

## **INSTITUTIONAL ARRANGEMENTS FOR ONSITE AND DECENTRALISED SYSTEMS: NEEDS AND OPPORTUNITIES FOR KEY PLAYERS IN THE FIELD OF DISTRIBUTED WASTEWATER MANAGEMENT**

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### **ABSTRACT**

Institutional arrangements – formal and informal processes, policies, regulations, and norms that govern approvals (design, construction and operation), ownership, management, pricing, performance accountability and responsibility for on-site and decentralised wastewater systems – are critical determinants for the success or failure of small scale sewerage systems. Inconsistencies and inadequacies in the above areas are core reasons for the failure of existing small sewerage systems, and the slow acceptance of decentralised systems as a permanent and viable part of Australia's infrastructure by regulatory authorities and large utilities.

This paper provides an analysis of different institutional perspectives, representing major players in today's small systems field - developers, water utilities, local councils and various private sector wastewater management organisations. Through interviews with representatives from each group, we explore the relevant relationships between relevant institutions and other players. We ask essential questions about how they are affected by current and draft legislation, "who pays" for different aspects of such systems and their management, who owns the relevant assets, who operates and maintains the assets, and the underlying drivers for the current dynamic of opportunities and constraints in this field.

We draw on a current research project commissioned by the Water and Environment Research Foundation in the USA, for enabling the success of management entities for onsite and decentralised systems. The US exhibits both similar and different institutional dynamics to Australia, so whilst the US is a potential source of fresh ideas for new thinking here, experiences there need to be compared with our experiences, so that we ground the work through conversations with Australian players.

Our testing of institutional issues of concern to Australian players reveals a focus with getting over the initial inertia against change, associated with issues relating to legitimacy, accountability, permitting, approvals, risk management, and financial and pricing arrangements. The US research identifies additional institutional issues that are equally critical, relating to successful management of service providers that span the public-private spectrum. The paper provides suggestions for change that will engender progress in the Australian small systems field, that combines legislative renewal and reform with rigorous business planning to support better functioning and management of small systems.

### **Key words**

Decentralised infrastructure, incentives, institutional arrangements, policy, regulations, stakeholders

### **INTRODUCTION**

Institutions and the arrangements between them (i.e., regarding finances, who has responsibility for what, and who holds whom accountable) are make or break issues for onsite and decentralised systems. Inconsistencies and inadequacies in regulatory and management arrangements represent core reasons for the operational failure of existing small systems and slow acceptance by large authorities, of decentralised systems as a permanent and viable part of Australia's infrastructure (Mitchell et al. 2008). As we stand on the cusp of a new water paradigm (Mitchell 2008) where the environmental, cost, and risk benefits of such systems are increasingly recognised by the mainstream water industry (Kelly, 2008), we need innovative thinking to envisage and trial a wide range of responsive institutional arrangements that span the public-private spectrum. The USA is one potential source for learning and ideas.

Before proceeding further into our paper, we will clarify our terminology. Consistent with emerging Australian terminology, we use 'decentralised' to mean wastewater systems that service two or more lots or premises (also referred to as 'clusters' in the literature); and 'distributed' to refer to the full range from onsites to large scale (or semi-centralised) decentralised systems. We use the term 'utility' to refer to suppliers of conventional sewerage services to avoid confusion with other authorities or regulators. By 'institutional arrangements' we mean the formal and informal processes, policies, regulations, and norms that govern approvals (design, construction and operation), ownership, management, pricing, and performance accountability and responsibility for on-site and decentralised wastewater systems.

