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Community views on the management of on-site wastewater treatment systems for the protection of groundwater in the Mount Gambier and Grant Districts

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Description: Aerial photograph of the Blue Lake at Mount Gambier, SA. This is a view to the South with the Mount Gambier urban area in the foreground. The extinct volcanic crater, filled with water is the town's water supply. CSIRO Land and Water ScienceImage File: BU5984

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EXECUTIVE SUMMARY

This document is a report on community views regarding the protection of groundwater by adequately managing on-site wastewater treatment systems (OWTS) located in the City of Mount Gambier and the District Council of Grant. Community participants and other stakeholders disclosed their opinions and shared their experiences of OWTS during interviews and community meetings. A review of the literature on generalised community attitudes to the protection of groundwater and maintenance and management of OWTS in *Social implications of management of on-site wastewater treatment systems for groundwater* (Alexander 2007) informs this report. This report and the literature review are outputs of the *Holistic solutions to management of on-site wastewater treatment systems over a karstic aquifer used for drinking water supplies* research project (2007-2008). The broad vision of the overall project is '*to progress community understanding of the effects of current on-site wastewater management systems and implement community extension programs to ensure the long term sustainable use of groundwater resources in the region'.* The four objectives of the overarching project are listed and this report addresses the second objective:

1. To provide a scientific basis to define design and maintenance criteria for on-site sanitation in the South East of South Australia through literature review, structured investigations and appropriate risk-assessment methods.
2. **To provide an informed basis to evaluate factors affecting community acceptance of alternative strategies that will protect groundwater quality and human health while allowing development over the longer term and to give opportunity for community input and support for ongoing measures.**
3. To present a recommended approach to selected communities prior to imposing regulations or procedures for broad-scale protection measures.
4. To document the study for further application in Australia to communities where on-site sanitation and water supply from unconfined aquifers co-exist, including in karst systems.

Outlined are the key issues raised during two community workshops by residents relying on on-site wastewater treatment systems in the Mount Gambier area. The workshops provided an opportunity for participants to share their understanding of issues and concerns associated with OWTS, particularly in relation to management and monitoring of systems. This community consultation process was used to understand community opinions on management strategies, institutional arrangements and possible distribution of costs to householders. Understanding of the OWTS management options preferred by some residents in Mount Gambier and the surrounding District Council of Grant informs and precedes engagement with the larger community. Community involvement in planning stages will better enable local councils to implement changes to OTWS management programs if required, in order to ensure the long term sustainable use of groundwater resources in the region.

Mount Gambier is a community that depends on water supplies from groundwater reservoirs. Local authorities responsible for maintaining drinking water quality would benefit from increased community understanding of potential sources of water pollutants. On-site treatment of household wastewater using septic tanks or aerobic treatment systems may be potential sources of groundwater pollution. Research shows that the effective management of on-site wastewater treatment systems is important in preventing pollution of waterways and groundwater supplies (Alexander 2007; Charles et al. 2005; Khalide & Dharmappa 1996; Nunn & Ross 2006). As there is a component of householder management associated with

OWTS, difficulties can arise when householders are unaware of the features of their wastewater systems, i.e. type, function, limitations and signs of malfunction (failure) (Alexander 2007; Arnold & Gallasch 2001; AS/NZS 1546.3:2001; Nunn & Ross 2006; South Australian Health Commission Code 1995; 1998). This report provides insights into community perceptions of OWTS and valuable local information for authorities endeavouring to implement 'best practice' management of OWTS.

This research shows that local authorities and community members are interested in collaboratively developing management strategies aimed at preventing further pollution of the groundwater, raising community awareness and developing land use planning for residential blocks that would enhance water resource management.

Generally, community members recognised and valued their local environment and natural resources and wanted to know more about OWTS. There were wide-ranging views amongst participants in their preparedness to manage their OWTS. Some participants wanted to retain all management duties, while others expressed a desire for the council to have a greater role in management and systems maintenance. There was also a contrast between rural (mainly septic) and peri-urban (mainly aerobic wastewater treatment systems (AWTS)) preferences for management. Many rural people wanted to retain self-management as they were accustomed to the system, while many peri-urban residents without previous experiences in OWTS preferred options of council management.

Residents were resistant to additional costs for maintenance. However, if OWTS were shown to be contaminating groundwater supplies, residents were prepared to consider several alternatives - as long as they had a choice and options were affordable. If available, the community wanted access to technological approaches (devices and tools) that would provide simple ways to measure OWTS function. There were community members who wanted continued responsibility for their wastewater systems; they were interested in the council providing clear guidelines for maintenance procedures and access to information on OWTS regulations in order to minimise the risk of groundwater contamination. Community participants were divided on the preferred method of maintenance provision. Some wanted to retain responsibility for the maintenance of their own systems and others expected council to take responsibility. The community was prepared to accept increased regulation and ongoing data management by councils. Some members of the community suggested they would prefer the council to provide incentives or rebates to promote residents to purchase effective OWTS that were less likely to pollute the groundwater. Local council's role and involvement would be to: provide ongoing administration of maintenance programs, provide advice, distribute information and initiate information sessions.

Costs of changes to maintenance services of OWTS could be absorbed by current council rates. Alternatively, increased rates or levies could offset increased cost to council for management services. Promotion of water saving benefits by using effluent from aerobic wastewater systems in gardens could encourage good management practices and environmental community stewardship.

The community called for knowledge regarding system functioning and maintenance requirements and continued research into pollution of groundwater sources by wastewater systems to further inform future wastewater management strategies. There was a general lack of knowledge and understanding of the treatment processes and maintenance requirements of wastewater systems. Community members wanted easily accessible

information about (i) the treatment processes within their wastewater system, (ii) identifying signs of system failure, (iii) use of suitable household chemicals to maintain treatment performance and (iv) essential maintenance requirements. It was considered essential that the local councils initiate a communication program to address the critical need for information as a priority. Several media for the presentation of valuable information were mentioned.

CONTENTS

1. INTRODUCTION

The City of Mount Gambier (CoMG) and the surrounding rural areas within the District Council of Grant, in the southeast of South Australia, rely heavily on groundwater from the underlying unconfined karstic aquifer for water supply (Alexander 2007; Blue Lake Management Plan 2006; Emmett & Telfer 1994; Levett, Vanderzalm & Dillon 2007; Wolf, Morris & Burn 2006). In Mount Gambier and the immediate surrounds, the reticulated drinking water supply is drawn from the Blue Lake, a volcanic crater lake which is fed by the unconfined karstic Gambier Limestone aquifer. Outside the bounds of the reticulated water supply, rural properties rely on groundwater sourced directly from their own bore and rainwater for their household water supply. The quality of water supply from the Blue Lake is managed by SA Water Corporation, while the quality of water supplied from private bores is the responsibility of the householder.

Population growth, agricultural intensification (i.e. timber, dairy and horticulture), growing industrial sectors and climatic variations have contributed to declining water levels and pollution in the unconfined aquifer (ABS 2001; Blue Lake Management Plan 2006; Dillon 1988; Fleming 2006; Harvey 1979; Lamontagne 2002; Lamontagne & Herczeg 2002; Vanderzalm et al. 2006; Wolf, Morris & Burn 2006). The increasing demand on the Blue Lake and the surrounding groundwater has raised issues of water availability, water usage and management of water quality (Canter & Knox 1985). The Blue Lake Management Plan (BLMP) has set strategic directions to ensure protection of the water quality and quantity within the Blue Lake and its groundwater capture zone in spite of the growing pressures on this water resource (BLMP 2006). Management strategies continue to be aimed at preventing further pollution by raising community awareness of the potential sources of groundwater pollution and developing land use planning policy for residential blocks that would enhance water resource management.

While the majority of Mount Gambier has been serviced by a sewer system since the 1970s, there is a small number of existing properties that were not connected to sewer and rely on on-site wastewater treatment systems (OWTS) for wastewater management. In addition, recent peri-urban developments within the CoMG bounds and all properties in the District Council of Grant use OWTS for wastewater management (Levett, Vanderzalm & Dillon 2007).

OWTS are potential point sources of pollution to the underlying groundwater, which in this case is used for drinking water supply. Local authorities are concerned about the potential for groundwater contamination through normal operation and/or through system failure and improved management is a priority within the current Blue Lake Management Plan (BLMP 2006).

Conventional septic systems and aerobic systems are two OWTS that comply with local government regulations in South Australia (Environmental Health 2007) and are in use in the Mount Gambier area. Installation of aerobic systems is a principle of Development Control within the City of Mount Gambier's Development Plan, while the District Council of Grant bases the system requirement on the physical characteristics of the development site (e.g. soil characteristics, allotment size; Levett, Vanderzalm & Dillon 2007).

