does not occur. Greywater should be diverted to sewer when it can not be appropriately used within the premises. It must be noted that greywater reuse should not be considered as a form of disposal.

Control: Don't install any component of an irrigation system within one metre of boundary lines, inground pools, inground potable water tanks, and buildings

This provides a buffer to neighbouring properties and the footings of buildings, preventing runoff to neighbouring properties and damage to buildings.

Control: Don't leave a greywater diversion device (GDD) on all the time. Treat it like a garden tap and only reuse greywater when your garden needs watering. Greywater is for reuse, not disposal

Greywater is a resource that can be used to replace drinking water for many final uses. It's important to recognize that greywater is for reuse, not disposal.

The greywater diversion device installed at a household must be able to divert the greywater back to sewer by a tap that is easily accessible to the resident. GDDs must only be turned on when the garden needs watering. Leaving a GDD turned on at all times has the potential to lead to over-watering. Just as a resident would not leave a drinking water tap turned on watering the garden at all times, the GDD should be used as a tap that is typically turned off (diverted to sewer). The ability to divert greywater to sewer also allows greywater that may be high in contaminants (e.g. generated by nappy washing) to be prevented from reuse.

Control: Don't reuse greywater for irrigation during rain

Diverting greywater to sewer when it is raining and after recent rainfall will help ensure that over-watering, which can potentially lead to an increase of the watertable height and increased salinity, does not occur.

Control: Don't over-water

Over-watering leads to too little oxygen being supplied to a plant's roots which reduces the uptake of nutrients and encourages disease. Over-watering also destabilises the soil area, which has the potential to make trees and shrubs more susceptible to blowing over or limb breakage.

If a temporary waterlogged area is identified, greywater should not be reused for irrigation on that area until the water has drained.

Areas that are prone to flooding or waterlogging during wet weather are likely to become waterlogged during irrigation with greywater, leading to runoff and percolation. By avoiding irrigation to such areas, risks associated with those hazards can be minimised.

Control: Don't let greywater go beyond the premises and cause a nuisance to neighbours

Ensuring greywater does not go beyond the premises it was generated on will minimise health and environment risks external to the premises.

Installing greywater components no closer than one metre from the boundary line, not irrigating during rain and not over-watering will all help prevent greywater from going beyond the premises it was generated on.

Control: Do be careful lifting and carrying buckets of greywater, particularly over slippery surfaces and on stairs or steps

Buckets of greywater can be heavy. One litre of greywater weighs one kilogram, so a full bucket is likely to weigh around five kilograms. Be careful when lifting and carrying buckets of greywater to prevent injuries and in particular on slippery surfaces and on stairs and steps. Consider using a second bucket and making two trips with half full (lighter) buckets.

Control: Do install a greywater diverter that incorporates some form of non-storage surge attenuation

A non-storage surge attenuation tank will prevent a surge of water from greywater-generating appliances (e.g. washing machines) from flooding the diverter and instead allow a gradual amount of greywater to be released into the irrigation system.

Control: Don't irrigate with greywater if premises are located on an aquifer that is used for drinking water

If premises are located on a drinking water aquifer there is a risk of greywater percolating to the aquifer and contaminating the drinking water supply.

Council can inform owners and residents as to whether premises are located on an aquifer that is used for drinking water.

Control: Do enrich the soil if irrigating with greywater, especially if located on dune sand or shallow rocky soils

Dune sand has a low potential for water storage and it is therefore not a suitable soil for irrigation with greywater.

Control: Do reuse manual bucketed greywater by manual bucketing at several locations rather than one single point

Reusing untreated bucketed greywater at several locations rather than one single point will prevent over-watering.

APPENDIX D – FACT SHEETS

Further detailed information on greywater reuse is available in the following fact sheets:

Greywater Fact Sheet 1: **Greywater diversion devices – Dos and Don'ts**

Greywater Fact Sheet 2: **Choosing the right greywater system for your needs**

Greywater Fact Sheet 3: **Irrigating with greywater**

Greywater Fact Sheet 4: **Keeping your plants and soil healthy with greywater**

Greywater Fact Sheet 5: **Maintenance of greywater treatment systems and diversion devices**

These fact sheets are available at www.deus.nsw.gov.au

DEPARTMENT OF ENERGY,
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Water for Life

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