In the United States, distributed systems are recognised as a permanent part of the nation's sewerage infrastructure. Around 25% of the population is served by distributed systems, and around 33% of new sewerage infrastructure installed is distributed (USEPA 2005). Over the last 10 years, US Congress has invested around US\$10 million directly in this sector for research and demonstration through the National Decentralized Water Resources Capacity Development Project (NDWRCDP) (Yeager et al. 2006), and indirectly through the availability of other funding schemes. Whilst these amount to paltry figures alongside the investment in centralised systems, it nonetheless has contributed to significant learning within the industry. The bulk of the funds has been invested in actual demonstrations, which have been reported as case studies (for example, Yeager et al. 2006, Pinkham et al. 2004) - in stark contrast to Australia, where very few funds have been invested in demonstration systems. Alongside the demonstration and technological projects are those investigating management questions, including questions about risk, asset management, governance, legislation and regulations, and finance and economics. These projects have resulted in a plethora of reports, guidelines and handbooks (see WERF, NDWRCDP). Whilst the US distributed sewerage industry still has plenty of difficulties to overcome, there is much that can be learned and adapted to the Australian experience.

One particular area of concern in the USA is the perception that there are insufficient successful businesses operating in this field to appropriately manage the risks. The USEPA designated a typology of management options and arrangements (USEPA 2003), from a very simple situation where council at least knows where on-site systems are, to a very sophisticated arrangement where the treatment system is located on-site, but owned and maintained by a third party, which could be, for example, a private contractor, a public utility, a subcontractor to a utility, a privately-owned public utility, etc. Whilst few organisations operate in a way that precisely aligns with the levels described, the typology still provides a useful framework for regulators and management entities to work within. This question of what helps or hinders different business and management models is of particular interest for the emerging sector in Australia.

In this paper we firstly provide an overview of a current Water and Environment Research Foundation (WERF) project to develop guidance to assist organisations to succeed financially and operationally as responsible management entities (RMEs) of distributed wastewater systems. We report on the outcomes to date of that project, and translate them to the Australian context through a series of interviews with representatives across the spectrum of key stakeholders in the Australian onsite and decentralised sector.

### **Assisting the Development of Successful Wastewater Management Businesses**

The goal of the current US-based WERF project is to develop resources to provide guidance to new and struggling distributed wastewater management entities across the US, to address the concern that there are too few successful entities in the sector. Previous projects have identified the characteristics of successful organizations (Yeager et al. 2004). In this project, the focus is on the financial and managerial aspects of **how** to become successful. Because the best kind of guidance comes from experience of both successes and failures, the approach has focused on learning from those in the field, through extensive interviews, workshops, and focus groups with people right across the sector and the country, and translating those learnings into resources for others. We have also undertaken a wide-ranging scan of literature from industries outside the wastewater sector that have some features in common, as a means of identifying new ideas for potential business models for distributed wastewater. Some of these other industries and their similarities are explained below:

- **Stormwater:** Stormwater management is a rapidly developing field. Like wastewater, it is primarily about providing a public good, and requires treatment devices on both public and private land, which brings up issues of access and management.
- **Energy:** In the USA, about a quarter of the population has their electricity provided by rural electrical cooperatives. Some of these have expanded into the water and wastewater service areas.
- **Timber:** Timber investment management organizations (TIMOs) are a rapidly growing field, and have similar disjunctions between asset ownership and management. Also like wastewater, the performance of the asset is not linked to the market - a benefit in volatile times - and the asset has characteristic risk profiles that need to be managed in real terms and in perception terms (e.g. bushfires).

The output of the project will be a set of resources (fact sheets, case studies, analytical tools) that guide an organization through the two stages of evaluating an opportunity, and preparing and running a business in the onsite and decentralised field. The key dimensions that determine the structure and function of management entities are whether the focus is on new or existing systems, whether the organization is public or private, and whether its status and intent is for-profit or not-for-profit. Some of the learnings to date, that have been drawn together under these two stages, are described below (Willetts et al. 2008).