Regardless of whether a wastewater system has been well designed and properly installed, treatment effectiveness is dependant on several factors. Alexander (2007) details the key factors affecting wastewater treatment systems supported by literature from Arnold and Gallasch (2001), AS/NZS 1546.3:(2001), Nunn and Ross (2006) and the South Australian Health Commission Code (1995; 1998). The main factors are (i) maintenance, (ii) system capacity, (iii) age of system, (iv) number of people in household, (v) shock loads, (vi) intermittent operation and (vii) level of householder knowledge. Consequently, there are many reported cases where on-site wastewater treatment systems meet design regulations and are approved for use, but once in operation in a household fail to treat effluent to required standards (Charles et al. 2005; Khalide & Dharmappa 1996; Nunn & Ross 2006). Design regulations for septic systems originally specified much smaller tanks (1620 L), however since 1988 regulations have required the minimum tank size to be 3000 L (which can serve up to six persons), and trench length has more than trebled (Levett, Vanderzalm & Dillon 2007). When households increase in size or house ownership or tenanted arrangements change, incompatibility between the septic system capability and water usage can be encountered.

Regular maintenance of septic systems and aerobic systems is required for optimal treatment performance. Desludging (the removal of accumulated solids) from septic tanks or the primary chamber of an aerobic system is required on an ongoing basis. Failing septic systems have the potential to contaminate groundwater supplies, especially when they are located in close proximity to the water supply bore or a karstic feature that increases the rate of contaminant movement through the aquifer (Levett, Vanderzalm & Dillon 2007). Failing wastewater systems can mean inadequately treated effluent is released into the environment which can lead to contamination of surrounding soil, groundwater and food supplies with possible human infection by bacterial organisms e.g. *Cryptosporidium*, *E.coli*, *Giardia* and Hepatitis A (Lazarova & Bahri 2005; NSW DLG 1998). Some household practices of irrigation with aerobic wastewater treatment systems AWTS effluent indicate noncompliance with the South Australian Department of Health guidelines and could pose potential health risks (SADH 2008).

The overuse of bleaches and disinfectants and disposal of anti-septics, pesticides, paints or other acidic or caustic substances in the system are known to result in system failure (NSW DLG 1998). Consequently, the correct use of cleaning products appropriate for septic systems is essential. The stability of the system function and the resultant treatment effectiveness can be impacted for a few months following an incident of inappropriate chemical use (chemical challenge). In new aerobic systems, initially the lack of solid matter can reduce treatment effectiveness as the bacterial colonies take time to establish. Odour and the formation of crust on the septic chamber are usually the most obvious indicators of system function.

When system failures occur, repair orders can be issued by council to ensure adherence to regulations. However, local authorities are looking for a more systematic approach. There are several options for the management of OWTS in Mount Gambier, ranging in cost, level of householder and external agency intervention required (i.e. council, water authority) and level of health and environmental protection provided (Alexander 2007 p.7; Levett Vanderzalm & Dillon 2007).

Cooper, Crase & Dollery (2006, p. 31) claim ‘water is both an integral component of the ecosystem and a fundamental social and economic good’. As such, various approaches to

the management of water resources have increasingly been used in Australian rural communities beset by problems of water scarcity (Cooper, Crase & Dollery 2006; Crase, Dollery & Wallis 2005).Water scarcity has resulted in interest by government departments and water utilities to realise sufficient supplies for water demand. Demand management activities encourage a reduction in domestic water consumption. Research has been conducted into catchment-wide benefits of improved wastewater treatment which suggests that by improving wastewater treatment, particularly in smaller communities, significant recycling opportunities exist (Cooper, Crase & Dollery 2006).

In Australia there have been several studies into community concerns about OWTS. Cooper, Crase & Dollery (2006) conducted interviews with community members in northeast Victoria on choices of alternative wastewater systems. Residents were largely concerned about the amount paid by the household for the wastewater service, the improvement to the environment and effect on the subdivision potential of their land. Ongoing personal responsibilities to maintain the optimality of the system were also a significant concern (Cooper, Crase & Dollery 2006). The primary motivation for purchasing a wastewater service contract was to shift the responsibility, along with maintenance expenditures, to others (Cooper, Crase & Dollery 2006).

Nunn & Ross (2006) surveyed a rural community in Victoria to ascertain compliance with permit requirements of effluent quality of aerobic systems. Concerns had been raised over non-compliance and poor system performance after installation. Two-thirds of the systems failed to comply with microbial quality requirements. Lack of householder knowledge about the function of their system and requirements for maintenance were major factors leading to non-compliance. Survey responses indicated that *'any owners had little knowledge about their systems, or frequency and type of maintenance, and few owners kept records or knew when maintenance was due* (Nunn & Ross 2006, p. 49)'. Cost of maintenance was also mentioned as an issue.

In Colac Otway Shire in Victoria, 30% of AWTS were discharging effluent off-site (Colac Otway 2002). Council began monitoring the performance and condition of on-site wastewater treatment systems, improved records systems, ensured collation of plans of all the on-site wastewater treatment systems, introduced a regular inspection program, instituted a community awareness program and assisted property owners to upgrade OWTS. Property owners were required to ensure on-site wastewater treatment systems were accessible and operating effectively, with more frequent desludging of tanks, unblocking of draining pits and testing of sand filter effluent etc. The approach to community engagement consisted of:

- presenting information about current waste water disposal techniques
- describing future waste water disposal concerns, options and costs
- inviting agency representatives to present information on wastewater disposal options to each community
- seeking each community's ideas, understanding their concerns and providing a clear communication and consultation framework for the implementation and ongoing processes involved in the development of long term waste water disposal plans
- surveying the communities willingness to fund the installation of a sewerage system or other options
- documenting and communicating Council's role as a strategic adviser and facilitator (Colac Otway 2002, p. 38).

There has been no follow up on the effectiveness of these strategies to date.

Arnold and Gallasch (2001) investigated the effectiveness of domestic on-site wastewater treatment systems in the Mount Lofty Ranges, one of the sources of Adelaide's drinking water. They found that there was a general lack of understanding of waste management issues;71% of the population did not recognise when their septic and soakage systems were failing (Arnold & Gallasch, p.17); furthermore, they did not understand that septic failures were illegal and could incur environmental and health risks. Educational information was distributed by project officers to improve knowledge of septic system operation, maintenance practices and identification of system failures. Educational booklets provided during the project were well received by residents as they claimed they knew little about the systems (Arnold & Gallasch).

The quality and implementation of environmental decision making can be improved by provision of information to the public and by active public participation (Crase, Dollery & Wallis 2005). Some Australian councils are taking a holistic approach to the management of wastewater treatment systems which will require proactive approaches to community partnerships. Literature on the benefits of public participation in environmental management decisions is extensive (Beder 2006). Community consultation is widely used as a means of improving the formulation and implementation of public policy that is acceptable to the community. Research conducted by Crase, Dollery & Wallis explored ways to optimise community consultation efforts by identifying major elements that facilitate successful engagements.

Public participation can also be problematic in terms of (i) lack of expertise, (ii) risk of biased input, (iii) risk of de-legitimisation, (iv) risk of over-legitimisation, (v) misrepresentation of consensus, (vi) insufficient influence and (vii) the cost of time and money (Korfmacher 2001). Consequently, there is a tendency for agencies to resist processes involving public participation. At the same time, diminishing trust in science has undermined technically based approaches to environmental regulation and has led to public demands for greater transparency in environmental decision making (Blackstock et al. 2006).

Social and institutional measures are required to support adoption of regulations to adequately protect groundwater quality in the City of Mount Gambier and the surrounding District Council of Grant local government areas, as outlined in the second objective of the overarching research project *Holistic solutions to management of on-site wastewater treatment systems over a karstic aquifer used for drinking water supplies*:

> *To provide an informed basis to evaluate factors affecting community acceptance of alternative strategies [for on-site wastewater treatment and management systems] that will protect groundwater quality and human health while allowing development over the longer term and to give opportunity for community input and support for on-going measures.*

This report details the opinions of community members and stakeholders in the Mount Gambier area in relation to the operation and management of existing OWTS and possible threats to groundwater quality by contamination from OWTS. Understanding of the OWTS management options preferred by some residents in Mount Gambier and Grant communities informs and precedes engagement with the larger community. Community involvement in planning stages will better enable local councils to implement changes to OTWS

management programs (if required) in order to ensure the long term sustainable use of groundwater resources in the region.

