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A REVIEW OF FACTORS INDICATING LIKELIHOOD OF AND MOTIVATIONS FOR HOUSEHOLD RAINWATER TANK ADOPTION

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Abstract

This paper outlines the state of the literature on the adoption of rainwater tanks by urban households in Australia. There has been rapid growth in this area of research in the past 5 years as policies encouraging rainwater tanks have emerged across the country and have been associated with a surge in tank installations in some areas. This research has not been covered by previous reviews and there is little evidence of cross-comparison occurring in the field.

This review shows that despite the paucity of literature on rainwater, what has been published provides good coverage of actual behaviour in comparison to the water management field as a whole. It summarises the findings of both quantitative and qualitative studies in relation to the factors determining the behaviour of households adopting rainwater tanks. It finds that the variables associated with quantitative research to date (socio-demographics, attitudes to water saving and knowledge about water sources) have been limited in distinguishing rainwater tank adopters from non-rainwater tank adopters. The picture emerging from the qualitative research is that, under the conditions of outdoor water restrictions, those who adopt a rainwater tank voluntarily do not appear to be motivated by a desire to reduce mains water use out of a sense of responsibility to the wider community. Instead these residents are primarily motivated by the desire to have an independent water supply for outdoor uses which they understand as providing independence from government restrictions on outdoor water use; or for others, as an action consistent with their environmental ethic.

This paper reveals that social research is making headway in identifying what might (or might not) distinguish likely rainwater tank users and what might motivate these people to install and use a rainwater tank. This can help to shape policy to better accommodate these motivations and enable resident interest in tanks to be maintained in the future.

1. Introduction

There are now several literature reviews that cover social research on alternative water sources and among these both Po et al. (2003) and Hurlimann et al. (2009) include rainwater in their scope. In a review that focused on public perceptions of water reuse, Po et al. (2003) found that rainwater was considered a more acceptable alternative water source than greywater or recycled water. Hurlimann et al. (2009) reviewed the literature on water-related behaviours and mapped it using concepts drawn from consumer behaviour theory. A key finding of Hurlimann et al. (2009, p.54) was that most of the research in the water-related behaviour field had been 'undertaken hypothetically, on communities who have not had actual experience with the water behaviours studied' and had focused on intended, rather than actual behaviour. In contrast to this finding, there is a growing body of Australian social research regarding rainwater related behaviour and rainwater tanks in urban households, much of which looks at *actual* behaviour in the studied community and is not covered by the reviews of either Po et al. (2003) or Hurlimann et al. (2009). Therefore a review of this literature benefits not only future research into rainwater use but may offer insights into research approaches

for the water-behaviour field as a whole. The dominant research on rainwater-related behaviour concerns the adoption of rainwater tanks, and both quantitative approaches and qualitative approaches have been used. So far the quantitative approaches have found little in the way of significant factors for predicting rainwater tank adoption. Of greater value has been the use of qualitative approaches; these have identified motivations for rainwater use as relating to outdoor use, independence and environmental concerns. The findings may have implications for the selection and efficiency of rainwater tanks compared to other water supply options.

This paper outlines the state of the literature on rainwater tanks in Australia, summarising both quantitative and qualitative studies in relation to the factors determining the behaviour of households adopting rainwater tanks. The recent findings summarised in this paper imply some important policy considerations for the application of the rainwater tank as an alternative water supply.

2. Context

The recent growth of rainwater-related research follows a surge in rainwater tank installations across the country. This rapid increase has seen rainwater tanks become mainstream in some areas and associated with particular demographics. It has occurred during a period of extended water restrictions where governments have subsidised, and in some cases mandated, rainwater tanks. The Australian Bureau of Statistics (ABS) reports that in 2007 there were almost 1.5 million households who reported using a rainwater tank as a source of water, comprising 19.3% of all households (ABS 2007, Table 2.11). While many of these tanks are in rural areas, a sizeable 572,000 are in capital cities. Growth was evident in the data with 229,000 households nationwide installing tanks since March 2004 and an additional 76,000 households waiting on delivery of a purchased tank at the time of the survey. However, the ABS data does not capture the extent of growth in some areas. Rainwater tank installation rates in South-East Queensland (SEQLD) have been particularly high, with Gardiner (2009, Table 1) calculating that as of August 2008 approximately 37% of SEQLD households had a rainwater tank (Gardiner et al. 2008). This has been achieved following significant government subsidies through the Waterwise rainwater tank rebate scheme as well as the addition of Queensland Development Code conditions in 2007 that mandate the installation of rainwater tanks for new developments (Gardiner et al. 2008). Similar programs have supported rainwater tank installations in other parts of the country, such as the Sydney Water tank rebate program and the NSW Government BASIX scheme, which also used development conditions to mandate water savings for new developments.