The first stage is about evaluating the opportunity. Experience suggests that a champion is key, particularly when what's being proposed is something new and requires changes in existing structures or regulations. The elements of the process are illustrated in Figure 1 below. Scoping meetings that bring all the stakeholders together have been found to be beneficial, as a management entity sits at the centre of an intricate web of relationships. Contextual factors are complex and their consideration involves assessing the drivers for a new management entity, like development pressure or an environmental problem or high costs for a proposed centralised system or failing systems. It also means assessing the existing wastewater situation and needs. For example, if it is an existing development with existing treatment systems, then the utility may want to only take on those systems that meet particular specifications. New developments on the other hand provide an opportunity to retain ownership and/or contractual management rights over known technologies. Legislation for technical performance is obviously important, but the experience of current publicly regulated management entities points clearly to issues of economic regulation as the most important factor affecting business viability. Often, economic regulators are familiar only with large scale systems. Costing and replacement models for large systems do not fit small scale systems, so pricing determinations are vexed. Related to this is what power a management entity has to enforce the payment of service fees. Looking for opportunities to capture 'economies of scope' has been found to be one way of ensuring diverse cash flows from day one e.g., businesses that supply several infrastructure services jointly, such as electricity and water, or water and solid waste. Sorting out funding options is another big hurdle, and has much to do with perception management, as TIMOs discovered. Wastewater infrastructure service providers are essentially low risk business opportunities that provide guaranteed solid returns over the long term. A structured process to identify the key risks (technical, socio-economic, environmental and financial) and develop management processes for them is another important early step.

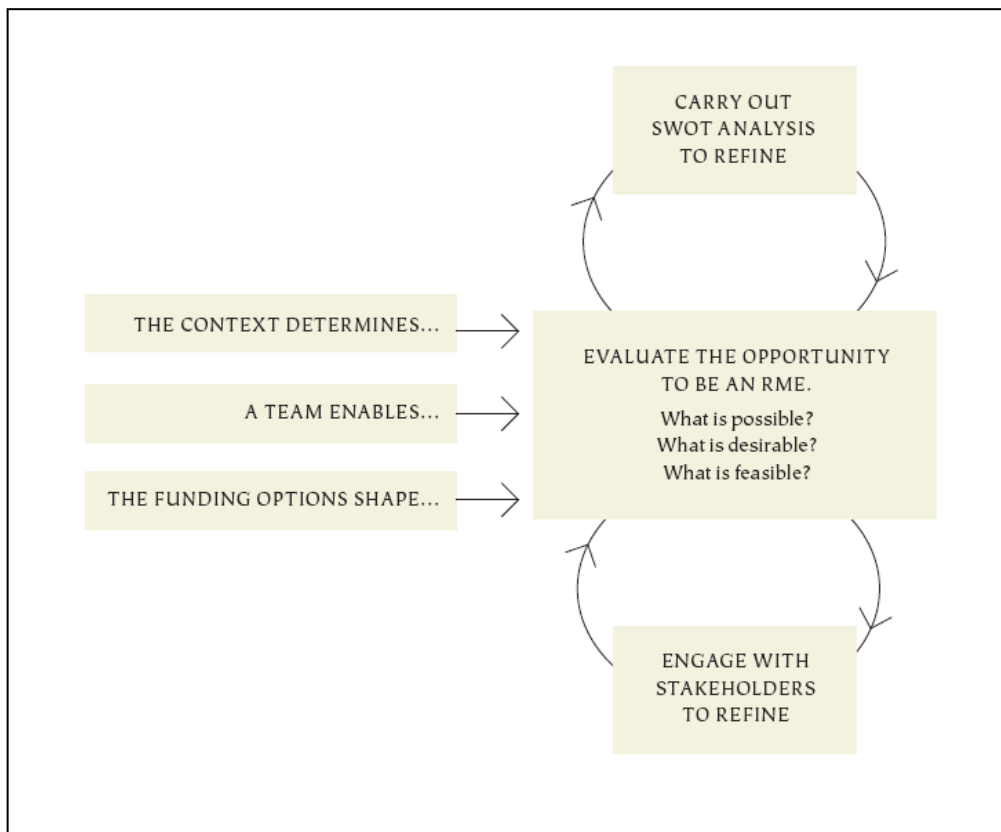


Figure 1. Elements in evaluating the opportunity to be a responsible management entity (RME) of decentralised systems (Willetts et al. 2008)

