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How Australians value water

Results from a literature review

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Executive summary

Water is both a practical, everyday substance and one to which people attribute substantial value and meaning, as a deeply integrated component of social life (Goeft, 2008) and a "vital source of life" itself (Strang, 2005c, p. 7). In Australia, conflicts over water have taken place between irrigators and environmentalists, urban and rural populations (Alston & Mason, 2008a), traditional owners and non-Indigenous populations (Jackson, Stoeckl, Straton & Stanley, 2008); industrial water users and recreational water users (Jackson et al., 2008; Strang, 2009); and private property owners and other members of the public (Jackson, et al., 2008). Action that is perceived to put water sources at risk, such as the mining efforts of the coal seam gas (CSG) industry, has the potential to trigger intense backlash from communities (News.com.au, 2012a; ABC Radio, 2011).

In order to understand social conflicts over water, it is essential to understand how it is valued and understood by different groups of people. As researchers have argued that a legal, technical, or managerial perspective easily underemphasises or overlooks social values (Kemp, et al., 2010; Goeft, 2008), it is particularly important for industrial managers and decision makers to inform themselves regarding water values. Understanding values is important because they assist to guide the selection and evaluation of behaviour and action (Schwartz & Bilsky, 1987), including action towards the environment.

This paper is intended to inform members and the larger audience of the Global CCS Institute of values and meanings relating to water in Australia, how these values break down by demographic group, and previous successes and failures in involving Australian communities in water-related decision making. In doing so, it aims to support mutual understanding and effective two-way engagement between the carbon capture and storage (CCS) industry and Australian communities, given that CCS, as an energy technology with potential impacts to water sources (Newmark, Friedman & Carroll, 2010), is stepping into fraught terrain.

Water values and demographic differences

An "immense range" of literature contributes to an understanding of how people perceive and attribute meaning to water (Burmil, Daniel & Hetherington, 1999, p. 99). People perceive diverse values in water: some are economic and practical, others are ecological, others are aesthetic and recreational, and others are religious in nature (Burmil, et al., 1999). Values have been studied by diverse social researchers, some who focus on culture as a main frame of reference, and others who focus on behaviour, and whose contributions this report emphasizes. Values are defined by Schwartz and Bilsky (1987) as personal concepts of desirable outcomes or desirable behaviours; they are broader than any specific situation, ranked relative to other values, and function to guide how behaviours are selected and evaluated. Values are relatively stable, though able to change over time (Rokeach, 1973). They are organised into value priorities, which are organised into value systems, which help guide behaviour and help individuals decide among courses of action (Rohan, 2000).

A review of the social science literature shows that the values seen in water appear to differ by a few key types of demographic categories and patterns of interpersonal difference, people's perceptions and understanding of risk and how risk associates with water:

- **Professional identity** is important for values of water because it requires seeing and relating to water in specific ways. Water's economic value to diverse industries and development projects is undeniable (Prosser, 2011). Individuals in mining and industry value water as an inexpensive commodity, part of the larger production process (Ringwood, 2006; Strang, 2009). Farmers identify with their ability to provide the larger society with agricultural output, and water is essential to them as part of the "stewardship" of the land they express by managing it for crop production (Strang, 2009).
- **Residential location** matters to water values because different geographical locations are not only associated with different professions, but also because they give people the opportunity to engage in

different water use practices: maintaining suburban lawns, building dams, and irrigating extensive fields (Strang, 2009). Use of water has value for displaying personal identity and place in society, both for rural and suburban residents (Askew & McGuirk, 2004; Strang, 2005b).

- **Cultural and religious heritage** affects how water is valued because different worldviews and religions have different understandings of the relationship between human beings and the rest of the natural world (Rose, 1996; Strang, 2005b, 2005c). In Australian Aboriginal religion, water may be valued as a living being (Rose, 1996) and the repository of individual and clan identity, whereas for a person who identifies as Christian, water may be valued as a resource given from God and a reminder of Him, but not a being in and of itself (Strang, 2005c). These different views of water imply different ways to relate to it.
- **Risk perception.** Being aware of how individuals perceive and respond to risk is crucial in understanding stakeholder values, attitudes and behaviour to water. Gaining an awareness of the many and complex social and cultural norms that influences stakeholder values, will assist the CCS Industry to better understand and respond to stakeholder concerns. As individual risk perception is influenced by past experience, knowledge or access to knowledge, and perceptions of trust in the source of such knowledge and degree of complexity attached to the risk, it is important when communicating with stakeholders of the risk and benefits of CCS that the Industry brings strong leadership to the discussions. Leadership that is based on integrity and good will that is transparent and open, and supports trust in both the source and the information toward encouraging rational, factually based risk decisions.
- **Environmental and ecological values**. When communicating with stakeholder groups the CCS Industry should consider carefully the different stakeholder groups' environmental values toward water, particularly those that centre on environmental concerns around the health and management of ecosystems, stewardship of land and water, and the conservation and biodiversity of these resources. Of equal importance is an understanding of the many social issues that accompany an environmental understanding of the value of water, such issues include for example infrastructure to support clean drinking water and sanitation, impacts on agriculture and the food industry. Attention to these concerns will ensure balance between the competing environmental and economic concerns that go hand in hand with human survival (Lacey, 2009).

Broader topics and concerns

Review of social scientific and associated literature has furthermore shown that certain patterns of topics arise in conversations and debates that are ostensibly about water. It appears that Australians are likely to associate water with concerns over scarcity and social conflict, the dangers of contamination, and over individual and group identity. After discussing values of water and how they break down by demographic groups with different worldviews, this paper will address a few more of these "other things" that Australians might actually be speaking about when they are talking about water. When individuals are discussing water, these other concerns are most likely hovering around the edges of the conversation—and are relevant to Institute members and industries that seek to engage in conversation with communities while avoiding "talking past one another" while engaging with communities.

Successful practices for water-related community engagement

Given the breadth of topics that are connected to water, and the highly personal and also political nature of some of these topics and values, any industry proposing a new type of development work that relates to water will need to act and communicate very carefully regarding their interests and intentions.

The third chapter describes four scenarios of water-related controversy in Australia: (1) water management via the Murray-Darling Basin Plan; (2) the Toowoomba Water Futures proposal; (3) Cougar Energy's work in underground coal gasification (UCG) in Kingaroy; and (4) coal seam gas (CSG) and its opposition across Australia. The relevance for CCS lies in various lessons learnt about how community engagement may succeed or fail, and how certain opposition movements have developed. Insights are offered by the examples of UCG in Kingaroy, recycled water in Toowoomba, and CSG and water management planning across Australia.

Recommendations

The results of this literature review imply the following recommendations for engineers, managers, and project participants in the global CCS industry:

1. The review reported that the CCS industry need to continually inform itself of, and monitor, the arguments being made against UCG as well as CCS specific water related incidents. **This includes a recommendation that the Institute support research into these concerns**, including the objections that people have to UCG, CCS and water—such as the groundwater contamination and transparency concerns related to UCG at Kingaroy. It is suggested that a national level survey and a series of workshops be utilised to capture data and insights be provided to the CCS industry on possible implications and practical recommendations.
2. There is a need for the CCS industry to **engage in a conversation regarding risk and benefit that is able to encompass a broader scope of concerns** than the technical likelihood or improbability of danger to aquifers due to of CO_2 leakage.
    a. Water's ability to have value in symbolizing personal identity and connection to place, and its ability to express power relations as well as meanings of purity and contamination, raises the **risk that industrial groups or CCS projects perceived as "outsiders" will be seen as threatening to individual and community well-being** if they take actions that could affect water resources.
    b. Awareness of different individual risk perception and the influences that drive these may provide insight into better understanding and responding to stakeholder risk assessment and decisions. **Relating back to recommendation one, this scope could be captured in a social science research project** and could provide foundational understandings to the industry on CCS specific perceptions related to water usage, potential contamination and their influence on public acceptance of CCS.
    c. In order to ensure integrity, good will, and transparency in engagement and communication with stakeholders and to build trust in both source and information will require strong leadership from the CCS Industry.
3. Professionals in engineering and managerial roles should remain aware that they may approach water-related issues with a different perspective than community members. Specifically, they may be less inclined to focus on its spiritual and aesthetic dimensions as opposed to its physical and scientific properties and the more tangible benefits it offers.
    a. As they ask a question or make a statement about water, members of the technical community working in CCS need to make an effort **to explicitly or implicitly convey to their audience that they are aware** that they are speaking about a substance with aesthetic, ecological, religious or spiritual, and recreational value, potential benefits to community and personal identity, as well as economic value.
4. Industries, projects, and research efforts perceived as water-related should **use existing best practices for community engagement.**
    a. To quote from authors Russell and Hampton (2006), "The key points have been spelled out repeatedly in the water sector as elsewhere:
        - that processes should be transparent
        - that people should be given comprehensive and credible information
        - that deliberation should encompass general water management in a region and start before specific [projects] are planned
        - that there should be open discussion of possible problems, and
        - that people should be informed at the outset of the extent to which their preferences will be taken into account."
5. Industries, projects, and research efforts perceived as water-related should take the **opportunity to conduct additional social research and to incorporate social science expertise**.

a. There is a need for additional research on Australian water values. This may include a media analysis on water-related issues experienced by industries similar to CCS, and the convening of focus groups to further explore community attitudes towards the intersection of water and CCS.

b. There is a need for additional research into water-related controversies experienced in Australia by other industries that pursue work underground that can be perceived as putting water resources at risk.

Part I Introduction

1 Introduction

Historically, water has been highly controversial in Australia (Powell, 2000), and values and beliefs around it are deeply felt. Australia not only has high rainfall variability, but also the lowest proportion of rainfall converted to runoff, related to significant evaporation of rainfall during its slow passage into rivers and streams (Prosser, 2011). Contemporary water use marks a stark contrast between scarcity and appetite: Australia is the driest inhabited continent on earth (James, 2003), yet its citizens were the fourth-highest water users per capita in the OECD in 2006 (OECD Environmental Performance Reviews, 2006).

All over the world, water is a highly valued substance for human wellbeing (Bark, MacDonald, Connor, Crossman, & Jackson, 2011). Across multiple cultures, the meanings associated with water range from the essence of life; the connecting fabric of a community; the substance of social identity; the means for maintaining health, wealth, and social order; and the means to social power and agency (Strang, 2005a, 2005c). This cross-cultural importance of water can only be magnified by Australia's relative water scarcity.

In light of longstanding histories of water conflicts, such as those related to the Murray-Darling river system (Chenoweth, Ewing & Bird, 2002) and recent water contamination controversies in Queensland (Australian Broadcasting Corporation, 2011), it is essential for any industrial or research group doing work in Australia that may be perceived as water-related to seek information on public attitudes towards this substance.

One such technology is carbon dioxide capture and storage (CCS). Subsurface geologic storage of carbon dioxide (CO_2) tends to be located under cap rock formations and at depths far below drinking water sources; i.e. below 800 meters (IEA Greenhouse Gas R&D Program, 2008). However, people may still understand that drilling to inject CO_2, and the injection and post-injection phases of CCS, will put groundwater and aquifers at risk (Little & Jackson, 2010; Newmark, Friedmann & Carroll, 2010; Orcutt 2010). As a water consuming technology, the incorporation of a CCS facility (such as an amine-based system) at a power plant can effectively double the volume of water required for the power plant if using conventional wet cooling towers. Although the volume of water used may fluctuate depending of the method of cooling applied, i.e. dry cooling methods require less water (Zhai, Rubin & Versteeg, 2011). CCS can therefore be a water intensive industrial process requiring informed understanding by local communities of the impact such a process may have on local water demands.

To fulfil its potential, as described by the International Energy Agency (IEA) and the Global CCS Institute (Global CCS Institute, 2011; IEA, 2009) as a greenhouse gas mitigation option, CCS must be seen as acceptable by people and communities (Ashworth, Boughen, Mayhew & Millar, 2009). If they proceed without adequate understanding of what water means to people, CCS developers could accidentally inspire social backlash and resistance. Uninformed, poorly chosen, or careless communication and action by the CCS industry regarding water could significantly damage prospects for CCS's future as a carbon mitigation option. Perceptions that CCS is related to coal seam gas (CSG) mining, underground coal gasification (UGC) technology, or both could associate it with the controversies that have attended the development and implementation of those technologies.

This literature review was undertaken to inform a broader research project to assess how Australians of all demographic groups value and understand the multiple uses served by their water sources. The ultimate goal is to inform Institute members and projects of social issues to anticipate as they make plans to inject CO_2 underground. This review will therefore (1) describe concepts, values and meanings relating to water and water use in Australia; (2) suggest how these values break down by demographic group; and (3) review what approaches, tools and practices have successfully involved people and communities in water-related decision making—or have failed to do so in ways that suggest a lesson for Institute members.

1.1 Relevance of water to Australian CCS R&D

The need for CCS advocates to discuss water carefully and thoughtfully stems from characteristics of the Australian context, as well as characteristics of CCS itself and what it shares with certain other technologies.

Australians have undergone a great deal of water scarcity (Australian Government, 2006), and also flooding (Geoscience Australia, 2011), paving the way for them to conceptually associate water with the ideas of drought and the need for conservation. “Almost every year, some part of Australia experiences drought” (Prosser, 2011, p. 5). The country is “now facing a shift in climate that is likely to lead to a drying of our landscape and perhaps increased variability in our drought-flood patterns” (Cullen, 2007, p. 98). When the total volume of water approved for removal from a river exceeds the average annual flow of that river, the river is said to be “over-allocated” (Victorian Women’s Trust, 2007, p. 29). In 2000, 168 of Australia’s 538 groundwater management units were either fully allocated or over-allocated; 55% of total water use derived from over-allocated surface water systems; (Australian Natural Resources Atlas, 2009) and over-allocation still exists today (Prosser, 2011). Additionally, issues surrounding excessive water extraction, soil salination, algal blooms and ecological degradation now plague the Murray-Darling Basin river system (Connell, 2007, p. 17-19), which is the most developed of all of the country’s rural water resources (Prosser, 2011).

Conflicts over water as a scarce but essential resource appear deeply rooted in Australia’s national historical consciousness. Early on, conflicts over waterholes occurred between settlers and indigenous people (Jackson, Stoeckl, Straton & Stanley, 2008). During the early settlement of the Northern Territory, north Queensland and Western Australia by Europeans, water resources were perceived as abundant, and little long-term planning for water management apparently took place (Jackson, et al, 2008). Australian cities such as Sydney were founded around water sources: Sydney was founded around the “tank stream” at Port Jackson in 1788, and Perth, Adelaide and Melbourne all similarly started with small, decentralized water infrastructure. For each of these cities, overuse of the water source and the spread of disease became a concern, leading to transitions to centralised water systems (Chanan, Kandasamy, Vigneswaran & Sharma, 2009).

More recently, water concerns related to the CSG industry have been raised over the hydraulic fracturing process (Roarty, 2011) and the risks of BTEX contamination of groundwater (Minister for Natural Resources, Mines and Energy and Minister for Trade, 2010). Also, sources reporting on Cougar Energy’s UCG pilot at Kingaroy have documented concerns over groundwater contamination and over the transparency of industry’s processes for responding to these concerns (Feary, 2011; Grayson, 2011; Grunt, 2011; Hueppauff, 2011; Sollars, 2011).

In addition to the emerging concerns regarding CSG and groundwater, social researchers have long noted some evidence that large infrastructural projects are often not universally accepted by their constituents: two examples are rural wind farms (Devine-Wright & Howes, 2010; Nadaie & Van der Horst, 2010; Pasqualetti, 2011) and dams, such as the Traveston Dam (Arthington, 2009; Wasimi, 2010). The case of community rejection of recycled water in Toowoomba, which will be discussed later in this report, is another example. Any industry planning large-scale technical interventions would do well to consider that people may reject and resist such projects for different reasons than industrial stakeholders themselves might have anticipated.

CCS, as an energy technology has potential impacts to water sources, such as by increased demand or “contamination of groundwater through leakage or brine displacement” (Newmark, et al, 2010, p. 651). As such, it may be associated with these concerns related to other controversial energy technologies of UCG and CGS. Given the existing link to water—and the fact that water has inspired many conflicts in Australia, particularly when related to subsurface industrial activity—it will be important to consider water values so as to take them into account while designing processes to make decisions regarding Australian CCS.

1.2 Importance of social and cultural research on water

Many people in positions of power or decision-making authority do not give significant attention to social values and how they vary across groups. Historian J.D. Powell (1991) describes generations of Australian engineers and managers who have approached water as a needed 'resource for development'—a resource that was abstract, without history. Today's engineers and managers working in the development of regions and institutions may see it in the same way (Bolitho, 2003; Henderson, 2010). Neglect of historical and social considerations by engineering and management professionals may also take place within the global CCS community, which researchers have characterised as an "epistemic community"; this concept means a group of professionals engaged in a shared knowledge-producing enterprise who share similar perceptions, beliefs, and political leanings (Stephens & Hansson, 2011).

Placing emphasis on efficiency, control, and industrial productivity is only one way to see water, and it may inadequately represent the broader community's perspective, thereby setting the scene for a clash of worldviews. Syme and Hatfield-Dodds (2007) mention that water management professionals are more likely to "emphasize efficiency, control, and industry outcomes," whereas communities think more broadly about how benefits and risks are distributed (p. 12). The tendency of managers to see resources as devoid of cultural meanings, whilst communities perceive them in different ways, highlights the importance of pursuing social research on how value and meaning are attributed to water and how to communicate and engage effectively amidst this diversity.

Consideration of water values is essential because it is one way to discover the differences between people's practical engagements with water, and thereby to improve one's ability to communicate about water across cultural differences. These differences run so deep that it may be said that different people who look at water do not even see the same thing. Considering values, and seeking to understand what water means for people, may lend insight into how they may react when they encounter the possibility of storing CO_2 deep underground beneath aquifers. Any insight into these reactions, and how other potential water controversies have been diffused or prevented in the past, will support CCS advocates in discussing water-related social concerns in a respectful and more comprehensive way.

1.3 Water governance

Governance is an inclusive concept that actively recognizes the relationship and dialogue between society and government (Rogers, 2002). This includes the various interests of civil society, government, and the private sector as well as the partnerships, and networks that exist between them (Pierre, 2000). Hence industry, such as the global CCS industry, may be thought of as a participant in governance (de Coninck & Backstrand, 2011; Rosenau, 2007). Water governance systems are concerned with how institutions behave and regulations affect political action and the prospect of solving societal problems, such as efficient and equitable allocation of water resources (United Nations World Water Assessment Programme, 2003).

Values, behaviour, and action regarding water are important to water governance. To date, a managerial and economic approach to valuing water has assumed dominance in discussions of water in Australia (Alston & Mason, 2008b). However, social researchers (e.g., Alston & Mason, 2008a,b; Ashworth, 2011b; Crampton & Ragusa, 2008; Goeft, 2008; Howard, 2008; Jackson, Stoeckl, Straton & Stanley, 2008; Miller & Buys 2008; Syme, et al., 2008) have been working to balance this perspective with a recognition of the other values and meanings water holds. Researchers argue that a dialogue of values between stakeholders will build trust and initiate much needed public participation in water governance (Pellizzoni, 2004). Incorporating values in the formulation of a water governance system can yield a socially acceptable system that will create the proper environment for the intended results of sustainable water governance policies (e.g. conservation, equity, accessibility, affordability, meeting consumer needs, and clean drinking-water) (United Nations World Water Assessment Programme, 2003). Increasing public participation will provide decision-makers with a way of learning and adapting to shifting values and changing societal conditions (Khan & Gerard, 2006).

What is good water governance?

According to the United Nations, good water governance requires public participation in decision-making at the water service area (i.e., local) level. This enables various stakeholders to share their experience, knowledge, understanding of the local societal conditions (United Nations World Water Assessment Programme, 2003, p378), the protection of human rights to water and the pursuit of sustainability. There are barriers to public participation which must be addressed by decision-makers to maximize the benefits of good governance, and there are drivers, for instance trust, that facilitate public participation. Many barriers to participation exist; some examples are a negative view of authority and a lack of awareness about the opportunities to participate (Lowndes, Pratchett, & Stoker, 2001a; 2001b; Lowndes & Wilson, 2001). As Runge (1992) states: "By institutionalizing a degree of fairness in the face of random allocation (e.g. rainfall), common-use rights may contribute to social stability at the same time that they promote efficient adaptation to changing resource availability" (p. 33). Chapters 3 and 4 will return to the questions of broad participation in water governance, but a full consideration of best practices for achieving fair and democratic representation is beyond the scope of this review.

Ostrum (1992) argues that to "begin to specify the conditions that are conducive to the emergence of coordinated, rather than independent actions by the individual users of a common pool resource" (p. 297), stakeholders will need to be given full and accurate information about (1) the physical structure of the resource, (2) past actions of other appropriators, (3) the relationship of demand to yield, (4) benefits and costs of various outcomes on different individuals and organisations, and (5) the likelihood other stakeholders will keep their promises. In doing so, regions can become more effective in anticipating issues and organise to prevent them, especially when water scarcity is pervasive (Simmons & Schwartz-Shea, 1993).

