“GREYWATER-WISE” – THE REQUIREMENT FOR NATIONAL GREYWATER REUSE GUIDELINES

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ABSTRACT

A recent survey identified the disposal of excess water and reduction of the loading to failing septic tank systems as the key drivers for greywater reuse in New Zealand. As a result, unregulated greywater disposal practices are more common than previously believed, particularly in rural areas of high environmental value. There are increasing demands for greywater systems as the general public becomes more water conscious; particularly as water metering is introduced throughout New Zealand. Some councils, such as Kapiti Coast District Council and Gisborne District Council, have developed specific guidelines for greywater use in their regions. However there is typically extensive variation between different councils, causing confusion and tension between engineers, system suppliers, and local government. The requirement for national guidelines is increasing and will likely need to be addressed in the near future. The Centre for Integrated Biowaste Research (CIBR)’s “Greywater-wise” program is investigating the impacts of greywater diversion and disposal practices on the environment, particularly focusing on the long-term implications for soil, groundwater and public health. The scientific information obtained from these studies will be essential to form the basis of a New Zealand specific Greywater Guideline that takes into account New Zealand’s unique soils and climate.

KEYWORDS

Greywater; National Guidelines; Regulations; Disposal; on-site wastewater management; environmental impact.

1 INTRODUCTION

Greywater (from showers, baths, bathrooms sinks and laundry) can account for up to 75% of the wastewater from a domestic household (Eriksson et al., 2002), with the remaining blackwater stream originating from toilets, kitchen sinks and dishwashers. It is an extremely variable wastewater stream that depends on the habits, health and practices of individual homeowners. Bathroom greywater is typically composed of hair, soap, shampoo, conditioner, toothpaste, body fats, oils, cleaning products, hair dye, nutrients and bacteria, including faecal coliforms, while laundry greywater generally contains lint, oils, greases, laundry detergents, chemicals, soap, nutrients, salts and bacteria, including faecal coliforms (Ormiston Associates Ltd, 2008).

Greywater has the potential to be diverted from the main wastewater stream and discharged separately. There are multiple reasons and drivers for practicing greywater diversion. The availability of fresh water is likely to have the biggest impact on the drivers for greywater reuse, and is most likely to vary globally. Fresh water is unevenly distributed worldwide, and countries with low-water availability, and therefore higher demand for water resources, have tended to show a greater interest in greywater reuse. Such countries use household greywater on-site for irrigation purposes, and generally have strict legislation in place to regulate such use. In New Zealand, water shortages do not tend to be an issue, except in some specific areas such as the Kapiti Coast, Central Otago and Gisborne. The drought experienced in many regions during the summer of 2013 was not a typical representation of the nation’s climate, and water shortages are not considered to be significant drivers of greywater reuse in New Zealand. Instead, issues surrounding the management of the treatment and discharge of wastewater are central to our high levels of greywater reuse. In particular, our ability to reduce the wastewater

flow by removing greywater may reduce the stress on infrastructure and the receiving environment (Cass et al., 2012). It is estimated that 15-50% of our 270,000 septic tanks are considered to be performing at a sub-optimal level (MfE, 2008). The typical causes of septic tank system failure are insufficient maintenance (responsible for 80% of failing systems), minor system damage (5%), poorly located disposal fields (5%) and a malfunctioning disposal system (10%) (Fig. 1; COVEC, 2007). Greywater diversion may help address many of these issues. However, there are conflicting views as to whether greywater diversion like this is appropriate. On the one hand, there is concern that there is potential damage to the soil and plant system, and also that there could be a possible risk to public health. Greywater has been reported to have a potentially high microbial load, including bacterial (Gross et al., 2007), protozoan (Birkes et al., 2004) and viral (O'Toole et al., 2012) as well as chemical contaminants originating from pharmaceuticals (Hernandez Leal et al., 2010) and household cleaning products (Harrow et al., 2011). On the other hand diversions can help to prolong the life of septic tank systems and reduce the need for additional plumbing for a 'batch' which is only used for several weeks of the year. Different regional and district councils have conflicting stances on greywater reuse, although most agree that questions remain to be answered regarding the safety of such greywater disposal practices, from both an environmental and public health perspective. In order to move towards a standard code for greywater reuse that is acceptable to all regulatory authorities, the Centre for Integrated Biowaste Research (CIBR) "Greywater-wise" project, based at ESR, is investigating greywater reuse, and is aiming to develop a tool for assessing the appropriateness of greywater discharge based on environmental and public health implications.