2. METHODOLOGY

Two community workshops were held on consecutive evenings at the Old Town Hall in Mount Gambier in February 2008. Attendees were recruited by telephoning community members from a database of residents with OWTS provided by the local councils. This database had been prepared to identify potential sampling sites for the biophysical sampling program. Some of the workshop attendees had already agreed to sampling from their OWTS and/or bore (where applicable). The purpose of the workshops was to acquire richness in detail and to understand the issues and concerns associated with on-site wastewater systems. In particular, participants were asked their viewpoints on questions framed under three main themes:

1. **Wastewater system options:** (i) knowledge of wastewater system, signs of failure and essential maintenance and (ii) effectiveness of established septic systems, options for new septic systems only at specific sites and aerobic systems mandatory for new developments in CoMG

2. **Management options:** (i) preferred wastewater management strategies for protecting groundwater from the impact of system failures, (ii) preferred choice of maintenance options - council management or self-monitoring of systems using professional service, (iii) fees for maintenance and (iv) regulatory compliance – e.g., desludging, chlorination

3. **Community engagement:** (i) the need for community involvement and understanding of the need for regular system maintenance to protect groundwater and (ii) educational and informational requirements to engage the community, release and publication of project results, recommendations and outcomes

The workshops were structured to elicit discussion both in plenary sessions and in small groups (Appendix A). Several council representatives and research scientists who were knowledgeable about the wastewater systems used locally were available at workshops to provide details about the functioning of and regulations concerning on-site wastewater systems and to answer any questions raised in the workshops.

Draft factsheets (Appendixes B & C) prepared by the local Environmental Health Officers were supplied to participants with septic and aerobic systems as an example of relevant information that could be useful to householders with OWTS.

In addition, six stakeholders involved in the distribution and maintenance of OWTS were interviewed and their viewpoints and experiences in dealing with community members in reference to OWTS were analysed. Stakeholders were purposively selected (a formalised qualitative approach) to understand other issues involved in wastewater treatment.

2.1 Recruitment and attendance

Telephone recruitment of approximately 20 community residents for each workshop was conducted followed by a confirmatory call to firm intentions of attendance. All who agreed to participate were sent letters of confirmation with maps showing the location of the venue. The initial workshop consisted of 15 participants, all from households with septic systems.

The second workshop of 11 participants consisted of one stakeholder, seven from households with aerobics systems and three from households with septic tanks. There was even representation from the two council areas in both workshops. Past research by ARCWIS (Australian Research Centre for Water in Society) indicated approximately 50% of community members who agree to participate actually attend on the day. Attendance at the first septic system workshop was 75% (of those agreeing to attend) and 58% at the second aerobic system workshop.

3. RESULTS

The purpose of the workshops was to explore the range of issues associated with the management of on-site wastewater systems. As such, what follows is a report of people's thoughts, perceptions and concerns; no attempt has been made to verify the factual nature or otherwise of what was said and there has been no analysis of frequency of comments.

The content does not reflect the authors' views, as it is important to record the issues and sentiments as they were portrayed. The report structures the discussions in amalgamated themes and frequently uses quotes to illustrate the points being made. Reflections on comments and points of view, scientific literature and information from meetings guiding the research have informed conclusions. This report is principally background research for the development of recommendations for modified management of OWTS in the Mount Gambier area, which will be developed in conjunction with the biophysical assessment of OWTS performance.

3.1 Current knowledge of septic tanks

3.1.1 Operation and maintenance

Generally, participants were aware of the construct (i.e. capacity, type) and placement of their septic systems. A few participants demonstrated detailed knowledge of their system's construct and function. However, most participants claimed limited knowledge of the system's functioning. Without experiencing major problems such as odours, blockages, backflows into toilets and water pooling from poor drainage, they assumed their systems were working effectively. One participant could not find the location of his septic system despite having a detailed map. He was rather concerned about the need to desludge the septic system at some point in time but assumed the system remained operational. Individual septic system function is known to be variable as each septic system varies in size, usage, design and is influenced by soil percolation.

Most participants suggested they had no regular maintenance routine, and had not desludged their systems in recent times, if at all. Most participants had not desludged their tanks at the recommended frequency (approximately every 4 years), because they were unaware of the recommended frequency and did not seem to know how to assess their system's performance unless an obvious problem such as a major blockage occurred. This suggests the main issue is to know whether the septic system is working effectively, and if not, what signs of failure would be recognisable by participants? This is illustrated by several comments:

> *We got ours [septic system] pumped out 11 years ago – and I have no idea about it – we don't have any smells*
>
> *We've had ours 30 years – and we've never had it pumped out....I build septic tanks – the performance depends on the soils, soil type around here varies, clay is no good for septics – but we've hardly any clay at all [around here].*

We have an old system with a 15m trench and it's never been pumped out in 15 years and we've never had a problem.

A participant tried using active agents (bioenzymes) to improve the septic system's function to no avail and a plumber was then called to rectify the problem.

3.1.2 System failure

Many participants did not report experiences of system failure, assumed to be represented by foul odours, backflow of toilets and pooling of water. Odour was generally accepted as a sign that the septic was not working optimally, or of failure- *'....most people can smell it [septic] when it's not working properly'.* Occasional wafts of odour were considered normal occurrences – '…*the only time it smells is if someone is standing next to the pipe when someone is having a shower'.*

Several women reported that odours were more frequent when particular chemicals and cleaning agents were used (e.g. bleaches). Their response was to minimise the usage of certain chemicals that might reduce efficiency of the biological treatment provided by the system. Consequently, households with higher water usage are more likely to mention episodes of system failure. For example:

I have a child and we are always washing, and the system is not coping - it's a small tank (1620 litres), with small trenches. I get it desludged every 6 months. I want to be hooked up to sewer.

I just want to get hooked to the sewer – the stench [system failure] out the front of our house, is coming straight through [the house].

More commonly, problems with toilet function (backing up and not flushing properly) initiated actions to desludge septic tanks.

Participants recognised that moisture surcharging from trenches was a possible indicator of failure, presenting as soggy patches or liquid pooling on the lawn, with occasional odours. Alternating or changing trenches was cited as a possible response to such failures (if systems contain additional trenches for this purpose). Some residents commented that they responded to signs of system overload, such as pooling, by increasing soakage capability (i.e. trench length). One participant noted the duality of the system:

If you have problems with your toilet then you should see if you have problems with your soakage. Just to get your tanks pumped out doesn't solve your problems, you need to change your soakage.....so [for me the sign would be if it] was a bit wet outside.

Interestingly, one participant claimed predictive powers, '…*a couple of days before it is going to rain the septic system smells'.*

3.1.3 Impacts on groundwater

Participants were concerned that failing soakages and trenches might potentially pollute the groundwater. This concern was expressed by a participant:

I started to have problems, so I just got out a shovel and started digging, and I found that where the soakage had started it had all collapsed and was heading down a drain, sinkhole or something like that.

This comment illustrates the need for the community to understand the nature of the surrounding karstic aquifer and the implications for groundwater protection.

Concerns were expressed as to the appropriate separation distance between the septic tanks and groundwater supply bores needed to avoid potential contamination. One participant claimed:*'…people should be concerned that their bore might be contaminated – people don't know the dangers'.* The distance between wastewater outlets and bores on the same property reportedly varied from 10 to 50 metres. Participants were unsure of mandatory set-back distances imposed by council or state authorities and were concerned that their bores might be subject to pollution from their own or neighbours' wastewater systems. To minimise public health risks, groundwater from bores was more commonly used for gardens or drinking water when there was an insufficient supply of rainwater –*'we don't drink the water, so we guess it is all right'.* Participants with fewer people in the household (reduced load) assumed their septics had no real impact on the groundwater, regardless of the effectiveness and function.

Some participants were concerned there was insufficient planning by local councils in providing sufficient residential land area to protect against contamination from neighbouring properties. Other participants were more concerned about new OWTS or bores being installed by neighbours in inappropriate places (e.g. drillers and plumbers not doing the right thing or council not checking applications properly). Land owners felt they were not given sufficient guidance about the preferred location of systems/bores. People were genuinely concerned about contamination and pollution to groundwater when they had bores on their properties.

It was suggested that councils should be proactive in regulating new subdivisions to ensure rural properties are of sufficient size to allow septic systems to be built according to guidelines and to prevent contamination of bores.

3.2 Management of septic tanks

3.2.1 Responsibility for maintenance

People were concerned about the risk of contamination to the individual, neighbours and groundwater; hence the need for ongoing maintenance was critical to discussions i.e.*, 'It's a health hazard, not just for the owners but for everyone surrounding – like everything there are risks'.* Participants cited instances of perceived health risks regarding adjacent soakage trenches and bores, sometimes placed close to vegetable gardens. One participant suggested that if people were responsible and prepared to look after their systems, they should be allowed to retain their septic systems (rather than connect to sewer or install an aerobic system).