Good water governance, and participatory approaches to governance, offer many benefits, for example, greater levels of trust between stakeholder groups (Khan & Gerard, 2006). Appropriate governance relates to broader social ideals, or values that are not attached to any one particular object or substance. Approaches driven by the participation of multiple stakeholders and perspectives build a diverse picture of water values, and provide for justice and fairness (Lacey, 2009). More details on specific better and worse practices and approaches to water governance are presented in chapters 3 and 4.

What high-level policy framework is now in place in Australia?

The Australian Government's Water for the Future program, of which both the Water Act 2007 and the National Water Initiative (NWI) are important components, establishes a framework for extensive reform around water use in Australia supported by national and state legislation and regulations relating to water, agriculture, conservation and environment, and the petroleum and gas industry (amongst others). The Water for the Future program seeks to: act on climate change; ensure the wise use of water across the nation; secure national water supplies; and support the health of the nation's river system (Department of Sustainability, Environment, Water Pollution and Communities, 2012). Included in the program's reforms are functions and roles of the National Water Commission (NWC) and the Murray-Darling Basin Authority (MDBA).

Since its launch in 2004, the NWC has implemented various projects including the NWI – established to implement wide sweeping changes to Australia's sustainable water management processes. The NWI undergoes biennial assessments to ensure its currency and relevance to assure ongoing sustainability of Australia's water supply and to meet the needs of the nation's many water stakeholders (NWC, 2011). Discussion paper submissions that help to inform the final 2011 assessment paper raised concerns of an unbalanced approach to implementing aspects of the reforms by the NWI (Queensland Farmers Federation, 2010).

The MDBA is charged with preparing the Basin Plan (currently in draft format) and implementing and enforcing the plan once adopted by the Australian Government (MDBA, n.d.). The MDBA has come under significant criticism by various stakeholders for the way in which it has addressed the consultative component of the Basin Plan development. Stakeholders such as the National Irrigators Council and the Murray Group of Concerned Communities cite an overall lack of engagement as a major concern,

particularly in reference to the period leading up to release of the recommendations of the draft plan and the minimal time permitted for comment (National Irrigators Council, 2010; Murray Group of Concerned Communities, 2010). Further detail on the Basin Plan is presented in chapter 3 as a case study in water governance and public participation.

Risk Management

The concept of "risk" is recognised as difficult to define (Tsohou et al., 2006; Frosdick, 1997, Gerber & von Solms, 2005) and differs between people (Slovic, 1987). It can be described as "something that is experienced or felt (real or perceived) by an individual, social group or economic unit" (Frank, 2011; Lacey and Moffat, 2012) and is often referred to in relation to hazards. Though hazards relating to water can be identified, such as contamination or loss of access; the degree of risk assigned to such hazards depends on a "complex interplay of a number of social variables" (Tsohue et al., 2006, p.199) influenced by human judgement. How risk is perceived differs across stakeholders, with experts and risk professionals perceiving risk differently to lay people. The combination of these different social influences and the uncertain nature of risk and its evaluation can make risk assessment difficult resulting in what may at times appear to be irrational decisions.

It may help to understand the different ways in which risk is assessed. Experts and risk professionals utilise a structured process of risk assessment to evaluate hazards and form strategies towards management and mitigation of a risk (Tsohue et al., 2006). Risk assessment involves formulated approaches that model the impacts of incidents – accidents, pollution, contamination, sabotage, tampering and so on – viewed primarily in terms of harm (victims – death or injury) and potential loss or damages (direct and indirect; financial and non-financial) (Slovic, 1987). Using logical reasoning, scientific understanding and deliberation to assess risk and inform decision making, water related risk management programs apply evaluative processes to identify threats and/or vulnerabilities, assigning quantifiable values through probability modelling to identify realisable impacts and costs, and industry or organisational tolerance levels to such risks. From these, remedies and possible controls are identified. Controls may include risk transfer (to a third party), acceptance (inability to control), avoidance (no exposure) or reduction (control measures). Mitigating risk in these situations involves designing, implementing and monitoring a risk management program tailored to specific water risk profiles (Tsohou, et al., 2006).

Risk management programs plan for the future, usually in terms of the lifetime of an event or project; this can be years and sometimes decades. In the case of water, water management programs seek to understand short to long term impacts of different factors such as population growth, rain and weather patterns, domestic, industry and agricultural requirements (Morel, 2006; Argyroudi, 2009; Lacey, 2009; Biasi, 2011). This forward planning has not historically accounted for "higher order impacts" (Slovic, 1987, p.284) or "wicked problems" (Adler & Kranowitz, 2005, p.12) considered 'diabolical' due to their complex nature and often far reaching implications spanning beyond a projects lifetime and boundaries; such as experienced following events of major environmental and ecological destruction, such as Chernobyl and the Three Mile Island nuclear incidents, or the Exxon Valdez oil spillage (Ricci, 2006). The ripple effects of these and other similar events have far reaching implications involving enormous cost and social impacts on industry and society (Slovic, 1987) and involve "multiple stakeholders, overlapping jurisdictions, and powerful moral dimensions," invoking memories of "deep, nasty and much remembered histories" (Adler & Kranowitz, 2006, p.11). In light of such experiences, risk management seeks to quantify and forward plan for such impacts, however this can be difficult to achieve when the risks are unknown.

Individuals use feeling based risk assessment relying on intuitive, quick and often automatic responses to hazardous situations (Slovic & Peters, 2006). These assessments are based on a multiple of factors, such as personal experience, or what an individual may have seen, heard, read (in the mass media for example) or been told, and are most frequently the result of deeply seated cultural and social beliefs and values adhering to mostly stable biases. Biases however may change depending upon the social structures across which an individual moves (Tsohue et al., 2006). Some risks, such as underground water depletion from overuse or contamination of potable water, however are not always immediate or evident, requiring consideration beyond the present. Individual assessment of non-immediate risks is considered to be "analytical, deliberative and verbal" (Slovic & Peters, 2006, p.322). Meaning based responses, "risk as

feelings" and "risk as analysis" (Slovic & Peters, p.322), reflect cultural and social beliefs and values, which in turn influence individual favourability measures and perceived benefits associated with a risk.

Research has found that high risk activities are more frequently positively viewed in light of the benefit they may bring, however this positive effect alters significantly dependent upon whether or not an activity or event is viewed as favourable, and whether or not the risk carried is perceived as voluntarily or involuntarily. When assessing activities considered being both favourable and voluntary individuals tend to positively assign low risk and high benefit potential. For example driving a car or skiing, even though statistically the risks associated with these activities are high the benefits that can be achieved are considered sufficient to warrant the risk (Slovic & Vastfjall, 2010). However, when an activity or event is considered unfavourably and the risk involuntary, any benefit that might be assigned to the risk is likely to be negatively viewed as low – particularly when the impacts are unknown – and the risk more frequently perceived as high.

In addition to cultural and social influences, an individual's favourability measure may be significantly impacted by past experience (self and others) that align to feelings of dread (Slovic & Peters, 2006), such as invoked by well documented catastrophes and disasters similar to those mentioned above, particularly if perceived as a potential threat to self, or others close to self. However, research has shown that in some circumstances, when the sense of proximity is considered far away or distant, risk assessment of catastrophic events with large mortality rates can be perceived as low where no immediate localised impact is anticipated. An inverse affect can also occur when feelings of dread or uncertainty of the unknown and individual moral and ethical convictions project forward to future generations (Visschers & Siegrist, 2008).

In most circumstances individuals instil information with meaning however such meaning can be misleading (Slovic & Vastfjall, 2010). When responding to risk, whether known or unknown, immediate or far reaching, individuals may respond with feeling to known or perceptions of known risks from past events, the favourability the individual assigns to the events and their perception of the voluntariness of the risks associated.

Trust in Information and Source

Research indicates that information source and the level of trust placed in the source are important factors for consideration for further understanding the risk choices of individuals. Trust can be defined as a "willingness to make oneself vulnerable to another because of expected beneficial outcomes" (Earle et al., 2007; Visschers & Siegrist, 2008 p.157). As with feeling based meaning, trust is strongly impacted by an individual's cultural and social influences. Terwel et al. (2009) conclude in their research on competency-based and integrity-based trust as a predictor of acceptance of CCS that trust in "organizations responsible for management of hazardous activities and complex technologies" (Terwel et al., 2009, p.1130) is a significant influencing variable in individual risk evaluation. Here trust is considered in terms of competency (experience and expertise) and integrity (honesty, openness and concern).

Adler and Kranowitz in their 2005 report "A Primer on Perceptions of Risk, Risk Communication and Building Trust" in relation to sequestration research, note the importance of approaching issues perceived as complex "wicked problems" such as CCS, from a position of strong leadership to bring "integrity, good will, trust and working relationships" (p.12) into play when communicating with stakeholder groups. Here it is noted that scientifically sourced information is likely to be trusted over information provided by organisations involved in the development and deployment of "risk" related technologies. Further, that benefit levels in relation to a risk are important influencing factors, as is the "distribution and nature of the hazard" itself (Adler & Kranowitz, 2005, p.15). In addition, the complexity of an issue, and how much knowledge a stakeholder has of the issue will strongly influence their understanding of how such an issue may be resolved. While perceptions of control bring another dimension to individual risk evaluation as this brings into play perceptions of the voluntariness of the risk assigned.

It is important for the CCS Industry to be aware when communicating with stakeholders that how and what is perceived to be a risk differs from stakeholder to stakeholder; that risk assessment can be either immediate and intuitive or deliberate and considered and that such assessment is dependent upon a

number of factors. Such factors include social and cultural norms and values, past experience, knowledge or access to knowledge, and perception of trust in the source of such knowledge, and the degree of complexity attached to the risk. Therefore, for issues of high complexity, such as in the case of CCS, communicating with stakeholders on the risk and benefits of the technology requires strong leadership from those with knowledge, i.e. industry and science, that is based on integrity and good will and works toward ensuring transparent open communication that supports trust in both the source and the information to encourage rational, factually based risk decisions.

Part II Values, worldviews and symbolism

2 Values worldviews and symbolism

Australians use water for agriculture, forestry and fishing, mining, manufacturing, electricity and gas supply, drinking water supply, household supply (Strang, 2009), power generation, sanitation, tourism, recreation and transport (Howard, 2008). This diversity of roles for water suggests a diversity of values that it may have to people.

First, this chapter will review and define what social scientists and other researchers understand by the concept of "value." Next, it will describe several key types of value that water offers to Australians:

- Economic and development value
- Ecological value
- Aesthetic and recreational value
- Spiritual value

Afterwards, the chapter will break these general values down by the key demographic groups which social scientists have found to value water differently, as part of different worldviews. Lastly, it will describe additional symbolic meanings that water is likely to have for Australians.

2.1 Values

Across the social sciences, values are widely viewed as a key determinant of human behaviour and social action. As deeply seated, psychologically-embedded beliefs about what goals are desirable and how those goals should be achieved, values help to shape all forms of human activity and strongly influence how people relate to each other and to the natural environment around them. In a world where human activity is at the root of widespread economic turbulence, social tension, and environmental degradation, there is a need to better understand how values affect behaviour, and more specifically, what values affect what behaviour. Given the essential role played by industry in modern society, examining the relationship between values and behaviour within an industry context is particularly important.

2.1.1 DEFINITIONS OF VALUES USED BY SOCIAL RESEARCHERS

Different definitions of values have been considered in the social sciences over the years. One interpretation notes values to be "single, stable beliefs, which are used as a standard to evaluate action and attitudes", transcending objects, being central to a person's beliefs and used to evaluate beliefs and belief connections (Heberlein, 1981). Schwartz and Bilsky (1987) also provide a comprehensive definition of values as: "concepts or beliefs about desirable end states or behaviours that transcend specific situations, guide selection or evaluation of behaviour and events, and are ordered by relative importance" (p. 551). In addition, Rokeach (1973) has outlined many of the key features of values and their distinguishing characteristics. He describes them as relatively stable though subject to change over time. According to Rokeach, "if values were completely unstable, continuity of human personality and society would be impossible" (1973, p. 6). While values are considered deeply held and enduring beliefs, they are not necessarily held consciously, and individuals may not even be aware of their personal values (Rokeach, 1973).

Social researchers have described a relationship among values, value priorities, value systems, and worldviews. Values are organized into value priorities, which work together to produce value systems, which in turn, form worldviews. Value priorities are the dynamic organisation of learned personal experiences and shared culture that is used to evaluate events and people, and select and justify actions (McClelland & Burnham, 1976; Schwartz, 1992, 1999; Rohan, 2000b). Value priorities influence perceptions

(Postman, Bruner, & McGinnies, 1948), and guide behaviour almost effortlessly, with little to no conscious awareness (Schwartz, 1996; Rohan, 2000). A value system is a relatively stable and predictable group of value priorities that help individuals and groups determine what is best for themselves and others (Rohan, 2000). Value systems are thereby related to individuals' worldviews, they significantly influence people to see the world in particular ways (Altemeyer, 1998; Parsons, 1948). As described by Rohan (2000), worldviews are primarily conscious beliefs about how things are or should be (i.e. perceptions of actual or potential realities).

What do values do?

Values do many things. On a basic level, values help individuals: (a) construct and cope with reality, (b) consciously/unconsciously formulate goals and (c) become successful members of social groups (Schwartz, 1987). This conclusion makes sense because values influence cognitive appraisals of situations (Feather, 1992), produce strong emotional responses (Barry & Wolf, 1965), and strongly influence (and immunize against) attitudes, beliefs, ideals, interests, and ideologies (Gudmundsdottir, 1990). Values also aid in the formation of social value systems (McLeod, Sotirovic & Holbert, 1998). These socially and cognitively constructed assumptions about social groups also influence motivational variables (and vice versa), affecting an array of factors that assist in goal development, such as effort and persistence, influencing how situations are constructed, conflicts resolved and decisions made (Rokeach, 1973; Feather, 1992).

According to Ball-Rokeach et al. (1984), values serve a dual purpose: to satisfy both individual and societal needs and demands; the ultimate goal being to help individuals discover and internalize their needs in accord with societal demands. Values transform individual needs into shared goals and behaviours that are "justified, exhorted, defended, and transmitted to succeeding generations" (Ball-Rokeach et al., 1984: p. 25), for the greater good. Such is the importance of values that they serve as the foundation for self-identity and concept, and the attitudes, beliefs, and actions generated through them. In light of this explanation, instrumental and terminal values may be conceptualised as types of social demands (Ball-Rokeach et al., 1984). The former and latter are socially desired behaviours (standards of judgment) and end-states, respectively.

Research into what values do can be grouped into two main categories: (a) behaviour-focused; and, (b) focused on culture and action. Given that the conceptualization of this literature review effort was more informed by the first of these research categories, this report's discussion of values primarily emphasizes a behaviour-based frame of reference, although it does also include insights from research addressing culture and action.

2.1.2 BEHAVIOUR-FOCUSED RESEARCH

Relationship between values and behaviour

According to researchers who emphasise human behaviour, values control, motivate (Rohan, 2000a; Schwartz & Bardi, 2001; Seligman, Olson & Zanna, 1996), predict (Rokeach, 1979; Williams, 1979), justify (Kristiansen & Zanna, 1988; Prince-Gibson & Schwartz, 1998; Rokeach, 1973), and direct (Rokeach; Schwartz, 1996; Seligman, Olson & Zanna, 1996) almost all behavioural outcomes (Williams, 1979). Fundamentally, they serve to establish and maintain pro-social behaviour (Feather, 1995; Hechter, 2000). According to Schwartz and Bardi (2001), values are repeatedly reinforced by social actors to define and elicit behaviour (as well as to justify demands); ultimately serving as internalized guides, relieving from particular groups the constant need for social control. Values inherent in laws, policies, practices, procedures, scripts, and customs serve to legitimise, interpret, sanction, and promote specific behaviours (Schwartz & Sagie, 2000). The issue arises when there is a conflict between these inherent values.

Some researchers have argued that values determine attitudes and behaviour (Gold & Russ, 1977; Gold & Robbins, 1979; Rokeach, 1973; Thomsen, Lavine & Kounios, 1996). In fact, research has shown the influence of values on attitudes and behaviour is pervasive (Mellema, 1995) and reciprocal. According to Klute et al. (2001), values are strongly influenced and mediated by behaviours and attitudes. Rokeach (1979) has shown extensively as well that values are significantly correlated with logically related attitudes

and behaviour. But, although values guide attitudes and/or behaviour, values are more likely to influence behaviour through attitudes than to influence behaviour directly (Braithwaite, 1997). Additional theoretical and empirical evidence clearly suggests likewise that behaviour influences attitudes and attitudes and behaviours are mutually reinforcing (Ajzen, 1988; Axinn & Thornton, 1992; Cherlin, 1981; Shuman & Johnson, 1976; Thorton, 1985).

Along with needs, values form the foundation of motivated human behaviour (Locke, 1991) and specify both desirable outcomes and the desirable means to their achievement. Values are held at the individual level but can also be shared in aggregate (Rokeach, 1979), and are thus relevant across multiple levels of analysis (Agle & Caldwell, 1999). As such, values help to shape the individual, organisational, and societal actions that will either advance or undermine long-term societal sustainability (Milbrath, 1989). Particularly important in this context is the ordered nature of values into value structures and hierarchies (Rokeach, 1973), as those values most central within the hierarchy (i.e. what is cared about most) will tend to have the greatest influence on individual behaviours and aggregate-level actions.

Relationship between values, motivation and goals

Motivation is an internal state that arouses individuals to act in particular ways (Ormrod, 2004). Since values have cognitive, affective, and behavioural elements (Maio & Olson, 1998; Rokeach, 1968), they are fundamental components of the motivational construct (Berndt & Miller, 1990; Fries, Schmid, Dietz & Hofer, 2005). According to Kilby "values are among the most powerful motivators, sometimes overriding such basic motives as fear, pain, and hunger" (1993, p. 73). Their ability to influence and give expression to basic human needs makes values quintessential to motivational processes (Rokeach, 1973).

According to Verplanken and Holland (2002), values are motivational constructs that evoke and guide the selection, fulfilment, and evaluation of goals (McLeod et al., 1998; Schwartz & Bardi, 2001; Verplanken & Holland, 2002). Goals are results toward which priorities and efforts are directed (Ormrod, 2004). Value systems represent an integrated, systematic, and coherent pattern of motivational goal types (Sagiv & Schwartz, 1995). In fact, the relationship between values and goals may be understood as reciprocal (Oishi, Diener & Suh, 1998).

2.1.3 CULTURE-FOCUSED RESEARCH

Relationship between values, culture and action

Many researchers accept that values are related to culture. Existing research in multiple disciplines takes values as the foundation of culture, or fundamentally important to it, inherent in cultural beliefs, practices, symbolic forms, knowledge, motivations, and skills (Cileli, 2000; Inglehart & Beker, 2000; Rokeach, 1973). Some social researchers argue that it is possible to study human values, culture, and actions without emphasizing the concept of "behaviour" (Shove, 2010), or considering behaviour choices to be driven by values and attitudes (Soufoulis, 2011). However, since research and theory of this type played less of a role in inspiring how this research project was conceptualised and planned, it therefore informs but does not comprise the main approach of this paper. A few key approaches and insights are reviewed below from researchers who study the interrelation of values, culture, and actions without emphasizing the concept of behaviour.

Some researchers argue for the importance of studying "practice" (Giddens, 1984; Schatzki, 2002; Reckwitz, 2002), and argue that "social theories of practice...and social theories of behaviour...are like chalk and cheese" in that the first considers "emergent dynamics," whereas the second considers "causal factors and external drivers" (Shove, 2010, p.1279).

Other researchers strive towards an "emic" or actors' point of view, rather than focusing on observable behaviours (Harris, 1976). Researchers and philosophers who believe that people participate in "action under a description" (Anscombe, 1957; Hacking, 1995; Sugarman, 2009) emphasise the importance of understanding people's own internal descriptions and understandings of what they are involved in, in contrast to focusing on externally observable behaviours.

Relatedly, anthropologists of science and medicine have contended that people interact with the categories (such as disease categories) that are available to them, as they come to identify with some labels and not with others, whilst the labels themselves come into existence and go out of existence over time (Hacking, 1999). A focus on labels or discourse, knowledge, identities, and values, such as this one, provides for "constructivist" accounts of social realities (de Coninck & Backstrand, 2011).

Researchers who do not emphasise the concept of behaviour see value in paying increased attention to political and infrastructural contexts, including the effects of infrastructure on practice; the confusing realm of subjectivity (Soufoulis, 2011); and the "cultural meanings, social purposes and practical effects" (Soufoulis, 2011, p.796) of resources and technologies (Shove, 2010; Sofoulis, 2011).