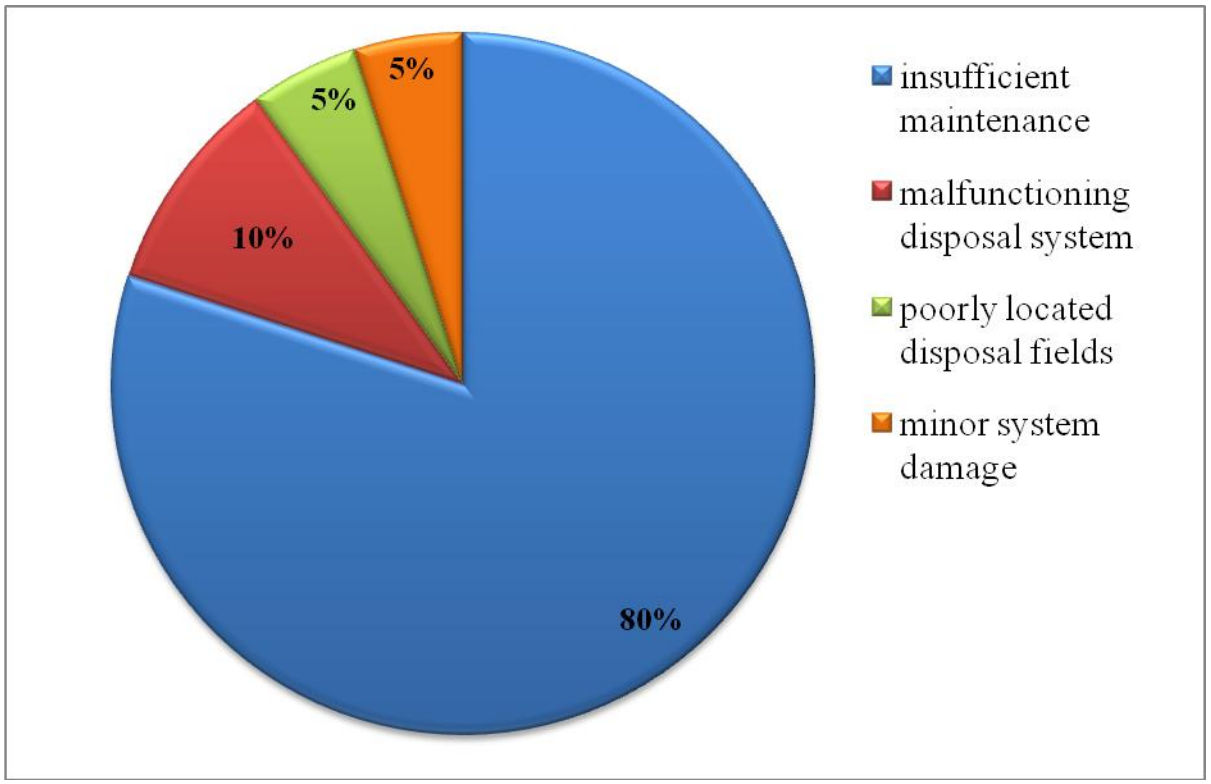
2 DRIVERS FOR GREYWATER REUSE

A report completed by Lowe Environmental Impact (Cass et al., 2012) investigated the key drivers for greywater reuse. That report found that the most common reason for diverting greywater is to reduce the pressure on infrastructure such as septic tanks, or because there is insufficient infrastructure, or unwillingness, to pipe greywater from a laundry at one side of the house to a septic tank at the other side of the house. Homeowners have also reported issues with undersized septic tanks, particularly at holiday homes that have short-term periods of high occupancy, and have seen that reducing the input of greywater is a viable means of maintaining the performance of their septic systems. The LEI report found that property owners tend to see greywater diversion as low risk, mainly due to the belief that greywater has a low pathogen content, or that once applied to soil the greywater is largely cleaned by the percolation process and exposure to sunlight and air. In addition to the unknown risks, the potential positive impacts of greywater application are also currently not quantified. Reusing greywater for irrigation has great potential to generate water savings, especially during dry periods. In addition, it is thought that any phosphorus containing detergents or personal care products could actually be having a beneficial fertilizing effect on the soil, although it is also possible that this could be offset by leaching also caused by increased phosphorus.

