The purpose of this paper is to support the argument that grey water, treated and recycled without harmful chemicals, is a sustainable water solution.

Nubian has developed the appliance like new model OASIS GT600.

Nubian encourages debate on this important topic.

# 7 Reasons why Grey is the new Green

1. Greywater is produced everyday.
2. Demand on precious drinking water is reduced by 40%.
3. Reduced chlorine discharge to the environment.
4. Treated greywater is good for your garden. Your garden is good for the environment.
5. The system is available today.
6. Infrastructure and energy costs are reduced.
7. If every new or renovated house in Australia recycled their greywater, savings each year would be adequate to meet the drinking water requirement of Geelong.

# 1. Greywater is produced everyday

***"I have 11,000 litres of rainwater storage used to flush toilets. No rain, no rainwater in storage. I am interested in a grey water solution"***

This is a quote of a prospective customer from an email enquiry to Nubian dated 1st December 2006. The point is potent. Harvesting rainwater has made a substantial contribution to management of our precious and scarce water resource in Australia. However if there is no rain, there is no rain water available for toilet flushing, or irrigation. In fact systems often rely on mains back up, and therefore potable water demand is not reduced at all.

The key benefit with Greywater treatment is that the source is available – every day.

Greywater is defined as the wastewater produced from hand basins, baths and showers, and clothes washers. The wastewater generated by toilets, kitchen sinks and dishwashers is not classified as greywater, it is blackwater[1]. The definition clearly identifies the

[1] Greywater, 2006, Sustainable sources, Accessed from http://www.greenbuilder.com/sourcebook/Greywater.html

sources of greywater and these are commonly found in all households, proving that greywater is produced everyday in Australia.

Greywater sources are listed below:

1. Bathrooms (baths, showers and washbasins):
   Water from the bathroom provides over 25 – 30%[2,3] of the water that could be captured for recycling. This water contains pathogens from humans, and chemicals and solids from soaps and shampoos.

2. Laundry:
   Over 95% of houses have a washing machine[4] implying that greywater from laundry is generated all over the country. Laundry water may contain elements such as phosphorus.

The potential for recycled greywater use in Australia is extensive.

Treated greywater can be used for laundry. There is not any difference from a hygienic-microbiological point of view between clothes washed with treated greywater or with drinking water. This has been established by overseas trials[5].

Treating greywater further increases its reusability and reduces the amount of drinking water needed by each household. Homes and families can enjoy their water resources without restriction.

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[2] Rathjen, D., Cullen, P., Ashbolt, N., Cunliffe, D., Langford, J., Listowski, A., McKay, J., Priestly, A., and Radcliffe, J, 2003, "Recycling water for our cities", Report to Prime Minister's Science, Engineering and Innovation Council.

[3] Brennan, M. J., Patterson, R. A. ,2004, "Economic Analysis of greywater recycling", In Proceedings of 1st International Conference on Onsite Wastewater Treatment and Recycling organized by Environmental Technology Centre, Murdoch University, Perth.

[4] Brennan, M. J., Patterson, R. A. ,2004, "Economic Analysis of greywater recycling", In Proceedings of 1st International Conference on Onsite Wastewater Treatment and Recycling organized by Environmental Technology Centre, Murdoch University, Perth.

[5] Department of Infrastructure, Planning and Natural Resources, 2004, "Greywater Reuse Systems", Preparation of Guidelines and Approval / Certification of Process Documentation.

# 2. Demand on drinking water is reduced by 40%

Many regions in Australia are subject to increasingly harsh water restrictions. However recycling treated greywater for re-use for irrigation and within the home can reduce the drinking water requirement of each household by nearly 40%.

The benchmark water requirement is 247 L/person/day[6]. Table 1 shows the water usage in 22 of the largest cities in Australia[7].