Discussions centred on personal responsibility for maintenance-*'everyone should be responsible for their own actions*'. One respondent felt that it was unreasonable to expect the

council to maintain the septic system as it is just one of a range of householder responsibilities when you own a rural property. It was suggested that *'…if you take away responsibility from people you cause bigger problems...empower people with knowledge and use sensible monitoring'.*

The need to have a choice of maintenance options was considered important, as this would allow community members to choose from a range of options with varying degrees of responsibility. Although maintenance of septic tanks was largely unscheduled and usually done in response to a problem, a reminder notice to desludge tanks was considered to be useful as it would prompt some residents to be proactively interested in their systems.

One participant illustrated the need for information about the septic systems and access to a maintenance program and implies a preference for an AWTS and a maintenance regime:

> *I would expect if there is a problem for the maintenance person to tell me about it....I know there's a concrete slab....I could lift it up and have a look...but what would you be looking for? How do you know its half full of solid? If I knew my septic was half full and affecting its functioning I might do something about it. At least with aerobic systems there is a servicing agent and/or booklet – those with a septic tank don't get any information.*

Other people felt that the council had a responsibility to make sure that systems were upgraded and functioning correctly. Council management or a central management system would be preferred if there were no additional costs to rate payers and it inferred increased compliance.

> *What is needed is to make the systems safe. I don't see why it isn't part of the rates…so many people are ignorant of their responsibilities.*
>
> *All comes down to people, when it costs money – they could be drinking out of a bore 20m away, but they won't have it pumped out because they want to save money. That's what it comes down to. Council should make them do it.*

Although most participants had not desludged their septic systems, those who had conducted regular desludging (every 4 years) could not identify whether their systems were working. Rather, they were relying on regular maintenance to avoid incidents of failure. There was some debate as to the appropriate maintenance regime for desludging septic tanks varying with the age of the house, size of tank and the number of people in the household;

> *No I think the house is too new for the time being, think if I just get it pumped out every 4 years.*
>
> *We have a big tank – maybe every 5 years? I don't think every 3-4 years would be necessary.*

3.2.2 Management options

If available, the community wanted access to technological approaches (devices and tools) that would provide simple ways to measure OWTS function. Those community members who wanted continued responsibility for their wastewater systems were interested in the council providing clear guidelines for maintenance procedures and access to information on OWTS regulations, to minimise the risk of groundwater contamination. Development of an indicator of system failure, perhaps a simple tool, would help people prevent pollution of properties and/or aquifers. Some participants suggested working collaboratively with the council to establish ways to manage their systems. Individual responsibility for management of systems would be preferred by well-informed residents.

> *People can manage their own system if they know what's going on. ...I don't think that this [information about management options] has been done – some assistance would be better than external management.*
> *I've got no idea about my system and I don't know if it is working well or not. If there was some way of measuring or knowing. I could be more responsible, I want to do the right thing. I gauge what I put down the drains, but how do I know it's effective?*

The need for regulation was voiced, *'…people need more knowledge – but you've got to force people to do '*. The preference was for local councils to develop and manage the options as it is a local matter, rather than being relevant to organisations dealing at a state (i.e. SA Water) or national level. Another option to consider was when properties were purchased, costs for mandatory maintenance or upgrading of septics could be shared by vendor and purchaser.

An alternative proposed by some participants could possibly be sewerage connection for all residents in the region (no OWTS). If practical, the costs would be born by the council or negotiated with the community. This option was considered impractical and too expensive by most of the participants.

3.3 Community engagement

3.3.1 Information requirements

Some participants were not given any information on the septic system when the house was purchased. Other participants had access to more detailed plans and maps, yet the actual septic system was still difficult to find.

> *I don't know how long it had been prior to us moving in that it [septic system] had been desludged. We discovered only recently a big soakage pit – a hole in the ground....We were left a map of everything.*

> *I know what I got, but don't know where it is – we have a couple of healthy plum trees – no odours, moisture – I would like someone to help me find it so I can get it desludged. The house is 12 years*

> *old. We have lived here the last four years – but I can't find the vent. We haven't had any problems but I just want to do something before we have any problems.*

Generally people did not tend to think about their wastewater systems, consequently education and information are both required. *'Out of sight, out of mind – unless a light is shone on it – we need the facts'.*

Information could be pitched to take advantage of self-interest through a growing awareness that householders may be contributing to contamination of bore water through their own actions. Explanation of cost effective measures would reinforce good management practices and assist residents to become proactive. An immediate measure, prior to initiating any changes to the current management systems, could be to have accessible information available to households e.g., fact sheets. Other media for knowledge transfer could be online information (via the council website), television commercials, radio, local papers, and flyers distributed with rate notices. The current *Waterwatch* program could be used to involve and educate school aged children, particularly those in outlying schools that use septic systems. Publicity of general information and solutions to wastewater management problems would be constructive. Fact sheets indicating recommended maintenance regimes, appropriate volume/type of household chemicals to be used and signs of failure could be distributed with rubbish/recycling notices. Information should be made available to occupants of rental properties as well as to homeowners.

It was suggested that the local government should be responsible for organising public communication programs. Additionally, the local council could provide (i) guidance on maintenance (ii) administration services (iii) information and (iv) archival records. Collectively, the information and administration services would be useful for the general community and new house owners or tenants, desludgers and maintenance service providers. Storage and dissemination of information is necessary, as often the person who builds the house has the information on the septic, but may not inform the next occupant. The information could be stored with the property deeds/title or on council records for distribution to new occupants.

As the public is concerned about pollution of groundwater, bore water tests could be available through the council and used to alert residents of contamination. Information on the groundwater quality (e.g. nitrate, bacteria) might encourage better maintenance of wastewater systems that are suspected of causing contamination.

3.3.2 Financial options

Issues of the distribution of the financial burden for changing maintenance programs predominantly involve equity and fairness. Some rural participants claimed they were already paying equivalent rates to council for fewer services than urban residents and did not want to incur additional expense for wastewater maintenance. An example of equity issues follows:

> *I don't see why we pay just as much in rates as they do in town, when we have our own septic and don't get sewer. We pay more for pumping water, [for electricity] for our bore than in town.*

Personal motivation to minimise costs and ease of operation are foremost in owners' minds.

It comes down to people – people don't do it because it costs money. If council made them do it, they would.

…99% of people just do what is the cheapest.

A $50 rebate on the cost of tank desludging (approx $250) was suggested as an incentive for householders to maintain their systems. Incentives offered by councils were viewed as the most effective option. Some participants suggested the council manage desludging with a bulk contract to provide a cheaper option than the contract desludgers presently used. Participants also considered increasing council rates with a range of payment options would be a suitable option to consider.

A rate reduction for pumping out septics- anything to reduce rates…. alternatively, I would pay $50 - $100 a year if someone enforced it, I wouldn't be happy but environmentally I'd have to go into my pocket.

Introduction of a levy on rates was considered unfair for those in the community who could least afford increased financial costs. While the introduction of aerobic systems could reduce the potential for groundwater contamination, without local evidence of pollution by failing septics, residents should not be asked to incur costs of installation of alternative systems, such as aerobic systems, costing up to $10,000. The introduction of Community Wastewater Management Systems (CWMS, formerly called Septic Tank Effluent Disposal Schemes or STEDS) in other areas enforced compliance and connection to the scheme, leaving little choice for residents. Comments by participants implied resentment due to residents having a lack of choice in the matter. It should be noted that the introduction of CWMS and sewer systems are not viable alternatives for rural areas, due to their low population density.

3.4 Summary – Septic Systems

Management

- Develop innovative technological approaches (devices and tools) to estimate OWTS function, which would provide simple ways to measure functioning.
- Council to provide clear guidelines for maintenance procedures and access to information on OWTS regulations
- Community members suggested they should work collaboratively with council to develop and manage a maintenance program
- Suggested models for maintenance (i) residents retain responsibility, (ii) council assumes responsibility
- Increased regulation, data management and audit by councils
- Promote benefits of wastewater management by appealing to self-interest and stewardship
- Use a variety of modes of delivering system management information

Community engagement

- The main issue is whether the septic systems were working efficiently, and if not what signs of failure would be recognisable by participants.
- Lack of knowledge. Some participants were not given any information on the septic system when the house was purchased nor knew anything about their system.
- People were concerned about the risk of contamination to individuals, neighbours and the groundwater. Hence the need for ongoing maintenance was critical.
- Information and factsheets on recommended maintenance regimes, appropriate volume/type of household chemicals to be used and signs of failure could be distributed with rubbish/recycling notices. Other forms of useful information would be online information, television commercials, radio, local papers, flyers, and school programs.
- Residents were resistant to incur costs for maintenance. However if pollution was evident from OWTS, residents were prepared to consider several alternatives as long as they had a choice and it was affordable.