Approaches to culture, values, and action through social research that does not privilege the concept of behaviour have offered insights such as the following examples regarding risk perceptions. Authors Beck (1992) and Giddens (1991) argue that cultural and social context, particularly the loss of trust in institutions, are expressed by people in terms of specific ways that "risk" is perceived (Giddens, 1991; Lane & Ward, n.d., p. 16). Furthermore, authors Peters and Slovic (1996), in an approach they call "cultural theory", state that four different worldviews—hierarchical, fatalistic, individualist and egalitarian—describe what ideals people hold and how they understand the rules governing social structure. These authors argue that within each worldview, people have different perceptions of risk (Peters & Slovic, 1996; Lane & Ward, n.d).

2.1.4 ORIGIN, MAINTENANCE, AND MODIFICATION OF VALUES

The process of value formation is not completely understood by social researchers (Kristiansen & Hotte, 1996). However, some available research gives a portrait of how people generate, maintain, and/or modify values. There are definite paths (i.e. life conditions and experiences) that serve as prominent catalysts for the formation and modification of values (Inglehart & Baker, 2000; Klute, Crouter, Aline, Sayer & McHale, 2001). Among these paths are social, cultural, institutional, economic, and contextual systems and circumstances (Bengston, 1975; Inglehart & Baker, 2000; Kasser, Ryan, Zax & Sameroff, 1995), historical and ecological factors (Xiao, 1999), age, sex, and schooling (Hechter et al., 1999), media (Ball-Rokeach, Rokeach & Grube, 1984), technology (Rokeach, 1973), as well as various cultural themes and images (Tomkins, 1965; Mosher & Tomkins, 1988; Sarbin, 1995; St. Aubin, 1996; Bronfenbrenner, 1979).

The process of valuation, propagated primarily by human nature (May, 1967) and agents of change (Tatto, 1996), is direct and indirect (Sonnekus & Schulze, 2002), internal and external, and based on perceived and actual realities. In order for voluntary valuation to occur, some basic requirements should be considered. The most important factor is trust in role models, followed by interest, commitment, and participation (Finkel & Ernst, 2005; Schwartz, Melech, Lehmann, Burgess, Harris, & Owens, 2001). The likelihood of value transmission is also elevated as perceived levels of competence, credibility, perceived similarity, and enthusiasm increase (Pintrich & Schunk, 2002). These attributes, characteristics of role models, increase observational and vicarious learning (Bandura, 1977; Pintrich & Schunk, 2002). Attention is another basic requirement. Although enduring value change can be made in one experimental session lasting less than one hour, this is not generally the case. Values must be at times continually reinforced to produce desired end-states (Feather, 1990; Rokeach, 1973; Williams, 1979). In short, according to Inglehart and Baker (2000), "empirical evidence from 65 societies indicates that values can and do change [and will] continue to reflect a society's cultural heritage" (p. 49).

2.2 Values placed on water

Water is critical, both to meet the basic biological needs of people and other living beings, and also too for aesthetic, cultural and spiritual purposes (Burmil, et al., 1999). Water's huge diversity of roles in people's daily lives paves the way for it to be valued in multiple ways. The following section summarises some of these values.

2.2.1 NATIONAL DEVELOPMENT AND ECONOMIC PRODUCTION

The main audience for this report on water values is assumed to be members of the Institute and a broader readership in the CCS community. Given that the CCS community has been characterised by social scientists as an "epistemic community" with shared perceptions, beliefs, and political leanings (Stephens et al., 2011), this readership is assumed to share certain personal characteristics. It is possible that among these shared beliefs is a particular view of water or at the very least, it is possible that the views and water values held by this paper's readership are substantially similar to those of mining or other industrial participants, or to those of water management professionals. Generally, emphasising economic value is a tendency of engineering and management professionals. Syme and Hatfield-Dodds (2007) mention that water management professionals are more likely to "emphasise efficiency, control, and industry outcomes," whereas communities think more broadly about how benefits and risks are distributed (p. 12). As a consequence of the assumption that CCS industry professionals may already be approaching water with "efficiency, control, and industry outcomes" in mind, detailed explanations of water's economic value are not included in this report.

Although water has undeniable instrumental value for industry and agriculture, seeing water primarily from an "instrumentalist" viewpoint (Bolitho, 2003) as a means to economic productivity takes attention away from other value positions. This could lead to opposition and social conflict between those perceived as economically powerful and other members of society. According to Alston and Mason (2008b) Australian government agencies tend to view water as an economic resource to be preserved and protected, but fail to include social dimensions in their understanding of water and waterways (Alston & Mason, 2008b). They also argue that viewing economic interests as paramount leads to favouring some stakeholders over others (Alston & Mason, 2008a). The commoditisation (i.e. the process of treating a good, service, or resource as a tradeable commodity), private ownership and the sale of water have inspired societal resistance in many countries (Finnegan, 2002). Journalist William Finnegan (2002) sees this trend of resistance as linked to the persistent view that access to clean water is a fundamental human right.

2.2.2 ENVIRONMENT AND ECOLOGY

Value(s) in relation to water have multiple meanings across the natural sciences. Concern exists that the environmental and ecological sciences are experiencing a state of flux in the use of language interpretation and the establishment of a common understanding of the terms "value", "values" and "valuing" of natural resources (Reser & Benrupperbaumer, 2005). There is a perception of a blurring of the understanding and application of these terminologies both in practice (management) and reporting (scientific) with emphasis seeming to be focused on instrumental and economic values. (Reser & Benrupperbaumer, 2005). This apparently is particularly so in terms of the social and natural sciences, with an emphasis on conservation and heritage assignment of significant natural phenomena around the World, including in Australia. Attempt has been made however to draw distinctions between what is essentially economic as opposed to social perceptions of these terminologies in relation to the ecology and environment and its resources. How these distinctions may impact this research project's summation of environmental and ecological value around water therefore depends upon which premise an individual or power authority might take to interpret the terms "value", "values" and "valuing" when considering a natural resource. This may go some way to understanding aspects of the conflicts experienced across different stakeholder groups involved in the recent MDBA Basin Plan development process. In seeking to restore the MDB to an ecological state that existed prior to more recent decades of high water consumption, the MDBA has a difficult task in aligning its goals to those of the water systems stakeholders. Where stakeholder values do not reflect that of the MDBA which seeks to balance economic benefits with long term ecological survival of the resource, reaching a point of agreement of how water should be managed and allocated will continue to be fraught with conflict.

By further broadening the scope of this segment beyond the environmental and ecological sciences to include philosophical and ethical considerations, the meanings of "value" and its various extensions become even more diverse and complex; being simultaneously separate and intertwined. Within the

natural sciences, value(s) are often perceived in terms of tangible outcomes such as within finance and economics (instrumental value), and the less tangible more esoteric dimensions of psychology, society and the social sciences, culture, spiritualism and philosophy (contractual ethics [moral principles, motivations – individual and shared – influenced by desires and concerns] accounting for rational agent(s) actions, and justice [fairness in process and distribution]) (Scalon, 1998; Lacey, 2009).

Lacey (2009) cites Sagoff (2004) as identifying three ways in which the natural environment is valued: "we, use; respect; and appreciate it" which leads to three value judgements – we "make preference judgements" in relation to its use, "moral or ethical judgements" regarding how we respect it, and "aesthetic judgements" regarding our appreciation of it (Sagoff 2004; Lacey 2009). Individuals make preference judgements regarding what is good, or of benefit, to them based primarily on welfare perspectives, utility maximisation and preference satisfaction. Moral or ethical judgements tend to be more general and focus on "what is right in principle" taking a societal or collective view in regard to both the present day and the future. Aesthetic judgements on the other hand focus on more intrinsic considerations of what is good in itself, or what is "beautiful and worth appreciating about nature" (Lacey, 2009). Such values are considered intrinsic due to the ethical and philosophical property placed on the environment and its resources, including water, being considered to hold in their own right for their own sake and not as a means to an end. It is important for the CCS Industry when communicating with stakeholder groups to consider different stakeholder's environmental values toward water, particularly those that centre on environmental concerns around the health and management of ecosystems, stewardship of land and water as a resource, and conservation and biodiversity. It is also important that the many social issues considered vital to an environmental understanding of the value of water are considered, such as infrastructure to support clean drinking water and sanitation, agriculture and the food industry and so on, to ensure a balance between the competing environmental and economic concerns with human survival (Lacey, 2009).

2.2.3 AESTHETICS AND RECREATION

Australian use of water for aesthetic and recreational purposes embodies several of the meanings of water which anthropologist Strang (2005c) believes occur in multiple cultures: first, support for health; and second, the generation and regeneration of the environment and of people. Aesthetic and recreational experiences with water can be active or passive (Burmil, et al., 1999). Social scientists have shown that views of water produce "beneficial psychopathological effects" (Burmil, 1999, p. 104) deserving of further exploration.

The aesthetic value of water can be experienced in diverse settings, both human-designed and also "wild". In focus groups conducted in Northern Australia, diverse participants referred to "a wide range of humanitarian, symbolic, and affective values" when describing water and rivers, including a life-giving role, a place for maintaining social connections, and a place to seek out a sense of being "overwhelmed, awed, or humbled by 'nature'" (Jackson, et al., 2007, p. 283). Water has particular value to people as part of arid landscapes, such as some Australian landscapes: it produces sounds, reflections, dramatic sculptured landscapes, oases, and other vegetation patterns (Burmil, et al., 1999). Some of the ways it creates value in an arid landscape are by defining "places" and enabling locations to take on a human "scale" within an otherwise immense landscape, increasing the perceived order and readability of the landscape (Burmil, 1977, p. 103-104), and creating juxtapositions and contrasts which increase aesthetic value (Kaplan, 1977 in Burmil, 1999).

Similarly to aesthetic value, water's importance for recreational value has been recognised on multiple levels. The use of water in sports and recreational activities—where "recreation" can be read literally as allowing participants to rebuild their "health and energies"—demonstrates water's role as a "vital source of life" (Strang, 2005c, p. 7). The Australian government, while speaking of water management planning, refers to "lifestyles and livelihoods" of a specific watershed area, particularly recreational fishing (Jackson et al., 2008), as worth preserving. Especially in such a dry inland environment as Australia's, some have said that the "amenity" value of water-based recreation is important to the public, and can bring in high levels of tourism with associated financial returns (Howard, 2008).

In fact, multiple researchers believe that Australia's natural features, including water bodies, are valued for aesthetic and recreational purposes to an increasing extent (Howard, 2008). Argent, Smailes and Griffin (2007) describe a "post-productive transition" in Australia's countryside around early 2000s, such that "extractive, land-based industry" is no longer the main determinant of the value of rural space (p. 217). Jackson et al. (2008) argue that as of late 2007, public attitudes towards tropical rivers had shifted from a "development focus" looking to exploit a resource, to a broader perspective that is more likely to consider "post-material" social values (p. 282), such as benefits to cultural identity (p. 275). Holmes (1997) argues for a similar transition in rural resource use and resource policy, meaning that Australia's rangelands are becoming increasingly valuable for "amenity" purposes rather than solely for agricultural outputs.

2.2.4 SPIRITUALITY AND RELIGION

Water plays a role in the traditions of multiple major religions. In Christian creation belief, God gathers the waters into one place to make way for land (Burmil, et al., 1999). As will be described in the next section, Aboriginal Australian legend tells of ancestral beings emerging from water sources (Strang, 2002), and water sources are also the source of new life for human beings and for connection to community and country (Strang, 2002; 2005b). In Islam, water is an important element of the "eternal gardens...promised to the faithful" (Burmil, et al., 1999, p.102). It symbolizes the transition between life and eternal life to the ancient Egyptians, who lived on the eastern bank of the Nile, and had their tombs on the western bank (Burmil, et al., 1999).

Water has spiritual value in many religions in that it is associated with purification and cleansing, due to its ability to absorb and carry away the debris of life (Preston, 1987 in Lahiri-Dutt, 2006, p. xv.). Contact with water, especially the Ganges, in Hindu society enables people to leave their sins behind, including the sins of previous lives (Lahiri-Dutt, 2006). In arid landscapes, water symbolizes "purity, sanctity, and rebirth"; since it provides a sense of cleanliness and refreshment, it is also associated with sensations of regained energy, youth, and health (Burmil, et al., 1999, p. 101).

2.3 Worldviews

Both values and beliefs regarding what is and is not acceptable or permissible for human beings to do to the environment differ across groups of people (Strang, 2005b). To say that people in different demographic groups see different values in water and behave differently towards it is a way to raise the topic of worldviews. This section argues that when assessing water's meaning and value, it is important to consider the following demographic differences: religion and cultural background; occupational category; and residential location.

2.3.1 PROFESSIONAL CATEGORY PERSPECTIVES

Professional identification with a particular type of work (occupational category demographic) and personal identification with a "home" and household terrain (residential location demographic), are key ways in which individuals make sense of their place in the world. In addition, people of different professions will have different amounts of exposure to ideas and values related to preserving environmental resources: A study conducted by Hurlimann (2006) found variation by occupational group, with participation in jobs that relate to sustainability seemingly increasing happiness to use recycled water (Hurlimann, 2006). This section will consider patterns social scientists have found in how rural agricultural professionals and urban and suburban garden keepers engage with water. In many ways, this discussion of occupation and geography foreshadows the next section's "broader topics" that water conversations tend to raise.

Rural agricultural and pastoral perspectives

Social scientists have described or speculated about an "adversarial" edge to the relationship between graziers and the natural environment and a tendency to conceptualize "nature" as a hostile force (e.g.

Mulcock, Pocock, & Toussaint, 2005). Graziers may see a certain hostility in the environment's unpredictability and ability to thwart human plans and aspirations via floods and droughts. At the same time, pastoralists have the opportunity to see the landscape as resource-rich and promising; in a sense, then, they can retain a "settler" attitude towards the continent and its features and resources, such as water (Mulcock et al., 2005).

Social scientists have also suggested that the relationship between pastoralists and the natural environment is mediated by types of material culture that symbolize ways to keep both nature and water under human control, in service of a particular type of productive creativity. The keeping of livestock, appearing to not only be associated with a controlling and technologically-mediated relationship with the landscape, but also with a type of creativity within which water plays a role. Strang (2005b) sees the history of pastoralism as relevant to the thematic association of water with creativity: graziers and pastoralists have recently been able to deploy infrastructure for water management that has enabled them to "make more" of the land, with respect to agricultural export productivity, than it would have been possible without their technical interventions.

One commonality between how farmers and pastoralists see water is inherent in the notion of morally-correct creativity or productivity (Strang, 2005b). The social role of workers in primary industries is to achieve this certain type of productivity on behalf of the larger Australian society (Strang, 2005b). As part of this social role, they must use and manage water, or at least hope for it to arrive. Strang identifies a moral edge to rural agricultural people's views of water, which can arise in conflicts over irrigation: the land is meant to be made "productive" through proper human stewardship and the appropriate use of water (Strang, 2009).

Strang makes the argument that pursuing an occupation in rural agriculture requires a great deal of embodied, day-to-day practice and experience in treating water as a means to achieve the type of productivity (in farm output, livestock, or both) that it is their social role to provide. If a person's identity is understood in relation or contrast to other potential identities—here, in contrast to urban gardeners or keepers of wildlife sanctuaries, than the identity of a rural agricultural professional requires seeing and using water in certain productive and instrumentalist ways, to create agricultural outputs on behalf of the larger Australian society.

Mining and industrial perspectives

Along with the rest of the globe, one of the key sustainability issues facing the Australian mining industry is access to water (Kemp, Bond, Franks & Cote, 2010). Water is likewise an essential input for manufacturing and extractive industries (Strang, 2009). According to Prosser, Wolf and Littleboy (2011), mining, manufacturing and other industries use approximately 20% of all water consumed in Australia which then creates a considerable amount of economic value for those industries. For example, industries such as mining have traditionally viewed water as an inexpensive commodity that is part of a larger production process (Ringwood, 2006). However, water is becoming more scarce for mining as well: alongside household water efficiency programs and government regulations, the mining industry has also had to reduce water use through options such as changing processing operations through to even closing down major facilities (Ringwood, 2006). From this, it can be seen that mining places value on this resource in unique ways.

From an industrial perspective, water is viewed as a core component to their business and their interaction with that resource is done through the lens of economics, linked to production and efficiencies. The non-industrial community, on the other hand, values water as a human right to access and has several religious, cultural and lifestyle values (Bills, 1952). The mining industry does acknowledge that their activities exist in a wider social and ecological context, yet that co-existence has the potential to lead to conflicts with community stakeholders due to fundamental value differences (Kemp et al., 2010; Ringwood, 2006).

The way in which water is valued in industry, and the potential differences between mining and industrial water values and other community members' water values, are relevant to CCS because the CCS community is an industrial stakeholder and as such, will want to learn from the previous and current experiences of other industries in communicating with community members across value differences.

2.3.2 PERSPECTIVES FROM GEOGRAPHIC LOCATIONS

Geographic locations matter to water values because they are not only associated with different professions, as previously discussed, but also because they give people the opportunity to engage in different water use practices, as this section will describe.

Strang (2009) argues that water use practices on dramatically different scales—including maintaining suburban lawns, building dams, and irrigating extensive fields—can be conceptualised as "gardening" activities, and according to how she uses the concept, are connected to personal identity, status and agency (p. 288). Water management in gardening, similar to water management on cattle stations, displays the ability of households to effectively act on and modify the immediate natural environment (Strang, 2005b).

Researchers have found that suburban people use water to create and display household gardens, which offer value in multiple ways. Askew and McGuire argue that suburban gardening practices enable householders to display an identity both conforms to community standards while also displaying uniqueness (Askew & McGuirk, 2004). According to their interpretation of results from 48 questionnaires and an additional unspecified number of semi-structured interviews with the local water company, local government, estate developers, and people residing in a new suburb near Newcastle, in New South Wales, people use water in suburban gardens to accumulate "cultural capital" (p. 2). They found that a distinctively well-gardened backyard offers social distinction, and is associated with meanings of a leisurely lifestyle. High levels of water inputs are required to maintain an "established standard of conformity and respectability" (p. 26) and to publically display that respectability. These researchers concluded that water is used as a "tool" for accumulating the cultural capital associated with a well-groomed, respectable backyard space, and it is also used as a "symbol" for displaying this cultural capital (p. 12).

As well as displaying identity and agency (i.e. the ability to effectively act), gardening and the enjoyment of gardens serves recreational functions as well. Woolmington & Burgess (1983) have commented on the "near obsession of affluent suburban inland Canberra dwellers with gardening" especially the keeping of lawns, and that spending time watering lawns can seemingly serve a recreational purpose for these suburban residents (Woolmington & Burgess, 1983).

2.3.3 RELIGION AND CULTURAL BACKGROUND

Of the many ways in which human diversity can lead to different views of water, religion and its associated cultural worldviews may prove significance in explaining some of these differences, despite having the least obvious connection to CCS. Religious stories have much to say and suggest regarding the relationship between people and the environment (Strang, 2005b). This section addresses two main types of religion found in Australia, and draws out the implications for how those who adhere to them value water.

Indigenous Australian cultural and religious perspectives

Aboriginal Australian cosmology[1] provides for a fundamentally different relationship between human beings and the natural world than that of European-Australians. Traditional owners of the land do not differentiate between land and water, viewing both as "country" (Howlitt & Suchet-Pearson, 2006) nor do they separate between human beings and nature, or culture and nature (Howlitt & Suchet-Pearson, 2006; Rose, 1996). Nature contributes to and is part of Aboriginal cultural and social relations (Howlitt & Suchet-Pearson, 2006).

Part of Aboriginal land relations is an identification with the environment, supporting long-term relationships with "country" and landscape to identity (Strang, 2005b) in which ancestral beings are

[1] It is difficult and potentially inappropriate to generalize across all of the cultures of the traditional owners of the land, the Aboriginal Australians, yet it is necessary for the purposes of this paper in order to show a general contrast to a dualistic, Christian worldview. By referring to them as two collectivities, no disrespect is meant towards the internal diversity of Aboriginal or Christian belief systems.

believed to take natural forms (Strang, 2005c) many of which emerge from water sources (Strang, 2002). Identification with these beings and their social communities, connect Aboriginal identity to the land (Rose, 1996). Ancestral forces inhabit the land, and it is essential to communicate with them in order to successfully fish or use resources from the environment (Rose, 1996).

In Aboriginal religion, water has a deep spiritual significance (Bark, et al., 2011) providing for the regeneration of human and community life. Clan's water sources are the place where humans are created: "spirit children", the source for new life in a woman's womb, are continually recreated in water. At death an individual's spirit returns to the water to once more become part of the ancestral force (Strang, 2005c, p. 3). Community regeneration also involves teaching youth about group values and way of life with visiting rivers considered an important social process for providing these opportunities (Jackson et al, 2008).