**Table 2.1 Each source of water use is expressed as a percentage of the residential consumption**

| **Component of Water Use** | **Percentage of Residential Consumption (%)** | **Average Daily water consumption (L/person/day)** |
|---|---|---|
| Laundry | 15 | 37.05 |
| Bathroom | 26 | 64.22 |
| Toilet Flushing | 20 | 49.40 |
| Kitchen | 5 | 12.35 |
| Residential Gardens | 34 | 83.98 |
| **Totals** | **100** | **247** |

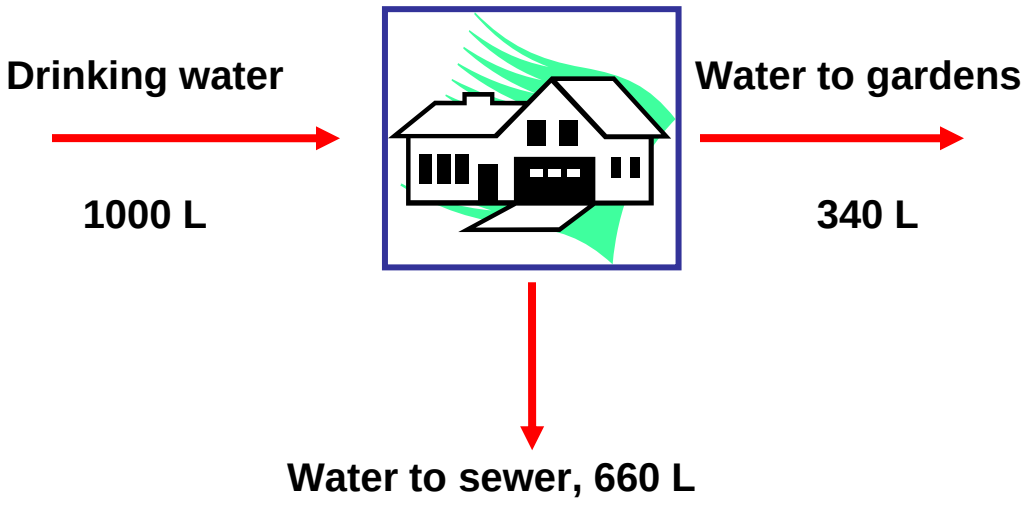


**Figure 2.1 shows the daily drinking water supplied to the gardens and wastewater pumped to sewer after use in a typical 4 person household (based on rounded average consumption values).**

[6] Basix, 2006, benchmarking BASIX.

[7] Rathjen, D., Cullen, P., Ashbolt, N., Cunliffe, D., Langford, J., Listowski, A., McKay, J., Priestly, A., and Radcliffe, J, 2003, "Recycling water for our cities", Report to Prime Minister's Science, Engineering and Innovation Council.

If greywater is not recycled, all of the drinking water supplied to the house excluding garden use, is pumped to sewer. Greywater is treated and reused in the house or garden, to preserve precious drinking water.

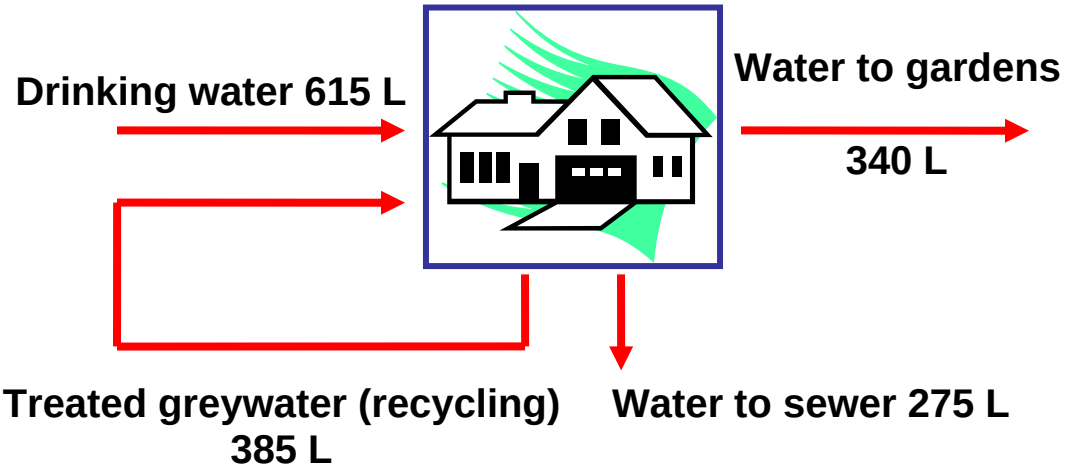


**Figure 2.2 shows the amount of treated greywater reused in the house and gardens, reducing the water to sewer by around 60% and the drinking water supplied to the house by nearly 40% (based on rounded average consumption values).**

The Nubian OASIS Greywater Treatment System is able to produce 385L/day for a typical 4 person household. As 385 L is being supplied as treated greywater, demand for drinking water is reduced to 615 L. This is clearly displayed in Figure 2.2

Treatment and recycling of greywater saves 39 – 40% of drinking water.