2.1 OVERBURDENED SEPTIC TANK SYSTEMS – SUPPORTED BY CIBR RESEARCH

In rural New Zealand, domestic wastewater is typically treated on-site. Many new property developments are investing in advanced wastewater treatment systems although an estimated 270,000 existing properties still operate a traditional primary treatment septic tank (MfE, 2008). Failure rates of these systems are high (15-50%) and it is generally accepted that many older septic tanks do not have sufficient capacity to process and dispose of the volumes of domestic wastewater produced by modern lifestyles.

Figure 1: Reasons for failure of septic tank systems in New Zealand. (COVEC 2007)



Many rural properties also experience extreme changes in occupancy, which may be sporadic and seasonal e.g. the family holiday home. Both on-going and temporarily elevated loading rates result in a decreased hydraulic retention time of wastewater in a septic tank system and poorer settling of suspended solids. This leads to clogging of the soakage area, increased discharge of microbial and chemical contaminants to groundwater and potential surface ponding of poorly treated wastewater, which has environmental and public health risk implications.

Photograph 1. Septic tank showing accumulation of solids that will lead to system failure.

There are two main options to remedy this failing situation: (1) replace/modify the existing septic tank to meet the new hydraulic requirements of the property or (2) reduce the volume of wastewater requiring treatment by the septic tank system. As greywater can account for 50-70% of domestic wastewater, its separation and diversion should increase the septic tank hydraulic retention time and theoretically improve the quality of the septic system effluent, thereby prolonging the life-span of the soakage area, lessen the impact on the receiving environment and reduce the public health risks.

The Centre for Integrated Biowaste Research (CIBR)* carried out a study that investigated the use of greywater diversion as a means of reducing the volume of wastewater directed to a domestic septic tank, and to determine if there were any associated environmental and public health risks from such a practice. That study (Siggins et al., 2013) concluded that greywater diversion could indeed improve the functioning of a failing septic tank system, while not compromising the efficiency of a well-functioning system. This research supports the use of greywater for this purpose, which is carried out extensively in rural New Zealand. In this case, greywater diversion may reduce the overall environmental and public health risks, particularly those associated with a failing septic tank system, and potential surface ponding or leaching of partially treated human waste. While many regional councils may not support the use of greywater for irrigation purposes, many are open to the diversion of greywater as a means of improving the efficiency of problematic septic tank systems. However, the lack of consistent greywater diversion guidelines for any purpose means that many homeowners do not have access to information that would assist them in carrying out this process in a safe way. The research carried out by Siggins et al., (2013) acknowledges that greywater quality varies significantly, both between properties, and in individual properties over time. This is completely dependent on the habits and wellbeing of the homeowners/occupiers. For example, households with small children using non-disposable nappies could expect to have higher levels of microbes such as *Escherichia coli* in their greywater than households with just adults. Also, households with occupants that are unwell may discharge pathogens or viruses into their greywater via hand-washing or showering. Therefore, if greywater diversion will reduce environmental and public health risks associated with failing on-site wastewater treatment systems, then *safe* greywater diversion will further reduce any potential health risks. The availability of a guideline document is essential so that the