These values imply that water should be treated in certain ways and that humans have a responsibility to care for and maintain "country" (Howlitt & Suchet-Pearson, 2006). James (2006) found the Anangu people of central Australia view water "not [as] a stagnant thing to be exploited" but rather as "a re-creative cycle to be nurtured" (p. 90); and that individuals (from the Pitjantjatjara people) relate to water based on a deep sense of respect and recognition of interdependence and interconnectedness, recognising it as "a sentient being, the body and spirit of Wanampi", the Rainbow Serpent (James, 2006, p. 86). As a consequence of this deep identification with water, damage to natural resources such as water, cause profound sadness and loss (Rose, 1996). Such views differ dramatically to a more pragmatic European-Australian understanding.

European-Australian cultural and religious perspectives

For the purposes of this paper, European-Australian culture and worldview are assumed to align with Christian religious values that consider an entirely different relationship with water than do Aboriginal religions.

In a Christian-influenced (European-Australian) worldview, land and the environment are not seen as sentient (i.e. feeling, sensing and thinking), agentive (i.e. having the capacity to take deliberate action, as an "agent" or doer) or productive of cultural knowledge. Rather, "culture" is divided from "nature". Masculine defined Christian characteristics of reason, consciousness and spirituality are separate from (and some would say, more highly valued than) nature, the physical and femininity (Strang, 2005b). Nature generally perceived not as a spiritual being, but rather as acquiring significance through association with, and as a material product of, God (Strang, 2005a).

From this viewpoint water and the environment being separate from humans,, subject to man's authority (Strang, 2005a) is an economically-oriented frame of reference. One that tends to divide nature from culture and to celebrate human reason in which water is treated as a material, non-living, non-spiritual substance holding primarily instrumental value that is possible of being realized through the proper "managerial" attitude and actions (Strang 2005b).

Unlike the Aboriginal view of water as a sentient being in the form the Water Snake, water imagery is used in the Christian religion as the "raining" or "pouring" down of God's fertility and Holy Spirit onto the earth and humankind (Strang, 2005c, p. 4). Another imagery of "living water" depicted in Christianity as a product of God (Strang, 2005a, p. 106), is different to water people use in their everyday lives, perceived as sacred and separately designated, distinct from the ordinary natural environment rather than part of the environment as in Aboriginal religion.

Such diversity of religious values and beliefs among stakeholder groups may prove relevant to water-related decision making where water resources are perceived to be at risk. Religious beliefs provide different ways of valuing and conceptualising human beings' relationship to the environment and may provide a sense of the type of action and responsibility people should take toward the environment (Rose, 1996; Strang, 2005b, 2005c).

2.3.4 GENDERED PERSPECTIVES

Though the current literature is inconclusive, there may be some relevance for gender to be included in conversations around water and CCS due to the possible implications gender carries for representation and participation in governance and decision making processes (Howitt & Suchet-Pearson, 2006; Lahiri-Dutt, 2006). Gender may be associated with what water values are more likely to be acknowledged and addressed by water decision making authorities (Alston & Mason, 2008a), and may assist the CCS industry to better prepare to interpret and understand the concerns internally-diverse communities may have over water.

Gender is often symbolically perceived in terms of function and space. Women are perceived as water consumers and domestic users, whereas "productive" uses of water (e.g. for farming and industry) are thought to be masculine (Lahiri-Dutt, 2006, p. xviii). Lahiri-Dutt (2006) notes work tasks and locations often have symbolic associations with gender and type of work; imposing differences in how men and women have a voice in making decisions over management and allocation of water.

Different gendered patterns of participation may result in men and women having different water experiences and corresponding values. Head and Muir (2006) noted that informal activities to collect and reuse grey water in Australian backyards were primarily practiced by women, however women were less likely than men to involve themselves in constructing informal household drainage and storage systems (Head & Muir, 2006).These gender differences may relate to the cultural norms for dividing tasks between men and women; in any case, they give men and women the opportunity to experience water differently and to have different engagements with it. Yet gender differences are not found in every practice related to water, for example, of all the water-saving personal measures surveyed by Miller and Buys (2008), statistically-significant gender differences only appeared in the tendency to turn off the tap while brushing one's teeth and to leave the toilet unflushed after use, both of which women were more likely to do.

Research has however noted gender differences in how water is perceived and valued. Social scientists such as Alston, Mason, Goodall and certain employees of the Victoria State Government argue women perceive water, waterways and water bodies differently. Goodall (2006) found that European-Australian and Indigenous Australian women have different relationships with rivers than do men in their same groups. The "My Victorian Waterway" survey research project found that for unknown reasons, women had greater knowledge of waterways and waterway health, and were more likely to express concerns regarding the long-term future health of waterways (Victoria State Government Department of Sustainability and the Environment, 2011). Alston and Mason (2008a, 2008b) argue that women, who dominate familial and caring roles in Australia, have the potential to bring a greater focus on "social flow" (understood as the use of water for enhancing community and social interaction and for imbuing cultural and spiritual value) into water management decision making bodies, if better represented politically on such bodies.

Research has found gendered differences in how Australians perceive risks to water supply purity. Crampton and Ragusa (2008) found, via surveys and interviews that Australians' concerns regarding drinking water vary by gender, location and urbanisation. Women were slightly more likely to fear that agricultural practices, or terrorism, could affect their drinking water, but gender was less important than location (i.e. urban versus rural) in influencing water concerns: women in rural areas were more concerned about their drinking water than urban women[2] (Crampton & Ragusa, 2008). Difference in water-related concerns may be seen to support the argument made by Alston and Mason (2008a) and others (Crampton & Ragusa, 2008; Head & Muir, 2006; Lahiri-Dutt & Harriden, 2008) that gender-related social roles are bound up with gender-specific perspectives on water's meanings, values and uses.

In sum, past research has sought to understand gendered water perceptions (Lahiri-Dutt & Harriden, 2006; Dowling, 2006; Goodall, 2006; Head & Muir, 2006) of which some have found gender differentiated

[2] The phase of analysis from which this finding was derived did not include men, in order to better "address an existing gap in the research literature" regarding rural Australian women (Crampton & Ragusa, 2008, p.11).

responses to questions posed about water's social value. There is support for gender based affects in regard to representation and participation in certain industries and forms of decision-making (Dowling 2006; Alston & Mason, 2008a). However cause or effect is uncertain in relation to representation of particular types of gendered values in contemporary Australian water governance (Alston & Mason, 2008a, 2008b). Some evidence exists for gender differences in water-related practices (Head and Muir, 2006) and water-related beliefs and knowledge (Victoria State Government Department of Sustainability and the Environment, 2011). Associations are evident regarding symbolism between water-related work, gender identity and spaces (Lahiri-Dutt, 2006). Gendered individuals are bound to see water differently due to practical experience, involvement in industries and/or decision-making processes and personal agreement or affinity with the meanings and values of water.

Differentiations in gender based water values may be of relevance to the CCS industry where there are direct implications for representation and participation in governance and decision making processes (Howitt & Suchet-Pearson, 2006; Lahiri-Dutt, 2006). The industry should consider that people, perspectives, functions, values and meanings of water have tended to be associated with each other. Less visible in mainstream discourse, involvement in participatory decision-making around water would provide greater visibility to these interests than experienced to date.

2.4 Other symbolic meanings

In addition to values and worldviews, symbolism is also important: review of the social science literature has found that Australians who are discussing water are likely to also be discussing other, broader issues and concerns that the water issue symbolises to them. Power, conflict, purity and contamination, and social identity are some of these symbolic meanings Australians associate with water.

2.4.1 SCARCITY, CONFLICT AND POWER

More recently, irrigators have been described as in conflict with environmentalists, as the intensification of agriculture challenges ecosystem needs (Jackson et al 2008). Water conflicts are described between urban and rural populations (Alston & Mason, 2008a); Indigenous or traditional owners and non-Indigenous populations (e.g. pastoralists and recreational fishers); industrial water users and recreational water users (Strang, 2009); and private property owners and other members of the public (Jackson, et al., 2008). Conflicts are described as crossing geographic regions, such as the issue of whether water should be transferred from northern Australia to Australia's south and from the Kimberly region to meet Perth and Adelaide's growing water needs (Jackson et al, 2008). Water conflicts have surrounded mining practices which either consume water or decrease its quality. For each of these types of conflict, a substantial collection of issues play into the public controversy, making it very hard to generalize across all water conflicts.

One clear generalization that can be drawn is that materially speaking, control over water has been the source of many conflicts; in fact, this control is negotiated at a symbolic as well as a material level. Symbolically speaking, Goodall (2006) believes that "water has continued to be a key expression of power relations in Australia until the present. Control over access to water, then over its source (river, rain, or artesian) and its quality (contaminated or pure) has been a defining enactment of coloniser dominance, while challenge to control over water has been a sustained element of resistance" (Goodall, 2006, p. 287).

The privatization of water has important symbolic dimensions, as to some observers it can be seen as an infringement of corporate interests into a realm that should not be subject to private ownership: "inclusion in the ownership and control of freshwater resources has often been seen as a fundamental form of enfranchisement and a basic human right" (Strang, 2009, p. 4). From this perspective, privatisation of water can be seen as an unacceptable form of enclosure and an abdication of one of government's key responsibilities (Strang, 2005c, 2009). Essentially, privatization conflicts are not solely about control on a material and economic level; they also demonstrate the persistence of deeply held beliefs about water as a common good (Strang, 2009).

2.4.2 PURITY AND RECYCLING

Of all the water-related questions that social scientists might have taken up, this literature review has revealed the densest concentration of existing research around what, broadly, may be understood as questions of water purity. Substantial effort has been made in studying public acceptance of various types of water, such as recycled and desalinated water, and how those attitudes break down by demographic group, location, or other variables.

Research literature on public perceptions of water recycling began to emerge in the United States in the 1970s and 1980s, and more recently has been produced in Australia (Miller & Buys, 2008). Much of this research focuses on recycled water perceptions for non-potable use (Miller & Buys, 2008). The Water*mark* project, an effort conducted by the Victorian Women's Trust to involve citizens in small groups to both learn about and discuss water-related information and attitudes, found that Australians are substantially less supportive of recycling for urban wastewater than are citizens of other countries around the world (Victorian Women's Trust, 2007). The level of controversy surrounding recycled water reuse has varied depending on whether the water is reused for non-potable household usage (e.g. toilet flushing and gardening), non-potable industry and agricultural usage, or potable (i.e. drinking quality) usage (Miller & Buys, 2008). Additional recent work has been done on recycled water's acceptability to communities (e.g. Fielding, Louis, Warren & Thompson, 2011; Nancarrrow, Porter & Leviston, 2010).

Acceptance of recycled water use has not been clearly shown to differ by demographic group in Australia, though findings are mixed. A study of Melbourne office workers did not show socio-demographic factors to be strong predictors of people's acceptance of recycled water (Hurlimann, 2006), and another study did not find a difference between groups of people residing in urban versus rural Victoria (Hurlimann, 2008). Yet a different survey effort did find gender, education, and age to affect acceptance levels of recycled water (Dolnicar & Schaefer, 2009). Researchers have more consistently found acceptance levels to be influenced by other non-demographic factors: "beliefs, perceptions and attitudes surrounding trust in the water authority, information provision, risk perception, environmental concern, fairness in implementation and perceived need to [sic] recycled water" (Hurlimann, 2006, p. 58). The factors influencing attitudes towards recycled water seemingly vary by study and are rarely purely demographic.

Another small body of research addresses the topic of desalinated water perceptions. Australians are said to have little personal experience with alternative water sources, and not to currently have the choice to use or not to use recycled or desalinated water systems, but have been exposed to widespread public debates over recycled and desalinated water options in the context of severe prolonged drought (Dolnicar & Schaefer, 2009).

Not only context and availability, but also intended uses for the recycled water, affect public perceptions of it. Dolnicar and Schafer (2009) found that the Australian public previously perceived "desalinated water as environmentally unfriendly, and recycled water as a public health hazard" (p. 888), but after five years of drought, are now more willing to accept "desalinated water for close-to-body uses" (p. 888), and "recycled water for garden watering and cleaning uses" (p.888). Approaches to desalinated water seem similarly diverse as approaches to recycled water, though perhaps with a more favourable trend towards acceptance over time.

2.4.3 PURITY AND CONTAMINATION

Beyond the acceptance of recycled water, some larger meanings have also been articulated for the symbolic dimension of "contamination" as related to water.

Thinking more broadly than types of water and their relative perceived cleanliness and acceptability to different types of people; social scientists have found that important symbolic concerns surround the cleanliness of water. Questions of polluted water do not solely appear to be questions of literal "dirt" of a concrete and measurable nature. Reactions to recycled water have encountered polarised reactions (Chanan, 2009); suggesting larger meanings and issues are in play. One example in particular was the recycled water issue in Toowoomba, Queensland, as described in a case study in section 3.1.2 of this report.

The residents of Toowoomba opposed recycled water for potable use (Hurlimann & Dolnicar, 2010). "Waste" water has been shown by social scientists to pose symbolic risks: "dirt" can be both literal and figurative or metaphorical (Douglas, 1966). Anxieties about wastewater reuse may also be anxieties about getting excessively close to other people's bodies, by means of being close to a fluid that has been close to (or passed through) other individuals' bodies (Strang, 2005a). People's response to flooding that carries sewerage shows this same anxiety (Strang, 2005a).

Furthermore, wholly in the symbolic realm, water metaphors have been used as a symbol of "social 'influx' and 'pollution'" of a community by unwanted social groups, who seem to pose a threat to the community they enter (Strang, 2005a). Anxieties about impure water have been shown to relate to anxieties over the participation of new, unwanted, or seemingly untrustworthy social groups in managing or distributing it (Strang, 2005a). This type of perceived threat relates to water's association with social identity, which will be discussed in the next section. As the case studies show, anxieties about "outsider" groups taking actions that affect water sources can also be a question of power and control.

2.4.4 IDENTITY AND BELONGING

Identity and belonging are thematically linked to water and waterways in several ways. As previously mentioned, the Aboriginal Australian cultural worldview positions water sources as repositories of clan identity, from which new lives originate within the ancestral force, and to which people return (Rose, 1996).

Water may not only provide for human identity and identification with social groups, but also serve as a symbol for identity. Since water is essential to human survival and state of being, in consuming it a person is connected to the place he or she lives and its substance (Strang, 2005a). Ideas about water sources are "part of what connects people to place" and are thus connected to ideas about identity and belonging (Lahiri-Dutt, 2006; Thomas, 1997). From a European/Australian Christian religious perspective, water has also been used as a symbol of social connection due to its role in rituals such as baptism demonstrating social inclusion (Strang, 2005a).

Speaking cross-culturally, Hussey and Dovers find that water bodies can provide for identity, status, survival and wealth (Hussey & Dovers. 2007). CSIRO researchers investigating human relations with Northern Australian waterways in 2008 found that rivers and water had cultural value for forming identity and generating a sense of well-being and belonging (Jackson, et al., 2008). In addition, sport and cultural rituals such as canoeing, water skiing, swimming and others provide opportunity for groups of people to form around common recreational interests.

Part III Applications

3 Applications

This report has described social science research results that reveal differences in water values held by people of different demographic groups. It has been shown that water is likely to be valued differently by people with different professional occupations (Ringwood, 2006; Strang, 2009); geographic locations of residence; and cultural and religious worldviews (Rose, 1996; Strang, 2005c). There is some evidence that water and its associated risks are perceived differently depending on gender (Lahiri-Dutt & Harriden, 2008) however research in this area remains inconclusive. From the diverse ways in which individuals make sense of and the multiplicity of other topics and subjects that discussion related to water might proxy, water is a fraught topic. The diversity of values and larger social concerns surrounding it provides a humbling reminder that any communication effort or research and development project with a connection to water resources might be interpreted by community members in different ways than was intended, for different reasons than were anticipated.

This section will describe four examples of controversy or social mobilisation related to water in Australia. Implications of these cases will then be discussed, and four implications will be drawn for members of the Institute and the CCS industry. The next chapter will extend these implications into four recommendations.

3.1 Case studies

In order to illustrate successes and failures in water governance, engagement, and decision making, four case studies are described below, each with a few implications for the CCS industry. Each explains the relationship that has developed between Australian community members and industry or government interests in relation to specific water management topics:

- Murray-Darling Basin
- Toowoomba Water Futures
- Cougar Energy Underground Coal Gasification, Kingaroy
- Coal Seam Gas and its opposition

3.1.1 MURRAY-DARLING BASIN

For many years, Australia's Murray-Darling Basin (MDB) has been at the centre of ongoing debate in relation to the allocation of water resources and catchment management (Chenoweth, Ewing, & Bird, 2002). In recent decades, Australia's largest river basin has been subject to many changes. Initiatives have been put into place that aim to address ongoing management issues, such as environmental restoration, as well as the water supply demands of irrigation and urban communities (Boully, 2004). The communities of the MDB have a long history of involvement in its management (Scanlon, 2006); however, community participation in recent schemes, such as the Basin Plan, has been problematic.

The Murray-Darling Basin Authority (MDBA) is responsible for developing a Basin Plan, and as required under the *Water Act 1997*, for determining "the volume of water required to maintain and restore environmental assets, using best available science and the principles of ecologically sustainable development" (Murray-Darling Basin Authority, 2010b, p. iii). In developing the plan, the MDBA put in place a Stakeholder Engagement Strategy with the objectives to:

- increase people's understanding of the Basin Plan issues and the Basin Plan development process
- create opportunities for people to provide relevant information to the development of the Basin Plan
- increase people's confidence in the planning and engagement process by MDBA adhering to our engagement principles, and
- acknowledge and value people's contribution to the planning process.

(Murray-Darling Basin Authority, 2009b, p. 4)

The MDBA also outlined a number of guiding principles for its engagement activities, including transparency, inclusiveness of diverse groups, and the use of methods that are appropriate and adaptive. Early engagement activities carried out by the MDBA included presentations and meetings with stakeholder groups such as the Basin Community Committee (BCC) (Murray-Darling Basin Authority, 2009b). The BCC was established in 2009, consisting of 16 members with expertise or interest in areas, such as community, Indigenous issues and water use. The main role of the committee is to advise the MDBA on community issues relating to the Basin Plan (Murray-Darling Basin Authority, 2009a).

The initial stage of the Basin Plan culminated in the release of the Guide to the proposed Basin Plan on the 8th of October 2010 (Murray-Darling Basin Authority, 2010a). This document was prepared for the purpose of public consultation and exposed the wider community to the data and rationale behind the proposals being made (Murray-Darling Basin Authority, 2010b). Following the Guide's release, information was made available through mail-outs, the Basin News eLetter, social media, the MDBA website and a phone line (Murray-Darling Basin Authority, 2010b). Approximately 28 regional meetings were also held following the guide's release, including two meetings targeted at Indigenous groups (Murray-Darling Basin Authority, 2010b). In addition, community members were invited to provide feedback on the Guide, by the 17th of December, for consideration in the draft Basin Plan (Murray Group of Concerned Communities, 2010).

Despite the apparent intention of the MDBA to engage with and consider the concerns of the MDB community, submissions made following the release of the Guide criticised the engagement process. Some of the main concerns expressed by community members were the lack of time to review the Guide's content and provide feedback (10 weeks), and the volume and complexity of the Guide itself. The guide consisted of 21 volumes in total, including an overview, technical document and 19 volumes outlining the provisions for each region. Furthermore, community members felt that the level of community consultation in preparing the Guide was inadequate; with others feeling the process was insincere, lacked trust and trivialised their concerns (Murray-Darling Basin Authority, 2011). In particular, the National Irrigators Council (NIC) felt community members should have been engaged before recommendations were made in order to outline the problem to the community and discuss possible solutions and alternatives (National Irrigators Council, 2010). The Murray Group of Concerned Communities (MGCC) criticised the MDBA for inadequately addressing concerns of regional and rural communities, noting after the Guide's release that the MDBA had not involved "stakeholders in planning stakeholder engagement..." (Murray Group of Concerned Communities, 2010, p. 3).

The communities' concerns about the engagement process were echoed in the criticisms outlined in the Inquiry into the impact of the Guide to the Murray-Darling Basin Plan conducted by the House of Representatives Standing Committee on Regional Australia. The inquiry found the MDBA failed to consult with community members in preparing the guide and as a result lacked local knowledge. Criticisms were also made regarding Indigenous involvement, with these groups underrepresented in the planning process (Standing Committee on Regional Australia, 2011). The activities of the MDBA following the release of the Guide were found to be ineffective in a number of ways. For example, communication efforts did not successfully portray the purpose of the guide as a preliminary document and "presenting the Guide to the community through a series of 'community information sessions' rather than consultative workshops" (Standing Committee on Regional Australia, 2011, p. 41) did not allow the community to provide feedback (Standing Committee on Regional Australia, 2011).

