

NUBIAN
WATER SYSTEMS



**Nubian Greywater Treatment and Recycling Systems
for Multi-dwelling and Commercial Applications**

**A Technical Overview for Architects, Hydraulic Consultants &
Engineers, Developers and Hydraulic Contractors & Plumbers**



Introduction

Nubian provides sustainable water solutions for the urban environment. We have the world's largest range of systems designed to allow people to use our planet's most precious resource sustainably. Our vision is to help to make homes and offices become water self-sufficient.

Nubian was formed to research, develop and bring to the market products that address one of the most significant global challenges in the 21st Century – the maintenance of adequate supplies of clean drinking water.

Nubian's greywater treatment and recycling technology has been developed for use in residential and office applications and has been proven to be effective in houses, apartments, prisons and 'sustainable' office developments.

Developed in Australia, where greywater recycling is well established under a structured state regulatory system, Nubian's systems have been accredited for "single-dwelling" use in all mainland states for the highest level of re-use options including above-ground irrigation and internal re-use for toilet flushing and clothes washing.

Not surprisingly, projects designed for commercial and multi-dwelling projects generally require a higher level of recycled water quality than single dwellings. Nubian is proud that in validation tests conforming to the Australian Guidelines for Water Recycling, its technology was able to deliver treated and recycled water to the standards required by:

- Australian State of New South Wales (NSW) Office of Water (Department of

Water and Energy): *"Guidelines for Management of Private Recycled Water Schemes"*

- State of Queensland: *"Queensland Plumbing and Wastewater Code"*
- EPA Victoria Guidelines for Environmental Management: *"Dual pipe water recycling schemes – Health and Environmental Risk Management"* (Publication 1015)

This document focuses on Nubian's solutions for these more demanding, commercial and multi-dwelling environments.

It is designed for architects, hydraulic consultants & engineers, developers and hydraulic contractors & plumbers and is aimed at helping them understand how Nubian has tackled the special requirements these environments present.

Nubian Commercial Greywater Treatment Systems

The Nubian CGT Series of products are designed as a skid-mounted, packaged plant able to be tailored to the specific application required by the end-customer.



Nubian CGT5 Commercial Greywater Treatment & Recycling System

The CGT Series has been developed from the highly successful and well proven Nubian single-dwelling system. It uses the same core technology but in addition is equipped with enhanced disinfection capability, control systems and remote management systems.

Common across all Nubian's systems is the ability to treat and recycle greywater to a high level of quality. Greywater can originate from showers, baths, basins and laundries but excludes wastewater from kitchens, dishwashers, toilets and urinals. Nubian's patented technology enables the safe re-use of the recycled water for a range of residential and commercial applications including:

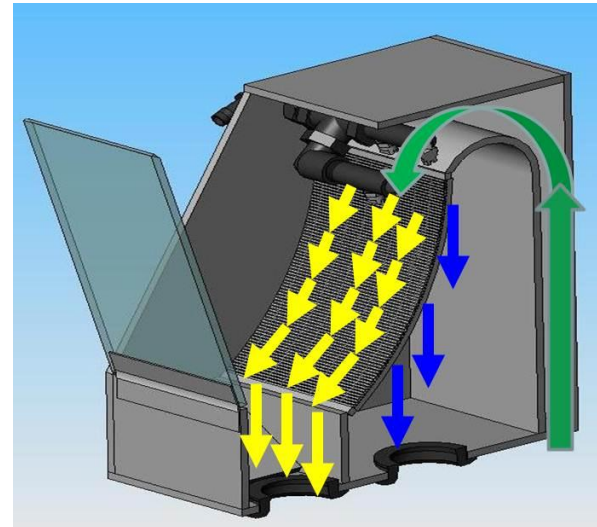
- Car washing
- Clothes washing – cold water input to a machine
- Cooling tower make-up
- Surface landscape irrigation
- Toilet flushing
- Water features

Each state and local authority regulates which of these applications are allowable but all regulators demand an effective and reliable treatment process. Nubian's treatment and recycling process is able to meet the toughest regulations due to its ability to consistently deliver a high quality of treated water. There are 4 key steps to the process.