The next stage is preparation for setting up and running the business. The elements here may seem self-evident but are frequently neglected, evidenced in the failure of many entities in this sector in the US (Yeager et al. 2006). Very few businesses had paid adequate attention to rigorous business planning which include choosing a particular business structure depending on the services and functions they provide, seeking the resources or funding sources available, and planning their organisational structure and governance model to suit. Experience has also shown the importance of financial planning with conservative estimates of income and expenditure projections over time, anticipated changes to the user base, and identifying funding and revenue streams with strategies to overcome a potentially very slow start-up period. It became clear that different business structures (eg public, private, not-for-profit etc.) each have different implications for how

they charge their customers (and what rights they had to enforce payment) and the resources they could access. Market planning that includes a strategy for growth and a marketing plan are important elements that were found to have improved business success. Successful management entities were also found to engage with stakeholders on an ongoing basis, and develop a communications plan to foster effective relationships (Pinkham et al. 2004).

What emerged from our 'Big Thinkers' focus group, held in Maryland in June 2008 with eight national leaders from inside and outside the field, is that trust and institutional arrangements (as defined in this paper) are the key determinants for successful businesses, and that they differ enormously across states in the US, and occasionally within states. For example, in the Pacific north-west states, a contractor model is preferred by legislators who have had a negative experience with developers who failed to adequately manage design, construction and handover, and who have developed trust in the local state association of self-regulating contractors. In the south-eastern states, the Adenus group has been able to set up many privately-owned publicly regulated utilities servicing new estates. In Virginia, Loudon Water, a public utility already providing centralised services to around fifty thousand customers is now extending its operations to provide decentralised services to areas of the county that have prohibited centralised sewerage because it is seen as a Trojan horse for development. Finally, in downtown New York at the high density redevelopment of Battery Park, a focus on sustainability for the whole development meant that regulators made a series of decisions to smooth the path for sewage capture, treatment and on-site recycling for toilet flushing and irrigation.

## QUALITATIVE METHODOLOGY

### Interviewing Stakeholders in Australia

To begin the process of translating the insights from the US study to the Australian situation, we undertook a small set of interviews on institutional arrangements for decentralised systems across a similar range of stakeholder perspectives. Our intent was to make a useful contribution by testing the waters for Australian institutional issues and ideas and see where there was resonance and difference with the US work. The Australian study is indicative, rather than comprehensive. The stakeholder organisations included a large metropolitan water utility, a property developer, an equipment supplier, a consultant providing technical and compliance services, a metropolitan local government authority and a peri-urban/semi-rural local government authority. Within each organisation, between one and four people participated in the interviews. Interviewees or their organisations were selected because of their proactive stance towards distributed systems. That is, their organisations see distributed systems as offering benefits that are worth pursuing, and are taking action accordingly.

Semi-structured, open-ended questions were asked, to explore practices and preferences around the key areas that have emerged from the USA study: financial, managerial, regulatory, business, relationship and governance issues. The following questions are indicative:

- What are the limitations of current and drafted legislation and responsibilities/accountabilities?
- Who pays for different aspects of systems and their management and how are prices set?
- Who owns, operates and maintains the relevant assets?
- What are the current opportunities and constraints in this field?
- What is changing (or needs to change) and what is driving this change?

Notes were then typed up, and themes were extracted from the data. Some themes were particular to one perspective, but most themes were brought up by most interviewees. The themes are presented in the results section, and are then synthesised and compared with the US experiences in the discussion.

## RESULTS

### Part 1: Overview of Australian Stakeholder Perspectives

A brief overview of the key themes raised by each stakeholder perspective is given below and described in the section that follows.