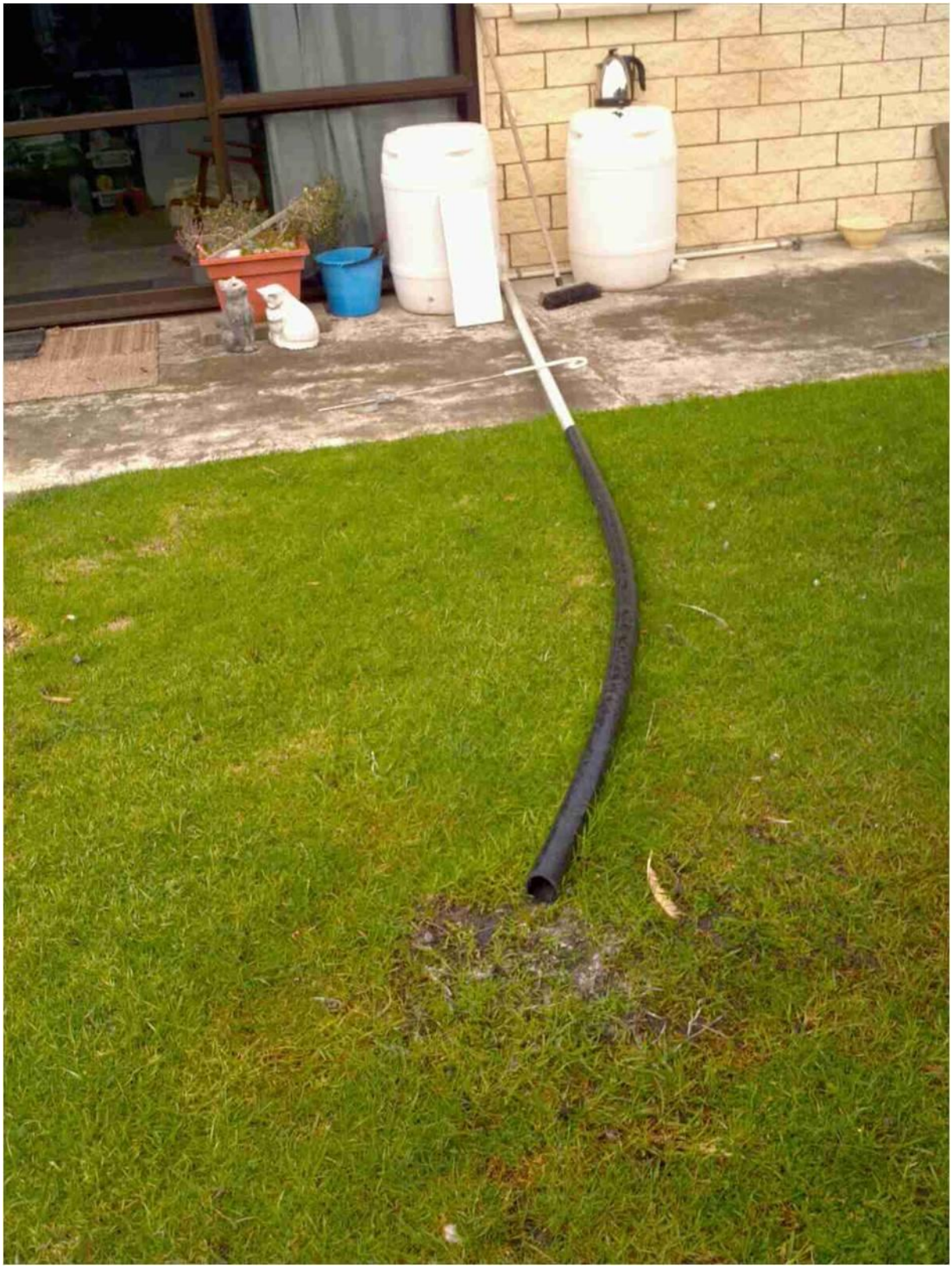
general public can carry out this practice in the safest possible way, in addition to standardizing greywater regulation on a national basis.

3 GREYWATER REUSE IN NEW ZEALAND

When contacted about greywater reuse, many regional councils have stated that greywater reuse or diversion is not extensively practiced in their region. Investigation of recent and current greywater-related resource consent applications showed that many regional councils only process 1-2 resource consents per year (personal communication Waikato Regional Council, Greater Wellington Regional Council). This number does not take into consideration the number of households practicing unregulated greywater reuse or disposal.

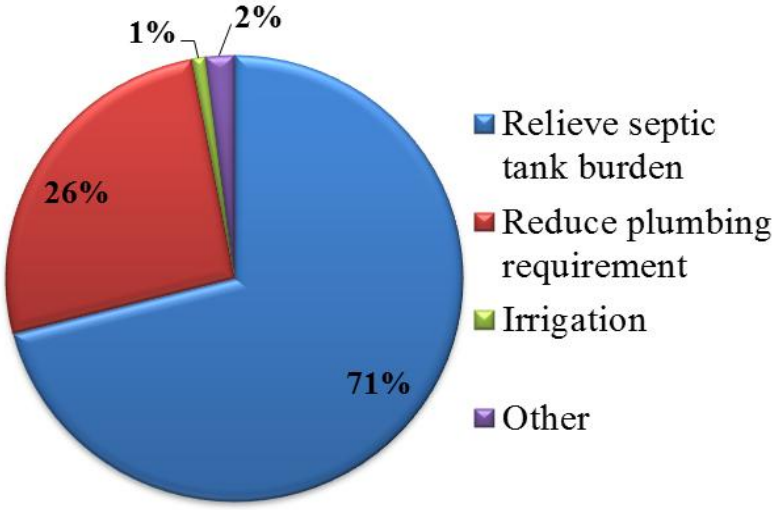
The CIBR (with direct input from ESR, Landcare Research and Lowe Environmental Impact) carried out a case study at a small coastal community that extensively practiced long-term (>20 years) unregulated greywater disposal. This greywater disposal was frequently as basic as the outlet pipe from a washing machine going out onto an area of lawn (Photograph 2).

