# Model agreements for sustainable water management systems:

## Model Agreements for rainwater and greywater use systems

October 2003

Draft 2

# Summary

This guide provides basic advice on the use and development of model operation and maintenance agreements for rainwater and greywater use systems alongside simple guidance on their incorporation in developments.

This guide identifies maintenance considerations and provides an outline of how the long-term responsibilities for the maintenance of rainwater and greywater use systems can be allocated.

**Model Agreements for sustainable water management systems**
**Model Agreements for rainwater and greywater use systems**

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National SUDS Working Group

Rainwater Harvesting Association

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# Glossary

| | |
|---|---|
| AA air gap | A device that uses an air gap to protect the mains potable water supply from contamination by a Class 5 risk (see Water Supply (Water Fittings) Regulations 1999) |
| Blackwater | Effluent discharged as sewage containing faecal matter. |
| Coliforms | A group of bacteria found in the intestines, faeces (of most animals), nutrient rich waters, soil and decaying plant material. |
| Commuted sum | A single payment paid at the beginning of an agreement to cover maintenance for an agreed period of time. |
| Disinfection | Treatment of water to reduce infective risk |
| Environmental regulators | The Environment Agency for England and Wales, SEPA in Scotland and in Northern Ireland the Northern Ireland Environment and Heritage Service. |
| Filtration | The act of removing sediment or other particles from a fluid by passing it through a filter. |
| First flush | The initial runoff from a site/catchment following the start of a rainfall event. As runoff travels over a catchment it will collect or dissolve pollutants and the "first flush" portion of the flow may be the most contaminated as a result. This is especially the case for intense storms and in small or more uniform catchments. In larger or more complex catchments pollution wash-off may contaminate runoff throughout a rainfall event and the first flush may not occur. |
| Greywater | Greywater is wastewater from sinks, baths, showers and domestic appliances. Kitchen sink or dishwasher wastewater is not generally collected for use as it has high levels of contamination from detergents, fats and food waste, making filtering and treatment difficult and costly. |
| Greywater use system | An above or below ground system that collects, stores treats and disinfects greywater for use as reclaimed water in properties. |
| Impermeable surface | An artificial non-porous surface that generates a surface water runoff after rainfall. |
| Infiltration – to the ground | The passage of surface water though the surface of the ground. |
| Model Agreement | A legal document that can be completed to form the basis of an agreement between two parties regarding the maintenance and operation of sustainable water management systems. |
| Permeable surface | A surface that is formed of material that is itself impervious to water but, by virtue of voids formed through the surface, allows infiltration of water to the sub-base through the pattern of voids, for example concrete block paving. |
| Pervious surface | A surface that allows inflow of rainwater into the underlying construction or soil. |

| | |
|---|---|
| Rainwater harvesting system | An above or below ground storage system that collects, treats, stores and distributes run-off of rain or snow from roofs. |
| Rainwater use systems | A system that collects rainwater from where it falls rather than allowing it to drain away, treats and stores it and then distributes it for use. This includes water that is collected within the boundaries of a property, from roofs and surrounding surfaces, including areas of hard standing and pervious paving. |
| Reclaimed water | Water which has been treated so that its quality is suitable for particular specified purposes such as irrigation, and/or toilet flushing. |
| Runoff | Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable, is saturated or rainfall is particularly intense |
| Section 106 TCPA 1990 | A section within the Town and Country Planning Act 1990 that allows a planning obligation to a local planning authority to be legally binding. |
| Separate sewer | A sewer for surface water or foul sewage, but not a combination of both. |
| Sewerage undertaker | This is a collective term relating to the statutory undertaking of water companies that are responsible for sewerage and sewage disposal, including surface water from roofs and yards draining through public sewers. |
| Source control | The control of runoff or pollution at or near its source. |
| Sub-catchment | A division of a catchment, allowing runoff management as near to the source as is reasonable. |
| SUDS | Sustainable Drainage Systems: a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques. |
| Sustainable water management system | The collective term for systems that promote the sustainable management of water. (For the purpose of this report SUDS and rainwater and greywater use systems are the main sustainable water manage systems considered). |
| Treatment | Improving the quality of water by physical, chemical and/or biological means. |
| Water supply undertaker | This is a collective term to cover water authorities, water companies and water utilities, that all supply mains water. |

# Abbreviations

| | |
|---|---|
| BOD | Biochemical Oxygen Demand |
| BSRIA | Building Services Research Information Association |
| BTSW | Buildings That Save Water |
| Cfu | Colony forming units |
| CIRIA | Construction Industry Research and Information Association |
| DEFRA | Department of Environment Food and Rural Affairs |
| DTI | Department of Trade and Industry |
| EA | Environment Agency |
| HMSO | Her Majesty's Stationary Office |
| NAW | National Assembly for Wales |
| NSWG | National SUDS Working Group |
| NTU | Nephelometric Turbidity Units |
| ODPM | Office of the Deputy Prime Minster |
| Ofwat | Office of Water Services |
| PPG | Planning Policy Guidance |
| SUDS | Sustainable Drainage Systems |
| SWMS | Sustainable water management system |
| USEPA | US Environmental Protection Agency |
| UV | Ultra violet (light) |
| WC | Water Closet (Toilet) |
| WLC | Whole Life Costing |
| WRAS | Water Regulations Advisory Scheme |

# Foreword

This guidance document has been prepared for use by all organisations involved in the provision and maintenance of sustainable water management systems. This may include:

- clients
- landscape architects
- consulting engineers
- land use planners
- architects
- environmental regulators
- sewerage undertakers
- residents
- tenants
- facility managers
- property and landowners.

***Model Agreements for sustainable water management systems*** is a series of documents resulting from a research project undertaken by CIRIA to facilitate the long term maintenance of sustainable drainage systems (SUDS) and rainwater/greywater use systems through the development and application of Model Agreements. A Model Agreement is just one method of allocating responsibilities for the maintenance of systems and consists of a legal agreement that can be used as the basis for agreements between two parties to facilitate the maintenance of sustainable water management systems.

There are two main outputs to the series:

***SUDS Model Agreements*** this document provides background and long-term framework for the operation and maintenance of SUDS. Model Agreements were developed for specific scenarios:

- Construction and maintenance of SUDS either as a Planning Obligation under Section 106 of the Town and Country Planning Act 1990 or as a condition attached to planning permission
- Construction and maintenance of SUDS between two parties (outside of the requirements for planning permission, ie Private SUDS Model Agreement)

***Model Agreements for rainwater/greywater use systems*** this document provides background to the operation and maintenance of rainwater/greywater use systems, providing a framework for the long-term operation and maintenance of reuse systems. The Model Agreement is set out for a variety of scenarios, ranging from single properties to multi occupancy properties.

The documents in this series are not intended for use as extensive reference documentation on the design and construction of sustainable water management systems but are designed to complement existing guidance documents and frameworks. Full details of such guidance are given in Section 1.

# 1 Introduction

Sustainable drainage and rainwater/greywater use systems in buildings form a key part of sustainable developments by reducing the impacts that might otherwise occur to surface water runoff and water resources. Effective systems can potentially reduce water consumption easing pressure on water resources, treatment and infrastructure. They can also reduce pressure on the wastewater systems as well. In addition, rainwater systems in a similar way to SUDS can help reduce down stream flooding.

CIRIA's recent publications on SUDS and rainwater/greywater use systems have identified the question of eventual ownership of the systems and, in particular, who will maintain them as being one of the biggest challenges in achieving wider uptake of sustainable water management systems. With these types of systems it is important that they are maintained/repaired properly if they are to perform consistently at design levels (and to minimise health and safety risks).

This document provides an example Model Agreement and simple guidance on its implementation within developments. A Model Agreement is a legal document that can be used as the basis for agreements between two parties (normally the customer and the maintenance provider) for the maintenance of systems.

The Model Agreement provided with this document is provided as an example of what can be used. It is not always necessary to use the Model Agreement and where necessary the wording and the clauses can be amended to reflect the specific circumstances.

## SCOPE

This guide aims to promote and encourage the sustainable use and management of water within the built environment by providing basic advice on the use and development of maintenance agreements for rainwater and greywater use systems alongside simple guidance on their incorporation into developments. The Model Agreement developed is relevant to the current legislation and policies within England and Wales (at November 2003). A complementary document has been produced looking at Model Agreements for SUDS.

The specific objectives of providing Model Agreements and guidance are to:

- encourage the incorporation of sustainable water management systems in new and existing developments
- provide guidance for developers and/or practitioners on the incorporation of sustainable water management systems into developments
- establish standard approaches to the allocation of responsibilities for the maintenance of sustainable water management systems
- make the adoption and allocation of maintenance for systems more straightforward allow cost savings and reduce future problems associated with operation and maintenance for clients of the construction industry.

## SOURCES OF INFORMATION

This guide and the associated Model Agreement have been developed from an extensive review of legislation and policy in England and Wales and consultation with relevant stakeholders from the construction and water industries. The Model

Agreement and guidance documents have been reviewed and agreed by a dedicated Project Steering Group comprising of experienced individuals representing a wide range of stakeholders in the sustainable management of water.

## STRUCTURE OF THE DOCUMENT

**Section 1 – Introduction** introduces the guidance and explains the scope of the project. It also provides information on how other guidance can be used to complement this document and the implementation of the Model Agreements.

**Section 2 – Sustainable water management** explains how sustainable development can be applied to the water environment and how sustainable water management systems can contribute to sustainable development.

**Section 3 – Background to rainwater and greywater use** provides a background to water resource management and explains the principles of sustainable water use within the built environment.

**Section 4 – Rainwater and greywater use systems** provides background information on the key components of rainwater and greywater use systems and the potential to link rainwater harvesting systems to SUDS.

**Section 5 – Policy, regulatory and guidance considerations** provides details of the current regulatory framework for rainwater and greywater use systems. The section also outlines some of the guidance available on systems.

**Section 6 – Maintenance of rainwater and greywater use systems** provides information about planning and implementation of maintenance for systems.

**Section 7 – Rainwater and greywater use systems Model Agreement** provides information on the framework for the Model Agreement.

**Section 8 – Commentary on the Model Agreement** provides details on how the Model Agreement and Schedule may be completed and used.

**Section 9 – The Model Agreement** this is where the Model Agreement is presented. An electronic template for the Model Agreement can be downloaded from www.ciria.org/suds.

## RELATIONSHIP TO OTHER GUIDANCE

This document forms part of a suite of CIRIA publications relating to both SUDS and rainwater/greywater use systems which together provide detailed information on the design and operation of sustainable water management systems. Related guidance includes:

- *Rainwater and greywater use in buildings – best practice guidance*, CIRIA Report C539, (CIRIA 2001). Provides best practice guidance on the use of rainwater and greywater systems in buildings.
- *Rainwater and greywater use in buildings – decision-making for water conservation,* CIRIA Report PR80, (CIRIA 2001). Provides an overview to the use of rainwater and greywater as a water conservation measure.
- *Sustainable water management- planning for new developments*, CIRIA RP627, (CIRIA 2003). Provides guidance on the incorporation of water resource and wastewater treatment issues as part of the planning process for new developments.