3. Water-behaviour coverage in rainwater tank literature

Despite the paucity of literature on rainwater, what has been published provides good coverage of actual water-related behaviour in comparison to the field as a whole. When this literature is mapped using the same behaviour categories as Hurlimann et al.'s (2009) conceptual map of the field it can be seen that the literature covers both intended and actual behaviour and there is rainwater tank literature available in many of the areas that Hurlimann et al. (2009) had marked as 'none/scarce research conducted' (See Appendix). The eight behaviours in this map were identified by Hurlimann et al. (2009) as key areas for research attention based on an analysis of Australian water policies and water industry publications. Naturally, as the Hurlimann et al. (2009) knowledge map is covering a larger field, the scale of the two will be different, but the map shows that there is sufficient coverage in the rainwater literature for a review to be of value to the wider field. In particular, there is good coverage of 'water-related purchases' via rainwater tank installation research and of 'non-potable use of water from an alternative source' via research on rainwater use.

Rainwater tank adoption is the most useful behaviour to focus on for further attention because this is the area of actual (rather than intended) behaviour that has been addressed by most researchers. The adoption of rainwater tanks has been researched by Gardiner (2010), ABS (2007), White (2009), Ryan et al. (2009), Brown (2010), Clarke and Brown (2006), and Collins (2008). This research can be divided into two broad approaches.

The first approach is quantitative and has aimed to identify variables which could explain which individuals in the community would have particular water use behaviours. The second approach is qualitative and has focused exclusively on users of rainwater tanks, seeking to identify their motivations and values without necessarily comparing them to the community as a whole. These two types of research have different applications in the policy process. Policy-makers are likely to be more interested in understanding the factors indicating the likelihood of support for rainwater tanks when choosing between different water supply options, whereas they may be more interested in motivations when already committed to rainwater tank use and seeking ways to increase adoption. The following discussion identifies the current literature on rainwater tank adoption with either of these two approaches.

4. Quantitative research: searching for factors indicating likelihood of rainwater tank adoption

The quantitative research on rainwater tank adoption has attempted to identify links between particular variables and the likelihood of support for rainwater tanks or actual adoption of rainwater tanks. This is a thin body of research, but includes studies from the ACT (Ryan et al. 2009), from SEQLD (White 2009), Bayside LGA in Melbourne (Clarke & Brown 2006) and the Ku-ring-gai LGA in Sydney (Brown & Davies 2007). Specifically, the variables that have been examined by researchers include the relationship between individual socio-demographic factors and the actual use of rainwater tanks (Ryan et al. 2009; White 2009; Clarke & Brown 2006) and on the hypothetical acceptance of rainwater for household uses (Clarke & Brown 2006; Brown & Davies 2007). Other factors investigated include the influence of knowledge about water sources (Ryan et al. 2009) and the influence of 'water saving' attitudes (Clarke & Brown 2006) on adoption.

The research on actual tank adoption suggests that personal characteristics as measured by socio-demographic factors may be used to indicate the influence of barriers to rainwater tank use but otherwise do not seem to be useful as a predictor of rainwater tank use. The ABS (2007) survey disaggregates national rainwater tank use by three attributes and these show that tank use is higher than the national average in households that are owner-occupied, consisting of a detached house (rather than a flat) and characterised as a 'family household' (rather than for example a 'group household' of unrelated people). In a study of the Melbourne local government area of Bayside, Clarke and Brown (2006) also found that the small number of respondents owning rainwater tanks were typically owner-occupiers of a freestanding house with higher weekly household incomes than the average Bayside resident. Clarke and Brown (2006) sought to better understand this result by examining the socio-demographic distribution of households in the same survey that that had installed water-efficient showerheads (a different water-related purchase). On the basis of this comparison, Clarke and Brown (2006) interpreted the association between owner-occupier status, separate dwelling, high income and rainwater tank ownership to be indicative of the ability or capacity to install rainwater tanks rather than a willingness to do so. This was based on the assumption that the same motivations would drive both rainwater tank adoption and installation of a water-efficient showerhead. Supporting this interpretation, Ryan et al. (2009) found that, when their analysis was limited to only those ACT residents who were residing in a detached house, the factors of income, education, gender and age all failed to distinguish the participants who were using collected rainwater to irrigate their gardens from those that were not. These authors also suggest that the association with high income may be no more than an indication of the ability to purchase a freestanding home.