**The utility** perspective noted that distributed systems have unique value in unique locations, and help to provide resilience, an increasingly important characteristic of infrastructure, so should be seen as part of the long term picture. However, they represent a change, so they have to work against significant inertia, and require consistent effort to argue for them within the business, within the industry, and within the sector. They also require different skill sets and new levels of collaboration right from the early days of planning. The key barrier from this perspective is the lack of legitimacy to act, and the risk that customers or developers might say 'no', and take a great idea to some kind of appeals tribunal process. This issue was seen to outweigh the mire of gaps in the permitting, approvals, and accountability processes.

**The developers** interviewed were also keen to leap into this space, and are wondering about adding the provision of water services to their business. Distributed systems provide financial benefits to developers through better control over staging within residential developments, and lower costs for augmentation of centralised systems upstream and downstream of the development. Our developers were concerned about two things: the lack of consistent permitting and approvals processes, and the inconsistency and inadequacy of financial regulations and processes to allow others into the market, and to provide transparency in existing arrangements.

For **the equipment manufacturer**, the key difficulty was found again to be the inconsistencies in permitting and approvals processes leading to enormous cost differences for the same system installed in two similar locations. There were also legitimacy and contractual issues, which means risks for the supplier. Finally, the skewing of funding towards centralised systems makes it difficult to get these systems up even when they provide a better option.

**The consultant's perspective** largely overlapped our developer and equipment manufacturer, while acknowledging it created an opportunity to offer services in obtaining permitting and approvals across jurisdictions, and to mediate between clients and regulators to reach greater commonality across jurisdictions.

**The metropolitan local authority** was concerned about staff not having the experience to make good judgements in this field. This concern was brought up independently by the consultant and the utility. Our peri-urban local authority was concerned about not having the resources to monitor and manage the systems once approvals are given. Both saw the need for significant collaboration in order to reduce the risk of processes going off the rails.

## **Results Part 2: Summary of Issues Raised**

The main themes arising from the interviews were legitimacy and accountability; permitting, approvals, and risk management; and financial and pricing arrangements.

### ***Legitimacy and accountability***

The absence of legitimacy for acting differently was identified in the interviews as a key gap. A utility, for example, has no legal backing to enforce a decision to invest in a decentralised option (say, greywater recycling that emerges as the best option from an integrated water cycle assessment) if a developer in the location refuses to cooperate. The utility has little recourse if the developer goes to an appeals tribunal. Legislative performance drivers or targets for utilities and third parties could provide the level of support needed for acting in this space.

Conversely, a developer has little opportunity to do more than install infrastructure and transfer ownership to the incumbent utility, reducing the drivers for exploring alternative sustainable systems. Special arrangements such as Community Title can enable decentralised systems to be operated independently within the boundary of a development. However, these can be fraught with issues such as the legal status and capacity of an entity such as a body corporate in contracting with service providers and in the event of system failure. Furthermore, such an entity could have little understanding of what is required.

### ***Permitting and approvals***

What system is permitted, and how it is designed, managed, operated and funded depends on the location. Entities operating in the sector cannot standardise operations, but need to meet very site specific requirements and documentation for gaining approvals (with highly variable costs) to operate in each location.

Several inconsistencies with current permitting and approval processes were highlighted. Although councils have responsibility for permitting decentralised systems, metropolitan councils in particular have not had experience with wastewater systems that have been the domain of the utility, and therefore do not have the expertise or processes in place to make technical assessments and approvals. Often those seeking approval also lack knowledge of the requirements and procedures, so councils have to devote time in pre-lodgement meetings etc, that stretch their resources. Furthermore, these time-consuming processes are repeated by different councils as new decentralised projects are proposed in different locations. High levels of staff turnover means that accumulated experience is often not transferred or built on.

Some ideas to address these were proposed. An external service of independent expertise to give technical signoff and accreditation to clients and operators under a common framework that all councils could use, could be funded by Federal or State government. A self-paced online training resource could be made available to build capacity among council staff, with common templates for all required documentation, that

staff in different councils across jurisdictions could use. These would also assist clients who want to establish systems in different council areas to conform to a single set of requirements.