Other relevant guidance has also been produced by BSRIA and the Environment Agency. BSRIA's guidance includes:

- *Rainwater and greywater in buildings – Project report and case studies,* BSRIA Technical Note TN7/2001, (BSRIA 2001). Provides details of demonstration sites, with rainwater or greywater use systems in the UK.
- *Water reclamation guidance – design and construction of systems using greywater,* BSRIA Technical Note TN 6/2002, (BSRIA 2002). Highlights issues of concern affecting the design, construction and installation of greywater use systems.
- *Water reclamation guidance – laboratory testing of systems using greywater,* BSRIA Technical Note TN 7/200, (BSRIA 2002). Provides a methodology for establishing the performance of greywater use systems.

The guidance produced by the Environment Agency includes:

- *A study of domestic greywater recycling,* (EA 1999) Provides information on a trial of greywater use systems.
- *Conserving water in buildings, (Water Efficiency Fact Cards),* (EA 2001). Provides an overview of measures to conserve water in buildings.
- *Harvesting rainwater for domestic uses: an information guide*. (EA 2003). Provides information on rainwater use systems.

# 2 Sustainable water management

## INTRODUCTION

The concept of sustainable water management supports economic and social development by optimising the use and management of water for people, agriculture, commerce and industry, whilst protecting and improving the environment for the future.

The Government wants sustainable development to be at the heart of policy making (DETR, 2000). The national strategy is defined in a "A better quality of life, a strategy for sustainable development in the UK" (DETR, 1999). In answering the question "What is sustainable development?", the strategy states:

*"At its heart is the simple idea of ensuring a better quality of life for everyone, now and for generations to come."*

The strategy specifically identifies water as an example of a renewable resource, which *"should be used in ways that do not endanger the resource or cause serious damage or pollution"*.

Reconciling the water needs of the natural environment with the demands of society poses many difficult challenges. The UK environment is under pressure from many directions: increased housing, increased population density (particularly in the south-east) and extended road networks all to meet the growing expectations of a population of rising affluence for an improved quality of life. In addition, the realisation and uncertainties of future climate change provide additional drivers for the adoption of a precautionary approach to water management.

## WHAT ARE SUSTAINABLE WATER MANAGEMENT SYSTEMS?

Sustainable water management systems are those systems or practices that support the sustainable management of water and positively contribute to the goals of sustainable development. This project is primarily concerned with sustainable drainage systems and rainwater and greywater use systems. In some circumstances SUDS and rainwater use systems can be combined, however within the UK this practice is currently not widespread.

## DRIVERS FOR SUSTAINABLE WATER MANAGEMENT

Sustainable water management is a concept that includes long-term environmental and social factors in decision making about the way water is managed or used in the built environment. It considers the quantity and quality of water used and disposed of as well as safeguarding the local environment and amenity. The drivers for sustainable water management are listed in Table 2.1 below.

## Table 2.1 Drivers for sustainable water management

| | |
|---|---|
| **Climate change** | There is growing evidence that our climate is changing. There maybe potential for household water use to increase as a result of hotter dryer summers and the flood risk to increase due to wetter colder winters. Climate change may also alter groundwater and river flow regimes. Sustainable water management systems may help reduce the impacts of climate change i.e. rainwater and greywater use systems could contribute to the efficient use of resources whilst sustainable drainage and the retention of surface water could facilitate groundwater recharge. |
| **Demographic changes** | Government projections indicate an increase of around 3.8 million households in England and Wales between 1996 and 2021. The majority of these new households are likely to be smaller which may increase the overall demand for water and potentially the amount of surface water runoff. |
| **Reducing surface runoff and diffuse pollution** | Rainwater use systems and sustainable drainage systems could facilitate the attenuation and storage of surface water runoff and potentially reduce the flood risk within a development area. Rainwater reuse systems and sustainable drainage are regarded as preventative systems, controlling water quantity and water quality at, or close to, the source. |
| **Potential to save costs** | Sustainable water management systems designed to reduce and control surface runoff means there may be a reduced need to supplement and increase existing infrastructure to cope with increased flows. They could also reduce the need to upgrade sewage treatment works to treat increased flows as a result of surface water runoff.<br>The use of rainwater and greywater use systems could assist in the reduction of demand for potable water and if implementation of systems is widespread could reduce the need for additional water resources and supply infrastructure.<br>Users of rainwater/greywater use systems may also benefit from reduced water supply and wastewater bills. |
| **Planning requirements** | With the introduction of PPG 25 – *Development and flood risk*, (2001) and the amendments to Part H of the Building Regulations (2002) many development plans and planning applications are encouraging or requesting the wider use of SUDS to provide the associated environmental benefits |

# 3 Background to rainwater and greywater use

**Definitions**

**Rainwater use systems** - A system that collects rainwater from where it falls treats and stores it and then distributes it for use (rather than allowing it to drain away). This includes water that is collected within the boundaries of a property, from roofs and surrounding surfaces, including areas of hand standing and pervious paving.

**Rainwater harvesting** - An above or below ground storage system that collects, treats, stores and distributes run-off of rain or snow from roofs.

**Greywater use systems** - An above or below ground system that collects, stores treats and disinfects greywater for use as reclaimed water in properties.

On first appearances it would seem that the UK has plenty of water. However, our growing population, thirst for water using appliances and potential climate changes may mean that our water resources are under increasing pressure. Analysis of housing projections suggests that there may be growing competition for available water between the environment and people, particularly in the south-east of England which already has low water availability. Thus, reducing demand for mains water can help reduce our impact on the environment. Using reclaimed water from rainwater and greywater use systems can help reduce this demand.

In addition to concern over water resources, there are also concerns about rainwater runoff from urban areas. Planning Policy Guidance Note (PPG25) on *Development and flood risks* requires that local authorities consider SUDS as means to reduce the potential for flooding and diffuse pollution affecting downstream developments. The use of rainwater close to its source within the built environment can contribute to the SUDS philosophy by helping manage surface water runoff.

## DEVELOPMENT OF THE TECHNOLOGY

Rainwater use (or rainwater harvesting) systems vary in design and scale from a water butt connected to a rainwater downpipe, to larger multi-user systems with centralised collection and treatment systems. The harvesting of rainwater is a simple and relatively safe practice, which has been used for hundreds of years. Some SUDS components, such as permeable pavements may also act as a catchment to supply water to a building.

Greywater use has developed from simple beginnings such as using washing-up water, or siphoned bath water for garden watering during periods of water shortages, to purpose designed packaged greywater systems that collect, treat, disinfect and distribute reclaimed water for use in buildings. Such systems are available in the UK, but have yet to be widely used.

Potential barriers to the widespread uptake of rainwater and greywater use systems within the UK include:

- the capital cost of the systems compared to the water and/or cost savings
- the cost of retrofitting rainwater and greywater use systems into existing buildings
- concern about the quality of reclaimed water
- the majority of greywater and rainwater use systems are not 'fit and forget' technology and require some maintenance.

## THE TWIN TRACK APPROACH TO SUSTAINABLE WATER RESOURCE MANAGEMENT

To achieve sustainable water management the approaches taken should be economically, environmentally and socially acceptable and avoid negative impacts on future generations.

The twin track approach of addressing both water demand and supply provides a holistic method of sustainably managing water resources (DEFRA 2002). There are many options available, rainwater and greywater use needs to be viewed in this context.

### Water demand

Water demand in the future is uncertain but the majority of forecasts predict an increase. To help manage this increasing demand there are a range of measures that may be applied, for example:

- consumer and developer education about water efficiency.
- water metering to incentivise water conservation
- the use of water efficient appliances
- mandating water sustainability requirements in planning approval processes

The measures above can help reduce demand for water but need to be proven to be cost effective. Most of the approaches require an initial capital investment (eg in meters, water efficient appliances), followed by costs spread over time to maintain them. One of the main issues to be addressed in implementing these measures is the awareness of the issues and benefits coupled with positive consumer behaviour.

### Water supply

The other thread of the twin track approach is to provide sustainable water supplies. As with water demand, the future is uncertain: How will the climate change in the future? How will technology (such as membrane technology) advance to treat previously uneconomic water resources? How will rainwater and greywater system technology evolve?

Despite the uncertainty there are a number of approaches that may be adopted:

- reduction in water lost through leakage
- treatment and use of blackwater
- promoting infiltration to ground through SUDS
- develop new surface water resources
- abstraction from marine sources (using desalination)

- use of groundwater sources (that require higher levels of treatment) where appropriate
- recharging of aquifers at times of water surplus

Most of the approaches to exploiting alternative water supplies may require technological developments to make utilisation of these sources more cost effective. This may become necessary as water demand increases and water supply decreases, such that the business case for increased spending becomes viable.

The potential changes in the habits of water users that accompanies the twin-track approach should help manage demand and may also serve to increase awareness of measures such as using rainwater and greywater. The twin-track approach may help stimulate more uptake of these systems. Furthermore, water companies have a legal duty to promote water efficiency to their customers, a commitment which is overseen by Ofwat. This extends to rainwater and greywater systems as part of an overall strategy for water conservation and sustainable water use and supply.

## RAINWATER AND GREYWATER SUSTAINABILITY

Rainwater and greywater use can contribute to sustainable water resource management by providing an alternative water supply (rainwater) and reducing water demand locally through using water more than once (greywater). At present (year 2004), rainwater and greywater systems are having a limited impact on UK water demand and supply as many of the benefits of using rainwater and greywater can only be realised where there is a widespread uptake of these systems.

Rainwater and greywater can contribute to sustainability on a local scale, particularly where:

- water resources are particularly scarce
- the cost of providing a (new) mains water supply is prohibitively high
- the user wishes to reduce mains consumption due to concerns over environmental impact of their supply (abstraction from rivers or creation of reservoirs)
- the user wishes to be independent of mains water as a lifestyle choice
- the user wishes to demonstrate the feasibility of using rainwater or greywater systems.

Other sustainability issues need to be considered such as the use of materials and energy in the production of components in addition rainwater and greywater systems also consume resources during operations, for example, electricity and chemicals for disinfection.

## WATER CONSERVATION IN BUILDINGS

There are five main approaches to reducing mains water use in buildings:

- water saving by good housekeeping, eg fixing dripping taps
- water saving behaviour
- use of efficient appliances (dual or ultra low flush toilets, waterless urinals).
- exploitation of alternative water supplies (for example rainwater use).
- recycling and reuse of water (for example greywater use).

Figure 3.1gives a decision tree approach to assessing options available for reducing mains water use.