Lessons for the CCS industry

The experience of the MDBA in releasing the Guide to the proposed Basin Plan showed that it is important for the CCS industry to engage with communities earlier rather than later. The lack of time for the community to provide input to the Guide (Murray-Darling Basin Authority, 2011), and the choice to make recommendations and to release the Guide before discussing solutions and alternatives with the community (National Irrigators Council, 2010), inspired criticism.

In addition to timing, this example suggests that the CCS industry should also attempt to adopt existing best practices of transparency and inclusive discussion in the process of engagement around water, rather than making recommendations in advance of consultation (National Irrigators Council, 2010). This example highlights the importance of developing information material targeted at an appropriate level, rather than substantial volumes of technical information with only a short period to review (Murray-Darling Basin Authority, 2011).

Ideally, planning for broad representation in CCS engagements will pre-empt the concerns that arose regarding representation of regional (Murray Group of Concerned Communities, 2010) and Indigenous (Standing Committee on Regional Australia, 2011) interests in consultation regarding the Guide. Demonstrable effort must be put in to ensure that all communities affected by a project are able to access information and engagement opportunities with developers. In learning from the release of the Guide, the CCS industry will also want to adopt a consultation process that provides clarity on the extent of power sharing. Because the Guide was not clearly presented as preliminary, and because the meetings explaining the guide were framed as "community information sessions" rather than consultative workshops (Standing Committee on Regional Australia, 2011, p. 41), the fact that some decision making power was still available to the community was obscured.

When interpreting the above case study, it is important to note that debate is quite polarised among stakeholders in relation to access, water rights and management of the MDB, due primary to the many and varied vested interests that are held around this important Australian water system.

3.1.2 TOOWOOMBA WATER FUTURES

As a result of challenges to water availability, water authorities have had to consider alternative water supplies such as treated wastewater and desalinated seawater (Dolnicar, Hurlimann & Nghiem, 2010). Historically, these projects have faced community opposition around the world (Dolnicar, et al., 2010).

The drought conditions experienced across Australia at the start of the millennium led to widespread water shortages and usage restrictions in urban and regional communities (Beeton, et al., 2006; Department of Natural Resources and Water, 2007). One community experiencing these restrictions was Toowoomba, located in southern Queensland, Australia. By 2005, the dam levels of Toowoomba had dropped below 30% and the issue of water supply was becoming desperate (Australian Broadcasting Corporation, 2005). In addressing these water shortages the Toowoomba Regional Council developed the Water Futures Initiative, and submitted the proposal to the National Water Commission on the 30th of June 2005 for Federal Government funding (Hurlimann & Dolnicar, 2010; Toowoomba Regional Council, 2006). The main proposal put forward as part of the Water Futures Initiative was the development of an advanced water treatment plant to supply potable recycled water to the region (Hurlimann & Dolnicar, 2010).

The Water Futures Initiative was primarily produced as a policy document and was publically launched by Federal and State Government representatives on the 1st of July 2005 (Hurlimann & Dolnicar, 2010). Prior to this launch, the Toowoomba Regional Council had not communicated the proposal to the general public; however, a three year community engagement plan had been included as part of the Water Futures Initiative (Hurlimann & Dolnicar, 2010). Within several weeks of the public announcement, Toowoomba community members had formed an opposition group called CADS – Citizens against drinking sewerage (Hurlimann & Dolnicar, 2010).

CADS mobilised quickly and held their first public meeting on the 25th of August 2005 (Hurlimann & Dolnicar, 2010). By the 24th of February 2006, CADS had collected 10,000 signatures in a petition against the proposal. With public opposition increasing, several members of the local, state and federal governments withdrew their support. The issue came to a head one month later on the 24th of March 2006, when the Federal Government made the decision to hold a referendum on the issue and announced their funding of the proposal would be conditional on a 'Yes' vote by the Toowoomba community (Hurlimann & Dolnicar, 2010).

In the lead up to the referendum, the Toowoomba Regional Council conducted an information campaign in support of the project, which included public forums and wide distribution of a Water Futures booklet explaining details of the scheme (Hurlimann & Dolnicar, 2010). However, by this stage CADS had been communicating their arguments against the project, such as concerns about health and the image of Toowoomba, for over six months. The council was put in the position of having to condense their engagement efforts into a short campaign against a well-established opposition. Meanwhile, public meetings and internet blog sites were being used by CADS to encourage Toowoomba residents to vote against the proposal (Hurlimann & Dolnicar, 2010).

The referendum was held on the 29th of July 2006, and 62% voted against the proposal (Australian Associated Press, 2006). As a result, the Water Futures Initiative was abandoned.

Hurlimann and Dolnicar (2010) suggest that CADS had a considerable advantage by being the first group to communicate their position to the Toowoomba community. Subsequently, CADS became a major source of information on the issue; this increased the difficulty of successfully communicating counter arguments and facts. Hurlimann and Dolnicar confirmed this opinion in focus groups with Toowoomba residents two years after the referendum, during which residents expressed the view that Toowoomba Regional Council released information as a reaction to CADS (Hurlimann & Dolnicar, 2010). Residents had wanted scientific and impartial information on details, such as the water treatment process. They felt that each group had vested interests, and that the information provided by both sides was biased (Hurlimann & Dolnicar, 2010).

Lessons for the CCS industry

As with the release of the Guide to the proposed Basin Plan, the controversy over Toowoomba's Water Futures Initiative shows that the timing of engagement is important for industries such as CCS that are

pursuing water-related work. The Water Futures Initiative project proposal announcement were made without pre-emptive public involvement and the council was put in the position of having to defend its proposal against immediate opposition (Hurlimann & Dolnicar, 2010).

Furthermore, the experience at Toowoomba shows that there is a need for the CCS industry to show early and consistent leadership in providing clear and comprehensive information to communities. When project proponents do not do so, opposition groups, such as CADS, could otherwise fill the social role of providing the public with information on the issue.

The sources and content of this information is also important. Toowoomba residents were seeking factual information from people they perceived they could trust. CCS project developers should ensure that external facing members of staff are able to articulate factual, relevant information about their project, in order to engender a sense of trust and openness with the local community. Engaging with independent experts and respected community leaders to provide non-bias perspectives would be a powerful tool to reassure local communities.

Last but not least, this case shows the importance to industry of anticipating the other meanings and values that water can be associated with, such as a sense of “purity” or a fear of contamination or pollution. CAD was named after the concept of “drinking sewerage” (Hurlimann & Dolnicar, 2010), thereby using fears of pollution to generate support. Even in a context of water scarcity—and perhaps especially in a context of scarcity, in which the public is sensitized to the rarity of pure water—potentially “dirty” water sources may not be tolerated.

3.1.3 COUGAR ENERGY UNDERGROUND COAL GASIFICATION, KINGAROY

UCG is a process that turns underground coal into gas through introduced combustion. The gas is extracted under pressure and used for energy production. In February 2009, the Queensland Government released its Underground Coal Gasification (UCG) policy. This policy provides for UCG trials in Queensland to gather information for determining the viability of the UCG industry for the state. Three pilot projects were identified under the new policy: Carbon Energy at Bloodwood Creek near Dalby, Cougar Energy near Kingaroy and Linc Energy near Chinchilla. Both Cougar Energy and Carbon Energy's UCG pilots have since been closed and decommissioned under Environmental Protection Orders. Linc Energy UCG continues to operate its pilot project (DERM, 2011a). The process that led to the closure of the Cougar Energy UCG plant in Kingaroy has been well documented by both the Queensland Government and the media.

In March 2009, the Queensland Government announced its support for the progressive development of Cougar's Kingaroy UCG project (Cougar Energy, 2010). From February 2009 to March 2010, Cougar Energy is reported to have instigated an extensive community consultative process (Phillips, 2009). Two events in particular were highlighted in documentation available on the Cougar Energy website[3]. Cougar Energy held an Open Day followed by a community consultative meeting on the 12th of October. These events were reported by Cougar Energy to be a direct result of a meeting in September 2009 with local community members, where calls were made for the company to listen to the community (Cougar Energy, 2009).

Cougar Energy reported the Open Day and meeting as a success, citing strong local interest. The Open day was reported to have attracted 70 community members while 100 attendees were present at the meeting in Kingaroy. Also in attendance at the meeting were the South Burnett Regional Council Mayor, David Carter, and Queensland Legislative Assembly Member for Nanango, Dorothy Pratt (MP). During the meeting, Cougar Energy indicated it was working towards implementing an independently chaired community consultative committee to ensure open communication between the parties involved and that the local community would be given an opportunity to nominate potential members (Cougar Energy, 2009).

An ABC Rural news article at the time entitled "Kingaroy farmers fear gas plant impacts" noted local community concern regarding potential water supply impacts as a result of coal conversion to gas processes (Phillips, 2009). A local action group, the Kingaroy Concerned Citizen's Group (KCCG), was formed. The KCCG was opposed to the Cougar Energy pilot UCG plant; its main concerns focused on air and water quality impacts and soil subsidence; issues reported to already have been addressed by a community consultative committee (Phillips, 2009).

In February 2010 the pilot plant was completed and underground gas firing scheduled to commence in the March. Cougar Energy expressed its pleasure at the company's excellent safety record to this stage, and its successful implementation of a positive community consultation program (Proactive Investors, 2010).

Following a flare malfunction in the plant's first week of operation in March in 2010, the cement lining in the well fractured. This malfunction was remediated. However, the public later discovered that Cougar Energy had conducted monitoring tests finding traces of the toxic chemicals benzene and toluene in local groundwater. The results of these tests were not publically released until June of the same year (Sollars, 2011). Although it was later proven that such traces were no longer evident in subsequent tests separately undertaken by Cougar Energy and the Department of Environment and Resource Management (DERM), questions would later be raised regarding the timing for reporting the contamination, and also regarding Cougar Energy's failure to assure the Queensland Government that there would be no further occurrences and that the necessary Environment Standards would be strictly adhered to in the future (Sollars, 2011; DERM, 2011a).

According to KCCG's overview of an August 2010 meeting attended by the Minister for the Environment Kate Jones (MP), local residents including citizen's group members called for more information about the

[3] Location of presentation: http://www.cougarenergy.com.au/presentations.html

Cougar Energy contamination reported in mid-July 2010 (Grunt, 2010). DERM representatives accompanying the Minister indicated that minimal information was available to the public due to limited details provided by Cougar at that time. Nevertheless, the meeting became a forum for expressions of public frustration and concern.

The 150 meeting attendees sought responses to questions relating to how and why a UCG plant had been permitted in Kingaroy, considering its valuable water source, high population and valuable agricultural land. Local community members expressed their displeasure at the lack of consultation and transparency accompanying the pilot's progress. Meeting minutes show that an extensive list of requirements for community engagement were presented to the Minister, for example, full information disclosure completion of Environmental Impact Statements for all trials, publish and respond to all Risk Assessments and immediate refusal of applications deemed potentially irreversibly damaging to the environment (Grunt, 2010).

In September 2010, Cougar Energy defended the Kingaroy UCG trial. It advised the government via letter that it would install additional wells and ensure regular testing to help its bid to reopen operations. The Minister for the Environment, Kate Jones (MP) indicated that the plant would not be permitted to reopen until all government concerns were satisfied. Community sentiment was highly critical of Cougar's letter to the government; one community member stated that Cougar's letter was further proof of the "contempt they have shown the local community" (Ninemsn News, 2010).

A 24 January 2011 DERM report entitled "Summary of considerations and recommendations on the environmental evaluations of Cougar Energy" made several recommendations, the most significant being the recommendation "the Cougar Energy trial *not* be reignited" (DERM, 2011d). Given that "ignition" means lighting the underground coal seam for gasification, this was effectively a recommendation that the project be discontinued.

A sequence of events in July 2011 saw the closure of the Cougar Energy UCG Plant by DERM. DERM issued cease operations, decommission and rehabilitation orders forcing the closure of Kingaroy UCG plant (Sollars, 2011; DERM, 2011a). Following this Cougar Energy worked closely with DERM to complete additional water tests. On July 15, DERM issued a media release advising of the closure of the site until the government could be assured water sources were protected after which Cougar Energy released advice that the original water test was incorrect. The next day, DERM authorised the serving of formal orders preventing Cougar recommencing operations (DERM, 2011c). Cougar claimed the governmental decision was unreasonable (DERM, 2011d).

An appeal hearing in December 2011 resulted in a court judge upholding DERM orders requiring Cougar Energy to decommission and rehabilitate the UCG plant land near Kingaroy (Hueppauff, 2011). The judge cited a major failure of the cement lining (cracking) within a few short days of operation as the cause of the leaching of benzene and toluene into the surrounding underground water supply, and Cougar Energy's failure to alert DERM of the incident at the time of the flare malfunction report. It was also noted that Kingaroy's water was potentially potable, and as such, could tolerate no "safe" levels of contaminants, countering Cougar Energy's assertions that no environmental harm had resulted from the flare malfunction.

The sequence of events around Kingaroy contributed to social concerns regarding UCG in other locations. An article in New Zealand's Waikato Times on September 28 (2011) covering a UCG project proposed for Waikato cited the Cougar Energy UCG plant contamination issue as a concern for all UCG projects. The KCCG's spokesman interviewed for the article noted that scientific facts could not be sidestepped; that the plant had major impact potential on the local farming community; and that it failed to comply with CSIRO recommendations not to locate a UCG plant in regions with potable water, near valuable aquifers, or where high value agricultural land was situated (Vance, 2011).

Lessons for the CCS industry

The Kingaroy contamination controversy shows that there is a need for the CCS industry to document and make available the results from the community consultation efforts it is pursuing. Cougar Energy reports or any other documentation on community consultation processes carried out between February 2009 to

March 2010 are not easily accessible online, except for documentation of a meeting on 3 September 2009 and an Open Day on 12 October 2009. Issues reportedly addressed by the community consultative committee (Cougar Energy, 2009) also became the focus for a local action group of "concerned citizens" (Philips, 2009). Where industry does not communicate the process and results from its community consultation work, it may be less clear to media and other observers that such consultation is indeed taking place, paving the way for reports of "concerned" or opposition efforts to play a proportionally larger role in the public conversation.

Kingaroy furthermore shows that the existence of scientific uncertainty (e.g. causes of contamination, or the state of the water table and how it is affected by sub-surface industrial work) can inspire community concern. In November 2011 a Kingaroy farmer found contaminants in his bore water which were found to have been caused by agriculture. He was unhappy at findings that contaminants in his bore water were agriculturally caused, stating that none of the chemicals found had been used on the property or nearby to the best of his knowledge. The farmer believed that the UCG polluting practices were causing uncertainty in the region (Gribbin, 2011). Lack of knowledge about the origins of contaminants, or their cause, was in itself a concern for this person and others.

The Kingaroy contamination controversy also demonstrates that water-related concerns are able to move from one location to another, aided by media transmission, which provides a warning for CCS proponents. The contamination issue experienced by Cougar Energy at Kingaroy was cited as a concern for other UCG projects by an article written in New Zealand (Vance, 2011). If concerns about UCG transcend specific locations in this way, particularly when media sources explicitly draw the link, concerns about CCS might be similarly mobile.

This example shows a need for transparency and consultation with the local community during the time which CCS demonstrations are taking place. Cougar Energy's actions during the 18 months or so leading up to the Kingaroy plant closure were criticized for an overall lack of transparency and poor community consultation (Sollars, 2011). Suspicions that tests had revealed toxic contamination of groundwater, but that the information had not been immediately released, led to public displeasure (Sollars, 2011; DERM, 2011a; Grunt, 2010). Ideally, CCS demonstrations can work proactively to maintain transparency and avoid the development of similar mistrust.

Also, this example shows a need for the CCS industry to inform itself of, and monitor, the arguments being made against UCG, including support of research into these concerns. The objections that people have to UCG and water—such as the groundwater contamination and transparency concerns related to UCG at Kingaroy—could be transferred and applied to the CCS industry.

3.1.4 COAL SEAM GAS AND ITS OPPOSITION

As of early 2012, the Australian mining industry is experiencing a rising tide of oppositional activity across the nation (News.com.au, 2012a; ABC Radio, 2011). Activist groups and alliances are establishing strongholds in regional and, more recently, outlying city suburban areas where mining activity is either under exploration, development or operation. Many of these groups, which have gained support from high profile conservation and environmental groups such as the Wilderness Society and Friends of the Earth (Wilderness Society, 2011; Friends of the Earth, n.d.), are focused on the Australian gas industry's increasing efforts to mine Coal Seam Gas (CSG). CSG is a naturally occurring gas, consisting mainly of methane, sourced from underground coal seams using water extraction processes (DERM, 2010).

The petroleum and gas industry has experienced substantial and rapid growth in the development of CSG technology in Australia over the past ten years, and CSG extraction set to expand exponentially over the coming decades (ABC Radio, 2011; Roarty, 2011). In 2008, Geoscience Australia identified 138 petajoules of productive CSG occurring within the Bowen, Surat and Sydney basins in Queensland and New South Wales, with an additional 15,369 potential petajoules yet to be realised. A further 810 petajoules of probable CSG productivity is indicated for the Clarence-Moreton, Gloucester and Gunnedah basins, and a total of 16,179 petajoules of existing and potential CSG is indicated within the central and eastern regions of Australia. These figures represent a 116% increase on 2007 reserves (Jones, 2011; Roarty, 2011). Further growth in this field is expected to expand rapidly in the next five years (Roarty, 2011). The majority of this growth is expected to continue in Queensland and New South Wales, which has 3,000 current and 1,600 proposed gas well sites (Jones, 2011).

A snapshot review of online websites and media coverage surrounding CSG in Australia in recent years identified 70 plus organisations actively opposing CSG, some of which participate in the "Lock the Gate Alliance" (Lock the Gate Alliance, 2012). Reasons for concern and opposition included a lack of consultation and transparency (Chalmers, 2011; Gooch, and Bacon, 2011); inadequate communication and information dissemination (Manning, 2011; Wildlife Tourism Australia, 2012); property access, damage and land rights; irrigation, floodwater flow and water access issues (both river and artesian); water quality, salinity, excessive production; pollution and contamination (Department of the Senate, 2011; Roarty, 2011) and wastewater disposal (Moore, n.d.: a); land devaluation and compensation (Commonwealth of Australia, 2011); stock and health concerns (Roarty, 2011; Crane-Murdoch, 2011; Moore, n.d.: a); deterioration of food production (Commonwealth of Australia, 2011); and the destruction of the Australian country way of life (Saunders, 2011a; Vasek, 2011). Primary among these appear to be concerns surrounding water.

Coal seam gas production is highly reliant upon water. The technology uses water in multiple ways: as a pressurizing force to fracture underground coal seams, to gain access to potential naturally occurring gas (in cases where fracturing is used); as a medium to carry a chemical and sand slurry used to assist gas diffusion from the coal seams; and as a depressurising force to encourage gas extraction (Jones, 2011). Returned to the surface following extraction, this water becomes a by-product of the process, and requires decontamination prior to reuse or disposal. Water use in CSG involves potentially toxic chemicals. Chemicals used in the fracturing process have included a chemical mix known as BTEX, which is used to stimulate hydraulic diffusion of CSG. These chemicals, known as volatile organic compounds (Sydney Morning Herald, 2011a), are toxic in excessive levels (Leusch & Bartkow, 2010). BTEX, an acronym for benzene, toluene, ethylbenzene and xylene, occurs naturally in groundwater in crude oil and gas deposits (DERM, 2011), and is also used in CSG during the "fracking" process (Minister for Natural Resources, Mines and Energy and Minister for Trade, 2010). The use of BTEX in CSG is now restricted in Australia (DERM, 2011b); however, one or more of these chemicals have been detected as present above recommended levels in a number of groundwater wells at different locations close to CSG sites in both Queensland and New South Wales (Cubby, 2010a,b; Woolly Days, 2010; Bigpond News, 2011). Other chemicals, such as "sodium hypochlorite, hydrochloric acid, cellulose, acetic acid and disinfectants" are also used for CSG extraction purposes (Roarty, 2011, p.2; DERM, 2011). CSG opponents, and government regulatory reviewers, are concerned about these chemicals' potential contraindications and their presence in potable water sources (Sydney Morning Herald, 2011a; DERM, 2011b).