### ***Risk management***

While non-metropolitan councils permit large numbers of onsite systems, lack of resources for ongoing monitoring and inspection regimes has led to the imposition of rigid maintenance requirements that are unrelated to the actual need for maintenance. A move to a common risk based regime by all councils was preferred by our interviewees, but progress was seen to be hampered by inadequate resources for establishing the necessary monitoring regimes.

Decentralised systems pose a challenge for both metropolitan and non-metropolitan councils in terms of lack of knowledge about their long term performance. Demonstration and pilot schemes were flagged as essential to build up the necessary body of knowledge. Another knowledge gap for research is the study of the system as a whole, to identify potential problems and the adaptations needed in the event of large numbers of decentralised systems being installed – for example, if volumes of wastewater in remaining conventional sewers became insufficient for effective water carriage.

Collaboration between permitting authorities to follow nationally consistent procedures and guidelines, to enable actors in the sector to adopt a standard approach for gaining approvals, for ascertaining the quality of recycled water, for planning risk management, monitoring and so on, was favoured by all our interviewees. One suggestion was for a national body with a website, with templates for risk management plans, for monitoring programs, etc., as well as a list of certified consultants and certified auditors. ISO quality assurance certification by companies could be secured with little additional effort to current requirements and would ensure improved processes and manage risks in the longer term.

For decentralised systems in sewerred areas, failure risk is managed through back up services from the incumbent utility that must be paid for on top of charges for the decentralised services – so users effectively pay twice. In non-sewerred areas, decentralised systems need to have redundancy built in. Recognising a key benefit of distributed systems i.e. that consequences are reduced through distribution, remains elusive.

### ***Financial arrangements***

Even if a total water cycle assessment shows that a decentralised option is the best for a site, the processes for choosing decentralised systems were seen to have a high transaction cost or ‘hassle factor’ associated with having to do more difficult and unfamiliar things than usual. For a utility, if there are no additional pushes or pulls, motivations for alternative services can be insufficient to surmount this barrier, even where cost assessments favour decentralised systems.

Under the current rules there is little opportunity for a developer to have greater involvement beyond being a supplier of physical infrastructure that is then handed to the incumbent utility to operate, and historically they have shown limited interest in acquiring alternative technologies. Exceptions have been when it has been too costly for the incumbent utility to service an area, when an area could be excluded from the utility’s service area for alternative service provided by a third party (in Queensland). Under normal circumstances it is financially disadvantageous for the utility to allow a third party to operate in its area. The Water Industry Competition Act (WICA) in NSW opens new opportunities for third party involvement, although these opportunities may be greatest for sewer mining. The transaction costs around the licensing process could determine whether the new opportunities are worthwhile exploring.

Processes for third parties to be rewarded for upstream and downstream benefits of decentralised systems within sewerred areas are absent. Although decentralised water recycling leads to reduced headworks and sewerage system augmentation, the incumbent utility typically reserves capacity to provide back-up services and therefore incurs, and passes on, the same system costs for asset upkeep as with conventional services to a development. Thus in effect the development has to pay twice for its decentralised infrastructure.

Institutions for financing are skewed in favour of centralised sewerage - usually a single entity needs to bear the full cost of a decentralised system. There are limited community grants and funds available for alternative decentralised systems, with “painful” processes for accessing such funds. Financial incentives (comparable to rainwater tank rebates) for encouraging decentralised systems are absent.

### ***Pricing arrangements***

Pricing regimes in sewerred areas do not encourage decentralised treatment and recycling, as the sewerage charge is typically based on a fixed charge and/or fixed percentage of the potable water supplied, irrespective of how much of this ends up in the sewer.

An incumbent utility's ability to price services to a difficult-to-service area by subsidising the cost within its overall pricing scheme can prevent a more cost effective alternative service by a third party. If pricing structures were kept independent of the utility and reflective of true costs, it can enable the most cost effective infrastructure for a site, whether it be centralised or an alternative model.