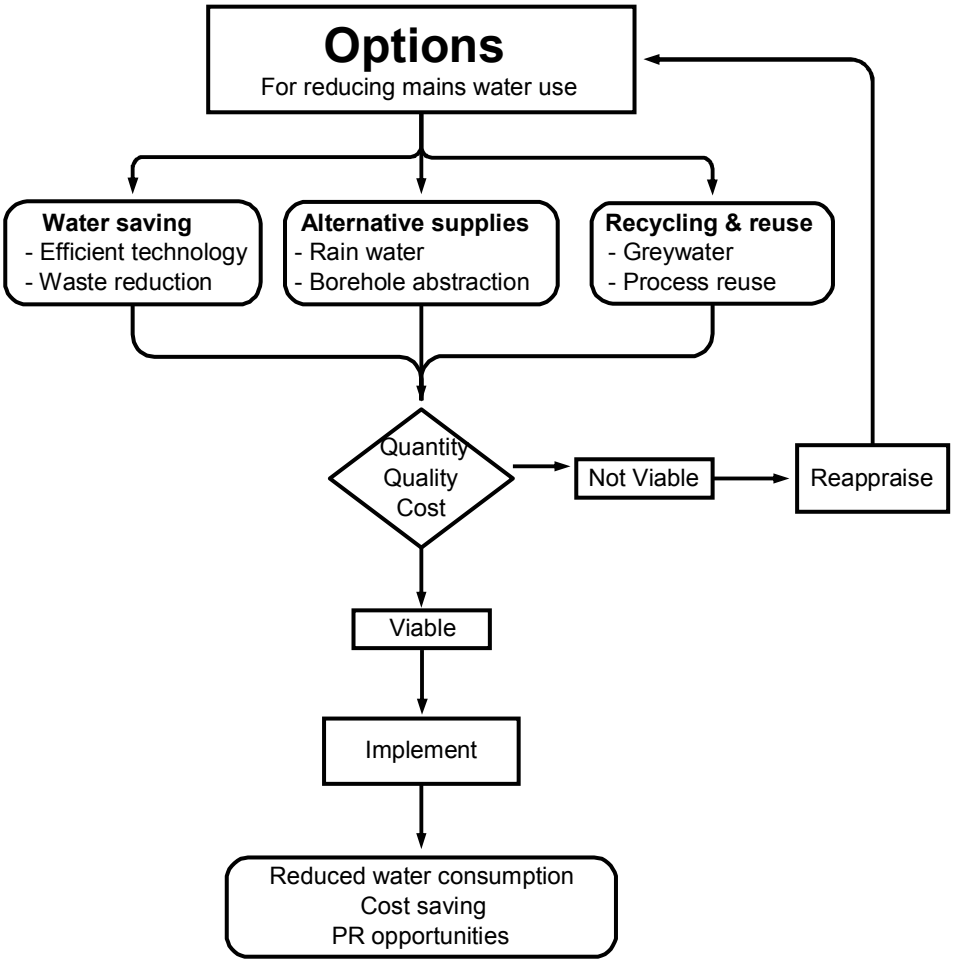


**Figure 3.1 Decision tree for reducing mains water use**

It should be noted that the use of water efficient appliances, such as showers and taps, may reduce greywater arisings and may reduce the reclaimed water yield. However, if these appliances are used to provide greywater to feed, for example, a low volume flush toilet then water demand should also be reduced. The ability of supply to meet demand will always need to be evaluated on a case-by-case basis.

# 4 Rainwater and greywater use systems

Rainwater and greywater use systems come in many different arrangements but have components and issues that are common to both. There are no specific legislative barriers to prevent the use of rainwater or greywater systems in the UK and there are currently no formal or legislative standards on water quality for rainwater or greywater systems (unless for drinking, when the Private Water Supply Regulations 1991 apply). However the design and installation of a rainwater or greywater system in a building already being supplied with mains water will be subject to regulation (section 5). It is wise to contact the local water company and or sewerage undertaker, the local building control department as well as contacting the local environmental regulators for guidance and advice.

Dependent on the end use of the water, different levels of water treatment or disinfection are required. Using rainwater and greywater without any treatment would be ideal as it minimises costs and reduces the use of materials and chemicals in the process. This is feasible for some applications, such as garden watering, as long as measures are taken to avoid stagnation of the stored water or build up of contamination in the soil. Due to its simplicity, the use of rainwater for irrigation is commonplace and its use for toilet flushing is growing within the UK. Campaigns and subsidies by water companies have contributed significantly to the simplest form of rainwater use, water butts, and also larger capacity systems for example; in nurseries and garden centres.

The guidance within this document focuses on the use of reclaimed water for non drinking purposes, primarily toilet flushing which currently accounts for around a quarter to a third of household water use.

For detailed guidance on the design and installation of rainwater and greywater use systems refer to *Rainwater and greywater use in buildings – best practice guidance*, CIRIA Report C539 and *Water reclamation guidance – design and construction of systems using greywater*, BSRIA Technical Note TN 6/2002.

## RAINWATER USE SYSTEMS

Rainwater can be collected from roofs and other hard surfaces around buildings. The water quality of collected rainwater is primarily dependent on the contaminants picked up from the air and the catchment area. Rainwater is generally low in contaminants.

Rainwater use systems generally consist of one or more storage tanks, pump, filtration units (normally coarse downpipe filters) and connecting pipework, some systems will also have disinfection apparatus. There is also likely to be some form of electronic control of the system. In most cases there will be a connection to the mains water supply so that the system can be automatically supplemented when there is not sufficient rainwater or demand is relatively high. Figure 4.1 relates to a typical rainwater system; proprietary systems differ in how they arrange these components

Figure 4.1 relates to a directly pumped rainwater system, there are a number of variations on this configuration. Some systems pump rainwater from an underground storage tank to a suitable header tank located at a higher level. If insufficient rainwater is available, then mains water tops up the tank via an AA air gap, which prevents contamination of mains water. Some systems use a pump from the mains water tank to top up the rainwater. Some more sophisticated systems

can have dual feed for rainwater and mains being directly fed into toilet cisterns. An air gap in the WC feed pipe prevents backflow which could result in mains water contamination.

Treatment of rainwater can include filtration, biological treatment and disinfection. The purpose of filtration is to remove solid material from the water before or after storage. The most common form of filtration is the use of an inline downpipe filter that removes debris and sediment. Rainwater use systems that use pervious pavements for their catchments should also have a suitable oil trap (oil separator) to remove oil and fuel residuals before it is filtered.

Once the water has been filtered, it may require disinfection to kill off microbiological and bacterial contamination. The majority of systems that use rainwater solely for toilet flushing do not employ disinfection. This practice is well established as being safe as long as good incoming water quality is maintained and the risks of contamination from catchments and system modification can be prevented.

Rainwater is inherently soft and, therefore, provided it is sufficiently clean, may be usefully used in washing machines (although this will require some modifications), car washing, and even for bathing once it has undergone appropriate treatment. Where the rainwater is to be used for drinking, washing and cooking, or use in a business that produces food or drink the Private Water Supply Regulations 1991 apply.

The availability of rainwater is dependent on weather, which is highly variable in the UK, both seasonally and geographically. However, the demand for water tends to be relatively constant. While it is possible to design and construct a rainwater system to meet 100 per cent of water requirements, it is rarely economic to do so (where there is already mains water provision). The large collection tank (or small reservoir) required and the space required to install a large system add considerably to the cost. A rainwater system is more likely to be optimised to provide useful savings of mains water at a reasonable cost. This assessment will take into account factors such as ready access to the available catchment surfaces, tank size and location, water quality requirements and potential usage.

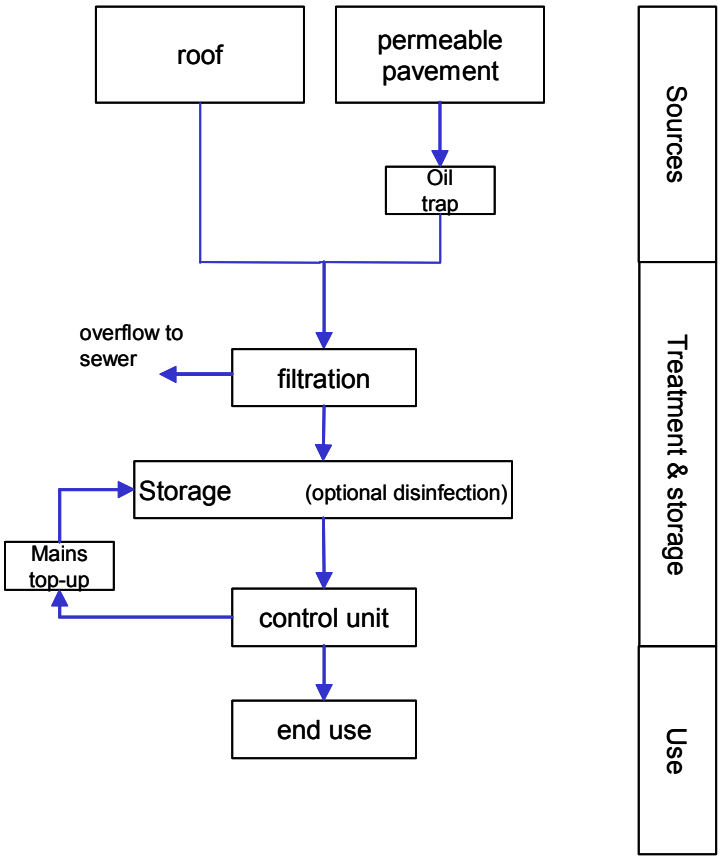


**Figure 4.1 Flow diagram of a rainwater system**

## GREYWATER USE SYSTEM

Greywater can be collected from sources such as sinks, baths, showers, or clothes washing machines. The water quality of collected greywater is dependent on the contaminants picked up during the use of the water. Greywater is generally warm, nutrient-rich, and high in contaminants making it an ideal medium for microbiological activity and bacteriological growth.

Greywater derived from baths, showers, hand basins and washing machines is less contaminated than greywater from kitchen sinks and dishwashers. The latter two sources may have a high fat, oil and foodstuff content but the former are likely to contain pathogens. As a result the majority of packaged greywater systems currently available for the domestic market are designed to only use greywater derviced from personal cleaning.

Greywater systems generally consist of one or more storage tanks, pump, filtration units, chemical dosing (for disinfection) and connecting pipework. There is also likely to be some form of electronic control of the system. In most cases there will be a connection to the mains water supply so that the system can be automatically supplemented when greywater arisings are low or demand is relatively high. Figure 4.2 relates to a typical greywater system; proprietary systems differ in how they arrange these components and what technology they use for filtration and disinfection.

Figure 4.2 is based on a greywater system that uses a header tank in the roof space, as with the rainwater system there are a number of variations on this system. These can include the use of direct fed systems which have the storage treatment and control panel in a unit that can provide reclaimed water for WC flushing.

The most common use of greywater is for toilet flushing. This partly reflects the water quality and the potential risks of using untreated greywater, and partly the close match between the demand for toilet flushing water and greywater arising (in domestic situations).

It is important that greywater is coarse filtered before it is stored. This is to prevent the build up of debris in the storage tank, which would encourage bacterial growth. Self cleaning filters are preferred as this reduces the need for user intervention or maintenance. Some communal systems have incorporated sand and carbon filters and some have used membrane filters. These filters whilst being relatively more expensive to apply provide a consistent end result.

Some systems incorporate biological treatment that encourage the development of a biofilm or bacterial colonies that breakdown nutrients and contaminants. Normally chemical disinfection is used, although ultraviolet disinfection can also be used if the water quality permits (requires low levels of turbidity).