The research on intended acceptance of rainwater tank water use and socio-demographic factors is limited but has the advantage of not reflecting the barriers that may exist regarding actual use. This research broadly supports the findings above that socio-demographic factors are not good indicators of acceptance, with the exception of a study that found gender and cultural background to be significant in the community of study. In their study area of Bayside in Melbourne, Clarke and Brown (2006) found that demographics were not associated with significant differences in the patterns of acceptance of rainwater for different household activities. However, in the Ku-ring-gai municipality of Sydney, Brown and Davis (2007) identified gender and

cultural background as significant for patterns of rainwater acceptance. They found both women and participants from a non-English speaking background showed more support for the use of rainwater across a range of household uses. Based on focus group discussions, Brown and Davis (2007) interpreted the greater appeal of rainwater among women as being reflective of strong traditional gender roles in the community where women were regarded as having more involvement with household decision-making regarding internal water use. They interpreted the significance of cultural backgrounds as representative of people from a non-English speaking background (primarily Eastern Asia in this study) having had greater experience with using alternative water sources in their country of origin. It is interesting that the only two significant demographic findings were both related to social markers with a strong cultural aspect, suggesting perhaps the presence of different cultures of water use.

Beyond socio-demographic indicators, the two other factors that have been examined in the quantitative research on rainwater tank use are the effect of attitudes to water saving (Clarke & Brown 2006; Ryan et al. 2009) and knowledge of water supply options (Ryan et al. 2009). Regarding the impact of attitudes, Clarke and Brown (2006), concluded that high awareness and a supportive attitude towards water saving are not good predictors of water conservation behaviour because in their study in the Bayside community, 95% of respondents agreed that saving household water was highly important, yet the community was still one of the highest water users in Melbourne and only 5% of households had installed rainwater tanks. Also looking at the effect of attitudes, Ryan et al. (2009) found that rainwater tank users exhibited similar responses to non-rainwater tank users to questions testing their support for harvested rainwater and other water supply options. Looking at the impact of knowledge on tank use behaviour, Ryan et al. (2009) found that tank users did self-report their knowledge regarding water supply options as being higher than the self-reported knowledge levels of non-rainwater tank users. However, Ryan explains that it is unclear whether higher self-reported knowledge preceded rainwater tank use or if the use of a rainwater tank contributed to an increase in perceived knowledge. Therefore, despite this finding, it is still unclear if a better knowledge of water supply options could be an indicator of the likelihood of rainwater tank adoption.

In summary, from the limited research available, socio-demographic factors such as income, education, gender and age do not appear to predict the likelihood of an individual installing a rainwater tank once barriers such as home ownership and dwelling status are accounted for. There are two additional findings of importance. First, while limited to only two studies, the research so far has not found attitudes to water saving or attitudes to the appropriateness of water sources to be predictive of rainwater tank use. Second, while perceived knowledge regarding water sources did differentiate between tank users and non-users, it appears an invalid predictor of tank use. Given quantitative approaches depend on testing for the right variable, current research in this area has been useful in identifying variables which are less successful for predicting rainwater tank use, but has had little to offer in the way of a strong explanation of rainwater tank adoption behaviour. We now turn to the qualitative research to further our understanding of this phenomenon.