## **DISCUSSION**

Our testing of institutional issues of concern amongst Australian stakeholders point to a focus on getting over the initial inertia associated with regulations, stakeholders and externally determined financial barriers. The recognition of regulatory inconsistencies, and the desire by regulators to work together towards common frameworks to achieve shared goals is reason for optimism. Although the environment for players other than the incumbent utility to offer wastewater services to customers is not well developed. NSW's Water Industry Competition Act (WICA) is a positive first step that could serve as a model for similar legislation in other states (Gray & Gardner 2008). The National Water Commission offers a potential platform for the development of a national directive and framework for permitting and regulating decentralised systems.

The decentralised wastewater sector is still in its early stages of development, both in the US (Nelson 2008) and Australia. While capacity constraints and high costs of expanding existing networks are common drivers in both places, other drivers are different. In the US, concerns about pollution and water quality have been a key driver in many places, and a desire to control development and growth, amongst others (Yeager et al. 2006; Pinkham et al. 2004). In contrast, in Australia, additional drivers were identified as meeting target building performance standards (such as the NSW BASIX scheme or the Queensland Development Code), and voluntary drivers such as organisations' internal sustainability aspirations and/or gaining high Green Star ratings.

There were some issues of concern that were common to stakeholders in both countries, such as inconsistencies in permitting processes across different jurisdictions, and financial regulation and pricing models that are designed specifically for centralised infrastructure and difficult to apply to decentralised systems. In order to facilitate the uptake of decentralised systems, it is important that the nuances of these systems are appreciated and addressed. If large numbers of decentralised systems are installed in a seweraged urban area, for example, the backup service from the incumbent utility need not be sized and costed as though they could all fail at the same time. Reduced use of existing infrastructure brings its own set of challenges, such as increased corrosion or blockages associated with reduced sewage flows.

The differences between the two countries, including higher numbers of people not connected to centralised systems and strong location-specific drivers in the US has meant that greater investment in decentralised systems has happened there. It also means that more entities involved in the sector have failed there for a variety of reasons. Often, these have been for internal reasons such as the technical, managerial and financial practices and governance structures of the entities (Yeager et al. 2006), as much as institutional shortcomings (Nelson 2008).

Gray & Gardner (2008) note that appropriate legal regimes and frameworks can be designed with the necessary safeguards for health, environmental and consumer protection, and are necessary, but are not of themselves sufficient for success. We noted several suggestions for improving the institutional landscape proposed by our interviewees. For other critical success factors, the experiences and research from the US are potential sources for learning, and for taking necessary steps to avoid failure.

## **CONCLUSION**

Innovative thinking to enable and trial a wide range of responsive institutional arrangements for distributed wastewater systems managed by a spectrum of public and private actors, is needed to capture the benefits of such systems. Research from the US offers many clues about the issues that might be important for an Australian decentralised wastewater industry to address. The analysis of different Australian stakeholder perspectives identified some of the institutional issues that are of particular concern. Reflecting the early stage in the advancement of the sector here, the institutional issues of concern mainly related to 'external' factors beyond the control of stakeholders, and associated with the initial inertia against change.

We conclude that current institutional arrangements in Australia for onsite and decentralised systems and their potential managers create a situation that is fraught and represents significant risk to most parties. This is slowing Australia's shift to a new paradigm in which such systems are an integrated part of a more sustainable water system. What is needed is new forms of collaboration, including the use of pilots and demonstrations that test and influence existing regulations and relationships. And of primary concern is the need for greater clarity about where responsibility and accountability lie in different situations. The National Water Commission and other stakeholders are urged to take notice of the points raised in this paper and

direct significant resources to focusing on resolving the many challenges presented by the institutional dimensions of this sector.

Finally we note from our research with the US decentralised industry, that 'internal' institutional issues relating to management and stakeholder engagement are equally critical for success. A successful Australian distributed wastewater industry will be enabled by adapting and applying the findings from the US work to address 'internal' issues and by resolving the 'external' institutional issues above at the same time.

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