Financial options

- Costs of changes to maintenance services to be absorbed by current council rates
- $50 rebate on cost of system maintenance
- Increased rates or levy to offset increased cost to council for management services
- Enforcement by council, residents bear cost
- Negotiation with community on cost of change over to aerobic systems if septic systems contributing to groundwater pollution
- Introduction of CWMS scheme, user-pays

3.5 Current knowledge of aerobic wastewater systems

3.5.1 Operation and maintenance

As reported for households with septic systems, participants with aerobic wastewater systems knew little about the functioning of their system or the signs of system failure.

> *…don't know how many litres it holds....no information, even when we bought the house.*
>
> *…it's [aerobic system] a big mystery in the ground*
>
> *In our case we had no choice. The development had no sewerage...and we had to put an aerobic system in...Basically I bought a block of land which said you have to do this.*

Several concerns about aerobic system function were expressed,

> *Every time I do washing I think about it. I've got little kids. I'm concerned about it every time because I don't want it breaking down.*
>
> *I fear that it's going to explode.*
>
> *…always worried about it breaking down, would like information on what products to use.*
>
> *I heard that if you're on antibiotics you will kill the system off – but it's the quantity that matters.*

3.5.2 System failure

Wafting odours were suspected indicators of system failure, but there was confusion as to the extent of odour that would definitely indicate failure. Residents reported variations in odour release from systems and often attempted to evaluate the cause and effect. Some chemicals, in particular, had a negative affect on the system, notably bleaches. Low phosphate washing powder was often used to avoid reoccurring problems with the systems. Various household cleaning products continued to be trialled and residents often changed previous cleaning/washing practices in response to problems. Resulting odours from the system were thought to indicate what could be used and what was best to avoid. Overloading systems with multiple washing loads and /or additional household members often precipitated odours.

> *We killed our system off in a few weeks.... we used 'Dynamo' in the washing machine...and we very quickly noticed the smell first, then we noticed black scum over the top of it, [the irrigation area]...My wife now uses 'Phosphorous-free Amway'. Sometimes we get a bit of a smell through our drains. I recently found a drain product which is environmentally friendly...an enzyme type compound. Only tried it today.... we have often mucked around with products.*

Aerobic systems differ to septic systems in that they have alarms systems to signal mechanical failure. Alarms are fitted to all pump components, to alert owners to high water levels and electrical malfunctions. Participants generally recruit maintenance personnel in response to these alarms, although some residents attempt to maintain filters to allow flow through the system and stop setting off high-water alarms.

> *Our system has been installed for 18 months...no smell issues – only thing was the over full alarm –I opened it up to see what I could find, I moved something and away it[alarm] went... – no smell or anything.*
>
> *Initially had a problem with the flow...had to fiddle around, the filter kept blocking up and the alarm went off.*

However, there is no alarm for lack of chlorine tablets or ineffective aeration or treatment. Generally participants were unaware of the need for chlorine tablets to be present at all times to kill bacteria.

3.5.3 Irrigation systems

Residents described methods for distribution of secondary-treated effluent from the aerobic system via irrigation systems. Watering lawns was thought to minimise contamination if systems failed by dispersing effluent over a larger area; this would also reduce the risk of killing other plant species. Dripper systems required attention from owners:

> *One thing I noticed in the first 12 months we could run our dripper directly [onto the garden] – no filtration, but now we have to filter them [drippers].*

Residents were not overly concerned about the public health risks from exposure to wastewater from their irrigation systems, '*It's only a problem if you spray it [treated effluent] around areas where people are going to be rolling around the lawn*'. Interviews and on-site observations of other residents in the study area confirmed that residents were watering lawns which were used for recreation purposes, rather than using separate designated irrigation areas (as required under regulations).

Some householders proactively manage the positioning of their irrigation systems. The irrigation systems supplied or recommended for use did not always function appropriately, so innovative practices arose which had the potential to incur health risks, e.g. installing high-pressure or movable sprinkling systems, using hoses, or changing fixed sprinkler heads. On-site consultation on the set up of irrigation systems was recommended in order to avoid contact with effluent and minimise public health risks. Advice was necessary to ensure appropriate set up of irrigation fields were in line with guidelines and requirements, while also remaining practical for the individual property.

The chemical composition of the wastewater available for irrigation was of concern (e.g., sodium levels), particularly the potential problems with vegetation health or contamination of home grown vegetables. Most residents were aware that the effluent could contaminate vegetable products, but not all.

> *…invariably people are trying to dispose wastewater in one spot...you can see the trees are starting to keel over...they need to treat it as a fertilizer, it's not a watering system.*

> *…most natives don't like nutrients at all.*

Furthermore, uptake of wastewater effluent would vary according to the season, forcing changes to irrigation systems and function;

> *…summer and winter – during winter trees not up taking nutrients...summer there is not much water [the nutrients are] concentrated.*

Residents were concerned about the potential for groundwater contamination and the appropriate separation distance between the irrigation field and the bore was queried.

Participants felt they benefited from access to the secondary-treated effluent from the aerobic wastewater systems as an additional water resource to use on their gardens. Some

enjoyed a benefit from the environmental value of water savings and reuse, even though they initially had no choice in selecting the system, nor had they been advised of this benefit.

3.6 Management of aerobic wastewater systems

3.6.1 Responsibility for maintenance

Generally, not much was known about the specific details of the aerobic maintenance requirements. Householders were aware that aerobic systems require a maintenance contract and thus maintenance issues were left to the contracted agent. Some residents were not aware the systems also required desludging every 4 years:

> *Get a bill for maintenance – the first year was free. I've seen the maintenance guy once – I happened to run into him when he came to do a service. Also, I rang him once about the high water alarm.*

The quarterly maintenance regime often took responsibility away from owners*, 'I'm never there when the service agent is there*'. However, other participants claimed they had a good relationship with service agents who were a valued source of information. The first year of maintenance is included in the purchase price of the system, and after that quarterly maintenance costs are invoiced to homeowners. While participants were obligated to maintenance contracts, they often did not feel they were getting value for money when they had little contact with the service agents. Some participants had had no idea what tasks were performed by the service agents and many thought that replenishing the chlorine tablets was the only task; therefore, they considered the maintenance charge to be unreasonable.

3.6.2 Management options

There was consensus on the need for continued research into groundwater pollution from wastewater systems. Councils maintain a list of aerobic systems operating, and service agents send quarterly maintenance records to local councils. Details of desludging of both septic and aerobic systems should also be recorded. Participants suggested that record keeping by council would ensure compliance by service agents and homeowners.

Community consultation was important in the development of future management systems, incorporating mandatory maintenance and testing of aerobic and septic systems.

> *Better to get consultation – if you just come from the top, it causes so much angst from people that they go against it [if not involved].*

Incentives or rebates from the local council or government were suggested as a means to encourage residents to change from septics to installation of aerobic systems. Council management was preferred for septic tanks, but it was suggested that homeowners should manage aerobic systems and maintain the connection with the maintenance person.

Other participants did not trust the 'bureaucratic' council and preferred the continued use of private service agents and/or plumbers.

> *…if council managed it [maintenance]... we would start to lose efficiency – we will lose the closeness we have with the plumber - they are reliable – they provide a report to council.*

Residents felt they had little choice in the type of OWTS installed, as the local councils preferred the installation of aerobic systems, and these residents wanted to retain a choice of management options.

3.7 Community engagement

3.7.1 Information requirements

As for residents with septic systems, participants with aerobic systems wanted information on chemicals that were safe to use in their systems. Householders (generally women) who manage household cleaning products require specific information on appropriate chemical usage. People have found it difficult to access information on chemicals that are suitable for use in aerobic systems. One participant contacted the company for an information booklet outlining acceptable chemicals.

Participants enquired about regulations for the minimum distance between irrigation systems and bores and expressed concerns about compliance on neighbouring properties. Information on the quality of water available for irrigation, its suitability for use in irrigating various types of vegetation and advice on installation of appropriate irrigation systems would be highly valued. Knowledge of irrigation systems needs to be improved for householders to take advantage of the resource available while also avoiding problems, such as ponding of wastewater. Information packs (as currently available from the District Council of Grant) and/or points of contact could be made available to new and potential residents. No comments were made on the effectiveness of the current available publications offered by District Council of Grant. Information on suitable systems could be made available on the council website.