5. Qualitative research: exploring motivations for rainwater tank adoption

Apart from a quantitative approach, the other type of research considering rainwater tank-related behaviour has taken a qualitative approach and has focused on understanding the motivations of users and what they value about the rainwater tank. Four recent studies have examined household motivations for voluntary rainwater tank adoption, all have been conducted on the east coast of Australia and there is little evidence of cross-comparison between them. In mid-2007, frustrated by the lack of published data on the motivations for householders installing rainwater tanks, Collins (2008) conducted a survey of 46 householders with rainwater tanks 'mostly residing on the Central Coast of NSW' (Collins 2008). Mid-2007 also marked the start of Gardiner's larger study (Gardiner et al. 2008; Gardiner 2009; Gardiner 2010) in SEQLD of rainwater tank owners who had received a government rainwater tank rebate or lived in a dwelling with a rainwater tank installed as part of a condition of permit. In parallel with Gardiner's study, White (2009) was also researching

attitudes of rainwater tank users in SEQLD in order to identify the range of factors that distinguished between adopters and non-adopters. There is a difference in the population studied by White (2009) and Gardiner (2010) in that the majority of White's respondents had voluntarily installed a rainwater tank, rather being compelled by a development condition. Interestingly, 23% of these did not claim a rebate for their tank (White 2009, p.256) and so would not have been included in Gardiner's study. Another contemporaneous study was conducted in the Little Stringybark Creek catchment east of Melbourne, which, as part of a broader project scope, sought to identify the factors influencing householder decisions to install a rainwater tank as part of their participation in this project (H. Brown 2010).

These four studies all examined the motivations of rainwater tank adopters using populations located in mains-connected urban areas that were subjected to water restrictions. While all of the studies used a qualitative approach with questions of an open-ended nature regarding user motivations, similar themes emerge in the findings. Under the conditions of outdoor water restrictions, it seems that voluntary rainwater tank adopters:

1. Do not appear to be motivated by a desire to reduce mains water use out of a sense of responsibility to the wider community.

2. Are primarily motivated by the desire to have an independent water supply for outdoor uses which they understand as:

    a) providing independence from government restrictions on outdoor water use; or
    b) an action consistent with their environmental ethic.

That voluntary rainwater tank adopters did not appear to be motivated by a sense of responsibility to the wider community was a point explicitly made by Gardiner (2010), Collins (2008) and White (2009). For example, Gardiner (2010, p.106) found that 'only 5% of 200 respondents [in receipt of a rebate] referred to community responsibility because of the drought and limited mains supplied as relevant to their decision to install a tank'. Similarly, Collins (2008, p.119) found that 'very few (3/46) of the respondents state that they had installed their rainwater tanks to make a contribution towards reducing the use of town water'. When White (2009, p.295) asked residents to comment on the influence of community-related concerns on their decision to adopt a tank, only 7% of respondents nominated statements of community value, such as the 'saving of mains water' and 'people need to be more responsible' as the primary motivation for adoption. White's research further identifies that 71% of rainwater tank adopters in that study 'specifically reported that community values were not an issue' in their decision to install a rainwater tank (2009, p.295).

Instead of a community-minded motivation for water savings, respondents across these studies more often reflected a personal resource-based understanding in which 'saving water' meant saving up a resource for later use on the garden or to meet other household uses. Gardiner (2010, p.106) reports that 'tank owners typically quote their motivations for installing a tank as to "save the garden" and "to save water"', as did Collins (2008, p.110), who stated 'the motivation of most was to have water available for purposes that are restricted for town water such as (predominantly) watering gardens, and also washing cars and windows, and topping up swimming pools'. Brown (2010, Table 1) also identified that a key value of the rainwater tank to households was that it provided a water source that was free from restrictions. Clearly, the presence of water restrictions in these communities has strongly shaped the motivations for rainwater tank adoption.

Enquiring about the motivations of SEQLD tank owners in greater depth, Gardiner (2010) and White (2009) both identified independence and environmental concerns as dominant values driving voluntary tank adoption. Gardiner (2010) grouped voluntary tank owners into those who were motivated by achieving an 'independent supply' or those who she called 'environmentalists'. This distinction was made based on

responses regarding expectations about the long term need for domestic rainwater collection, environmental behaviours such recycling and composting, attitudes towards legislating rainwater tank use and practices regarding tank management. While not attempting to group respondents, White (2009, pp.299-300) found that in an open-response question about the primary reason for installing a tank, the dominant concepts that emerged were independence (60% responses) and environment (38%) as well as compatibility (58%), which reflected a range of comments from physical compatibility regarding space on the property for a tank to compatibility with 'lifestyle'.