Furthermore, CSG extraction is additionally contentious for multiple stakeholders because it uses a substantial volume of water (Department of Natural Resources, Mines and Energy, 2004; Roarty, 2011). People are concerned over how water extraction from the Murray-Darling and the Great Artesian basins will impact water access and quality both now and in the future (Moore, n.d.: b). Concerns include the way in which underground water systems interact and what potential damage the draining of one system may have on another (Department of Natural Resources, Mines and Energy, 2004). An independent study commissioned by Central Downs Irrigation Limited (CDIL), confirmed member concerns that "the Condamine Alluvium is hydraulically connected to the Walloon Coal Measure" from which large volumes of water are being extracted annually by the CSG industry in Queensland. The study also confirmed stakeholder concern that the lowering of water levels in the Walloon Coal Measure will cause the Condamine Alluvium to cross migrate its waters with the Walloon Coal Measure's waters (CDIL, 2011; Hillier, 2010) reducing water access to agriculture in the regions reliant upon it, and potentially impacting ecologies and environments these water systems underpin. Agricultural stakeholders whose livelihoods are directly reliant upon water allocations are now experiencing increasing reductions (not explicitly related to CSG) in their allocations (Department of the Senate, 2011), with this pattern set to continue as the Australian Government's National Water Commission (NWC) seeks to balance water supply and secure its management into the future. Given the possibility that the Australian Government's controlled management of water resources will result in allocation reductions as part of its water management plans, community members may fear that the allocation of water for CSG will reduce water availability for other purposes (ALFA, n.d.).

Increasing opposition to coal seam gas mining, and the mobilisation of community and interest groups, has culminated in a number of separate recent incidents of protestation. Several examples are noted below:

- **Tara Blockade (Queensland)**
  In May 2011, protesters created a blockade across Queensland Gas Company driveways to protest the construction of a gas pipeline through a rural residential estate in Tara, Queensland (Sydney Morning Herald, 2011b).
- **Pilliga/Eastern Star Gas Protest (New South Wales)**
  In July 2011, a protester climbed and harnessed himself to an Eastern Star Gas rig for a day to protest against CSG activities in the Pilliga Forest near Narrabri (Fuller, 2011). Separate to this protest, groups in the Pilliga region have commissioned surveys of the area to demonstrate its environmental significance (Ingall, 2011).
- **St Peters Rally (New South Wales)**
  Approximately 2,000 people attended a rally held in Sydney on 18 September 2011, stopping traffic as the protest progressed through the suburb of Newtown. Rally attendees were protesting a proposed CSG mine intended for location in St Peters close to homes and schools. Protestor concerns included the granting of an exploration license for the mine without community consultation and risk assessment (Chalmers, 2011).
- **Keep the Scenic Rim Scenic – Protesters on Peaks (Queensland)**
  On 16th of October 2011, a wide scale protest against CSG took place in the Scenic Rim region, with protestors displaying large signs and posters from mountain peaks, ovals, dams and farmland. These efforts received considerable media coverage and were part of the Defend our Water National Day of Action campaign (Keep the Scenic Rim Scenic, 2011).
- **Defend our Water National Day of Action (Australia-wide)**
  A national event took place on 16 October 2011. On this day, people gathered in different regional communities and urban centres to protest against coal seam gas (Getup, 2011).
- **Barrington-Gloucester Blockade (New South Wales)**
  In Barrington-Gloucester in New South Wales, protesters from the Barrington-Gloucester Stroud Preservation Alliance blockaded an AGL gas exploration site for two weeks in December 2011. They demanded an independent water study be carried out, but AGL only agreed to a deferment of operations until its own internal study could be completed (Saunders, 2011b).

- **Kerry Blockade (Queensland)**
  In January 2012, a group of residents of Scenic Rim in south east Queensland protested against the CSG exploration activities of Arrow Energy in the Kerry area. They did so by creating a blockade for 10 days on the site of an exploration well. The event drew significant media coverage and resulted in over a dozen arrests. The group was concerned about potential contamination of groundwater and wanted baseline tests to be conducted. Members were also disgruntled with the lack of community consultation and demanded that negotiations take place with Arrow Energy (Wovoka and Bullock, 2012; GetUp, 2012; News.com.au, 2012b).

In August 2011, the Australian Government launched an Inquiry (the Inquiry) into CSG. The Inquiry is still underway, and intends to look into the concerns and issues raised by stakeholders regarding the technology, in order to determine and report on the environmental and social impacts of CSG activities. A call for submissions to the Inquiry closed on 14 September 2011. Since its launch, the Standing Committee managing the inquiry has travelled to different locations across the states in order to hear witness accounts. To date, hearings have been held in Alstonville, Taree, Narrabri and Mittagong in regional New South Wales; and Roma, Dalby and Brisbane in southeast Queensland (SMH, 2011a). Another three hearings have also been held at Parliament House in Sydney. A final report is due for release on 3 May 2012 (NSW Legislative Council, 2011; Parliament of NSW, 2011).

In the meantime, following the introduction of the Coal Seam Gas Moratorium Bill 2011 to the New South Wales Parliament in November 2011, strong support exists for a call for a moratorium on CSG from community groups and other stakeholders (Buckingham, 2011). The Bill underwent debate over a 5-day period following its introduction; further debate has been adjourned to an undetermined future sitting of the Parliament. Community members have criticized recent efforts to implement National Water Initiative (NWI) reforms as inadequately addressing CSG and other new technologies: An open letter to the NWC from the Australian National University responding to a call for input highlighted concerns that the 2011 assessment failed to consider the emergence and rapid expansion of new technologies and the threats such technologies impose upon water resources, citing coal seam gas extraction as a significant example (Hussey & Pittock, 2011).

Lessons for the CCS industry

The development of opposition to CSG shows that subsurface activity perceived to put water resources at risk, conducted by energy-related industries, may meet organised, widespread, and fast-spreading opposition. Although a great range of concerns exist amidst the more than 70 organisations opposing CSG (Chalmers, 2011; Commonwealth of Australia, 2011; Crane-Murdoch, 2011; Department of the Senate, 2011; Gooch & Bacon, 2011; Manning, 2011; Moore, n.d:a; Roarty, 2011; Saunders, 2011a; Vasek, 2011; Wildlife Tourism Australia, 2012), many share in common a concern for impacts on water, and their protests may spread quickly and receive media visibility (Chalmers, 2011; Getup, 2011; GetUp, 2012; Ingall, 2011; Keep the Scenic Rim Scenic, 2011; News.com.au, 2012b; Saunders, 2011b; Sydney Morning Herald, 2011b; Wovoka and Bullock, 2012).

The case of nationwide CSG opposition also shows that organised community resistance can lead to political action against an industry perceived to put water resources at risk. One example of this is the call for a moratorium on CSG in New South Wales (Buckingham, 2011) and the beginning of an inquiry into CSG across Australia (NSW Legislative Council, 2011; Parliament of NSW, 2011; SMH, 2011a). Another is the National Partnership Agreement, which Queensland recently signed, which will take steps to strengthen the scientific evidence base related to CSG and large coal mining projects in Australia (Australian Labour Party, 2012).

Also, as previously mentioned, it appears that the CCS industry should monitor and inform itself of the arguments being made against CSG. The objections that people have to mining in general or CSG specifically—such as the hydraulic fracturing process (Roarty, 2011) and the risks of BTEX contamination of groundwater (Minister for Natural Resources, Mines and Energy and Minister for Trade, 2010)—could be transformed and applied to the CCS industry. In pursing subsurface injection of a material, carbon dioxide or "carbon," that is poorly understood by the public (Wallquist, Visschers & Siegrist, 2009; Paukovic, Brunsting, & de Best-Waldhober, 2011; Whitmarsh, Seyfang, & O'Neill, 2011), CCS will be stepping into

difficult territory and part of this will be working through the poor perceptions created by these other industries (J. Lacey, personal communication, 13 February 2012.). It is recommended that CCS proponents consider whether to support additional research into these concerns and be clear on the key points of differentiation between CSG and CCS.

3.2 Discussion and implications

Four case studies cannot provide a truly comprehensive description of Australian water controversies. Nevertheless, they do encompass two new and controversial technical practices; an incident in which water was seen as "impure" was resisted by the community; and a recent chapter in the history of efforts to devise effective policy around water was vigorously and publicly opposed. These case studies and other events may be discussed in terms of four implications for industry and other participants in water governance.

3.2.1 SOCIAL CONVERSATIONS "ABOUT" WATER MAY ALSO BE "ABOUT" MUCH MORE

Recognizing the multiple values of water, as mentioned above, is necessary for interpreting how people think and speak about it, yet is not completely sufficient for understanding water-related controversies. In addition to considering values, it is also possible to see a social conversation regarding water as an arena in which many types of "games" take place. These games are interpersonal negotiations regarding the broader topics this paper has related to water: scarcity, conflict, and power; purity, recycling, and contamination; personal and group identities; and other crucial dimensions of social life.

Regarding conflict and power, questions of when to engage the community—such as the Murray Darling Basin Authority had to address while releasing the Guide to the Proposed Basin Plan and was later criticised for, and the Water Futures Initiative handled in a way that the community found problematic—can be seen as a contest for power. This is a contest over how fundamental or foundational a level of planning process community involvement will be allowed to take place on. For instance, releasing 21 volumes of technical material provides a potentially overwhelming contribution to the planning conversation; it will be hard for any group which sees the issue fundamentally differently to provide an equally concentrated and substantial statement of their position, and thereby gain a more equal position in the conversation. Likewise, concerns about inadequate representation in decision making processes can be thought about as political or power-related concerns. Furthermore, struggles over access and control may touch on issues of personal power over one's property, as demonstrated by the "Lock the Gate" theme that unifies many opponents of CSG.

Regarding purity and identity, questions of "pure" or "contaminated" water may touch on broader concerns of both a community and an organisation's identity. This can be seen in the case of Toowoomba, where the opposition group CADS argued that Toowoomba's image as a community would be at risk if recycled water were accepted (Hurlimann & Dolnicar, 2010). Fears for the continuation of the "Australian way of life" experienced in the country previous to industrial interventions also animate resistance movements opposing CSG (Saunders, 2011a; Vasek, 2011). In a context of scientific uncertainty, fears of underground contamination may become directed at an organisation that has been previously criticised for lack of transparency, such as Cougar Energy in Kingaroy (Sollars, 2011; DERM, 2011a) and the CSG industry generally (Sydney Morning Herald, 2011a; DERM, 2011). At Kingaroy, concerns over transparency evident in August 2010 (Grunt, 2011) were later followed by additional fears of contamination in November 2011 (Gribbin, 2011), showing that organizations that have been identified as potential polluters can experience a persistent lack of community trust.

3.2.2 WHEN TWO AUSTRALIANS SPEAK ABOUT WATER, THEY MAY NOT BE SPEAKING ABOUT THE SAME THING

Two Australians discussing water may in fact be discussing different benefits, values, or end-state objectives, given how diverse this paper has shown water values to be across demographic groups. Whereas water has undeniable economic value to diverse industries and development projects (Prosser, 2011), seeing it purely in economic terms and emphasizing efficiency, control, and industrial productivity is more characteristic of engineers and managers (Bolitho, 2003; Henderson, 2010) and water management professionals in general, while potentially under representing other values and community worldviews

(Syme & Hatfield-Dodds, 2007). As an example, users of UCG technology (such as Cougar Energy) are interested in exploiting a natural resource, while using a water as a means to that end, whereas for the Kingaroy community, they saw their water source and land as more broadly valuable (Grayson, 2011; Grunt, 2010), including for its "green" reputation (Vance, 2011). To residents of Kingaroy, water was seemingly more of a means to enable the community to retain its identity as "green" and as agriculturally-productive.

As a consequence of value differences, individuals discussing the risks to water they perceive run the risk of "speaking past each other." They may be thinking of different desired end-state objectives or ways in which they experience benefit via interactions with water, and speaking without making those end-state objectives explicitly part of the conversation.

3.2.3 TIMING, TRANSPARENCY AND DIVERSITY OF ENGAGEMENT ARE KEY TO EFFECTIVE WATER-RELATED CONVERSATIONS BETWEEN INDUSTRY AND COMMUNITIES

Timing

As evident in the case studies, the timing of engagement and communication activities regarding water management issues is an important consideration. In the case of the Water Futures Initiative in Toowoomba, the decision and announcement were made without public involvement and the council was put in the position of having to defend their proposal against immediate opposition. These events highlight the importance of engaging with communities in the early stages of a proposal and ensuring they are provided with accurate and detailed information from trusted sources.

Efforts to engage relevant stakeholders, including the wider community, should occur when a potential development or proposal is being considered, as opposed to when development is imminent (Khan & Gerrard, 2006). One advantage of early engagement is that it maximises the amount of time available to build the level of trust and confidence with the community (Khan & Gerrard, 2006). Being proactive at a timely stage means the organisation or proponent is well placed to deal with issues as they emerge, as opposed to being forced into a defensive position (Khan & Gerrard, 2006).

Transparency

Processes of engagement should be transparent and clearly set out to stakeholders. In the case of the Kingaroy CSG controversy, one of the main criticisms made against Cougar Energy by the project's various stakeholders during the 18 months or so leading up to the Kingaroy plant closure was an overall lack of transparency and poor community consultation (Sollars, 2011). From the start of the decision-making process, the role of community members should be clearly defined in terms of the level of influence they may have on possible outcomes. In addition, the lead organisation or agency should explain how the input of a community has been used or explain why community information was not taken into account (von Korff, d'Aquino, Daniell & Bijlsma, 2010). This relates to transparency regarding the extent to which power or authority is shared.

Diversity of engagement

Community members have different ways in which they learn, communicate and interact. In addition, outreach may need to occur across a wide scale and a diverse array of groups, such as in the case of the Murray-Darling Basin. Therefore, the methods of public participation and engagement, and information dissemination that are undertaken should be diverse in order to reach out to those involved (Cavaye, 2004; Hartley, 2006; Webler & Tuler, 2006). Presenting information in a variety of formats will also ensure that information access is fair across the community (Hartley, 2006).

3.2.4 SOCIAL RESEARCH OFFERS WAYS TO STRENGTHEN DESCRIPTIONS AND ASSESSMENTS, IMPROVE HOW "PROBLEMS" ARE UNDERSTOOD, SUGGEST POTENTIAL INTERVENTIONS, AND ENHANCE DECISION MAKERS' SELF-AWARENESS

Addressing the topic of water with sensitivity and respect for human difference will be possible if the substantial lessons obtained through social research are taken into account. A full review of "best practices" for community engagement is beyond the scope of this paper; however, explained below are a few key ways in which social research is able to contribute to water-related conversations and decision-making. Social science has supported efforts to:

- assess and describe community attitudes (e.g. Ashworth, et al., 2011a; Fielding et al., 2011; Hurlimann, 2006; Hurlimann & McKay, 2004; Hurlimann, 2008; Syme & Hatfield-Dodds, 2007) and social scenarios more broadly;
- clarify the "problems" that water-related decision making may both pose and respond to (e.g. Hurlimann, Hemphil, McKay & Geursen, 2008);
- deliver approaches and interventions that increase people's level of engagement with water issues (e.g. Lahiri-Dutt & Harriden, 2008; Webb, Burgin, & Maheshwari, 2008; Robertson, Nichols, Horwitz, Bradby & MacKintosh, 2000); and
- increase the understanding that decision makers have of their own positioning, actions, and their consequences (e.g. Flick, 1998; O'Brien, 2001; McNiff, 2012; Reason & Bradbury, 2001).

Creating more nuanced descriptions

It almost goes without saying that social science lends skill in defining questions to be asked, and interpreting research data in accordance with its unique expertise (Flick, 2011). Social scientists have assisted in collecting information to characterise and describe the attitudes, beliefs, and other personal characteristics of the people who reside in a given location (Ashworth, et al., 2011a), and have identified patterns and interrelationships in those attitudes and beliefs. For example, surveys have been carried out to measure gender differences in perceptions of water security (Crampton & Ragusa, 2008) and beliefs relating to riverside zone management (Fielding, Terry, Masser, Bordia & Hogg, 2005), and to study community perceptions of water from alternate sources (Dolnicar & Hurliman, 2010).

Social science has also provided benchmarking tools. Where a benchmark is defined as "a standard by which something can be measured and change over time assessed" (Cary & Pisarski, 2011, p. 1148), benchmarking tools are capable of providing a snapshot of a community's attitudes, values, behaviours and knowledge related to a body of water or water more generally (Cary & Pisarski, 2011). Benchmarking tools have been applied to assess "the social dimensions of river health, community behaviours related to rivers and community understanding of human impacts on rivers" in Victoria, Australia (Cary & Pisarski, 2011). The contribution of these descriptive methods and others is a more nuanced description of the "field" in which decision makers are acting.

Framing the problem

Social researchers are also able to provide decision makers, such as managers in the CCS industry, with alternative understandings of the social problem or situation being approached.

Broadly, social researchers can contribute ways of seeing a problem or scenario that are fundamentally different to the ways in which decision makers and communicators have been trained and tend to think. For example, Michael Callon's "actor-network theory" (ANT) from the field of Science and Technology Studies offers a perspective from which non-human participants in a larger social assemblage, such as water, may be seen as having agency (Callon, 1987; Harvey, in press). Agency, in ANT, is understood as the ability to wilfully participate or not participate in the larger network of human and non-human entities that certain members are attempting to drive towards some outcome (Callon, 1987; Harvey, in press). Water, from an ANT perspective, is no longer a substrate to be acted upon, but a participant in a broader social arrangement that may "enable and support, or resist and disrupt, human intention" (Harvey, 2011, p.

1500). The ANT perspective, incidentally, seems closer to an Aboriginal Australian cultural and religious perspective on the agency of non-human entities, in that it affords water itself the ability to disrupt or support larger projects in which it has become involved. The significance of contributions from social theory like this one is that where traditional thinking has failed, and traditional questions have failed to find answers that can inform a better approach, new conceptualizations may provide a crucial foundation for new water management styles and strategies.

Social theory makes more specific contributions as well. Although a member of the Murray Darling Basin Authority has written that "there is no social theory on water in Australia" (Henderson, 2010, p. 101), social scientists have nevertheless assisted in developing broader ways to conceptualize the value people experience through their interactions with water (Hurlimann et al, 2008). Revised conceptualizations of value have the potential to change policy development approaches in fundamental ways, one of which is the development of better metrics to make social and other non-market water values visible. For example, responding to a perceived lack of integration of social analysis into water policy decision making, Syme, Porter, Goeft & Kington (2008) argue that there is a need for a metric that will include the assessment of various benefits offered by water on a single scale. The answer they propose is the "sphere of needs," which is a conceptual model and a suggested means to consider the range of individual and community needs related to water. The "sphere of needs" exemplifies how conceptual work can also be highly practical and applicable to the needs of decision makers (Syme et al., 2008).

Framing an intervention or communication effort

Social research has delivered and enhanced ways to achieve public engagement and participation in decision making, and thereby achieve the inclusion of multiple perspectives in discussions of water. Participatory processes work on both the individual and group level, and offer many benefits, including increased legitimacy for decision making institutions; increased trust; better decisions that are less expensive and more relevant, due to the new information, ideas, and perspectives from stakeholders; easier implementation of decisions; and strengthening of "civic competency" as people learn how to be more involved in community life and community leadership (von Korff, et al., 2010).

Research-informed interventions for engaging people on the individual level regarding water and environmental decision making include means to get people discussing their personal experiences and behaviours. Examples of these approaches include "water diaries" (Lahiri-Dutt & Harriden, 2008), "action conversations" (Webb et al., 2008) and "environmental narratives" (Robertson, et. al, 2000).

- In a "water diary", a person records daily activity that involve water use, thereby engaging him or herself in tracking and reflecting on daily practices including water (Lahiri-Dutt & Harriden, 2008).
- Webb, Burgin and Maheshwari (2008) propose the "action conversation" as a method that can engage seemingly 'hard to reach' or 'apathetic' people, by exploring what constraints people see to changing their behaviours while also framing scientific messages in public language.
- Robertson, Nichols, Horwitz, Bradby and MacKintosh (2000) define "environmental narratives" as oral histories and other stories and anecdotes conveying knowledge and perceptions that have been experienced by a single narrator. The authors argue that "environmental narratives" can support ecosystem health by driving a change of perspective in both the speaker and the researchers regarding the landscape.

Research-informed group processes have successfully enabled stakeholder engagement related to multiple complex issues. Many types of formal processes exist that relate to other complex issues, and these could easily be adopted to suit the needs of water-related engagement.

- Proctor and Drechsler (2006) propose a structured decision making process called "deliberative multicriteria evaluation" (DMCE) that builds on previous experience with "multicriteria evaluation" (MCE). DMCE offers "structure and integration in complex decision problems" by involving a "citizens' jury" in a deliberative, interactive process (p. 171).
- More recently, women led a group engagement effort called "Watermark" to build people's knowledge of water issues and leave them more able to participate in debates and discussions about water

(Victorian Women's Trust, 2007). The program went through a process of developing learning materials and a website between 2004 and 2006; then it developed a process for convening small groups to discuss the materials and consider potential actions to take (Victorian Women's Trust, 2007). Watermark was foundational in conceptualizing such a type of small-group information dissemination and behaviour change support strategy. Due to the program's success, other types of participatory engagement have been based off of it, such as the Energymark program developed by CSIRO (Ashworth, 2011b) and the Questacon Water Tour and educational materials (http://water.questacon.edu.au/).