The councils were expected to be responsible for providing this additional information and ongoing advice. Reminder notices to check systems and desludge every four years could be included in council rate notices, and actively promoted to the community through various forms of media. Council could run information sessions covering a range of topics relevant to rural living (building, planning, wastewater treatment systems etc.) for prospective new home owners/builders. Follow up services/interaction/information from council would ensure system information was provided to new property purchasers.

The system information distributed by commercial suppliers varies between products and suppliers. Council should insist that the owner is provided with standardised information produced by council that can be used in conjunction with system specific information from suppliers. Furthermore, system information must be provided to homeowners and occupiers as well as builders and plumbers. When a plumber or builder is the contact person on the house approval, all the relevant information is provided to them and may not be passed on to the householder. Council databases/recording systems could ensure appropriate information transfer has occurred.

Householders may not be informed of the reasons that a particular wastewater system was chosen by the plumber or builder, and are largely reliant on their judgement and information. Participants queried the longevity of systems and the need to replace parts.

3.8 Summary – Aerobic Systems

Management

- Community consultation was important in the development of future management systems incorporating mandatory maintenance and testing of aerobic and septic systems.
- Council was expected to provide incentives or rebates and administer maintenance programs, as well as provide advice, distribute information and initiate information sessions
- Council managed contractual maintenance agreements or agreements with private enterprise
- Council management of systems maintenance and administration of desludging arrangements

Community engagement

- Participants wanted information on chemicals that were safe to use in their systems.
- Information was required on regulations for the distance between irrigation systems and bores
- Information was required on the appropriate distribution of wastewater on vegetation
- Information packs and/or points of contact could be made available to distribute information to new and potential residents
- Information required about desludging requirements
- Need for continued research into pollution to groundwater from wastewater systems
- Participants felt they benefited from access to the secondary-treated effluent from the aerobic systems for use on their gardens

Financial options

- Costs absorbed by rates, incentives or rebate systems to encourage regular maintenance
- Enforcement by council, residents bear cost
- Households continue to manage aerobic systems paying costs to contracted service agents
- Council tender system to engage private enterprise

3.9 Stakeholder opinions

3.9.1 Plumbers and service agents

Stormwater pollution was seen to be a far greater hazard to groundwater than the potential for point source pollution from OWTS. Historical land use, including industry and agriculture, has resulted in significant pollution of the groundwater in the unconfined aquifer. It was recognised that regulations have become more stringent and the potential for groundwater contamination has been considerably reduced.

Failing septic systems have the potential to pollute groundwater when blocked or requiring desludging. Urban areas of Mount Gambier are largely sewered or use aerobic wastewater systems, while septics are more common on older properties or in outlying areas. Aerobic systems are seen as superior to septic systems by plumbers/service agents as they provide additional treatment and thus reduce the probability of polluting the groundwater.

Maintenance of aerobic systems is administered by contractors and reported to the council on a regular basis. However, there is no standardised form in place for quarterly maintenance reports to council or the householder. Maintenance regimes differ between system types and service agents (an example is provided in Appendix D). Plumbers installing and servicing AWTS have individualised checking procedures and approaches to their interactions with customers. A service agent claimed he made a point of speaking with the householder whenever possible when he was on-site and particularly when new systems had been installed. In addition to quarterly servicing, service agents are called in response to system breakdowns and alarms. Generally residents are not particularly concerned with their systems unless a breakdown occurred and they expect the service agents to rectify the problem.

A range of aerobic systems are available for installation in the Mount Gambier region. The choice of aerobic wastewater system sold is the service agent's personal decision and may be influenced by distribution rights and product characteristics .i.e., plastic tanks might be preferred to concrete tanks due to ease of installation.

Local suppliers of concrete tanks suggest septic tanks are superior as they tend to be large systems, require less maintenance, only require desludging every few years, are sturdy, don't crack or weather and thus won't pollute groundwater. Septics were considered suitable in outlying areas with less dense population, which would minimise the pollution of groundwater and provide a safe, less expensive system. However, over the last few years more aerobic systems had been installed in the area. The choice was dependant on soil type, size of blocks and conformity to council regulations.

The council should have some role in the regulation and maintenance of all wastewater systems, particularly when properties change ownership. Opinions were expressed suggesting that council struggled with record keeping and/or managing alternative wastewater systems and that private enterprise should continue to maintain systems and keep appropriate records to inform the council.

The most common enquiry of maintenance personnel was regarding advice on the appropriate products to use to prevent system failure. If certain products or antibiotics were in the system and causing failures (odours/scum layers), residents were advised by maintenance personnel to add 'dynamic lifter' to improve system performance.

Irrigation systems associated with AWTS are more complex, and many do not get set up immediately after the system is commissioned. Homeowners are also likely to interfere with the systems, moving sprinklers and adding hoses. Straight dripper lines in designated irrigation areas are the usual practice. The irrigation system needs to be seen as and managed as a fertilizer system rather than a watering system.

One service agent approached new households with an information pack and tried to meet and discuss the function of the systems with owners where possible. Discussions were often centred on irrigation systems as householders struggled to dispose of effluent effectively and protect vegetation and public health. The information packs indicate the trees best suited to these conditions.

3.9.2 Desludging operators

At present there are no regulations in place to ensure that residents de-sludge their wastewater systems. Of those who do regularly desludge their systems, the frequency is approximately 2-3 yearly for septic tanks, depending on the size of the tank, number of people in the household and use of water i.e., spa, dishwashers, showers. The length of the soakage trench of septic systems can determine maintenance as does seasonal variation (i.e. soakage) which is slower in winter months. Aerobic tanks are usually pumped out every 5-7 years.

The general public are considered to have '*no idea about the function of their septic and aerobic wastewater systems',* the motivation for sludge removal is usually when tanks are overfull or the trenches are failing to distribute effluent. Solids can also block pumps in aerobic systems and owners incur additional maintenance costs to repair systems. Public health issues arise when failure occurs in aerobic systems, with untreated wastewater sprayed on gardens.

Some residents don't know they have a septic system, nor that they have to manage the soakage and desludge the tank. Awareness could be raised by the council introducing flyers with the rate notices, sending out reminder notices and contacting residents on databases directly to facilitate desludging practices. Essentially the general public requires information about what not to put into their systems and understand which products are most suitable. Additionally, it is important not to use recycled toilet paper which does not break down sufficiently and contributes to blockages. Indicators of failure of septic tank function are:

- Odours emitted when septics are full and inadequately treated effluent moves into soakage trenches
- Drains gurgling, toilet flushing breaking airlocks and emitting odours
- Soakage soggy, indicating water retention
- Toilets and other drains backing up

CWMS schemes provide another alternative, though only economical for councils when there are sufficient households within a certain area contributing to the system. Options are available for the council to contract out the desludging of the 3,000 on-site wastewater systems in the area. However, the tendering process may engage a remote business, i.e. Adelaide based, which would limit the availability of system crisis management which regularly occurs. The ability to service the increased number of households would have to be considered by local operators when designing business operations, e.g. number of employees, number and quality of trucks available. The council should require that desludging administration details are collected after servicing and stored with details of maintenance of aerobic systems to ensure that systems are maintained effectively.

The desluding operator suggested that residents should have more choice in type of OWTS. Councils generally require aerobic systems yet septic systems can last for a long time as long as they are maintained, are simple and don't require electricity and pumps to run effectively. Monitoring of system maintenance is required as residents tend to forget about their wastewater systems. The operator indicated that maintenance of septics requires mosquito proofing air vents, 12 monthly visual inspections, and a regular plan of desludging every 3-4 years.

3.10 Summary – Stakeholders

Management
- Standardised reporting forms sent to council
- Council regulation of maintenance and record keeping and general administration

Community engagement
- Household chemical use information
- Information on indicators of system failures
- Information packs for residents, general information made available
- Increase choice of systems for residents
- Need for monitoring of maintenance

Financial options
- Possibility of tender system

4. DISCUSSION

Management of OWTS is important in preventing pollution into waterways and maintenance of sustainable supplies of groundwater sourced from karstic aquifers. Householder knowledge, attitudes, beliefs and behaviours regarding OWTS issues such as use, maintenance and monitoring are likely to continue as significant factors in effective treatment of wastewater. Clearly, in this study, community members recognised and valued their local environment and natural resources. However, no mention was made of the risks from rapid movement of contaminants in a karstic aquifer system, indicating that the community may not understand the geological implications that could lead to the movement of groundwater pollutants into their drinking water supply. Some concerns were voiced about the risk of contamination by wastewater to their and their neighbours' groundwater supplies and many residents were conscious of the need for ongoing maintenance to reduce the incidence of OWTS failure.