# 3. Reduced chlorine discharge to the environment

Mains supplied drinking water in Australia is typically treated with Chlorine.

Chlorine is an ozone depleting gas[8]. It is important to limit its release into the environment. Town drinking water contains 5 mg/L of chlorine induced at water treatment. Most greywater treatment systems also use chlorine for disinfection. The Nubian OASIS system however uses UV disinfection limiting chlorine effects on ozone depletion.

Recycled greywater comprises over 39% of the water being supplied to the household. This means that there is 39% less chlorine in the water supply and hence discharged to the environment. If the 20.2 million[9] population of Australia treated their greywater, there would be an annual chlorine reduction of 3,500 tonnes.

[8] Fahey, D.W., 2002, Twenty Questions and Answers about the Ozone layer.

[9] Australian Bureau of Statistics, 2006, Accessed from http://www.abs.gov.au on 27th November, 2006.

# 4. Treated greywater is good for your garden. Your garden is good for the environment.

The use of treated greywater can help to develop a greener Australia which is both advantageous and essential. Aside from being a reliable source of water, it provides essential nutrients such as phosphorus making it valuable for maintaining gardens.

The advantages of having more trees and plants are outlined below:

- In a country where skin cancer poses such a large threat, trees provide shade and protection from the sun.
- Evapotranspiration (evaporation from the leaves) helps in cooling as it absorbs heat from the air[10].
- In the winter, trees serve as protection from the wind.
- Trees increase evaporation. As more moisture from water bodies is evaporated and condensed as clouds; there is a greater chance of precipitation[11].
- Trees filter smoke, dust and ash from the air making it cleaner to breathe.
- Plants absorb carbon dioxide from the air and convert it to essential oxygen through photosynthesis. By absorbing this carbon dioxide, they help mitigate global warming and the greenhouse effect[12].
- Leaves from the trees create soil organic matter.
- Roots of trees increase permeability. This retains water from storms and prevents runoff, reduces soil erosion and increases ground water recharge. It can be seen that trees and gardens are indispensable in maintaining the environment.
- Plants increase the aesthetic value of the area. They attract birds and other wildlife making urban areas more pleasant to live and work in[13]. This increases the productivity and hence the economy.
- Plants are also necessary to produce fruit and vegetables.

Previously, devices have been used to divert untreated greywater to the gardens. However this may have detrimental effects on the soil quality. Treated greywater from the Nubian OASIS system can be beneficial for the garden in comparison to untreated greywater:

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[10] U.S Environmental Protection Agency, 2006, "Trees and Vegetation, Heat Island Effect, Accessed on 28th November, 2006 from http://www.epa.gov/heatisland/strategies/vegetation.html

[11] Reynolds, E. R. C., Thompson, F. B., 1988, "Forests, Climate and Hydrology", The United Nations University.

[12] Dam, M., 2006, Accessed on 28th November, 2006 from http://www.treehelp.com/features/features-benefits.asp

[13] Dam, M., 2006, Accessed on 28th November, 2006 from http://www.treehelp.com/features/features-benefits.asp

1. Treated greywater contains essential phosphorus

A high concentration of phosphorus in untreated greywater is undesirable because it encourages algae growth in rivers. Algae utilize the oxygen reserve in the water body killing marine life. It also blocks sunlight hindering any further plant growth. In addition to its impact on the environment, phosphorus is detrimental to humans. It is found in nature as phosphates, ingestion of which may lead to kidney failure and osteoporosis[14]. Untreated greywater has a high phosphorus content of 10-15 mg/L and can be detrimental to the environment and human health.

Treating the greywater reduces the phosphorus content to 3 mg/L decreasing its threat to the environment. In controlled amounts phosphorus can be highly beneficial to your garden because it is an essential element which acts as a natural fertilizer, reducing the need for garden fertilizer[15]. Hence, the Nubian OASIS Greywater Treatment System helps to maintain gardens.