Enhancing decision makers' self-awareness

Not only views of water, but also views of the social process of research and community consultation itself, may be modified by contributions from social research. Anthropologists experienced in studying alternative worldviews and experienced in working with people who hold such worldviews place a high value on "reflexivity," which may be understood as the active work to remain aware of how one's own beliefs and priorities influence one's own participation in a social situation and how "the subjectivities of the researcher *and* those being studied are part of the research" (Flick, 1998, p. 6). Reflexivity is also an important part of "action research" (O'Brien, 2001; McNiff, 2012) and "participatory action research", in which researchers collaborate with the communities they study, in order to propose new actions and directions the community might take (Reason & Bradbury, 2001).

Attempting to practice reflexivity may lead to alternative views of the community consultation process itself, which may suggest modifications or improvements. For example, it is possible that moves to conduct more water-related decision making at the local level may be seen as an unambiguous social good; however, deliberate attempts at reflexivity—i.e. envisioning how one's own actions create certain effects—can lead to a more qualified sense of optimism (Jennings & Moore, 2000). Social researchers have argued that "regionalisation", or decentralised consultation, is in itself a type of governance, and one that may favour citizens who are already "empowered" (Jennings & Moore, 2000, p.182) and actively managing and using relationships with local politicians (Graycar, 1981), rather than achieving its stated ends of providing broad participation, empowerment, fairness, democracy, and accountability (Jennings & Moore, 2000). Critical assessment of such activity resulting from the application of reflexivity and careful attention to one's own assumptions, may provide support for the development of better social interventions to more effectively achieve the desired outcomes.

Part IV Conclusions and recommendations

4 Conclusion and Recommendations

The complexity of people's engagements with water, and water's ability to look fundamentally different in one person's eyes as opposed to another's, highlights the need for absolute sensitivity and caution in addressing water within any cultural landscape, particularly in the Australian context of water scarcity. CCS, the Institute, and its members are only one player in the Australian water landscape, and a relatively new one at that; as such, it is essential for the technology's proponents to be aware of current concerns and take advantage of existing knowledge related to water and public engagement.

This chapter provides recommendations to Institute members, participants in the global CCS industry, and others involved in planning or implementing public engagement efforts related to water resources.

4.1 Recommendations for action and future research

1. The review reported that the CCS industry need to continually inform itself of, and monitor, the arguments being made against UCG as well as CCS specific water related incidents. **This includes a recommendation that the Institute support research into these concerns**, including the objections that people have to UCG, CCS and water—such as the groundwater contamination and transparency concerns related to UCG at Kingaroy. It is suggested that a national level survey and a series of workshopS be utilised to capture data and insights be provided to the CCS industry on possible implications and practical recommendations.
2. There is a need for the CCS industry to **engage in a conversation regarding risk and benefit that is able to encompass a broader scope of concerns** than the technical likelihood or improbability of danger to aquifers due to of CO_2 leakage.
    a. Water's ability to have value in symbolizing personal identity and connection to place, and its ability to express power relations as well as meanings of purity and contamination, raises the **risk that industrial groups or CCS projects perceived as "outsiders" will be seen as threatening to individual and community well-being** if they take actions that could affect water resources.
    b. Awareness of different individual risk perception and the influences that drive these may provide insight into better understanding and responding to stakeholder risk assessment and decisions. **Relating back to recommendation one, this scope could be captured in a social science research project** and could provide foundational understandings to the industry on CCS specific perceptions related to water usage, potential contamination and their influence on public acceptance of CCS.
    c. In order to ensure integrity, good will, and transparency in engagement and communication with stakeholders and to build trust in both source and information will require strong leadership from the CCS Industry.
3. Professionals in engineering and managerial roles should remain aware that they may approach water-related issues with a different perspective than community members. Specifically, they may be less inclined to focus on its spiritual and aesthetic dimensions as opposed to its physical and scientific properties and the more tangible benefits it offers.
    a. As they ask a question or make a statement about water, members of the technical community working in CCS need to make an effort **to explicitly or implicitly convey to their audience that they are aware** that they are speaking about a substance with aesthetic, ecological, religious or spiritual, and recreational value, potential benefits to community and personal identity, as well as economic value.
4. Industries, projects, and research efforts perceived as water-related should **use existing best practices for community engagement.**

a. To quote from authors Russell and Hampton (2006), “The key points have been spelled out repeatedly in the water sector as elsewhere:
    - that processes should be transparent
    - that people should be given comprehensive and credible information
    - that deliberation should encompass general water management in a region and start before specific [projects] are planned
    - that there should be open discussion of possible problems, and
    - that people should be informed at the outset of the extent to which their preferences will be taken into account.”

5. Industries, projects, and research efforts perceived as water-related should take the **opportunity to conduct additional social research and to incorporate social science expertise**.
    a. There is a need for additional research on Australian water values. This may include a media analysis on water-related issues experienced by industries similar to CCS, and the convening of focus groups to further explore community attitudes towards the intersection of water and CCS.
    b. There is a need for additional research into water-related controversies experienced in Australia by other industries that pursue work underground that can be perceived as putting water resources at risk

In conclusion, water is both a practical, everyday substance and one to which people attribute substantial value and meaning, as a deeply integrated component of life. As like other parts of the world, Australia has continual conflicts over water between irrigators and environmentalists; urban and rural populations, traditional owners and non-Indigenous populations; industrial water users and recreational water users; and private property owners and other members of the public. One key trigger point for backlash from the community is any perception that water sources are put at risk. Such a reaction has recently been experienced in the mining of coal seam gas.

The aim of this paper was to understand social conflicts over water and how it is valued and understood by different groups of people in order to provide fundamental principles to the CCS industry and provide practical recommendations based on current literature. From our perspective it is particularly important for industrial managers and decision makers to inform themselves regarding water values because they assist to guide the selection and evaluation of behaviour and action, including action towards the environment. By drawing upon previous successes and failures in involving Australian communities in water-related decision making, we highlighted the key learning that could benefit the CCS industry and also identified areas for future research. As an energy technology with potential impacts to water sources, a lack of essential knowledge on the diverse values related to water, or how to connect in effective two-way engagement between the CCS Industry and Australian communities, could result in fundamental errors. Particularly, if such an understanding in not included in current and future CCS projects.

References

ABC Radio (2011). *Coal seam comes under scrutiny*. Inside Business, ABC Radio. Retrieved from http://www.abc.net.au/insidebusiness/content/2011/s3298382.htm

Adler, P.S. & Kranowitz, J.L. (2006). *A Primer on Perceptions of Risk, Risk Communication and Building Trust*. The Keystone Center, Keystone.

Anscombe, G. E. M. (1957). *Intention.* Oxford, England: Blackwell.

Agle, B. R., & Caldwell, C. B. (1999). Understanding Research on Values in Business. *Business & Society, 38*(3), 326-387. doi: 10.1177/000765039903800305

Ajzen, I. (1988). *Attitudes, personality and behavior*. Chicago, IL: Dorsey Press.

Alston, M. (2004). Who is down on the farm? Social aspects of Australian agriculture in the 21st century. *Agriculture and Human Values, 21*(1), 37-46. Retrieved from ABI/INFORM Global. (Document ID: 536865031).

Alston, M., & Mason, R. (2008a). Who Determines Access to Australia's Water? Social Flow, Gender, Citizenship And Stakeholder Priorities In The Australian Water Crisis. *Rural Society, 18*(3), 214.

Alston, M., & Mason, R. (2008b). Who turns the taps off? Introducing social flow to the Australian water debate. [Case study]. *Rural Society, 18*(2), 131(139).

Altemeyer, B. (1998). The other "authoritarian personality". In M. P. Zanna (Ed.), *Advances in Experimental Social Psychology* (pp. 47-92). San Diego: Academic.

Argent, N., Smailes, P., & Griffin, T. (2007). The Amenity Complex: Towards a Framework for Analysing and Predicting the Emergence of a Multifunctional Countryside in Australia. *Geographical Research, 45*(3), 217-232.

Argyroudi, A. (2009). *Dilemmas and Learning Accounts around the Traveston Dam Proposal on the Mary River (South East Queensland of Australia)*. Sourced from http://stud.epsilon.slu.se/343/

Arthington, A. (2009). Australian lungfish, *Neoceratodus forsteri*, threatened by a new dam. *Environmental Biology of Fishes, 84*(2), 211-221. doi: 10.1007/s10641-008-9414-y

Ashworth, P., Boughen, N., Mayhew, M., & Millar, F. (2009). From research to action: Now we have to move on CCS communication. *International Journal of Greenhouse Gas Control, 4*(2), 426-433.

Ashworth, P., Bradbury, J., Feenstra, C. F. J. Y., Greenberg, S., Hund, G., Mikunda, T., et al. (2011a). *Communication and engagement toolkit for CCS projects*. Brisbane: CSIRO.

Ashworth, P. (2011b). Chapter 10: Reducing energy demand: the imperative for behavioural change. In CSIRO (Ed.), Reducing energy demand: the imperative for behavioural change. Pullenvale: CSIRO. Retrieved from http://www.publish.csiro.au/?act=view_file&file_id=CSIRO_CC_Chapter%2010.pdf.

Askew, L. E., & McGuirk, P. M. (2004). Watering the suburbs: Distinction, conformity and the suburban garden. *Australian Geographer, 35*(1), 17-37.

Australian Associated Press (2006). Toowoomba says no to recycled water. *Sydney Morning Herald*. Retrieved from http://www.smh.com.au/news/national/toowoomba-says-no-to-recycled-water/2006/07/29/1153816419568.html

Australian Broadcasting Corporation (2005). Govt urged to review water agreement. Retrieved from http://www.abc.net.au/news/2005-08-25/govt-urged-to-review-water-agreement/2088834

Australian Broadcasting Corporation (2011). Is Coal Seam Gas worth the risk? The backlash to a billion dollar industry. Retrieved from http://www.abc.net.au/7.30/content/2011/s3321223.htm?site=widebay

Australian Government. (2006). Water scarcity and demand. *Connected water: Managing the linkages between surface water and ground water*. Retrieved 15 February, 2012, from http://www.connectedwater.gov.au/copyright.html

Australian Labour Party. (2012). Queensland signs up to CSG agreement. Retrieved 22 February, 2012, from http://www.naturalgasasia.com/queensland-signs-up-to-csg-agreement-4598

Australian Lot Feeders Association (ALFA) (n.d.). Water. Retrieved from http://www.feedlots.com.au/index.php?option=com_content&view=article&id=93:water&catid=35:key-area-policy&Itemid=120

Australian Natural Resources Atlas. (2009). *Australian Water Resources Assessment 2000*. Retrieved from http://www.anra.gov.au/topics/water/pubs/national/water_summary.html.

Axinn, W. G., & Thornton, A. (1992). The influence on parental resources on the timing of the transition to marriage. *Social Science Research, 21,* 261-285.

Ball-Rokeach, S. J., Rokeach, M., & Grube, J. W. (1984). *The great American values test: Influencing behavior and beliefs through television*. New York: Free Press.

Bandura, A. (1977). *Social Leaning Theory*. Englewood Cliffs, N.J.: Prentice-Hall.

Bark, R., D. H. MacDonald, et al. (2011). Water values. Water: Science and Solutions for Australia. I. P. Prosser, CSIRO Publishing. Retrieved from: http://www.csiro.au/resources/Water-Book

Beck, U. (1992). *Risk society: Towards a new modernity.* London: SAGE.

Beeton, R. B., Buckley, K. I., Jones, G. J., Morgan, D., Reichelt, R. E., & Trewin, D. (2006). *Australia State of the Environment 2006, Independent report to the Australian Government Minister for the Environment and Heritage*. Retrieved 2 Feb 2012. from http://www.environment.gov.au/soe/2006/publications/report/pubs/soe-2006-report.pdf.

Bengston, V. L. (1975). Generation and family effects in value socialization. *American Sociological Review, 40,* 358-371.

Berndt, T. J., & Miller, K. E. (1990). Expectancies, values, and achievement in junior high school. *Journal of Educational Psychology, 82,* 319-326.

Biasi, G. (2011). *What is Risk Mitigation?* From Associates, Insight, Education, Events on Qualified Remodeler.com/NARI. Retrieved from http://qualifiedremodeler.epubxpress.com/wps/portal/qur/c0/04_SB8K8xLLM9MSSzPy8xBz9CP0os3iLkCAPEzcPIwN3jyBzAyNTA18358AgA_cwY_1I_ShzXPIWBob6ISATM_UjLQ2MLUDMYv1IAxBdoB9paAQWyC8tSk7VjyxOTSxKztAvyE5MqkpNqnJ0VFQEAFBN5wQ!/

Bigpond News (2011). *Carcinogens found in CSG project*. 28 August 2011. Retrieved from http://bigpondnews.com/articles/National-Rural/2011/08/28/Carcinogens_found_in_CSG_project_655260.html

Bills, R. E. (1952). The effect of a value on learning. In G.H. Seward (Ed.), *Psychotherapy and culture conflict* (pp. 217-222): Ronald Press.

Bolitho, A. (2003). *New dimensions in water conversation; An interanimation of writing and water.* Doctorate of Creative Arts, University of Technology, Sydney.

Boully, L. (2004). *Participatory Governance: Intra and Inter Governmental Consultation and Community Engagement in the Murray-Darling Basin Initiative.* Paper presented at the 7th Annual Corporate Governance in the public sector Conference, Canberra.

Braithwaite, V. (1997). Harmony and security value orientations in political evaluation. *Personality and Social Psychology Bulletin*. *23*(4), 401-414.

Bronfenbrenner, U. (1979). *The ecology of human development*. Cambridge, MA: Harvard University Press.

Buckingham, J (2011). Coal Seam Gas Moratorium Bill 2011. Introduced to the NSW Parliament by the Hon. Jeremy Buckingham MLC on 11 November 2011. Retrieved from http://www.parliament.nsw.gov.au/prod/parlment/nswbills.nsf/0/F4CE08EEB343A54CCA25788B00242FD6

Burmil, S., Daniel, T. C., & Hetherington, J. D. (1999). Human values and perceptions of water in arid landscapes. *Landscape and Urban Planning, 44*(1999), 99-109.

Callon, M. (1987). Society in the making: The study of technology as a tool for sociological analysis. . In W. E. Bijker, T. P. Hughes & T. J. Pinch (Eds.), *The social construction of technological systems: New directions in the sociology and history of technology*. Cambridge: MIT Press.

Cary, J., & Pisarski, A. (2011). Social benchmarking to improve river ecosystems. *Water science and technology, 64*(5), 1148-1153.

Cavaye, J. (2004). Governance and community engagement: The Australia experience. In W. R. Lovan, M. Murray & R. Shaffer (Eds.), *Participatory Governance: Planning, Conflict Mediation and Public Decision Making in Civil Society* (pp. 85-102): Ashgate Publishing.

Chalmers, S. (2011). Climate Change: No Coal Seam Gas Rally – Newtown, Sydney, NSW. Green Times, 19 September 2011. Retrieved from http://www.greentimes.com.au/climate-change/no-coal-seam-gas-rally-newtown-sydney-nsw.html

Chanan, A., Kandasamy, J., Vigneswaran, S., & Sharma, D. (2009). A gradualist approach to address Australia's urban water challenge. *Desalination, 249*(3), 1012-1016.

Chenoweth, J. L., Ewing, S. A., & Bird, J. F. (2002). Procedures for Ensuring Community Involvement in Multijurisdictional River Basins: A Comparison of the Murray-Darling and Mekong River Basins. *Environmental Management, 29*(4), 497-509.

Cherlin, A. J. (1981). *Marriage, divorce, remarriage*. Cambridge, MA: Harvard University Press.

Cileli, M. (2000). Change in value orientations of Turkish youth from 1989-1995. *The Journal of Psychology, 134*(3), 297-305.

Commonwealth of Australia (2011). *Meeting of the Murray-Darling Basin system*, Official Committee Hansard, SENATE, Rural Affairs and Transport References Committee, 20 July 2011, Brisbane. Retrieved from http://www.aph.gov.au/hansard/senate/commttee/s171.pdf

Connell, D. (2007). *Water politics in the Murray-Darling Basin*. Annandale, N.S.W.: Federation Press.

Cougar Energy (2009). *Cougar Energy's Kingaroy Open Day Wins Strong Interest from Local Community*. Retrieved from http://www.cougarenergy.com.au/pdf/ASX_announcement_KingaroyOpenDay.pdf.

Cougar Energy (2010). Kingaroy Pilot Project Preparing for Production. Retrieved from http://www.cougarenergy.com.au/pdf/ASX_Announcement_Kingaroy_Update_Feb_2010.pdf.

Crampton, A., & Ragusa, A. (2008). My water's fine, isn't it? An exploration of the gendered perception of water quality and security in Australia. *Rural Society, 18*(3), 202-202-213.

Crane-Murdoch, S. (2011). *Unpacking health hazards in fracking's chemical cocktail*, High Country News (21 February 2011). Retrieved from http://www.hcn.org/issues/43.3/unpacking-health-hazardsin-frackings-chemical-cocktail

Cubby, B. (2010a). *Origin stops coal seam gas drilling after chemicals found in water*. Sydney Morning. 21 October 2010. Retrieved from http://www.smh.com.au/environment/energy-smart/origin-stops-coal-seam-gas-drilling-after-chemicals-found-in-water-20101020-16ud7.html#ixzz1lof1QfqL

Cullen, P. (2007). Knowledge investments underpinning national water reform. In V. Cullen (Ed.), *This Land Our Water: A collection of papers by Peter Cullen* (pp. 95-103). Hindmarsh: ATF Press.

de Coninck, H., & Bäckstrand, K. (2011). An International Relations perspective on the global politics of carbon dioxide capture and storage. *Global Environmental Change, 21*(2), 368-378. doi: 10.1016/j.gloenvcha.2011.03.006

Department of Environment and Resource Management (DERM) (2010). *Healthy Headwaters Coal Seam Gas Feasibility Study Factsheet*, December 2010, W184. Retrieved from http://www.derm.qld.gov.au/environmental_management/coal-seam-gas/water-feasibility-study/index.html

Department of Environment and Resource Management (DERM) (2011a). *CSG Regulation*. (Last updated: December 2011) Retrieved from http://www.derm.qld.gov.au/environmental_management/coal-seam-gas/regulation.html

Department of Environment and Resource Management (DERM) (2011b). *Fracking and BTEX*. Factsheets (30 August 2011). Retrieved from http://www.derm.qld.gov.au/factsheets/pdf/csg/csg8.pdf

Department of Environment and Resource Management (DERM) (2011c). *Underground Coal Gasification*. (last updated: August 2011) Retrieved from http://www.derm.qld.gov.au/environmental_management/ucg/index.html.

Department of Environment and Resource Management (DERM) (2011d). ISP Summary Report on the Environmental Evaluations of Cougar Energy. Report of the Independent Scientific Panel on Underground Coal Gasification to the Department of Employment, Economic Development and Innovation (DEEDI) in response to a request from the Department of Environment and Resource Management (DERM). Retrieved from http://www.derm.qld.gov.au/environmental_management/ucg/documents/cougar-energy-report.pdf.

Department of Natural Resources and Water (2007). *The South East Queensland Drought to 2007*. Retrieved from http://www.longpaddock.qld.gov.au/about/publications/pdf/seq_drought_2007.pdf.

Department of Natural Resources, Mines and Energy (2004). *Coal Seam Gas Water Management Study NRO001*. Prepared by Parson Brinkenhoff. Retrieved from http://www.ret.gov.au/resources/industry_consultation/regional_minerals_programs/coal_seam_gas_water_management_study/Pages/CoalSeamGasWaterManagementStudy.aspx

Department of the Senate (2011). *Management of the Murray Darling Basin: Interim report: the impact of mining coal seam gas on the management of the Murray Darling Basin*. Prepared by the Senate Standing Committee on Rural Affairs and Transport. Retrieved from http://www.aph.gov.au/senate/committee/rat_ctte/mdb/interim_report/report.pdf

Department of Sustainability, Environment, Water Pollution and Communities,. (2012). Water in Australia: Water for the Future. *Water for the Future* Retrieved 15 from http://www.environment.gov.au/water/australia/index.html

Dolnicar, S., & Hurlimann, A. (2010). Chapter 13 Desalinated Versus Recycled Water: What Does the Public Think?, *Sustainability Science and Engineering* (Vol. 2, pp. 375-388).

Dolnicar, S., Hurlimann, A., & Nghiem, L. D. (2010). The effect of information on public acceptance - The case of water from alternative sources. *Journal of Environmental Management, 91*(6), 1288-1293.

Dolnicar, S., & Schafer, A. I. (2009). Desalinated versus recycled water: Public perceptions and profiles of the accepters. *Journal of Environmental Management, 90*(2), 888-900.

Douglas, M. (1966). *Purity and danger: An analysis of the concepts of pollution and taboo*. London: Routledge.