The theme of independence, while dominated by the desire for freedom from water restrictions, seems to have a number of other aspects relating to trust in government and perhaps financial security. Those persons identified by Gardiner (2010) as motivated by the desire for an independent supply were more likely than average respondents to be against legislation for the use of tank water, to agree that the tank allows water use as if there were no restrictions and to see the tank as 'their own private resource' (Gardiner 2010, Table 4). In the conclusion of the paper, Gardiner (2010, p.110), extended her interpretation of the views of this group from seeking independence from water restrictions to independence from 'centralised water management decisions'. This broader interpretation seems to be supported by White (2009), whose study found that, in addition to water restrictions, several other motivations emerged that he grouped under a broader conceptualisation of independence. One was the idea that a tank provided water supply security and that 'with the way dam levels are going' a reserve water supply may be beneficial to have in the future (White 2009, p.336). White (2009, pp.340-341) also found that a small proportion of respondents raised concerns about the use of chlorine and the potential for recycled water to be introduced to the mains water supply as reasons to seek an independent water supply via a rainwater tank.

The independence theme could perhaps also be used to interpret the findings of the Stringybark Creek study, where Brown (2010) found that several residents saw the benefit of a rainwater tank as reducing their financial dependence on the mains water supply. There were two dimensions to this finding. First, some respondents approaching retirement valued the anticipated reduction in future water bills because they expected to have a fixed income in retirement that was smaller than their current income. Second, several interviewees expected future rises in the cost of mains water and wanted to reduce their exposure to such increases. This was not a prominent theme in the analysis of the SEQLD research, although Gardiner (2010, Table 4) identified that another feature of the 'independent supply' group was that they were more likely to feel that their water bills were lower because of the tank. It may be that security of supply and financial security have been tied together because of public discussions of the high costs of proposed augmentations of the water supply, such as desalination, and have thus increased the appeal of an independent water supply.

Environmental motivations were clearly identified as significant by Gardiner (2010) and White (2009) but were discussed in less depth than the influence of independence. Those persons identified by Gardiner (2010) as 'environmentalist' in their attitudes to rainwater tanks were more likely to 'feel that water restrictions will be needed in the longer term', be supportive of legislation for the use of rainwater tanks, and be engaged in recycling and composting than the average respondent (Gardiner 2010, Table 4). Elsewhere, Gardiner (2010, p.106) mentions that this group had 'a longer-term focus, were motivated by communal gains and ... tended to believe their tank water was superior in quality to mains supply'. Gardiner mentions little else about the environmentalist group until her conclusion, which suggests that for this group rainwater tanks were part of a personal outlook or 'life view that placed an emphasis on controlled personal consumption' (2010, p.110). It is not clear what evidence was available to support this wider claim regarding life view. There is an apparent contradiction between the idea that this group is motivated by 'communal gains' and the earlier finding that perceived community benefit was a weak motivation for rainwater tank adopters. White (2009) helped to resolve this inconsistency by distinguishing environmental concerns as an interest in minimising household environmental impact and a concern for the environmental impacts of human activity. In contrast, he defined community concerns related more to a sense of responsibility to the wider community. Neither Collins (2008)

nor Brown (2010) referred to environmental concern as something nominated as a significant motivation for rainwater tank use, although Brown discussed it as a broader motivation for residential participation in the Stringy Bark Creek Project.

These categories of 'independent supply' and 'environmentalist' are further supported by Gardiner's (2010) work regarding residents whose tank ownership was not voluntary but rather the result of a development condition mandating tank installation. The addition of this group of tank owners introduced a new attitude grouping in Gardiner's study but not a new set of motivations. Gardiner found that the attitudes of the mandatory tank owners were either concerned (like the rebate recipients) with an 'independent supply' or were 'environmentalists'; otherwise they were 'not interested' in the tank. Unlike the other two groups this group of uninterested residents would not install a tank again if they moved house, did not see the need for long-term water restrictions, did not see a need for tanks once dams are full and rarely cleaned or inspected their tank (Gardiner 2010, Table 4).