Difficulties arise when householders are unaware of the features of their wastewater systems, i.e. type, function, limitations and signs of malfunction (failure). Research by Arnold and Gallasch (2001) found there was a general lack of understanding of waste management issues and little recognition of signs of septic system failure in the Mount Lofty Ranges, the source of Adelaide's water supply. Similarly, Nunn and Ross (2006) found most of the 21 AWTS they sampled in Victoria failed to comply with regulations due to a lack of household knowledge of the system's function and maintenance requirements. Groundwater can become contaminated by collective discharge of failing septic systems (Perkins & Hanson 1990), and Schwartz *et al.* (1998) report widespread contamination of private wells and springs, of which residents were unaware. Low cost maintenance practices were not taken up even though residents understood the need to maintain their systems, and there was limited knowledge of drinking water quality and OWTS function (Schwartz et al. 1998).

Similarly, some of the participants from the Mount Gambier region were ill-informed with little knowledge and understanding of the OWTS treatment processes and maintenance requirements. Some residents could not determine whether their wastewater systems were working effectively, as signs of failure were not immediately recognisable. However, other participants were proactively interested in and involved in maintaining their OWTS.

Previous research suggests on-site systems can be perceived to be problematic and that residents prefer to shift the responsibility for the sewage and drainage systems, along with maintenance expenditures, to others (Alexander 2007). As found by Nunn and Ross (2006), McKee and McNulty (2003), and Schwartz et al. (1998), participants in this study were resistant to incurring costs for maintenance. However, if OWTS were shown to be contaminating groundwater supplies, participants claimed they were prepared to consider several alternatives - as long as they had choice and options were affordable.

It is important to determine the role of the local authorities and community in defining 'best practice' maintenance for preferred wastewater treatment systems. The majority of options considered for future wastewater treatment in the Mount Gambier region propose increased local government responsibilities and decreased householder responsibilities for management of the systems. In this study, there were wide-ranging views amongst participants in their preparedness to manage their OWTS; some participants wanted to retain all management duties, while others expressed a desire for the council to have a greater role

in management and systems maintenance. Households with aerobic systems generally preferred to continue to contract and pay for service agents directly and to retain responsibility for their systems.

There was also a contrast between rural (mainly septic) and peri-urban (mainly AWTS) preferences for management. Many rural people wanted to retain self-management as they were accustomed to OWTS, while many peri-urban residents without previous experiences in OWTS preferred the option of council management. Lindholm, Greatorex and Paruch (2005) also found that urban people are more likely to favour conventional systems (sewer systems), while rural people are more tolerant of using and maintaining on-site wastewater systems. To deal with this division, literature on the benefits of public participation in environmental management decisions could inform future management decisions (Beder 2006). Crase, Dollery and Wallis (2005) state the quality and implementation of environmental decision making can be improved through provision of information to the public and by active public participation. Participants from the Mount Gambier region involved in the research supported the concept of working collaboratively with councils to develop options for the management of OWTS.

Participants voiced opinions that suggested they would accept increased regulation and ongoing data management by councils. Some members of the community suggested they would prefer the council to provide incentives or rebates to promote residents to purchase effective OWTS that were less likely to pollute the groundwater. Participants perceived local council's role and involvement would be in ongoing administration of maintenance and monitoring programs, providing advice, distributing information and initiating information sessions. It was suggested that council promote the benefits of wastewater system management by appealing to self-interest by publicising the cost benefits of maintenance in avoiding system breakdown; and increase community stewardship by demonstrating the need for groundwater protection. Promotion of water saving benefits from using effluent from aerobic wastewater systems in gardens could encourage good management practices and environmental community stewardship.

Costs of changes to maintenance services for septic systems could be absorbed by current council rates or encouraged as an incentive or rebate on the cost of system maintenance. Alternatively, increased rates or levies could offset increased cost to council for management services. Another alternative is for residents to bear the cost and for council to enforce regulations (which is the current situation for aerobic systems). If serious groundwater contamination was occurring from septic systems, the community was prepared to negotiate on the cost of change over to aerobic systems. The introduction of a CWMS scheme provided a final option, however this is not feasible in rural areas as the system density is too low.

The participants at times voiced unrealistic expectations such as (i) sewering rural living blocks; (ii) a CWMS for all of the District Council of Grant; (ii) access to technological approaches (devices and tools) that would provide simple ways to measure OWTS function, and (iv) that council rates in rural areas should be less than in the City of Mount Gambier (whereas a less dense population requires each household to pay more). In fact, sewers and CWMS do not work over such large areas, nor would they be affordable by utility services. At present, there are no easy definitive measures of septic system treatment performance.

Community members, who wanted continued responsibility for their wastewater systems, were interested in the council providing clear guidelines for maintenance procedures and access to information on OWTS regulations. The community called for knowledge regarding system functioning and maintenance requirements and continued research into pollution of groundwater sources by wastewater systems to further inform future wastewater management strategies. There was a general lack of knowledge and understanding of the treatment processes and maintenance requirements of wastewater systems. Community members wanted easily accessible information about (i) the treatment processes within their wastewater system, (ii) identifying signs of system failure, (iii) use of suitable household chemicals to maintain treatment performance and (iii) essential maintenance requirements. It was considered essential that the local councils initiate a communication program to address the critical need for information as a priority. This is supported by Arnold and Gallasch (2001) and Schwartz et al. (1998) where residents appreciated education booklets and programs, factsheets and brochures on OWTS function and maintenance.

Primarily, participants wanted information on chemicals that were safe to use in their systems. They were also interested in information on indicators of system failures and desludging requirements. Residents with aerobic wastewater systems were interested in information detailing regulations on the distance of irrigation systems from bores, and appropriate distribution of wastewater on suitable plants, fruit trees and lawns. Information and factsheets on recommended maintenance regimes, appropriate volume/type of household chemicals to be used and signs of failure could be distributed to households with rubbish/recycling or rate notices etc. Other forms of useful information would be online information, television commercials, radio, local papers, flyers (letterbox drop), and school programs.

Information is currently available from the local councils, on council websites and on the South Australian Department of Health website. However, these resources could be better promoted to the community and perhaps repackaged into more effective formats.

5. SUMMARY

This research shows that local authorities and community members are interested in collaboratively developing management strategies aimed at preventing further pollution of the groundwater, raising community awareness and developing land use planning for residential blocks that would enhance water resource management. Thus, it is recommended that community consultation is undertaken to develop an improved management strategy, based on the options outlined in Table 3 of Levett, Vanderzalm & Dillon (2007).

In the interim, there are clearly a number of recommendations arising from the community meetings that could be implemented to improve the current management regime, while also remaining valid under a revised management strategy.

Increased administration of the current management regime is recommended, including:

- a database of OWTS within the council area detailing physical attributes of systems and maintenance records, including septic tank desludging
- a standardised protocol for maintenance reporting to council and the householder
- all documentation relating to the installation of a new OWTS to be sent to applicant (i.e. plumber, builder, installer) and the householder
- development of measures to audit the management program

A community education program is required, comprising:

- improved resources for householders i.e. information booklets, fact sheets, maintenance reminders
- varied means and frequency of knowledge dissemination i.e. online resources, distribution with rate notices, television advertisements, community meetings

The community also requested monitoring programs to assess the impacts of OWTS on groundwater quality in order to substantiate the need for changes to the current management programs.

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APPENDIX A

Workshop agenda

Each workshop was approximately two hours in duration, with the majority of time allocated to participant discussion, and consisted of:

- A *welcome and introduction* which outlined the purpose of the workshop
- A *plenary discussion* to elicit an overview of participants' knowledge of the workings of their wastewater systems
- A brief *information overview* of system functioning and council regulations of system operation
- Facilitated *small group discussions* to understand participants' perceptions and concerns about their onsite wastewater systems, health and environmental risks (e.g. safe and unsafe systems; maintenance and governance issues)
- Facilitated *small group discussions* to understand participants' perceptions of management options, need for monitoring and community responsibility to prevent groundwater pollution
- A *plenary session* to summarise key messages and questions.

At each workshop, the research team consisted of:

- a main facilitator to oversee the whole workshop and facilitate the plenary sessions
- two to three small group facilitators and scribes, supported by recording equipment
- two Environmental Health Officers, one from Mount Gambier Council and one from the District Council of Grant who presented the treatment process overview to the group.