2. Treated greywater has reduced thermotolerant coliforms

Untreated greywater has 1000,000 – 100,000,000 cfu/100 mL of thermotolerant coliforms. These pathogens can infect humans who are in close contact with untreated greywater making it unsuitable for use in gardens growing fruit or vegetables.

Treated water from the Nubian OASIS System contains less than 10 cfu/100 mL making it satisfactory for human contact. Furthermore, the UV disinfection used prevents regrowth of pathogens[16]. Treated greywater is suitable for use in fruit and vegetable gardens.

3. Treated greywater maintains soil fertility and organic matter content

Soils are maintained at neutral conditions (pH 6.0 – 8.0) to preserve their fertility. The use of treated greywater does not affect the fertility because it is output at pH 7.0. The BOD content is less than 10 mg/L preventing the risk of foul smelling odours in the garden because of organic matter decay.

[14 , 16] Lenntech Water Treatment & air purification Holding B.V., 2006, "Phosphorus – P", accessed on 28th November, 2006, from http://www.lenntech.com/Periodic-chart-elements/P-en.htm

[16] Department of Infrastructure, Planning and Natural Resources, 2004, "Greywater Reuse Systems", Preparation of Guidelines and Approval / Certification of Process Documentation.

4. Treated greywater will not pose water logging problems

Previously common problems with diverted greywater usage were water logging and flooding. The Nubian OASIS system allows the distribution of treated greywater when required by the soil and the excess is pumped to the sewers to avoid flooding[17].

5. Treated greywater should not affect soil salinity

When recycling greywater with the Nubian Oasis Greywater Treatment System it is important to use detergents that have potassium salts or liquid concentrates. The sodium salt concentration in the treated greywater will then be greatly reduced. Hence the use of treated greywater would not significantly affect the salinity of the soil.

Many salts are added to domestic greywater and these are primarily of sodium. The commonly found salts are sodium chlorides from the human diet, sodium nitrates from meat preservatives and food preparation, sodium sulphates, sodium tripolyphosphates and sodium carbonates from laundry products and sodium stearates from soaps. Due to the presence of these salts using recycled greywater may increase the salinity of the soil. Sodium salts are extremely soluble and cannot be removed from solution by precipitation nor can they be biologically degraded to non-ionic forms. Therefore preventing these salts from entering the wastewater stream is the most efficient method of reducing the high salinity hazard from recycling greywater. Laundry detergents and soaps are the primary source of the high salt concentration in greywater[18]. In order to reduce the risk of high soil salinity, detergents using sodium salts are replaced by those using potassium salts or liquid concentrates[19].

# 5. The system is available today

Traditional solutions to address the scarcity of water take time. You can take control today and install a Greywater treatment system that saves water, money and the environment.

Most of the water used in houses in Australia is stored in dams or obtained as rainwater. A dam takes a long time to build but a Nubian OASIS Greywater Treatment System can be installed in one day. The treated greywater is suitable for most household uses except as drinking water.

[17] Maxey, A., 2005, Greywater Regulations

[18] Dr. Patterson, R. A., 2006, "Consideration of soil salinity when assessing land application of effluent or greywater", Lanfax Laboratories, Armidale.

[19] Water Corporation, 2002, "Using greywater"

The Warragamba dam of the Wollondilly region that stores 80% of Sydney's water took 12 years to build[20]. The dam announced to commence in 2008 on the Central Coast is projected to take up to 10 years to build and fill with the first water set available in 2013[21].

Waiting for a drought to break is unpredictable and uncontrollable. It is essential to employ a system of constant water supply during such a time of decreasing annual rainfall.

The Nubian OASIS Greywater Treatment System can be installed in one working day and will ensure a constant supply of water for the various uses around the house while conserving Australia's fresh water resources.

# 6. Infrastructure and energy costs are reduced

The more houses use Greywater treatment systems, the less demand there is on aging and constrained infrastructure, and the less financial and environmental cost to manage distribution and waste treatment.

For a population of 20.2 million in Australia, nearly 6 billion kWh of energy is being used for sewage treatment and about 5 billion tonnes of green house gas is released[22].

Water Requirement

If all of the houses for the current population are retrofitted with Nubian OASIS Greywater Treatment Systems, 700,000 ML/a of drinking water can be saved and would not need to be pumped to sewer (because the system treats and recycles 40% of the drinking water supplied).