Interestingly, Gardiner found that it was the presence of a mandated connection to internal plumbing that distinguished those most likely to be in the group of 'not interested'. The characteristics of this group, and the link to the mandatory internal plumbing connection in particular, led Gardiner to conclude that 'the existence of the internal plumbing connection is changing the way that householders envisage the resource value of their tank' (Gardiner 2010, p.107) and that this group 'regarded the tank as an extension of the water supply' (Gardiner 2010, p.100). An internal connection combined with mains back-up means that the tank offers neither an 'independent supply' for the garden, because saved water will quickly be consumed by indoor needs, nor does it easily allow 'environmentalists' to be actively engaged in managing their resource use when to distinguish between sources of mains and rain water is difficult with such configurations (Gardiner 2010, p.105). Therefore, it is unsurprising that Gardiner found most of these residents to be disinterested in the rainwater tank. The role of water restrictions in shaping motivations and the disinterest of many residents with mandated internally-connected tanks has implications for future water use, as outlined in our concluding remarks.

6. Conclusion

This paper has attempted to draw together the contemporary but disparate Australian literature in order to identify the key policy implications for rainwater tanks as water supply sources. In summary, the literature on rainwater tank installation reveals there is a rapidly growing body of research on water-related behaviours regarding rainwater tanks that has been missed by earlier reviews and could add to our understanding of actual water-related behaviour. This research has been stimulated by a surge in rainwater tank installations. Two approaches have been used in the research: a quantitative approach and a qualitative approach. The variables associated with quantitative research have, to date, been limited in distinguishing rainwater tank adopters from non-rainwater tank adopters, although the findings of Brown and Davis (2007) regarding the influence of gender and culture suggest that there may be cultures of water users with different attitudes to rainwater tanks. By comparison, qualitative approaches have sought to understand the motivations of users with some success and have identified drivers that were missing from earlier research. In particular, qualitative research has found that the ability to use rainwater for restricted purposes, the access to an independent water supply and the ability to reduce household environmental impact are important motivators of household adoption.

The identified motivations for rainwater tank adoption directly link to the 'decentralised' nature of a rainwater tank and to the influence of regulatory context regarding restrictions on mains water. While Hurlimann et al. (2009) and Po et al. (2003) have included rainwater as one option in a set of alternative supply solutions, the unique nature of motivations for rainwater tank use suggests there is a strong need to distinguish between centralised and decentralised supply options in research. Unlike alternative non-potable water supply options,

which may be delivered via a third pipe scheme such as recycled wastewater, or mixed with the potable water supply such as desalinated water, interest in using rainwater appears to be directly linked to the feeling of independence and self-management it can give to a household.

Hence, arising from this review are three important implications for urban water policy. First, policy-makers seeking to estimate the potential for rainwater tank adoption should know that demographic and socio-economic data do not appear to be effective predictors of adoption, although owner-occupied 'family households' of detached stock appear most likely to incorporate rainwater tanks. With the growth in population in Australian cities predicted to increase dramatically over the next 30 years, rainwater tanks may be less popular in areas of increasing density depending on the type of housing that evolves. The role of local culture associated with water use may also be significant, for example communities of a particular ethnic origin may be more receptive to the use of rainwater than others. Likewise, in communities where traditional gender roles are strongly held, women may have more household influence in determining which indoor applications rainwater is used for and thus display stronger attitudes regarding appropriate uses for rainwater. More research is needed to investigate the role of local culture before stronger conclusions can be drawn.

Second, from the qualitative research, it appears that rainwater tanks are most valued when they offer an independent water source for outdoor use in periods of water restrictions. Use in this manner offers some community benefit because the harvested stormwater will infiltrate into the sub-soil via the garden and is diverted from urban waterways. This practice is also developing community skills in managing a finite water supply and in maintaining rainwater tank systems. If these practices continue beyond the restrictions period, then there will be a continued benefit by reducing the demand on mains water associated with outdoor use. However this use will not reduce indoor mains water demand and there is some risk that the 'independent supply' motivations of some users could result in the rainwater tank supply being used on top of mains water allocations to maintain a pre-drought lifestyle of very high outdoor water use and thus not reduce mains water consumption at all.

Third, these findings suggest that mandating that rainwater tanks be connected to internal plumbing may be a risky strategy for achieving long-term water conservation. It seems that under conditions of a mandatory internal connection, residents are denied the personal benefits that could otherwise motivate them to engage in management and maintenance of the tank. As Gardiner (2010) has identified, this poses a risk to the long-term use of rainwater tanks in these households because residents may respond to problems with the tank by disconnecting it rather than maintaining the system. Mandated internal connections may indeed reduce the potential for water-conservative behaviour in the household where the rainwater tank is deemed a mere extension to the mains water supply.

