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PERFORMANCE
SUMMARY
REPORT
**Domestic Greywater
Treatment System**



for
AquaReuse Pty Ltd

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1 INTRODUCTION

Domestic greywater treatment systems (DGTS) are becoming a need in Australia, as residences strive to provide water for internal and external uses during significant drought conditions. There is also a growing community desire to be more environmentally conscious in their consumption decisions.

AquaReuse are responding to this need, and have worked with Ecowise Environmental Pty Ltd (Ecowise) in a consultative and applied research capacity. This Performance Summary Report provides a brief overview of the major scientific findings from the range of cooperative projects undertaken since April 2004.

2 NATURE OF STUDIES

DGTS require accreditation by NSW Health via the DGTS Accreditation Guidelines (February 2005). This guideline includes residential systems treating up to ten persons per day, equivalent to 900 Ld⁻¹. AquaReuse wished to gain NSW Health accreditation of their peat based biological filter system (Model ADF1), designed for a flow of nine persons, or 810 Ld⁻¹, including kitchen sink, but not insinkers. Ecowise were commissioned by AquaReuse to conduct the required monitoring program to gain accreditation.

A test site facility was confirmed at a caravan park and camping site in Jervis Bay, NSW. The site includes permanent resident cabins and caravans, tourist cabins and caravans, and camping sites with some amenities. This site was chosen due to its ready access to the range of greywater sources wanted for treatment (laundry, bath, sinks, shower, kitchen sink), insitu greywater sump well, ready access to greywater plumbing, guarantee of flow at desired flow rates, proximal location. Site staff were also very interested in the project, and the possibility to reuse greywater for toilet flushing (and possibly laundry use), reducing the need for tank and rainwater. The test site was setup in October 2004 and commissioned during November 2004. Figure 1 shows the biological community within the peat biofilter.



Figure 1: Biological Community Within Peat Bed Filter at Test Site Installation

AquaReuse also installed two R&D test sites at residential premises, one in Katoomba, New South Wales and one in Tamborine, Queensland. These sites were monitored at least once weekly for over 20 weeks for a range of physical, chemical and biological parameters. The aims were various but included regrowth or organisms in treated and stored effluent, biological community constituents using traditional and molecular techniques, FRNA phage spiking trials to assess virus removal capability, and routine gathering of data from DGTS.

3 RESULTS

The data from the **Jervis Bay** site monitored for six months for accreditation purposes, is summarised in Table 1 below. It can be seen that the AquaReuse DGTS readily meets the NSW Health effluent criteria for all forms of reuse, including toilet flushing and laundry. The effluent results were stable and generally below laboratory detection.

Sample	BOD (mgL ⁻¹)	Suspended Solids (mgL ⁻¹)	Thermotolerant Coliforms (cfu/100mL)
Influent (n=16)			
Maximum	550	440	5,800,000
Minimum	110	42	120,000
50%ile	245	130	1,100,000
90%ile	410	270	2,700,000
Effluent (n=28)			
Maximum	3	4	1
Minimum	0	0	0
50%ile	0	2	0
10%ile	0	0	0
<i>10%ile represents the number whereby 90% of all samples are less than. This relates to the performance criteria required to be met by the NSW health Guidelines.</i>			

Storage of effluent for later reuse is essentially not available to the single householder. Councils and regulators indicate that effluent cannot be held for longer than 24 hours. In this project, we assessed the ability for a treated greywater effluent to support the re-growth of *Escherichia coli* (*E. coli*). Sampling of the Jervis Bay test facility stored greywater effluent was conducted fortnightly over around 3 months (test site facility). After six weeks of analysis, the laboratory sample was spiked with *E. coli* using the BTF 'bioball' which includes a quantifiable 30 organisms (laboratory spike A). This was placed into 1L, giving 3 organisms per 100mL. After a further 5 weeks analysis, additional bioballs were added (3) to spike the sample again. This time the spiking generated 13 organisms per 100mL (laboratory spike B).