1. Pre-screening

The pre-screening system uses an automatic self-cleaning mechanical screen to remove hair, lint and other coarse materials to prevent blockages and fouling of the system. Due to

its unique design the pre-screen requires limited maintenance interventions and is able to operate effectively at high processing volumes.



Self-cleaning pre-screen separates incoming greywater from solids

2. Bio-filtration

The second and principal stage of treatment in the Nubian system occurs in the patented submerged, aerated biofilter. Greywater flows through the biofilter under gravity and contaminant removal is achieved through a combination of physical removal, adsorption and microbial induced aerobic degradation.

The physical removal mechanisms are those typical of granular medium filters; straining, sedimentation, impaction, interception and adhesion. However, Nubian's patented system is superior to conventional granular medium filters as it provides additional treatment through the proprietary media.

The properties of the media allow a significant degree of adsorption to occur which complements the physical removal mechanisms. The combined capacities for physical removal,

adsorption and bacterial degradation create an extremely robust treatment system.

3. Disinfection

To meet the regulatory standards required in commercial and multi-dwelling applications Nubian uses a powerful, 'triple-barrier' approach to disinfection consisting of ...

1. Ultrafiltration

- A 0.02 micron, automatic backwashing, ultrafiltration membrane system is used to provide a barrier to bacteria, viruses and parasites such as Cryptosporidium and Giardia, and to improve turbidity
- The system incorporates on-line membrane integrity testing and automatic "clean-in-place" technology

2. Ultraviolet (UV) radiation

- A high (>250mJ/cm²) dose of UV radiation is applied to the treated water, following ultrafiltration
- Nubian uses systems incorporating on-board UV intensity, UV transmissivity measurement and automatic quartz tube cleaning

3. Chlorination

- As a final step the recycled water is chlorinated to ensure a level of residual disinfection in the recycled water distribution system

4. Real-time Water Quality Analysis

Critical to ensuring that the recycling system is operating to the required standard is the ability to constantly monitor the quality of the treated water. Nubian's CGT Series incorporates real-time water quality assurance using a multi-parameter on-line analyser.

The water quality analyser is configured to measure turbidity, pH and free chlorine. It directly controls chlorine dosing using proportional control.

System Control

The Nubian CGT Series uses a proprietary control system that integrates, coordinates and optimises a number of subsystems:

- Flowmeters
- Pressure sensors
- Level sensors
- Water quality monitors
- Sub-system status alerts
- Manual inputs via touch-screen interface

The controller is a combination of systems which enable it to monitor, process-control, event-log and manage the entire process. The core of the system is an industrial PC running Windows XP Embedded with IEC61131-3 compliant control software.



'Windows-style' touchscreen interface

The supervisory controller comes equipped with a 15" colour touchscreen that presents the operator with a visual operator interface and 'Windows-style' menus. Operator, system administrator and technician level password protection allows control screens to be limited to specific personnel.

Organics, Nutrients and Pathogen Removal

The treatment process of Nubian's CGT Series achieves a very high degree of organic, nutrient and pathogen removal. The biofilter is designed to utilise a combination of microbial degradation, straining, impaction and interception to cause the media to retain a significant portion of organic matter and pathogens. Further retention of particulate organics plus dissolved organics and nutrients is achieved by adsorption.

Retained contaminants are discharged to sewer during the automatic backwash cycle.

Supplementing the biofilter, the multiple disinfection stages achieve a very high kill rate of pathogenic organisms.

If the treated water is to be used for irrigation then an important element of greywater recycling is the degree of nutrient (Nitrogen and Phosphorus) removal. The Nubian CGT Series typically removes more than 40% of both Phosphorus and Total Kjeldahl Nitrogen.

Pathogen Control

For anyone wanting to implement a safe greywater recycling system the critical reference point is *The Australian Guidelines for Water Recycling*. This is a detailed analysis of the

risks, to both human health and the environment, which arise from water recycling. The document sets out guidelines for managing these risks to levels which are considered acceptable.

Nubian has used *The Guidelines* to develop its water quality targets and risk management protocols and to ensure that risks are managed to acceptable levels on an ongoing basis.

The basis for *The Guidelines* is the recycling of sewage with the concept of "log reduction values" (LRVs) used to define both the target water quality levels *and* the actual disinfection system performance. The required reduction in pathogen levels from the 'influent water' to the 'recycled water' is expressed as an LRV. For example 90% removal is an LRV of 1 while 99% removal is an LRV of 2.