In addition to this 104,000 new houses are built in Australia every year[23]. The average number of people in an Australian household is 2.6[24]. If these new houses used the Nubian OASIS system, they would recycle 9,700 ML/annum of treated greywater.

[20] The Wollondilly Region of NSW, 2005, "Natural Attractions- Warragamba Dam", Accessed on 23rd November, 2006, from http://www.stonequarry.com.au/nature/warragamba_dam.html

[21] Hunter Water, 2006, "Drought Proofing the Hunter and Central Coast", Fact Sheet.

[22] Australian Government, Department of the Environment and Heritage Australian Greenhouse Office, 2005, "AGO Factors and Methods Workbook".

[23] ABS Dwelling Commencements, 2006, Cat No: 8750.0

[24] Australian Social Trends, 2006, Australian Bureau of Statistics, Accessed on 27th November, 2006, from http:///abs.gov.au on

The total treated greywater from all of these houses that would not be pumped to sewer is 710,000 ML/annum.

| Households | Water that is not pumped to sewer (ML/annum) |
|---|---|
| Current | 700,000 |
| New houses | 9700 |
| **Total** | **710,000** |

Energy Requirement

The energy needed for sewage treatment in Sydney is 475 KWh/ML[25]. Using this as a basis for all of Australia, employment of greywater treatment could save about 337 million kWh of electrical energy every year by reducing the power requirement to clean sewage. Green house gas emissions can be reduced by 270 kilo tonnes[26].

The cost of recycling non-potable water is estimated at $6/kL[27]. 12.8 GL of waste water is recycled annually in Sydney[28] resulting in an operating cost of $77 million. The cost of operating a Nubian OASIS Greywater Treatment System is $6.30/kL which is around the same as the cost of recycling non-potable water. This implies that there is not a significantly increased cost on the users.

Furthermore, if all of the houses employ greywater treatment, there will be a 60% reduction in waste water being managed at the municipal level (as seen in part 2) potentially reducing non-potable water recycling operating costs.

Capital expenditure for water and wastewater in Sydney for 2005 was $510 million[29]. With a 60% reduction in the wastewater being pumped to sewer, the equipment needed for sewage treatment is reduced and the capital expenditure may be reduced.

In 2005 Sydney Water spent $43 million to extend sewerage services[30]. With a reduction in the sewage being produced with greywater treatment, these expenses may be offset.

[25, 30] Sydney Water, 2005, "Environmental, Social and Economic Performance", Sydney Water Annual Report 2005.

[26] Australian Government, Department of the Environment and Heritage Australian Greenhouse Office, 2005, "AGO Factors and Methods Workbook".

[27, 31] Marsden Jacob Associates, 2006, "Securing Australia's Urban Water Supplies: Opportunities and Impediments", FINAL REPORT.

[30] Sydney Water, 2005, "Environmental, Social and Economic Performance", Sydney Water Annual Report 2005.

# 7. If every new or renovated house in Australia recycled their greywater, savings each year would be adequate to meet the drinking water requirement of Geelong.

104,000 new houses are built and 34,000 are renovated every year in Australia[31]. If all the new or renovated houses are installed with a Nubian OASIS Greywater Treatment System, Australia can save about 12,600 ML/a of drinking water which would have otherwise been used for toilet flushing and garden water. This is enough water to meet the annual drinking water requirement of Geelong (population 125,380[32]).

If all of the current households for the 20.2 million Australian population use the Nubian OASIS Greywater Treatment System, 700,000 ML/a of treated greywater can be recycled. This is enough water to meet the combined drinking water requirements of Melbourne and Sydney, the most densely populated cosmopolitan cities of Australia.

# 8. Company contact details

NUBIAN WATER SYSTEMS PTY LTD

3/83-85 Whiting Street

Artarmon NSW 2064

Tel: 02 9438 5522

Fax: 02 9438 5566

Email: enquiries@nubian.com.au

Web: www.nubian.com.au

[31] Renovations Monitor, 2006, "Renovation Work Increases in Early 2006)", HIA Economics group, Accessed on 23rd November, 2006, from http://economics.hia.asn.au

[32] Commonwealth of Australia, 2006 "City Population", Accessed on 4th December, 2006 from http://www.citypopulation.de/Australia-UC.html

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