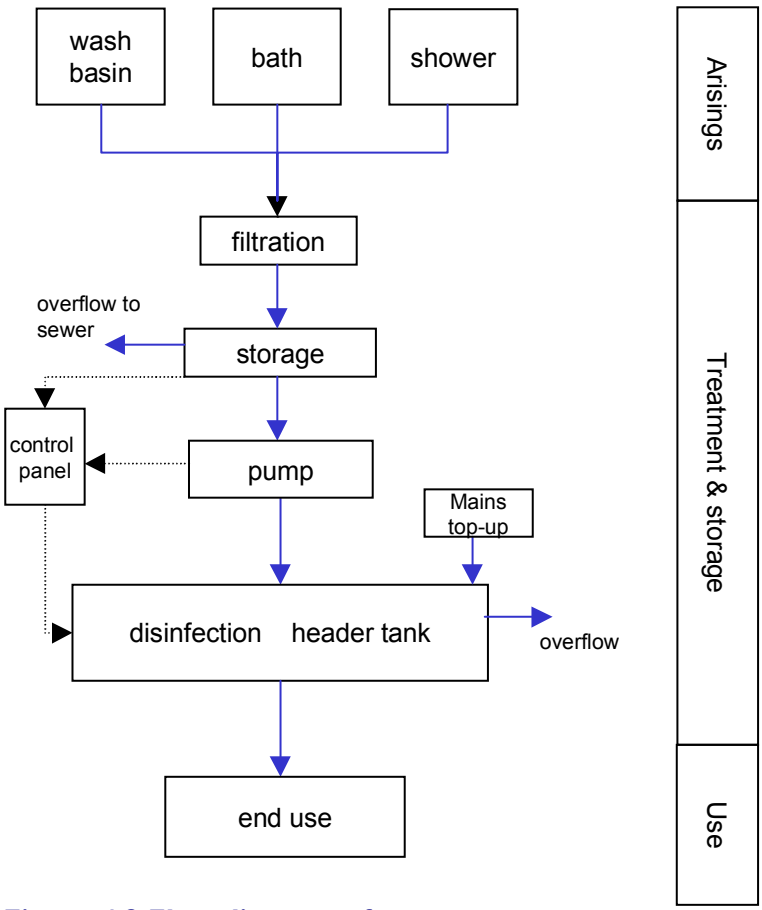


**Figure 4.2 Flow diagram of a greywater system**

## COMBINING RAINWATER SYSTEMS AND SUDS

Rainwater harvesting systems may be used to reduce the volume of runoff from a building or development enabling surface water to be controlled at source. This can provide a source control function and is often considered as a prevention or management technique. However, it will only provide a temporary source control function until the storage tank is full, as it will overflow to a drainage system.

Stored water is held in storage tanks and the permanent storage volume required for re-use is provided in addition to the volume required to attenuate stormwater flows, unless a continuous rate of use can be guaranteed.

# 5 Policy, regulatory and guidance considerations

There is no formal government policy for the use of rainwater and greywater use systems either in the home or as part of an industrial development. However, through the promotion of sustainable development and other initiatives, the government encourages a reduction in the use of resources. Uptake on sustainable water management systems would go a long way towards achieving this goal.

## REGULATIONS FOR RAINWATER AND GREYWATER USE

Anyone considering the installation of a rainwater or greywater system should consult their local water company to ensure compliance with the current regulations. There are no legislative barriers to prevent the use of rainwater or greywater systems in the UK. However, there are numerous regulations that relate to the installation and use of rainwater and greywater systems. Some regulations like the Health and Safety at Work Act are also relevant to systems even when installed in a private house.

The relevant regulations that should be consulted are listed below.

### Health and Safety at Work Act 1974

This applies to rainwater/greywater use systems where electrical or potentially hazardous chemicals are used. In non-domestic installations where chemicals are used for disinfection they would also be subject to COSHH.

Under this Act there is also a requirement to minimise the risk of exposure to biological hazards which could include bacterial and coliforms.

### Water Industry Act 1999

This relates to sewerage undertakers being able to levy additional charges to any customer who discharges from a source other than a potable network into a foul sewer.

In practice, the issue of discharge of rainwater from roofs into foul sewers is often ignored by water companies as the volumes are relatively small. However, in some instances this can cause problems with the drainage infrastructure.

### Water Supply (Water Fittings) Regulations 1999

These are primarily concerned with the prevention of mains water supply contamination and reducing wastage. The main consideration regarding the installation and operation of rainwater/greywater use systems is in relation to the prevention of cross contamination and backflow, primarily through the specification of an air gap.

The need for pipework identification is also mentioned, it stipulates that all pipelines are identified including those carrying greywater as well as those providing reclaimed water for end use (guided by WRAS). The Regulations also provide specifications designed to prevent inefficient use for WC flush volumes and other water using appliances.

**Building Regulations 2000 (as amended)**

These relate to greywater systems and the connection of sinks, showers, baths (and appliances) providing greywater to a vented stack. This may prevent loss of the water seal in the traps associated with individual fittings or appliances.

**Private Water Supplies Regulations 1991** – These provide information in relation to the collection of water for human consumption.

**The Prevention or Control of Legionellosis (Including Legionaires' Disease)- Approved Code of Practice L8** – related to the control of legionellosis risk.

**Construction (Design and Management) Regulations 2000** – these Regulations relate to health and safety within project planning and management of construction and maintenance. Systems should be designed and installed to facilitate safe operation and management.

**Control of Substances Hazardous to Health Regulations (COSHH) 1992** – these Regulations relate to the use of chemical disinfection and microbiological hazards which may arise during maintenance.

**The Electricity at Work Regulations 1989**- these relate to the installation of rainwater and greywater systems in a non domestic application and primarily relates to the use of a control system and pumps.

**Personal Protective Equipment at Work Regulations 1992** – these relate to the provision of personal protective equipment (eg eye and hearing protection, masks and respirators as well as gloves).

**Provision and use of Work Equipment Regulations 1995** – these introduce a requirement to report injuries and dangerous occurrences.

**Confined Spaces Regulations 1997** – these require a risk assessment and safe method of work for unavoidable entry to any confined spaces, eg cleaning large tanks. On commercial or industrial sites a permit to work will normally be required.

**Manual Handling Operations Regulations 1992** - these regulations seek to reduce the incidence of injury and ill-health arising from the manual handling of loads at work.

**Workplace (Health, Safety and Welfare) Regulations 1992** – these relate to responsibilities of employers to ensure rainwater and greywater use systems can be safely operated and maintained. A risk assessment will need to be undertaken identifying potential impacts on persons coming into contact with reclaimed water.

## GUIDANCE ON RAINWATER AND GREYWATER USE SYSTEMS

### WRAS guidance

Advice on the Water Supply (Water Fittings) Regulations 1999 is given by the Water Regulations Advisory Scheme (WRAS). Their information and guidance notes provide information on the specification and design of reclaimed water systems. Guidance notes can be downloaded from WRAS at www.wras.co.uk.

#### WRAS 9-02-04 – Reclaimed Water Systems

This guidance note aims to support water conservation and prevent cross contamination of mains water from water reclamation systems. The note provides information about the causes of contamination, classes of water quality and useful information on the installation, operation and management of reclaimed water systems (including rainwater and greywater use systems) It also provides a hazard assessment methodology based on the type of system and potential exposure.

#### WRAS 9-02-05 – Marking and Identification of Pipework for Reclaimed (Greywater) Systems

This guidance note stipulates that pipes carrying reclaimed water should be clearly distinguishable from those carrying mains water, helping reduce accidental cross-connection.

### Pipework identification guidance

The Water Fittings Regulations 1999 require the identification of pipework used for rainwater and greywater use. All pipework should be labelled in accordance with British Standard (BS1710) and the guidance provided in WRAS Guidance Note 9-02-05. Care must be taken not to cross-connect reclaimed water and mains water pipework during installation or subsequent work on a property. Pipe marking is therefore essential to help prevent accidental cross-connections, which could contaminate mains water supply.

WRAS guidance on pipe marking to avoid accidental cross connections with potable water is:

| | |
|---|---|
| **Greywater** | green/black/green bands with the words GREYWATER |
| **Reclaimed water** | green/black/green bands with an additional white band in the centre and the words RECLAIMED WATER |

Any outlets supply reclaimed water must also be clearly labelled according to quality and end use. More detailed guidance is provided in the WRAS Guidance Note.

### Dealing with risk

The level of risk that exists when using reclaimed water varies depending on the quality of the rainwater or greywater that is collected and the end use. When a system is designed the quality of the raw water, the end use and the nature of the end users should be considered in the form of a risk assessment to determine the most appropriate treatment methods, ongoing monitoring Schedule and maintenance frequency.

The scale of the system should also be considered, as greater risk can be associated with multi-user systems because the number of users exposed to the reclaimed water is greater. This may include the very young or very old that may be particularly susceptible to illnesses. It is also possible that the ability to control the quality of the inflowing rainwater and/or greywater may also be reduced in larger scale systems, eg educational establishments or halls of residents. Definitions of single and multi-user systems are shown in Table 5.1.

**Table 5.1. Definitions of single and multi-user systems**

| | |
|---|---|
| Single user system | These include rainwater and greywater use systems that are designed for single users, normally a household. |
| Multi-user system | These can be residential and commercial rainwater/greywater use systems designed specifically to serve multiple properties and users, eg flats, residential and/or housing associations, hotels, offices and other commercial applications. |

Conversely, it may also be the case that larger scale systems and the associated economies of scale facilitate improved maintenance procedures thereby reducing potential risk of failure. This can also reduce the users exposure to the mechanics of a systems for an individual household. A risk assessment should be undertaken on a case by case basis, more information about risk assessments are shown in the box below.

**Risk assessment**

A risk assessment should consider factors such as:

- The source of the raw water, ie
  - Condition or age of the roof (rainwater use systems)
  - Potential sources of contamination
  - Source of the greywater
- Number and type of users (ie school, hospital, commercial buildings)
- Exposure to risks
- Awareness of users of the reclaimed water
- Potential end use

More general information about risk assessments can be found on the HSE website www.hse.gov.uk

Levels of risk are likely to be low for rainwater use systems. The rainwater collected will invariably be less polluted than greywater, although it may be contaminated by bird droppings or leaves and other organic matter from the catchment area. Where a rainwater system is used in a single user environment, the user is likely to be aware of the risks and will take appropriate steps. In this case any treatment (above settlement and coarse filtration) is unlikely to be required. In a multi-user environment the users may not be as aware of the nature of the reclaimed water. In these situations, some treatment may be justified as the risks from cross-contamination or incorrect use of the reclaimed water are greater.

Levels of risk to the end user are higher in greywater use systems than rainwater systems. Greywater contains a variety of contaminants, including fats, grease, cleaning products and in some cases human faecal matter. Treatment (including

disinfection) of the greywater is required in order to ensure that the reclaimed water is safe for the application that it is used for.

### Water quality guidance

There are a number of technical guidance documents that relate to the quality of reclaimed water as there is currently no binding standard within the UK. Guidelines and recommendations for the use of reclaimed water in the UK have been produced by the following organisations and projects:

- CIRIA's Buildings That Save Water (BTSW)
- BSRIA's Water Reclamation Standard
- WRAS Reclaimed Water Systems

In some cases the American USEPA guidelines for water reuse are also used, a summary of these standards is shown in Table 5.2 below. Following these guidelines should help reduce the risk of disease transfer from the use of rainwater or greywater. Different requirements are employed in different countries and there is no universal agreement on the parameters to be measured, although the commonest concerns relate to the microbial activity and nutrient levels within reclaimed water.