The table below shows the Log removal results achieved in an independently run series of 'pathogen challenge tests'. These results demonstrate that the Nubian CGT Series achieves high rates of pathogen removal, significantly exceeding the requirements of *The Australian Water Recycling Guidelines*.

Parameter	AGWR Guidelines	LRV Achieved
E.Coli	3.0	7 – 8
Clostridia	3.0	3 – 5
FRNA (virus)	4.5	6 – 10

Nubian's system significantly exceeds "Guidelines" requirements

Installation and Operation

Nubian systems require separate, vented, plumbing waste pipes from tubs, showers,

washing machine and hand basins to the untreated greywater tank.

Recycled water supply pipes to toilets, washing machine and irrigation connection points must be connected to the treated greywater system. Where potable water backup is required, additional cross connection and backflow prevention devices must be installed in line with local plumbing codes.

Installation and commissioning of the CGT Series can usually be accomplished in 2 to 3 days although connection to plumbing and mechanical systems of the building varies with the complexity of the project.

Commissioning of the Nubian system requires a set of procedures to be followed which include plumbing and system checks, wet testing, loading and washing biological growth and filtration media, followed by individual component commissioning and the initiation of greywater processing.

The CGT Series operates within the conventional system of public water, sewage, distribution and collection. Potable water, sewerage pipes and stormwater infrastructure are still utilised – no additional infrastructure is required.

The system is designed so that it can be taken offline for maintenance without requiring alterations or modifications to any building plumbing infrastructure. The system is taken offline by a single valve which routes all greywater directly to sewer. Once offline, the system may be serviced without interference to wastewater disposal.

Overflow and drain pipes connect all components of the Nubian CGTS to sewer. In the event of extreme flows or system malfunction, greywater is automatically or manually diverted to sewer.

Installation and Operation

The Nubian CGT Series is appropriate for multi-dwelling, commercial and industrial applications. The modular and scalable nature of the system allows for water flows from 500 to 100,000 litres per day to be managed.

Nubian's CGT Series is a skid mounted package system generally consisting of 3 elements:

1. Treatment skid, incorporating Nubian's patented biofilters in either 2,000, 5,000 or 50,000 litre per day modules
2. Disinfection skid, incorporating a triple barrier (UF, UV and chlorination) disinfection system, water quality monitoring
3. Supervisory control and communications package together with remote monitoring system



Nubian CGT2 Commercial Greywater Treatment & Recycling System

The system skids are built using corrosion resistant materials and are designed to fit into standard shipping containers.

System Maintenance Regime and Operating Costs

To maintain a high level of ongoing performance, all Nubian systems operate under a planned maintenance program with scheduled interventions at 2-monthly intervals in the first year following installation and quarterly intervals in subsequent years.

Outside of planned maintenance interventions, service events are notified through a visible and audible system. Service events are also relayed to Nubian’s customer support department through the system’s remote monitoring software.

These system management capabilities, plus the automatic event logging software, ensure that the CGT Series delivers consistently high quality and reliable greywater treatment and recycling.

Operating Costs

Operating costs for the Nubian CGT Series vary with the system capacity and application but are very low compared to alternative technology.

Nubian’s low operating costs are achieved in 3 ways:

1. The system has very low power consumption
2. There are very few consumable items and the system uses no expensive chemicals
3. Water loss through backwashing is typically around 3%

Daily System Capacity	Energy Use kWhr/m ³	Maint. Mhr/m ³	Parts & Consum. \$/m ³
6 m ³	2.9	0.011	2.17
10 m ³	2.5	0.005	1.59
20 m ³	2.0	0.003	1.15
40 m ³	1.6	0.003	0.97
80 m ³	1.4	0.003	0.92

Examples of system operating costs

Summary

Nubian recognises the critical nature of greywater treatment and recycling. Having robust, reliable and effective technology is vital to support the growing community demand for sustainable water use.

Using the CGT Series architects, hydraulic consultants & engineers, developers and hydraulic contractors & plumbers are able to safely respond to their clients’ needs, regulators requirements and the communities concerns.

For more information visit: www.nubian.com.au

Call Nubian

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