APPENDIX B

Septic System Maintenance – Factsheet given to participants

Septic System Maintenance

Proper maintenance of septic tanks saves you money on repair costs and protects the environment in Mount Gambier. Failing septic tanks can mean that inadequately treated effluent is released into the environment. This can lead to contamination of surrounding soil and groundwater, or may pose a human health concern in the event of human contact.

Caring for Your Septic System

- Regularly desludge your tank. Septic tanks require periodic cleaning or pumping out to remove accumulated solids. Generally, this is required every 2 years for a 1620 litre tank and every four years for a 3000 litre tank, though it can be more often.

- Use household detergents, disinfectants and bleaches sparingly. Where possible use products labelled as 'septic safe' and follow directions for use.

Avoid where possible	Use Instead
Anti-Bacterial Solutions: Milton Tablets, Napisan, Nursil, Cold Power, Milton - Nursery Land, Nappy Plus, Pine O Clean, Nappy Soft, Nappy Fresh, Toilet Duck Bleaches: Domestos, Lemon Budget, White King, Grade, Marvolinn Bleach, Zixo Premium, Lemon Bleach Toilet Cleaners Harpic, Ajax, Blue Loo, Aussa	Pre-wash Stain Remover: Oz Kleen Prewash Power Laundry Liquid: Earth choice laundry liquid Fabric Softener: Earth choice fabric softener Toilet cleaner: Earth choice toilet cleaner Duck Active Liquid fresh fragrance (for toilet bowl) Multipurpose cleaner: Orange power multipurpose cleaner Shower, bath & tile cleaner: Orange Power shower, bath & tile cleaner Dishwash Liquid: Earth choice dishwash liquid

- Use only biodegradable toilet paper. Facial tissues, sanitary napkins, tampons and disposable nappies should not be flushed down the toilet.

- Minimise volumes of incoming water (e.g. by spreading washing loads over the week)

- Don't use the septic for the disposal of chemicals. Don't dispose of anti-septics pesticides, paints and other strong chemical in the septic system

- Don't drive vehicles over your septic tank or absorption trenches

- Prevent mosquitoes breeding by ensuring that access openings are sealed and that all vents are fitted with mosquito proof mesh.

Odour Problems

For correct functioning septic tanks need to operate under alkaline (non-acidic) conditions. The normal bacteria may die off under acid conditions resulting in offensive odours. Some factors which can cause acid conditions and odour problems include:

- Excessive use of cleaning chemicals
- Use of the wrong type of cleaning chemicals
- Shock volumes of incoming water (e.g. from several loads of washing in quick succession)
- Lack of use of the system while the house has been vacant

Odour problems can be corrected using hydrated lime available from hardware stores. 'Bunnings' sells 20 kg bags of hydrated lime for $9.80.

- Mix 0.5 kg of lime with 10 litres of water
- Flush the mixture down the toilet 2 or 3 times a day for 3 to 4 days, until a total of about 5 kg is used.
- If desired, 5 kg of lime to 10 litres of water can be used in one hit; however this can be more difficult to flush through the system, especially with dual flush cisterns.
- If the odour persists, repeat after 7 days.

Failing Septic Systems

Some older septic systems may fail and require replacement. The first signs of this can be soggy patches on the surface of the ground in the area where the absorption trenches are located. This can be accompanied by strong odours and blocked pipes.

Who Can Help

- Septic Tank Desludgers.
  Septic tanks need to be regularly pumped out. Look under 'Septic tank cleaning services' in the Yellow Pages

- Plumbers
  Plumbers can advise in the event that you suspect that your septic system is blocked or failing.

- Environmental Health Officers
  Contact council for further advice on septic tank maintenance and meeting regulatory requirements.
  City of Mount Gambier - Environmental Health Division (08)8721 2530
  Grant District Council – Environmental Health Division (08)8721 0444

APPENDIX C

Aerobic System Maintenance – Factsheet given to participants

Aerobic System Maintenance

Proper maintenance of aerobic waste water treatment systems saves you money on repair costs and protects the environment in Mount Gambier. Failing aerobic systems can mean that inadequately treated effluent is released into the environment. This can lead to contamination of surrounding soil and groundwater, or may pose a human health concern in the event of human contact.

Caring for Your Aerobic System

- Get Your Tank Routinely Serviced. Aerobic wastewater treatment units must be serviced by the system manufacturer or an accredited service agent at 3 monthly intervals or as recommended by the manufacturer in the service manual.

- Reduce hazards in irrigation areas. Use drippers and/or low sprays over dedicated mulched areas, away from recreational areas.

- Get your septic tank component of the system regularly desludged, to remove accumulated solids. Generally, this is required every four years for a 3000 litre tank, though it can be more often. To desludge a 3000 litre tank costs around $260 every four years.

- Use household detergents, disinfectants and bleaches sparingly. Where possible use products labelled as ‘septic safe’ and follow directions for use.

Avoid where possible	Use Instead
Anti-Bacterial Solutions: Milton Tablets, Napisan, Nursil, Cold Power, Milton - Nursery Land, Nappy Plus, Pine O Clean, Nappy Soft, Nappy Fresh, Toilet Duck Bleaches: Domestos, Lemon Budget, White King, Grade, Marvolinn Bleach, Zixo Premium, Lemon Bleach Toilet Cleaners Harpic, Ajax, Blue Loo, Aussa	Pre-wash Stain Remover: Oz Kleen Prewash Power Laundry Liquid: Earth choice laundry liquid Fabric Softener: Earth choice fabric softener Toilet cleaner: Earth choice toilet cleaner Duck Active Liquid fresh fragrance (for toilet bowl) Multipurpose cleaner: Orange power multipurpose cleaner Shower, bath & tile cleaner: Orange Power shower, bath & tile cleaner Dishwash Liquid: Earth choice dishwash liquid

- Use only biodegradable toilet paper. Facial tissues, sanitary napkins, tampons and disposable nappies should not be flushed down the toilet.
- Minimise volumes of incoming water (e.g. by spreading washing loads over the week)
- Don't use the aerobic system for the disposal of chemicals. Don't dispose of anti-septics pesticides, paints and other strong chemical in the aerobic system

Odour Problems

For correct functioning the septic component of the aerobic system needs to operate under alkaline (non-acidic) conditions. The normal bacteria may die off under acid conditions resulting in offensive odours. Some factors which can cause acid conditions and odour problems include:

- Excessive use of cleaning chemicals
- Use of the wrong type of cleaning chemicals
- Shock volumes of incoming water (e.g. from several loads of washing in quick succession)
- Lack of use of the system while the house has been vacant

Odour problems can be corrected using hydrated lime available from hardware stores. 'Bunnings' sells 20 kg bags of hydrated lime for $9.80.

- Mix 0.5 kg of lime with 10 litres of water, to make a wet slurry
- Flush the mixture down the toilet 2 or 3 times a day for 3 to 4 days, until a total of about 5 kg is used.
- If desired, 5 kg of lime to 10 litres of water can be used in one hit; however this can be more difficult to flush through the system, especially with dual flush cisterns.
- If the odour persists, repeat after 7 days.

Who Can Help

- Service agents and plumbers
  Plumbers can advise in the event that you suspect that your aerobic system is not functioning correctly.

- Septic Tank Desludgers.
  The septic tank component of the aerobic system needs to be regularly pumped out. Look under 'Septic tank cleaning services' in the Yellow Pages

- SA Department of Health
  List of plants and shrubs suitable for the surface irrigation areas. Local plant nurseries can provide further advice about plants suitable for local climates and soils.
  www.health.sa.gov.au (08)8226 7107

- Environmental Health Officers
  Contact council for further advice on aerobic system maintenance and meeting regulatory requirements.

APPENDIX D

Aerobic system quarterly maintenance procedure performed by service agent

Quarterly maintenance procedure

- access the interior system
- visual inspection of system
- note any odours (service agent knows what it should smell like)
- look for crust on surface of septic chamber (good sign). If no crust, may be due to excessive household chemical use or not enough raw solids going into tank (can take 12 months to build up bacteria colonies with some households).
- check chlorine tablets and replenish-
- take effluent sample from clarification chamber – check pH (pH = 6-8 is ok)
- check air blower works and clean air blower filter
- if there is sludge or scum in the clarification chamber, make adjustments to air blower
- turn off air blower
- check alarms (if householder is home and can access house)
- activate pump manually, listen to sound it makes, look at discharge of effluent
- check irrigation system for ponding or surcharge from property
- issue service sheet to householder
- can return scum from clarification chamber to septic chamber using skimmer
- sludge must be returned manually (using bucket etc)
- inform householders on appropriate household chemical use and maintenance issues if householder present
- information pack and personal explanation to householder if installing a new system a

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