The risks involved with these systems are described below, followed by some guidance on the appropriate treatment methods for different systems.

**Table 5.2 Summary of water quality technical guidance for non-potable water**

| Parameter | BSRIA* | USEPA | WRAS | Bathing Water Directive |
|---|---|---|---|---|
| | | | | |
| **$BOD_5$ *** | Dissolved oxygen > 1mg/l | < 10 mg/l $BOD_5$ | Not provided | Not provided |
| **Turbidity †** | Opacity < 60% At 254nm | < 2 NTU | Not provided | Not provided |
| **Microbiological quality ◊** | <1000 cfu/100 ml total coliforms | *(E.Coli)* < 1 cfu/ 100ml | <10,000 cfu/100ml faecal coliforms<br><br><100cfu/100ml fecal enterococci | <10,000 cfu/100ml total coliforms<br><br><2000 cfu/100ml faecal coliforms |
| **pH (measure of acidity or alkalinity)** | Not provided | 6 – 9 | Not provided | Not provided |
| **Chlorine ($Cl_2$) residual disinfectant** | 0.5 – 2 mg/l | < 1 mg/l | Not provided | Not provided |

**Notes**

* The BSRIA guidance is for toilet flushing with greywater only. (Table 5.5 has further details)

† The BSRIA test for opacity is simpler than the turbidity test recommended by the USEPA.

◊ Various different standards are recommended. The test for total coliforms is simplest, but still would be required to be undertaken by a laboratory.

### Treatment recommendations for rainwater use systems

Treatment recommendations for rainwater use systems are set out in Table 5.3. The treatment required should be the subject of a risk assessment as described in the section above to determine whether disinfection of the rainwater is required.

### Table 5.3 Design recommendations for rainwater use systems

| Application | End use | Treatment requirements |
|---|---|---|
| Single user | WC flushing, irrigation and other non potable uses | Settlement and coarse filtration |
| Multi user | WC flushing, irrigation and other non potable uses | Settlement and coarse filtration (plus disinfection to achieve total coliforms <1000 cfu/100ml if thought necessary) |

## Testing regime for rainwater use systems

If disinfection is required for rainwater use systems, testing should be carried out as part of the maintenance to ensure that the reclaimed water meets the required standard. These requirements are described in Table 5.4 below.

### Table 5.4 Testing recommendations for rainwater use systems that use disinfection

| Test | Value | Frequency | Location |
|---|---|---|---|
| Residual disinfectant | >0.5 mg/l (chlorine) | Annual | Point of use (eg WC cistern) |
| *Or*[1] | | | |
| Total coliforms | < 1000 cfu/100ml | Annual | Point of use (eg WC cistern) |

**Notes**

[1] A test for either residential disinfectant or total coliforms is required as if residential disinfectant is present there should be no coliforms risk.

Note that only one of the above tests is required. Usually this would be the test for residual disinfectant. This can be carried out using in-situ hand held monitoring equipment. Tests for total coliforms need to be carried out under laboratory conditions. Where another method of disinfection is used (such as bromine) an appropriate residual level of disinfectant should be applied in accordance with the manufacturer's instructions.

It is unlikely to be beneficial to test rainwater systems on more than an annual basis. For large multi-user applications this may be increased to testing at 6 monthly intervals. Tests should be carried out using water at the point of use, such as the WC cistern.

If at any time there is visual deterioration in the quality of the water this indicates a reduction in the quality of the reclaimed water. In this instance an inspection and remedial maintenance work may be required.

## Treatment recommendations for greywater use systems

This section sets out the treatment requirements for greywater use systems. More tests are required than for rainwater use systems to ensure that the water is of the appropriate quality for the intended use. There are no binding water quality standards for reclaimed water. In their absence, the most appropriate form of guidance for reclaimed water is the BSRIA standard set out in Table 5.5.

### Type approval

BSRIA's Water Reclamation Guidance sets out a standard for the benefit of manufacturers, specifiers, installers and end users of water reclamation systems. The standard provides a methodology for establishing the safety and performance of packaged water reclamation systems.

Systems that comply with the standard are expected to function safely and achieve the required reclaimed water quality in circumstances specified by

the system manufacturer. The performance should be verified during the commissioning phase before reclaimed water is used and thereafter through periodic testing. Type approval of greywater use systems should remove the need for complex testing against each of the individual parameters. Instead, a simple test of the level of residual disinfectant during each maintenance visit should be carried out. Additional tests may still be required for larger multi-use greywater systems.

### Treatment design recommendation

The BSRIA standard only applies to reclaimed water for three types of end use, being:

- toilet flushing
- gravity fed irrigation systems
- pressure applications (eg vehicle washing)

Pressure applications require higher quality water as opposed to WC flushing. This is primarily related to increased risk of exposure and ingestion through the formation of spray and aerosol. A summary of these standards are set out in Table 5.5.

**Table 5.5 Design guidelines for greywater use systems (BSRIA 2002)**

| Use | Test | Value |
|---|---|---|
| WC Flushing | Total coliforms<br>Max residual disinfectant*<br>Min residual disinfectant | <1000 cfu/100 ml<br>2 mg/l ($Cl_2$)<br>0.5 mg/l ($Cl_2$) |
| Gravity fed irrigation systems | Total coliforms<br>Max residual disinfectant*<br>Min residual disinfectant | <1000 cfu/100 ml<br>0.5mg/l ($Cl_2$)<br>N/A |
| Pressure applications | Total coliforms<br>Max residual disinfectant*<br>Min residual disinfectant | <10 cfu/100 ml<br>0.5mg/l ($Cl_2$)<br>N/A |
| All applications | Dissolved oxygen<br>Turbidity † | Dissolved oxygen > 1mg/l<br>Opacity < 60% at 254nm |

**Notes**

* For disinfectants other than chlorine appropriate residual concentrations and appropriate analytical methods should be in accordance with the manufacturer's recommendations.

† Normally measured with a 1cm cube

### Testing regime for greywater use systems

The testing regime required will vary depending on whether the greywater use system has type approval and the risk associated with the number of users. The risk associated with greywater systems increases with the number of users due to factors such as cross-contamination and the discharge of unsuitable substances to the greywater equipment.

Tables 5.6 - 5.9 below set out the proposed testing requirements for greywater for both single and multi-user environments for equipment with and without type approval. The required treatment values should be in accordance with the guidelines in Table 5.5.

There is an option for measuring residual disinfectant or total coliforms. Usually this would be the test for residual disinfectant as it can be carried out using in-situ

hand held monitoring equipment. Tests for total coliforms need to be carried out under laboratory conditions.

Where another method of disinfection is used (such as bromine) an appropriate residual level of disinfectant should be applied in accordance with the manufacturer's instructions. All samples should be taken from the point of use, for example the WC cistern.

If at any time there is an aesthetic deterioration in the quality of the water (either bad odour or visual appearance) this indicates a reduction in the quality of the reclaimed water. In this instance an inspection and remedial maintenance work may be required.

### Table 5.6 Testing recommendations for greywater use systems, single user with type approval

| Test | Frequency | Value |
|---|---|---|
| Residual disinfectant | Annual | See Table 5.5 |
| *Or*[l] | | |
| Total coliforms | Annual | See Table 5.5 |

**Notes**

[l] A test for either residential disinfectant or total coliforms is required as if residential disinfectant is present there should be no coliforms risk.

Additional annual tests may be required for greywater equipment that does not have type approval to ensure that it conforms to the BSRIA guidelines. These are set out in Table 5.7 below.

### Table 5.7 Testing recommendations for greywater use systems, single user without type approval

| Test | Frequency | Value |
|---|---|---|
| Dissolved oxygen | Annual | Dissolved oxygen > 1mg/l |
| Turbidity† | Annual | Opacity < 60% at 254nm |
| *And* | | |
| Residual disinfectant | Annual | See Table 5.5 |
| *Or*[l] | | |
| Total coliforms | Annual | See Table 5.5 |

**Notes**

† Normally measured with a 1cm cube

[l] A test for either residential disinfectant or total coliforms is required as if residential disinfectant is present there should be no coliforms risk.

The frequency of testing for multi-user systems is likely to be higher than for single user systems. This should be considered on a risk assessment basis. Tables 5.8 and 5.9 show guidance on the frequency of testing.

### Table 5.8 Testing recommendations for greywater use systems, multi-user with type approval

| Test | Frequency | Value |
|---|---|---|
| Dissolved oxygen | Annual | Dissolved oxygen > 1mg/l |
| Turbidity† | Annual | Opacity < 60% at 254nm |
| *And* | | |
| Residual disinfectant | 3 - 6 months | See Table 5.5 |
| *Or* | | |
| Total coliforms | 3 - 6 months | See Table 5.5 |

**Notes**

† Normally measured with a 1cm cube

[l] A test for either residential disinfectant or total coliforms is required as if residential disinfectant is present there should be no coliforms risk.

### Table 5.9 Testing recommendations for greywater use systems, multi-user without type approval

| Test | Frequency | Value |
|---|---|---|
| Dissolved oxygen | 6 months | Dissolved oxygen > 1mg/l |
| Turbidity† | 6 months | Opacity < 60% at 254nm |
| *And* | | |
| Residual disinfectant | Monthly | See Table 5.5 |
| *Or*[l] | | |
| Total coliforms | Monthly | See Table 5.5 |

**Notes**

† Normally measured with a 1cm cube

[l] A test for either residential disinfectant or total coliforms is required as if residential disinfectant is present there should be no coliforms risk.

# 6 Maintenance of rainwater and greywater use systems

The impact and sustained use of rainwater and greywater use systems depends on the enthusiasm and commitment of the users (or organisation responsible for maintenance) to make them work. The technology does require some user intervention, if the user is not committed or enthusiastic about undertaking maintenance, benefits from the system may not be realised and it may cause problems for system users.

Before a maintenance regime for a rainwater or greywater use system can be implemented a handover inspection should take place to ensure that the client has a robust and operational system that is unlikely to fail due to errors in design and/or installation. The handover process should include the provision of a manual with details on servicing and maintenance requirements for the specific system.

The enclosed Model Agreement is a legal document that can be completed to form the basis of an agreement between two parties regarding the maintenance and operation of sustainable water management systems this should help ensure that systems operate as designed and that routine maintenance requirements are undertaken.

If the reader is considering purchasing a greywater use system it may be beneficial for them to check if it complies with BSRIA's standard for water reclamation. In other situations it will be important for the manufacturer of systems to provide information detailed in table 6.1.