Table 2 summarises the data for *E. coli* from the test site and laboratory samples. It can be seen that significant growth of *E. coli* was not supported by the stable treated greywater effluent generated by the AquaReuse process. When the laboratory samples were spiked with organisms, their growth was not supported, probably due to the low nutrient and carbon content of the effluent, and its biologically stable nature.

Test Site facility		Laboratory Spike A		Laboratory Spike B	
Week 0	0	Week 0	3	Week 0	13
Week 2	0	Week 1	0	Week 1	0
Week 4	0	Week 2	0	Week 2	0
Week 6	0	Week 3	0	Week 3	0
Week 8	0	Week 4	0	Week 4	0
Week 10	0	Week 5	0	Week 5	0
Week 12	16	Week 6	0		

A **FRNA phage spiking trial** was undertaken to assess the removal of phage (surrogate for viruses) over process units. Figure 2 shows phage removal by process units at the QLD facility. Phage was initially spiked at a level of 120 billion pfu per 100mL. Once placed into the influent sump, this gave a feed concentration of around 17 million pfu per 100mL. Effluent levels are very low, demonstrating model virus reduction across the AquaReuse approach, however complete removal was not achieved, as would be expected for these difficult to treat organisms.

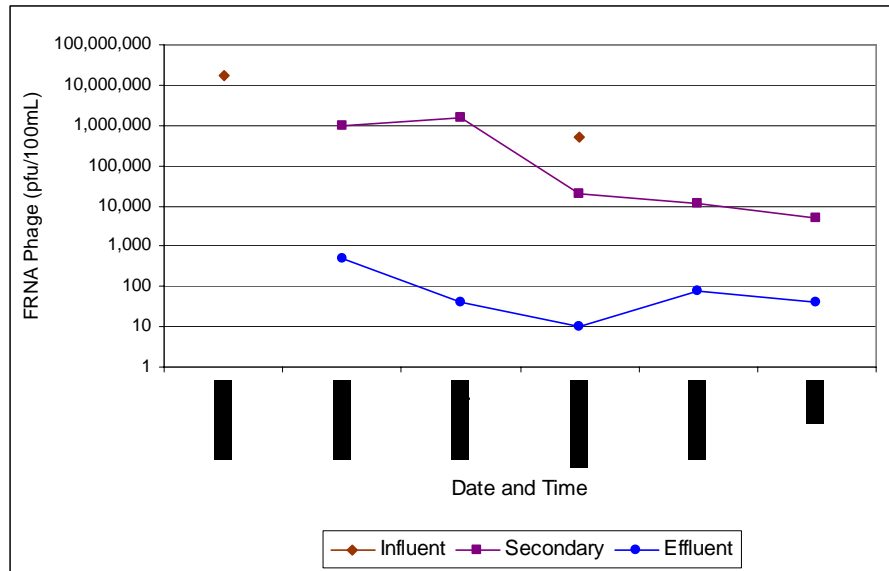


Figure 2: FRNA Phage Levels Over Process Units (QLD), Demonstrating Probable Virus Removal Efficiency

4 OBSERVATIONS

Throughout the monitoring programs undertaken across all study areas, records were maintained as to issues / aspects of the system operation, by Ecowise and the site operators. Few issues were noted during the program. No significant odour was generated during operation. No process unit failures were noted. The systems did not undergo any maintenance of any kind – either routine or reactively. The UV units (where used) did not have a lamp change or other interference. The site tanks and infrastructure experienced all weather elements and did not show any signs of detriment.

5 FINDINGS

The AquaReuse DGTS is a stable treatment process that is well designed and engineered. The facility includes suitable alarms and engineered contingencies built in, based on a thorough approach to understanding the domestic greywater situation. Good scientific data exists across all the systems monitored to demonstrate excellent effluent quality from a range of installations, in varied climate regimes.

The AquaReuse system appears to require minimal maintenance or interference, nor reactive management. Indeed, all sites operated with minimal management during the monitoring programs. The facilities did not produce significant noise or odour to impact residences, and did not at any time completely fail for any process unit. AquaReuse should represent a good delivered product to the domestic greywater market.

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