It is important that rainwater tank policies accommodate the motivations of householders as once the tank is installed it is the behaviour of the residents in using and maintaining the tank which enable long-term community benefits to be achieved. This paper has revealed that social research is making headway in identifying what might (or might not) distinguish likely rainwater tank users and what might motivate these people to install and use a rainwater tank. This can help to shape policy to better accommodate these motivations and enable resident interest in tanks to be maintained in the future.

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8. References

ABS, 2007. *4602.0 - Environmental Issues: People's Views and Practices, Mar 2007*, Australian Bureau of Statistics.

Brown, H., 2010. *Report into the factors that influence community and local government participation in the Little Stringybark Creek project (Draft)*, Little Stringybark Creek Project, University of Melbourne.

Brown, R. & Davies, P., 2007. Understanding community receptivity to water re-use: Ku-ring-gai Council case study. *Water Science & Technology*, 55(4), 283.

Clarke, J. & Brown, R., 2006. Understanding the factors that influence domestic water consumption within Melbourne. *Australian Journal of Water Resources*, 10(3), 261.

Collins, R., 2008. Effectiveness of domestic rainwater tanks. *Water (Melbourne)*, 36(2), 116-120.

Gardiner, A., 2010. Do rainwater tanks herald a cultural change in household water use? *Australasian Journal of Environmental Management*, 17, 100-110.

Gardiner, A., 2009. Domestic rainwater tanks: usage and maintenance patterns in South East Queensland. *Water (Melbourne)*, 36(1), 151-156.

Gardiner, A., Skoien, P. & Gardner, T., 2008. Decentralised water supplies: South-East Queensland householders' experience and attitudes. *Water*, 36(1), 53-58.

Hurlimann, A., Dolnicar, S. & Meyer, P., 2009. Understanding behaviour to inform water supply management in developed nations - A review of literature, conceptual model and research agenda. *Journal of Environmental Management*, 91(1), 47-56.

Po, M., Kaercher, J. & Nancarrow, B., 2003. Literature review of factors influencing public perceptions of water reuse. *Report to Australian Urban Water Conservation and Reuse Research Program*.

Ryan, A., Spash, C. & Measham, T., 2009. Socio-economic and psychological predictors of domestic greywater and rainwater collection: Evidence from Australia. *Journal of Hydrology*, 379(1-2), 164-171.

White, D., 2009. *Decentralised Environmental Technology Adoption: The Household Experience with Rainwater Harvesting*. PhD. Griffith University.

APPENDIX – Knowledge map of rainwater literature compared to water-related behaviour literature as a whole

Table 1 (a) Hurlimann et al. (2009) knowledge map of water supply management literature

Intended behaviour		
1. Water-related illegal behaviour	4. Joining a water interest group	7. Drink water from an alternative source
2. Relocation due to water restrictions	5. Communication of water-related issues	8. Non-potable use of water from an alternative source
3. Water-related purchase	6. Water conservation	

Actual behaviour		
1. Water-related illegal behaviour	4. Joining a water interest group	7. Drink water from an alternative source
2. Relocation due to water restrictions	5. Communication of water-related issues	8. Non-potable use of water from an alternative source
3. Water-related purchase	6. Water conservation	

Table 1(b) Knowledge map of rainwater tank management literature

Rainwater specific - Intended behaviour		
1. Water-related illegal behaviour	4. Joining a water interest group	7. Drink water from an alternative source (harvested rainwater)
2. Relocation due to water restrictions	5. Communication of water-related issues	8. Non-potable use of harvested rainwater
3. Water-related purchase	6. Water conservation	

Rainwater specific - Actual behaviour		
1. Water-related illegal behaviour	4. Joining a water interest group	7. Drink water from an alternative source (harvested rainwater)
2. Relocation due to water restrictions	5. Communication of water-related issues	8. Non-potable use of harvested rainwater
3. Water-related purchase	6. Water conservation	

Legend

None/scarce research conducted	Medium level of research
Low level of research	Well researched