**Table 6.1 Information to be supplied by systems manufacturer**

| | |
|---|---|
| **Contact details** | Name of manufacturer, address, telephone number, fax number, e-mail and web address. |
| **System details** | Model number/serial number, date of manufacture and place of purchase. Listing of system parts and specifications, separating consumables such as disinfectant and rubber seals. Possibly in graphical format with each part given a number and listed. |
| **Installation instructions** | The operation of the unit should be explained (ie what it does and how it works.<br>A list of additional items required for installation that are not included with the system should be given. This may well include any specialised tools.<br>Installation instructions should include safety considerations and should be clear, concise and listed in order. Diagrams should be used. |
| **Commissioning instructions** | This should contain a list of checks to be made before the system is activated. A tick box checklist could be a helpful procedure for this.<br>A fault finding procedure (possibly in a table or flow chart format) |
| **User instructions** | Instruction on general day to day system operation including how to carry out simple tasks that are expected to be done by the user. A schedule for when trained maintenance personnel are required. Simple fault finding guide to the users. |
| **Operation and maintenance instructions** | In-depth instructions for safe system maintenance. Including in-depth system fault finding. |
| **Maintenance log book** | Records details of maintenance carried out. |
| **Other information** | List of product approvals<br>Certification of warranty and conditions if given.<br>Listing of recognised service agents or retailers of the system. |

## CONSIDERATIONS DURING MAINTENANCE

Well-designed rainwater and greywater use systems should be safe to operate. However, installation and maintenance activities may create risks. The risks are mainly associated with greywater use systems, some of these risks may be exacerbated during periods of system failure. Risk assessments should be carried out by those undertaking maintenance and procedures to minimise risks should be followed. The key areas of concern (adapted from BSRIA's guidance) are:

### Accident hazards

Care must be taken when inspecting and working on elements of systems, this could include inspection of storage or header tanks, working on roofs and gutters and general grounds work.

### Biological hazards

Any part of the system should be assumed to be exposed to contamination with pathogenic bacteria, this is particularly relevant to greywater use systems. Maintenance personnel and other people who come into contact with greywater or reclaimed water from rainwater and greywater use systems should wash their hands before eating and wash overalls after use. Greywater collection pipework and tanks should be treated as if contaminated with faecal material; operatives should wear gloves and overalls when cutting into systems and when cleaning tanks.

### Chemical hazards

Chemicals used for disinfection may be hazardous in undiluted form through skin contact, ingestion or inhalation. Containers must be properly labelled and kept in a secure place out of reach of children. Suppliers must give guidance on handling precautions and instructions on what to do in the case of accidental skin contact, ingestion, or spillage.

## INSPECTIONS

Routine inspections should be carried out in accordance with manufacturer's instructions and guidance on testing (this can and should be included in the Model Agreement). Annual testing is suggested for single domestic rainwater use systems, and 6 monthly to annual testing is recommended for greywater use systems.

Where these systems are being used in multi-user situations this frequency should increase in line with the perceived risk. Rainwater use systems should be tested 6 monthly and greywater use systems every month. More frequent inspections and testing maybe required during commissioning and the early phases of operation, or where the impacts of failure are high

Water quality monitoring cannot be effectively enforced by regulators. However, the Model Agreement can make monitoring by the maintainer contractual. Monitoring is considered to be prudent, particularly where many people are using the water. Reducing risks, however, needs to be addressed in system design. Systems should be able to meet high water standard criteria and be designed to fail-safe if any components of the treatment system fail.

### System failure

Proprietary rainwater systems and rainwater harvesting systems tend to be reliable and manufacturers generally provide instructions on system use and fault finding. Manufacturers are now being encouraged to provide users with a control panel to provide information on water levels and the operation of components like pumps. Within rainwater use systems pump failure tends to be the most common cause of unplanned maintenance.

Greywater systems are more complex than rainwater systems as they have a greater number of components and more sophisticated treatment. Users of systems should be provided with instructions on operation and fault finding. If rainwater or greywater treatment systems fail it is possible that health risks may increase, as a result many systems have a fail-safe mechanism to prevent untreated water being supplied for use. Systems failures can include:

- failed or faulty pumps
- control panel failure
- disinfectant not adequate or expires
- faulty switch valves
- filter blockage.

Ensuring that systems are installed and commissioned correctly can reduce system failures. This process should be undertaken during the handover stage and includes pipework, integrity of storage and the reliability of components like pipes and switch valves.

## MAINTENANCE

The design of systems should facilitate the safe and convenient access by personnel and where necessary construction plant. Collection tanks may need periodic access to maintain pumps, change or clean filters and occasionally tanks themselves may need to be cleaned.

For greywater systems header tanks may also need to be accessed to maintain level controls, valves and control systems.

Where maintenance is not undertaken by the equipment supplier full instructions should be supplied to the customer. Instructions should include:

- the name, address and telephone number of the system supplier and/or delegated maintenance company
- the model and serial/contract number of the system
- if appropriate the approvals body (and certificate number) certifying compliance with standards. In the case of greywater it's BSRIA's Water Reclamation Standard.
- general safety advice including the avoidance of hazards
- guidance on the effective use of the system to maximise the sustainable management and use of water
- start up and shut-down procedures
- periodic checks to be carried out by the operator
- planned monitoring and maintenance requirements

- consumable requirements
- basic fault finding.

### Routine maintenance

The majority of systems on the market are not currently 'fit-and-forget', they require periodic checking and maintenance to ensure trouble free operation. Where systems are well maintained their operation is considerably more reliable. Some activities will be suitable for most users to undertake (although not necessarily desirable) eg replacement or cleaning of filters and top-up of disinfectant reservoirs. Other maintenance tasks, such as servicing the submerged pump or control panel, may require specialised service visits.

There are wide differences in the extent of planned maintenance between different systems. Single domestic and some multi-user rainwater systems are essentially maintenance free apart from cleaning gutters and/or catchments and filters. Some greywater system manufacturers are aiming to develop systems that are maintenance free, others require three monthly inspection and disinfectant top-up.

The frequencies provided in Tables 6.2 and 6.3 below are broadly based on findings from the BTSW project. Manufacturers of proprietary systems and specific components should also be able to advise on the necessary frequency of maintenance and monitoring for the systems and should be contacted in the first instance.

### Rainwater systems

Many systems are designed to reduce the level of user intervention required, as such, systems are simple to maintain but periodic checks may be needed. The main components that may require routine operation and maintenance checks are the pump, valves, filters and disinfection system (if installed). The suggested frequency for maintenance activities stated in table 6.2 is based on a single domestic system, for multi-user applications it may be necessary to increase the frequency of maintenance visits.

**Table 6.2 Typical frequency of maintenance activities for rainwater systems**

| Component of system | Maintenance frequency |
|---|---|
| Manual cleaning filters | Monthly |
| Self cleaning and/or coarse filters | Check and clean every three months depending on site (ie tree cover) |
| Roofs and gutter | Cleaning once or twice a year depending on site |
| Ultra-violet disinfection | Six months or annual replacement depending on system |
| Chemical disinfection | Some systems require monthly replacement of disinfectant |
| Pump | Annual check of functioning and wiring |
| Tank | Visual inspection of the tank is recommended at least once a year. Excessive silt should be removed.<br>Tank cleaning and draining down the tank may not be required for some time (every 10 years). |
| Mains water top-up | Should be checked every 6 months to annually to ensure it is working |

Pumps are reliable as long as they run within the design specification. Pumps on small domestic systems are designed to be maintenance free. Larger pumps may require periodic maintenance, greasing seal changes etc.

### Greywater systems

Some systems are being designed to require minimal user intervention. Although the majority of systems currently require the addition of disinfectant, and possibly the checking of filters. Some systems also require monitoring to ensure they are operational and providing savings. The frequency of disinfectant top up on the systems can vary from three to 12 months. Most systems prevent untreated greywater being used when disinfectant runs out.

Experience from the BTSW project suggest that where there was no clear indication of system status on the control panel, users could be completely unaware of a failure and the system would automatically use mains water.

**Table 6.3 Typical frequency of maintenance activities for greywater systems**

| Component of system | Maintenance frequency |
|---|---|
| Manual cleaning filters | Monthly but this depends on the systems and sediment loading of the water |
| Self cleaning and/or coarse filters | Check and clean every three months depending on site (ie tree cover) |
| Biological cultures | Periodic cleaning – frequency and replacement of sand or media dependent on system and should be in line with manufacturers specification |
| Ultra-violet disinfection | Six months or annual replacement depending on system |
| Chemical disinfection | Some systems require monthly replacement of disinfectant |
| Membrane treatment | Periodic cleaning - frequency and chemical dosage in line with manufacturers specification |
| Pump | Annual check of functioning and wiring |
| Tank | Visual inspection of the tank is recommended at least once a year. Excessive silt should be removed<br>Tank cleaning and draining down the tank may not be required for some time (every 10 years) |
| Mains water top-up | Should be checked annually to ensure it is working |

Operation and maintenance manuals for greywater systems should be supplied with all systems. This literature should include system specification and technical information and more detailed maintenance and servicing requirements.

Manufacturers of packaged domestic greywater systems recommend an annual service by qualified person (however, users may prefer more frequent checks). This would mainly entail the cleaning of filters and functional system checks. There may also be recommendations for other maintenance tasks on a longer time scale, eg checking the electrical integrity of the pump.

For multi-user systems, operation and maintenance of the system would normally lie with the building owner or operator. Operational checks, and maintenance of systems components may have to be undertaken more regularly and by professional staff which can be accommodated under the Model Agreement. However, it is possible that basic monitoring and consumable replenishment may be undertaken by appropriately trained on-site staff or contracted out (again under the Model Agreement).

### Waste management issues

If filters are removed or replaced they require careful handling and safe disposal. Disposable filters from domestic systems may be disposed of with general household refuse. Ultra-violet lamps use mercury vapour and so should not be disposed of in general refuse. Local authorities should be contacted for advice on the appropriate disposal of filters from multi-user systems and UV lamps.

Waste from the cleaning of storage tanks should be correctly disposed of. A waste product cleansing service may be used, in which case a specialised contractor may

be required. Underground storage tanks may also need to be cleaned by using pump systems or by entering the tank, care should be taken when working in confined spaces.

### Handover of properties

When buying a property, prospective buyers must be made aware that a rainwater or greywater system is installed. Maintenance and operational requirements must be made clear. Rainwater and greywater use systems Model Agreement

# 7 Development of rainwater and greywater use systems Model Agreements

The Model Agreement developed for this project has been based on a detailed Legislation Review and consultation exercise. The legislation review provided the legal framework for the agreement to be used and the consultation provided a list of potential scenarios that agreements would need to be used for. The Model Agreement is based on current legislation (November 2003).

## THE MODEL AGREEMENT

The Model Agreement is a simple contract between the property owner/tenant (Customer) and the maintenance provider (the Maintainer). It is primarily set-up to help facilitate ongoing maintenance of rainwater and greywater use systems. The owner could be either a single household or multi user organisations such as a residential or housing association, or a commercial body. This contract sets out the responsibilities of the parties, the number of maintenance visits and the charges for the services. A diagram showing the main elements of the Agreement is shown in Figure 7.1. The contract has two main components:

- The Model Agreement
- The Schedule

The Model Agreement places a number of obligations on both the Maintainer and the Customer. The Maintainer's obligations are to ensure that all maintenance duties are carried out effectively as instructed in the schedule of work. The Customer's obligations include the provision of access to the system.