Photograph 2. Example of unregulated greywater disposal in a small coastal community.



This community of approximately 400 properties includes a combination of permanent residents and holiday homes or 'batches'. As part of a survey carried out by the local council, 40% of the community was found to use some form of unregulated greywater diversion/disposal system. This on-going practice has become more prevalent as 'batches' have been added to and expanded. Of the residents with a greywater system, 71% used greywater to take pressure off their septic tank, 26% used it to save plumbing to the other side of the house and just 1% intentionally used it to irrigate their garden or lawn (Fig. 2).

Figure 2. Survey results showing the reasons for greywater diversion/disposal in the coastal community case study (n= ca. 200)



The vast majority of greywater diverted for disposal purposes ended up as 'soakage', or in other words was simply allowed to run out onto a lawn or into a dedicated soak pit (Photograph 2). The majority of residents (96%) expressed concerns about using greywater. Many didn't want to continue using it as they were while only 7% wanted to continue their current greywater disposal practice. The other 52% were unsure about whether they wanted to continue greywater disposal. These statistics demonstrate that there is uncertainty and a lack of knowledge among homeowners who have these unregulated, home-made systems, suggesting that further research resulting in a set of guidelines for greywater reuse would be very useful.

From discussions with District and Regional Council contacts, private environmental consultancies and industry engineers, the use of unregulated greywater systems is not an unusual practice in other holiday communities throughout New Zealand; and possibly is prevalent in other non-reticulated communities which do not have a holiday population influx. Other instances of greywater disposal practices at a similar scale to the case study have been mentioned by multiple sources. As a result, the national usage of greywater is likely to be far greater than initially thought. The potential for this high rate of usage of greywater warrants more effort to determine the impact of such practices, in particular the impact on public health.

The provision of a greywater guideline document will provide the homeowners in our case study community, and other similar communities, with the information they are actively seeking regarding greywater diversion and disposal. With this information available to them, they will be better placed to make safe choices regarding the fate of their greywater. This survey has shown that the lack of a guideline document will not deter homeowners from diverting greywater. Conversely, the provision of such a document is not likely to encourage homeowners to start diverting greywater if this was not already practiced by a household. The availability of a guideline document would be intended to allow households that already divert greywater for disposal or irrigation, to do so in a manner that is safest for themselves and their environment.

4 ADDRESSING CONCERNS OF USING GREYWATER FOR IRRIGATION

The CIBR is aware that the proposed greywater guidelines must be based on scientific research, and that research must be specific to New Zealand conditions. As well as providing technical information to be of assistance to regional councils granting resource consents, the guidelines must also address questions and concerns asked by the general public. If this is not the case, the guidelines are not likely to be accepted or followed by the public, and the impact of such a document would be limited. For example, while the CIBR would not advise the use of greywater for irrigation of edible crops, there is limited research specific to New Zealand's soil and climate to support this position. The CIBR is currently carrying out research in the form of a field-study using greywater to irrigate various crops and determine the risks associated with this practice. It is envisioned that the guidelines would be regularly updated to incorporate the findings of this type of ongoing research as more data is obtained in this emerging area.

5 CONCLUSIONS

The lack of a nationally applicable greywater reuse guideline document is an issue for both homeowners and regulatory authorities. While such a document is not likely to promote greywater reuse, it will provide a valuable resource for homeowners that are already practicing greywater division. The availability of information may encourage homeowners with existing unregulated systems to obtain the required documentation for such practices. The guidelines will also assist regulatory authorities to provide standard information and requirements on a national basis to prevent confusion and frustration of homeowners, system suppliers, installers and maintenance personnel. Overall, this should result in an increase in the standard of greywater diversion systems, a higher adherence to regulatory requirements and a decrease in the public and environmental health risks associated with greywater diversion and disposal.

ACKNOWLEDGEMENTS

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