Details of the services to be provided are set out in the Schedule that can be amended to provide specific information about the maintenance tasks required. This should specify the activities that should be undertaken during each maintenance visit. Commentary and guidance on the Private SUDS Model Agreement is provided in section 8.

The Agreement is set out in accordance with the legislative review, one of the key areas being water quality. The BSRIA standard for greywater systems should be used, where these are not available BSRIA standards for reclaimed water are recommended for the quality of the greywater. No treatment would be expected for rainwater systems, except for where the risk assessment deems it necessary.

### Scenarios for the Model Agreement

The Model Agreement for rainwater and greywater use is set out for a variety of scenarios, ranging from single domestic to multi-user situations. In a single user situation the Agreement will often be between the householder and the maintenance organisation. For some larger single systems this Agreement may between a building operator/facilities management company and the maintainer. This may require an additional agreement between the tenant and/or property owner and the building operator/facilities management company. This is represented in figure 7.1.

The Agreement designed for multi-user scenarios will often be for a communal system that may include housing associations or those within an industrial estate or commercial business park. These may sometimes be represented by a facilities manager and/or building operator and often require an additional agreement between those that benefit from the system and manage the building.

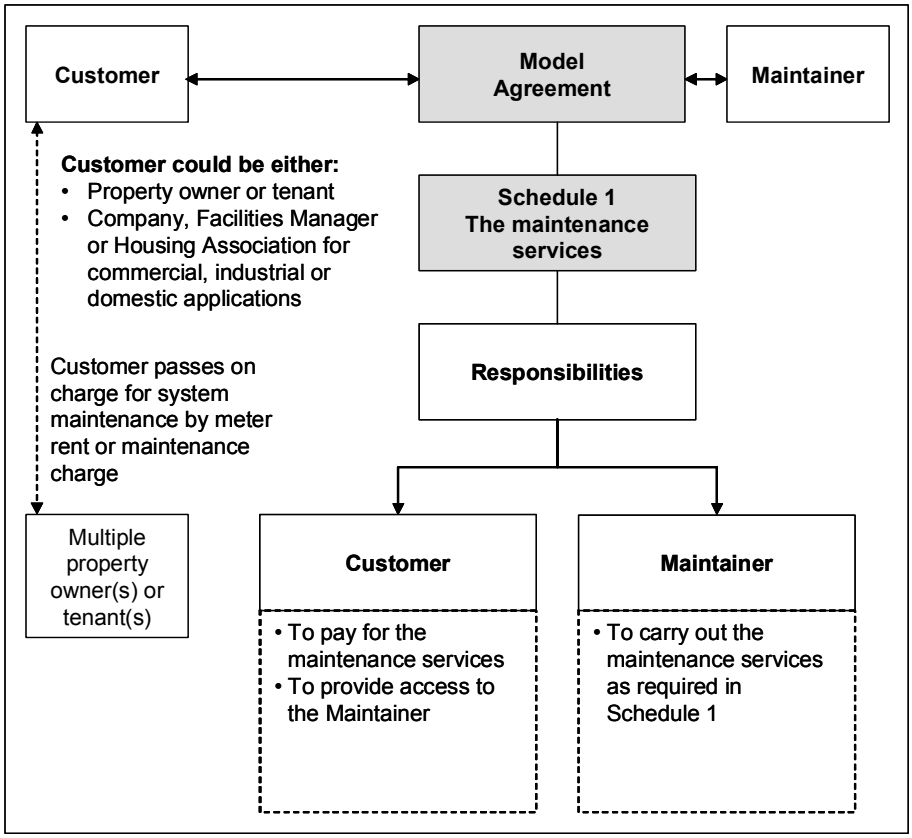


**Figure 7.1 Diagram showing the mechanism for the rainwater and greywater use Model Agreement**

### Model Agreements and the planning framework

In areas that are water resource scarce some Local Authorities may insist that rainwater or greywater use systems are incorporated into developments. They can do this by developing an agreement under The Town and Country Planning Act 1990. This sets out the current framework for planning and development control in England and Wales.

The 1990 Act allows local planning authorities to attach conditions when granting planning permission for developments and these can be used to encourage sustainable water management.

Section 106 of the Act allows a legally binding agreement to be entered into between the local planning authority and a third party or parties – commonly referred to as a 'planning obligation'. The Section 106 'planning obligation' can:

- restrict the level and type of development
- require specific activities to be carried out in, on, under or over the land
- require money for specified purposes to be paid to the local planning authority (on a specified date or dates or periodically).

These criteria allow the local planning authority to specify, within the obligation, the work to be carried out in connection with the sustainable water management. This is underpinned by the Local Government Act 2000 where local authorities have a duty to promote the improvement of the environment and contribute to sustainable development of their areas.

Section 106 Agreements can be used to specify infrastructure to be used within developments, particularly water supply and wastewater infrastructure such as rainwater and greywater use systems. The enclosed Model Agreement can be used within the S106 framework to ensure that the systems are maintained, helping to sustain potential water savings and reduce any potential health risks.

# 8 Commentary on the Model Agreement

## COMMENTARY ON THE MODEL AGREEMENT

The following section sets out guidance to the Model Agreement for Rainwater and Greywater use systems

| | |
|---|---|
| **Section 1 - Details of parties** | |
| | The details of both Parties (Maintainer and Customer) should be entered into the tables.<br><br>This defines the two Parties to the Agreement who are from here on referred to as the Maintainer and the Customer. |
| **Section 2 – The Agreement** | |
| | This section sets out the charges agreed for the scheduled maintenance visits and additional services. It also sets out the commencement date and provides space for signature of the Agreement.<br><br>*The frequency of maintenance visits should be entered in the first line.* This should be selected to take into account the life of all consumables, so that they can be replaced during maintenance visits before they run out or deteriorate.<br><br>The date of the first maintenance visit *should be specified by entering the maximum number of months in the second line.*<br><br>*The word 'Standard' or 'Premium' should be deleted or crossed through* to indicate the chosen level of service.<br><br>*The first table 'Maintenance Charges' should be filled in with the agreed annual charge for the regular maintenance visits.*<br><br>*The second table 'Rates for additional services' should be filled in* with the agreed charges for an emergency visit and an additional maintenance visit. These costs exclude VAT, which must be paid by the Customer.<br><br>The 'emergency visit labour charge' is to cover the cost of an additional inspection requested by the Customer to take place outside of the defined working hours. The 'additional maintenance visit charge' is to cover the cost of any additional maintenance visits requested by the Customer to take place within the defined working hours. For these additional services, the same Maintenance Services will be required as for a standard Maintenance Visit.<br><br>The Commencement Date is the date from which the Agreement comes into force. *This should be filled in using the space provided. A representative of the Customer and of the Maintainer should sign and insert their name and date of signature in the spaces provided.* |
| **Section 3 – Definitions** | |
| | These clauses set out the definitions of the key terms used in the Agreement:<br><br>It is worth noting that:<br>○ the Commencement Date is the date from which the Agreement comes into force. *This should be filled in using the space provided in clause 3.3*. This may or may not be the date of the Agreement<br>○ Consumables are the parts which the Maintainer will be responsible for replacing during each Maintenance Visit<br>○ replacement Parts are defined as all elements of the Equipment that are not Consumables |
| **Section 4 – Maintenance services** | |
| Clause 4.1 & 4.2. | Section 4 set out actions that the Maintainer will be required to carry out during each Maintenance Visits.<br><br>The specific actions required to maintain the equipment are set out in Schedule 1. |
| Clauses 4.3 & 4.4 | Clause 4.3 sets out the requirement for a full inspection and replenishment of the Consumables listed in Tables 2 and 3 of Schedule 1. |

| | |
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| | Clause 4.4 set out the responsibility of the Maintainer for provision of the Consumables listed in Table 2 of Schedule 1. The Customer will be responsible for providing the other Consumables free of charge. |
| Clauses 4.5, 4.6 & 4.7 | The working hours in which the Maintainer will carry out the visits are defined in Clause 4.5. *Details of the working hours should be entered in this clause.*<br><br>Clause 4.6 sets out the timescale in which the Maintainer must respond to requests for additional services.<br><br>Clause 4.7 states that this Agreement will take precedence over the Maintainers Standard Conditions of Sale. |
| **Section 5 – Exclusion from services** | |
| | These clauses set out the actions which are excluded from the Agreement. These can be summarised as follows:<br><br>o modifications to the Equipment<br>o defects caused by misuse, neglect or failure to follow the instructions, except those caused by the Maintainer. |
| **Section 6 – Standard service OR Premium service** | |
| | This section describes the two alternative levels of service.<br><br>*The section not relating to the chosen level of service should be crossed through or deleted.* |
| Standard Service | The main conditions applying to the standard level of service are the following:<br><br>o the Customer must pay for all additional maintenance visits and Replacement Parts (including labour) unless caused by the Maintainer's negligence<br>o the Maintainer must detail any Replacement Parts required in the maintenance report<br>o during Additional Maintenance Visits the Maintainer should identify and correct any faults. The cost of any Replacement Parts should be agreed with the Customer prior to installation. |
| Premium Service | The main conditions applying to the premium level of service are the following:<br><br>o the Maintainer must supply, install and test all Replacement Parts within 7 days of identifying the fault<br>o the Maintainer will carry out additional Maintenance Visits if the Customer reports a fault with the Equipment<br>o the Customer must pay for all Emergency visits<br>o during Additional Maintenance Visits the Maintainer should identify and correct any faults. |
| **Section 7 – Maintenance charges** | |
| Clause 7.1 | These clauses set out the terms that apply to the payment of the Maintenance Charges.<br><br>The agreed charges will be paid every year in advance, on or before the Commencement Date and the same date of every following year that the Agreement is kept in force.<br><br>If the Customer does not pay on time the Maintainer may terminate the Agreement as set out in Section 15. |
| Clause 7.2 | This clause sets out the Maintainer's right to amend the charges for the following year by written notice given at least 30 days before the annual renewal of the Agreement. The Customer is under no obligation to renew the Agreement for a further year.<br><br>The Maintainer may terminate the Agreement if the Customer does not pay the Maintenance Charges on time. The Customer is given 30 days from the due date to pay the Maintenance Charges. |
| Clause 7.3 | The Customer will be responsible for paying VAT on the charges and will not make any deductions from them. |
| **Section 8 – Customer's obligations** | |
| | These clauses set out the Customer's obligations under the Agreement. These are summarised as the following:<br><br>o pay the charges promptly<br>o operate the Equipment properly<br>o not to move or modify the Equipment without consent<br>o make any operation and maintenance records available to the Maintainer |

| | |
|---|---|
| | ○ provide access<br>○ maintain associated drainage and pipework |
| **Section 9 – Maintainer's obligations** | |
| | These clauses set out the Maintainer's obligations under the Agreement. These are summarised as the following:<br><br>○ carry out the maintenance in a proper, diligent and workmanlike manner<br>○ use appropriate equipment and competent staff<br>○ indemnify the Customer against any losses due to the Maintainer's neglect or default<br>○ rectify any breach of the Agreement identified by the Customer |
| **Section 10 – VAT** | |
| | These clauses set out that VAT should be paid in addition to any charges unless otherwise stated. |
| **Section 11 – Liability** | |
| | These clauses limit the Maintainer's liabilities in connection with the failure of the equipment to losses or damage caused by the Maintainer's negligence. |
| **Section 12 – Commencement and Term of the Agreement** | |
| | These clauses set out that the Agreement will run for a year at a time or until one party gives 30 days' prior written notice.<br><br>If the Customer moves house it is advised that he terminates the Contract and notifies the incoming owner/tenant of the agreement in advance to enable him to enter into a similar agreement. |
| **Section 13 – Termination for breach** | |
| | These clauses set out the reasons for which the Agreement may be terminated immediately. These can be summarised as follows:<br><br>○ the Customer or Maintainer fails to comply in all respects with the Agreement<br>○ either party dies or becomes bankrupt<br>○ either party is subject to liquidation or receivership. |
| **Section 14 – Termination consequences** | |
| | This section sets out the consequences of termination of the Agreement. |
| Clause 14.1 & 14.2 | These clauses set out that within 30 days of termination the Maintainer must produce a final account taking into account:<br><br>○ any refund due to the Customer for Maintenance Visits paid for in advance but not yet carried out. This should be calculated in proportion to the total number of visits paid for.<br>○ all arrears due to the Maintainer under this Agreement.<br><br>This account should be settled within 30 days of receipt of the final account. |
| Clause 14.3 & 14.4 | These clauses give both parties the entitlement to use the rights granted by the Agreement, including enforcing the other party's liabilities or other common law rights available for redress as a consequence of breach of this Agreement. |
| **Section 15 – Sub-contracting** | |
| Clause 15.1 | This clause sets out that the Maintainer may sub-contract its obligations subject to the Customer's prior written consent. |
| Clause 15.2 | This clause sets out that the Customer may only assign or delegate any of the rights of the Agreement to another party with the prior written consent of the Maintainer. |
| **Section 16 – Third party rights** | |
| | No other parties may acquire any rights from this Agreement. |
| **Section 17 – Discretion** | |
| | This clause sets out that any discretion or opinion exercised will only be binding if it is agreed in writing by both parties. |
| **Section 18 – Variation** | |
| | According to this Clause no variation to the Agreement will be valid unless it is agreed in writing by both parties. |
| **Section 19 – Law and jurisdiction** | |
| | English law and the jurisdiction of English courts applies to this Agreement. |
| **Section 20 – Change of address** | |
| | Under this clause both parties must give notice of a change of address or contact detail at the earliest possible opportunity, within a maximum of 48 hours. |

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|---|---|
| **Section 21 – Notices** | |
| | These clauses set out the conditions which must be met for a notice to be considered to have been served. |
| **Section 22 – Force Majeure** | |
| | This clause sets out that either party whose actions are prevented by Force Majeure must give prompt notice and use their best endeavours to carry out the action but will be excused if these fail. |
| **Section 23 – Arbitration** | |
| | This clause allows the parties to refer disputes to a commonly-agreed independent arbitrator, or where one cannot be agreed upon, to an arbitrator nominated by the President of the Chartered Institution of Arbitrators. |

## COMMENTARY ON SCHEDULE 1

The following section sets out guidance to Schedule 1 of the Model Agreement for Rainwater and Greywater use systems.

| | |
|---|---|
| **Section 1 - Details of the Equipment** | |
| Clause 1 | Details of the rainwater or greywater equipment should be included in this section. *Any drawings, maintenance manuals or other guidance should be included as Appendix 1 and a brief description of this information provided.* |
| **Section 2 – Health, Safety and Environment** | |
| Clauses 2.1 & 2.2 | Maintenance of this equipment may be hazardous if not correctly managed. Risk assessments should be carried out by the Maintainer in advance of carrying out this maintenance work, and all procedures should be strictly followed.<br><br>*A list of any site specific precautions should be included in the Schedule.* This should include any information that is particularly relevant to the site, such as the storage of hazardous substances, etc. There are unlikely to be any site specific precautions in the domestic environment.<br><br>More information about risk assessments and health and safety in the workplace is available from the Health & Safety Executive (see www.hse.gov.uk for more details). |
| Clauses 2.3 & 2.4 | These clauses relate to the environmental impact associated with the disposal of any consumables or replacement parts. These items should be disposed of in a safe and proper manner.<br><br>More information about waste disposal is available from the Environment Agency (see www.environment-agency.gov.uk for more details). |
| **Section 3 – Consumables** | |
| Clauses 3.1 and 3.2 | It is important that all consumables (eg filters, disinfectant, etc) are replaced at the frequency recommended by the manufacturer. The manufacturer's instructions should set this out in the maintenance information.<br><br>*Table 2 should be completed showing all consumables that are to be provided and replaced by the Maintainer during the maintenance visits.* The Maintainer should charge the Customer for the cost of the materials as part of the maintenance charge.<br><br>*Table 3 should be completed to show any consumables that are to be replaced by the Maintainer during the maintenance visits but will be provided by the Customer.* It is possible that a large organisation may purchase the consumables directly from the manufacturer for replacement by the Maintainer. In this case the Maintainer should only charge for the labour cost involved in making the replacement. |
| **Section 4 – Water quality** | |
| Clause 4.1 Rainwater use systems | This clause sets out the standards to which the rainwater should be treated, the tests that are required and the frequency of testing. *Table 4 should be completed with reference to Section 5 of the guidance document, the manufacturer's instructions or other statutory guidance if it becomes available.*<br><br>If tests shown in Table 4 are not required these should be removed.<br><br>Standards for residual disinfectant are only available for chlorine. If another disinfectant is used, such as bromine, the residual disinfectant required should be in accordance with manufacturer's instructions. |
| Clause 4.1 Greywater | This clause sets out the standards to which the greywater should be treated, the tests that are required and the frequency of testing. *Table 4 should be completed with reference to Section 5 of the guidance document or other statutory guidance if it becomes available.*<br><br>If tests shown in Table 4 are not required these should be removed.<br><br>Standards for residual disinfectant are only available for chlorine. If another disinfectant is used, such as bromine, the residual disinfectant required should be in accordance with manufacturer's instructions. |
| Clause 4.2 | This clause sets out the requirements for carrying out the tests specified in Table 4. |
| Clause 4.3 | It is important that a record of maintenance visits and all work carried out is kept. This clause requires the Maintainer to provide a maintenance report following each visit. *The time interval between the maintenance visit and the provision of the maintenance report should be included.* |

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|---|---|
| Clause 4.4 | This clause sets out the procedure to be followed should any of the water quality tests not conform to the standards set out in Table 4. The procedure is as follows;<br><br>1. The Maintainer takes and analyses a further set of samples<br>2. If these fail the Maintainer carries out remedial work to ensure the Equipment is working correctly<br>3. Further samples are tested to see if the Equipment conforms.<br><br>All testing and labour is at the expense of the Maintainer. |
| **Section 5 – Mechanical and electrical equipment** | |
| Clauses 5.1 and 5.2 | There will be a number of tasks that should be carried out during each visit related to the mechanical equipment. This will ensure that it continues to function correctly.<br><br>Where appropriate all mechanical items shall be oiled, greased, re-sealed and left in a satisfactory condition by the Maintainer.<br><br>*The specific tasks maintenance tasks required should be included as Clause 5.2.* It is likely that the manufacturer will provide a list of maintenance tasks with the instructions. |
| Clauses 5.3 and 5.4 | There will be a number of tasks that should be carried out during each visit related to the electrical equipment. This will ensure that it continues to function correctly.<br><br>It is essential that all items of electrical equipment are made safe following any maintenance work that is carried out.<br><br>*The specific maintenance tasks required should be included as Clause 5.4.* It is likely that the manufacturer will provide a list of maintenance tasks with the instructions. |
| **Section 6 – Water supplied to the Equipment** | |
| Clause 6.1 | It is essential that no foul water sources are connected to the greywater or rainwater equipment. |
| **Section 7 – Labelling of pipework** | |
| Clauses 7.1 and 7.2 | All reclaimed water pipework should be labelled correctly in accordance with current WRAS guidance. This is fully described in Section 5 of the guidance. More information about WRAS is available at www.wras.co.uk.<br><br>Where any changes to the greywater pipework are made by the Maintainer this shall be in accordance with WRAS guidelines above. Further, a clear diagram indicating the changes to the pipework shall be provided to the Customer with the maintenance report. |
| **Section 8 – Mains water backup** | |
| Clause 8.1 and 8.2 | If there is a meter fitted to the potable water backup this should be read during each Maintenance visit. High readings will indicate low use of the reclaimed water. |

# 9 Model Agreement

*Model agreement will be here or inserted in a pocket. Reference will be given to location of electronic templates.*

# 10 Bibliography


BSRIA (2001) Rainwater and greywater in buildings – Project report and case studies, BSRIA Technical Note TN7/2001.

BSRIA (2002) Water reclamation guidance – design and construction of systems using greywater, BSRIA Technical Note TN 6/2002.

BSRIA (2002) Water reclamation guidance – laboratory testing of systems using greywater, BSRIA Technical Note TN 7/200.

CIRIA (2000) Sustainable Urban Drainage Systems – design manual for Scotland and Northern Ireland. C521, CIRIA, London

CIRIA (2000) Sustainable Urban Drainage Systems – design manual for England and Wales. C522. CIRIA, London

CIRIA (2001) Sustainable Urban Drainage Systems – best practice manual. C523. CIRIA, London

CIRIA (2002) Source control using constructed pervious surfaces. Hydraulic, structural and water quality performance issues. C582. CIRIA, London

CIRIA (2003) Sustainable drainage systems – hydraulic, structural and water quality advice, CIRIA RP 663.

CIRIA (2003) Sustainable water management- planning for new developments, CIRIA RP627.

DEFRA (20020 Directing the flow. DEFRA, London

Dixon, A. Butler, D. & Fewkes, A. Guidelines for greywater reuse – health issues. Journal of Chartered Institution of Water & Environmental Management, 13,5, 322-326, 1999.

EA (1999) A study of domestic greywater recycling

EA, (2001) Conserving water in buildings, (Water Efficiency Fact Cards)

EA, 2003, Harvesting rainwater for domestic uses: an information guide.

HMSO (1999) Water Supply (Water Fittings) Regulations 1999. Statutory Instruments No. 1148, Water Industry, England and Wales

Water Regulations Advisory Scheme (1999) Information and Guidance Note: Marking and Identification of Pipework for Reclaimed (Greywater) Systems. , WRAS, August 1999, No.9-02-05 Issue 1.

Water Regulations Advisory Scheme (1999) Information and Guidance Note: Reclaimed Water Systems, Information About Installing Modifying or Maintaining Reclaimed Water Systems. WRAS, August 1999, No. 9-02-04 Issue 1.


## USEFUL WEBSITE ADDRESSES

| | |
|---|---|
| CIRIA | http://www.ciria.org<br>http://www.ciria.org/suds |
| DEFRA | http://www.defra.gov.uk/ |
| Environment Agency | http://www.environment-agency.gov.uk/savewater |
| HSE | http://www.hse.gov.uk |
| ODPM | http://www.odpm.gov.uk |
| Ofwat | http://www.ofwat.gov.uk |
| WRAS | http://www.wras.co.uk |