Dowling, J. (2006). Fishing for power? Women in the fishing industry in Australia. In K. Lahiri-Dutt (Ed.), *Fluid bonds: Views on gender and water* (pp. 138-149). Kolkata: STREE.

Earle , T . C . , Siegrist , M . and Gutscher , H . (2007). Trust, Risk Perception, and the TCC Model of Cooperation . In Siegrist, M., Earle, T.C. and Gutscher, H. (eds) Trust in Cooperative Risk Management: Uncertainty and Scepticism in the Public Mind . London: Earthscan , pp 1 – 49 .

Feary, C. (2011). Cougar Energy sues Queensland government, DERM officials for more than $34M. Retrieved from http://www.proactiveinvestors.com.au/companies/news/20803/cougar-energy-sues-queensland-government-derm-officials-for-more-than-34m-20803.html.

Feather, N. T. (1992). Values, valences, expectations, and actions. *Journal of Social Issues, 48*(2), 109-124.

Feather, N. T. (1995). Values, valences, and choice: The influence of values on the perceived attractiveness and choice of alternatives. *Journal of Personality and Social Psychology, 68(6),* 1135-1151.

Feather, N.T. (1990). Bridging the gap between values and actions: Recent applications of the expectancy-value model. In E. Higgins & R. Sorrentino (Eds.), *The handbook of motivation and cognition: Foundations of social behavior* (Vol. 2, pp. 151-192). New York: Guilford Press.

Fielding, K. S., Terry, D. J., Masser, B. M., Bordia, P. P., & Hogg, M. A. (2005). Explaining landholders' decisions about riparian zone management: the role of behavioural, normative, and control beliefs. *Journal of Environmental Management, 77*(1), 12-21.

Fielding, K. S., Louis, W. R., Warren, C. and Thompson, A. (2011). Understanding household attitudes and behaviours towards waste, water and energy conservation. In Peter W. Newton (Ed.), *Urban Consumption* (pp. 199-214) Collingwood, VIC, Australia: CSIRO Publishing.

Finnegan, W. (2002). Leasing the rain. *The New Yorker,* (8 April 2002). Retrieved from http://www.newyorker.com/archive/2002/04/08/020408fa_FACT1

Finkel, S. E., & Ernst, H. R. (2005). Civic education in post-apartheid south Africa: Alternative paths to the development of political knowledge and democratic values. *Political Psychology, 26*(3), 333-364.

Flick, U. (1998). *An introduction to qualitative research*. London: SAGE.

Franks, DM. (2011). *Management of the social impacts of mining*. In SME Mining Engineering Handbook 3rd ed. (pp. 1817-1825) Littleton, Colorado, USA: Society for Mining, Metallurgy, and Exploration.

Fries, S., Schmid, S., Dietz, F., & Hofer, M. (2005). Conflicting values and their impact on learning. *European Journal of Psychology of Education, 20*(3), 259-273.

Friends of the Earth Australia (FoE) (n.d.). *Coal Seam Gas*. Retrieved from http://foe.org.au/coal-coal-seam-gas

Frosdick, S. (1997). The techniques of risk analysis are insufficient in themselves. *Disaster Prevention and Management*, 6(3), 165 – 177 doi 10.1108/09653569710172937

Fuller, K. (2011). *Coal Seam Gas Protest Ends*. ABC New England North West. Retrieved from http://www.abc.net.au/local/stories/2011/07/05/3261049.htm

Gerber, M. & von Solms, R. (2005). Management of risk in the information age. *Computers & Security*, 24(1), 16-30. Retrieved from http://www.sciencedirect.com/science/article/pii/S0167404804002780

Geoscience Australia. (2011). Research Reports - Floods Retrieved 17 February 2012, from http://www.ga.gov.au/hazards/flood/reports.html

GetUp (2011). Defend our Water! National Day of Action on Coal Seam Gas. Posted by Kelsey, 20 October 2011. Retrieved from http://blog.getup.org.au/2011/10/20/defend-our-water-national-day-of-action-on-coal-seam-gas/

GetUp (2012). *Local stories: the coal seam gas campaign heats up*. Posted by Kelsey, 23 January 2012. Retrieved from http://blog.getup.org.au/2012/01/23/1511/

Giddens, A. (1991). Modernity and self-identity: Self and society in the late modern age. Cambridge: Polity.

Giddens, A. (1984). *The Constitution of Society*. Cambridge: Polity Press.

Giordano, M. (2005). The Meaning of Water. *The Geographical Journal, 171*(Jun 2005), 180-180.

Global CCS Institute (2011). *The global status of CCS*. Canberra: Global CCS Institute.

Goeft, U. (2008). *Water centrality for water and society.* Bachelor of Science (Environmental Management) Honors, Edith Cowan University.

Gold , J. A., & Robbins, M. A. (1979). Attitudes and values: A further test of the semantic memory model. *Journal of Social Psychology, 108,* 75-81.

Gold, J. A., & Russ, R. C. (1977). A semantic memory approach to the conceptualization of attitudes and values. *Journal of Social Psychology, 102,* 233-240.

Gooch, N. and Bacon, W. (2011). Meet the Inner-City Coal Seam Gas Drillers. NSW Politics, New Matilda. Retrieved from http://newmatilda.com/2011/03/25/meet-inner-city-coal-seam-gas-drillers

Goodall, H. (2006). Gender, race and rivers: Women and water in northern NSW. In K. Lahiri-Dutt (Ed.), *Fluid bonds: Views on gender and water* (pp. 287-304). Kolkata: STREE.

Graycar, A. 1981. The Australian Assistance Plan. In *Decisions*: *Case Studies in Australian Public Policy*, Encel, S, Wilenski, P. & Schaffer B (eds). Longman Cheshire: Melbourne; 41–51.

Grayson, M. (2011). John Dalton, Kingaroy Concerned Citizens Group; Mark Derriman, Chief Operations Officer, Queensland Bauxite. Retrieved from http://www.abc.net.au/rural/regions/content/201104/3202042.htm.

Gribbin, C. (2011). *Company cleared of water contamination on Kingaroy property*. Retrieved from http://www.abc.net.au/rural/news/content/201111/s3353281.htm.

Griffiths, T., & Robin, L. (Eds.). (1997). *Ecology and empire: environmental history of settler societies*. Carlton South, Vic.: Melbourne University Press.

Grunt (2011). *Kingaroy Concerned Citizens Group Meeting*. Retrieved from http://chatter.bunyawatch.com/Chatter3/00002c8c.htm.

Gudmundsdottir, S. (1990). Values in pedagogical content knowledge. *Journal of Teacher Education, 41*(3), 44-52.

Hacking, I. (1999). Making up people. In M. Biagioli (Ed.), *The Science Studies Reader* (pp. 161-171). London: Routledge.

Hacking, I. (1995). *Rewriting the soul: Multiple personality and the sciences of memory*. Princeton: Princeton University Press.

Harris, M. (1976). History and Significance of the EMIC/ETIC Distinction. *Annual Review of Anthropology, 5*(1), 329-350. doi: doi:10.1146/annurev.an.05.100176.001553

Harvey, P. (In press). Knowledge and experimental practice: A dialogue between anthropology and science and technology studies. In R. Fardon, O. Harris, T. Marchand, M. Nuttall, C. Shore, V. Strang & R. Wilson (Eds.), *A Handbook of Social Anthropology, Association of Social Anthropologists of the United Kingdom and Commonwealth*. London: Sage.

Hartley, T. W. (2006). Public perception and participation in water reuse. *Desalination, 187*(1-3), 115-126.

Head, L., & Muir, P. (2006). Women, men, and water in Australian backyards. In K. Lahiri-Dutt (Ed.), *Fluid bonds: Views on gender and water* (pp. 185-201). Kolkata: STREE.

Heberlein, T. A. (1981). Environmental attitudes. *Zeitschrift fur Umweltpolitik*, 2, 241-270

Hechter, M. J. (2000). Agenda for sociology at the start of the twenty-first century. *Annual Review of Sociology, 26,* 697-698.

Hechter, M. J., Ranger-Moore, J., Jasso, G., & Horne, C. (1999). Do values matter? An analysis of advance directives for medical treatment. *European Sociological Review, 15*(4), 405-430.

Henderson, K. (2010). Review Essay: Water and Culture in Australia: Some Alternative Perspectives. *Thesis Eleven,*102(97).

Hillier, J.R. (2010). *Groundwater connections between the Walloon Coal Measures and the Alluvium of the Condamine River*. A report for the Central Downs Irrigation Limited, August 2010. Retrieved from http://www.cdil.com.au/documents/JHillierfinaldoc.pdf

Holmes, J. H. (1997). Diversity and change in Australia's rangeland regions: translating resource values into regional benefits. *Rangeland journal, 19*(1), 3-25.

Howard, J. L. (2008). The Future of the Murray River: Amenity Re-Considered? *Geographical Research, 46*(3), 291-291-302.

Howitt, R., & Suchet-Pearson, S. (2006). Changing country, telling stories: Research ethics, methods, and empowerment in working with Aboriginal women. In K. Lahiri-Dutt (Ed.), *Fluid bonds: Views on gender and water* (pp. 48-63). Kolkata: STREE.

Hurlimann, A. (2006). Melbourne office worker attitudes to recycled water use. *Water, 33*(7), 58-65.

Hurlimann, A., & Dolnicar, S. (2010). When public opposition defeats alternative water projects - The case of Toowoomba Australia. *Water Research, 44*(1), 287-297.

Hurlimann, A., Hemphill, E., McKay, J., & Geursen, G. (2008). Establishing components of community satisfaction with recycled water use through a structural equation model. *Journal of Environmental Management, 88*(4), 1221-1232.

Hurlimann, A., & McKay, J. (2004). Attitudes to reclaimed water for domestic use: Part 2. Trust. *Water (Australia), 31*(5), 40-40-45.

Hurlimann, A. C. (2008). Urban versus regional - how public attitudes to recycled water differ in these contexts. *Water Science & Technology, 57*(5), 891-891-899.

Hussey, K. and Dovers, S. (2007), *Managing water for Australia: the social and institutional challenges*, Melbourne: CSIRO Publishing

Hussey, K. and Pittock, J. (2011). *Submission on the 2011 Biennial Assessment of the National Water Initiative*. Open Letter submission to the National Water Commission. Retrieved from http://www.water.anu.edu.au/project/auscew/pdf/submissions/NWC_Biennial_Assessment_Submission_Hussey_and_Pittock_8Jan2011.pdf

IEA (2009). *Technology roadmap: Carbon capture and storage*. Paris: IEA/OECD. Retrieved from http://www.iea.org/Papers/2009/CCS_Roadmap.pdf

IEA Greenhouse Gas R&D Program. (2008). *Geologic storage of carbon dioxide: Staying safely underground*.

Ingall, J. (2011). *Pilliga Survey finds threatened species*. ABC New England North West, 20 October 2011.

Inglehart, R., & Beker, W. E. (2000). Modernization, cultural change, and the persistence of traditional values. *American Sociological Review, 65*(1), 19-51.

Jackson, S., Stoeckl, N., Straton, A., & Stanley, O. (2008). The Changing Value of Australian Tropical Rivers. *Geographical Research, 46*(3), 275-275-290.

James, D. (2006). Re-sourcing the sacredness of water. In K. Lahiri-Dutt (Ed.), *Fluid bonds: Views on gender and water* (pp. 85-104). Kolkata: STREE.

James, K. (2003). Water Issues in Australia-An LCA Perspective. *The international journal of life cycle assessment, 8*(4), 242-242.

Jennings, S., & Moore, S. (2000). The rhetoric behind regionalization in Australian natural resource management: myth, reality and moving forward. *Journal of Environmental Policy & Planning, 2*(3), 177-191. doi: 10.1080/714038553

Jones, G. (2011). *Coal seam gas in Australia. Inside Water: Gary Jones shares Australia's water experience with the world* (31 March 2011). Retrieved from http://insidewater.ewater.com.au/2011/03/31/coal-seam-gas-in-australia/

Kasperson, R.E., Renn, O. Slovic, P., Brown, H.S. and Emel, J., Goble, R., Kasperson, J.X. and Ritick, S. (1988). The Social Amplification of Risk A Conceptual Framework, *Risk Analysis*, 8(2), 177-187

Kasser, T., Ryan, R. M., Zax, M., & Sameroff, A. J. (1995). The relations of maternal and social environments to late adolescent's materialistic and prosocial values. *Developmental Psychology, 31,* 907-914.

Keep the Scenic Rim Scenic (2011). *Can you help us with a show of support?* Retrieved from http://www.keepthescenicrimscenic.com/

Kemp, D., Bond, C. J., Franks, D. M., & Cote, C. (2010). Mining, water and human rights: making the connection. *Journal of Cleaner Production, 18*(15), 1553-1562. doi: 10.1016/j.jclepro.2010.06.008

Khan, S. J., & Gerrard, L. E. (2006). Stakeholder communications for successful water reuse operations. *Desalination, 187*(1-3), 191-202.

Kilby, R. W. (1993). *The study of human values*. Lanham, MD: University Press of America.

Klute, M. M., Crouter, A. C., Aline, G. Sayer, & McHale, S. M. (2001). Occupational self-direction, values, and egalitarian relationships: A study of dual-earner couples. *Journal of Marriage and Family, 64,* 139-151.

Kristiansen, C. M., & Hotte, A. M. (1996). Morality and the self: Implications for the when and how of value-attitude-behavior relations. In J. M. Olson & M. P. Zanna (Eds.), *The Ontario symposium: The psychology of values* (pp. 77-105). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Kristiansen, C. M. and Zanna, M. P. (1988). Justifying attitudes by appealing to values: A functional perspective*. British Journal of Social Psychology*, *27*(3), 247–256.

Lacey, J. (2009). *Toward a conceptual framework for a more sustainable water ethic: Identifying the ethical underpinnings of water management.* Doctor of Philosophy Doctoral thesis, University of Queensland, Queensland.

Lacey, J . & Moffat, K. (2012). *A Framework for Technology Assessment in the Minerals Down Under Flagship; Integrating Life Cycle Assessment and Social Analysis of Mining Technologies*. CSIRO, Australia.

Lahiri-Dutt, Kuntala, ed. (2006). *Fluid bonds: Views on gender and water*. Kolkata: STREE.

Lahiri-Dutt, K. (2006). Introduction. In K. Lahiri-Dutt (Ed.), *Fluid bonds: Views on gender and water* (pp. xiii-xl). Kolkata: STREE.

Lahiri-Dutt, K. (2006). Preface. In K. Lahiri-Dutt (Ed.), *Fluid bonds: Views on gender and water* (pp. viv-xii). Kolkata: STREE.

Lahiri-Dutt, K., & Harriden, K. (2008). Act on Gender: A Peep into Intra-Household Water Use in the Australian Capital Territory (Act) Region. *Rural Society, 18*(3), 230-243.

Lane, M., & Ward, J. Theme 4: Social, Institutional and Economic Challenges. In CSIRO (Ed.). Australian Recycling Centre of Excellence: CSIRO.

Leusch, F. and Bartkow, M. (2010). *A short primer on benzene, toluene, ethylbenzene and xylenes (BTEX) in the environment and in hydraulic fracturing fluids*. Griffith University, Smart Water Research Centre, 17 Nov 2010. Retrieved from http://www.derm.qld.gov.au/environmental_management/coal-seam-gas/pdf/btex-report.pdf

Little, M. G., & Jackson, R. B. Potential Impacts of Leakage from Deep CO2 Geosequestration on Overlying Freshwater Aquifers. *Environmental Science & Technology, 44*(23), 9225-9232.

Locke, E. A. (1991). The motivation sequence, the motivation hub, and the motivation core. *Organizational Behavior and Human Decision Processes, 50*(2), 288-299. doi: 10.1016/0749-5978(91)90023-m

Lock the Gate Alliance. (2012). *Participating groups.* Retrieved 12 February, 2012, from http://lockthegate.org.au/groups/

Lowndes, V., Pratchett, L., & Stoker, G. (2001a). Local political participation: the impact of rules-in-use. *Public Administration, 84(3),* 539 - 561.

Lowndes, V., Pratchett, L., & Stoker, G. (2001b). Trends in Public Participation: Part 2 - Citizen's Perspectives. *Public Administration, 79(2),* 445 - 455.

Lowndes, V., & Wilson, D. (2001). Social Capital and Local Governance: Exploring the Institutional Design Variable. *Political Studies, 49,* 629 - 647.

Maio, G. R., & Olson, J. M. (2000). What is a value expressive attitude? In G. Maio & J. Olson (Eds.), *Why we evaluate: Functions of attitudes* (pp. 249-269). Mahwah, NJ: Erlbaum.

Manning, P. (2011). *The seam old story springs a leak*, Sydney Morning Herald. Retrieved from http://www.smh.com.au/business/the-seam-old-story-springs-a-leak-20111118-1nne6.html#ixzz1jQBlxgpX

McClelland, D. C., & Burnham, D. H. (1976). Power is the great motivator. *Harvard Business Review, 54*(2), 100-110.

McLeod, J. M., Sotirovic, M., & Holbert, L. R. (1998). Values as sociotropic judgments influencing communication patterns. *Communication Research, 25*(5), 453-485.

McNiff, J. (2012). Action *research for professional development: Concise advice for new action researchers* Retrieved 17 February, 2012, from http://www.jeanmcniff.com/ar-booklet.asp

Mellema, A. (1995). On the relationship between attitudes and values: Exploring the moderating effects of self-monitoring and south-monitoring schematicity. *Personality and Social Psychology Bulletin, 21,* 885-892.

Milbrath, L. W. (1989). *Envisioning a sustainable society: Learning our way out*. Albany, New York: State University of New York Press.

Miller, E., & Buys, L. (2008). Water-recycling in South-East Queensland, Australia: What do men and women think? *Rural Society, 18*(3), 220-220-229.

Minister for Natural Resources, Mines and Energy and Minister for Trade, The Honourable Stephen Robertson (October 5, 2010). *BTEX ban enforced through legislation*. Press Release. Retrieved from http://statements.cabinet.qld.gov.au/MMS/StatementDisplaySingle.aspx?id=71854

Moore, M. (n.d.: a). *The Scoping Paper on the NSW Coal and Gas Strategy*, 110415. Submission to the NSW Department of Planning on behalf of the NSW Irrigators Council. Retrieved from http://www.nswic.org.au/pdf/Submissions/110415.pdf

Moore, M. (n.d.: b). The Management of the Murray-Darling Basin ADDENDUM Impact of Mining Coal Seam Gas, 110630. Submission to the Senate Standing Committee on Rural Affairs and Transport. Retrieved from http://www.nswic.org.au/pdf/Submissions/110630.pdf

Morel, B. & Linkov, I. (eds) (2006) *Environmental Security and Environmental Management: The Role of Risk Management*, 3-16. Springer: Netherlands.

Mosher, D. L., & Tomkins, S. S. (1988). Scripting the macho man: Hyper-masculine socialization and enculturalization. *Journal of Sex Research, 25,* 60-84.

Mulcock, J., Pocock, C., & Toussaint, Y. (2005). Introduction: Current Directions in Australian Anthropologies of the Environment. *The Australian Journal of Anthropology, 16*(3), 281-281-293.

Murray-Darling Basin Authority (MDBA) (n.d.). About the Murray-Darling Basin Authority. Retrieved from http://www.mdba.gov.au/about

Murray-Darling Basin Authority (2009a). Members of the Basin Community Committee Retrieved from http://www.mdba.gov.au/explore-the-basin/communities/basin-community-committee/members

Murray-Darling Basin Authority (2009b). Stakeholder Engagement Strategy, from http://www.mdba.gov.au/files/publications/Stakeholder-Engagement-Strategy-brochure.pdf

Murray-Darling Basin Authority (2010a). Basin Plan Guide released for public discussion. Retrieved from http://www.mdba.gov.au/media_centre/media_releases/basin-plan-guide-released-for-public-discussion

Murray-Darling Basin Authority (2010b). *Guide to the proposed Basin Plan: overview*. Retrieved from http://download.mdba.gov.au/Guide_to_the_Basin_Plan_Volume_1_web.pdf.

Murray-Darling Basin Authority (2011). Overview of feedback on the Guide to the proposed Basin Plan Retrieved from http://www.mdba.gov.au/files/publications/2011-basin-plan-feedback-report-20110511.pdf

Murray Group of Concerned Communities (2010). Murray Group of Concerned Communities – Submission to the Murray Darling Basin Authority Retrieved from http://www.basinplan.com.au/media/user_documents/pdf/37871/murray-group-of-concerned-communities-1297219958.pdf

National Irrigators Council (2010). Submission to the "Guide to the Proposed Murray Darling Basin Plan" Retrieved from http://www.irrigators.org.au/media/1f4b19f2294ff7fa1c393dc7f431a5c4.pdf

National Water Commission (NWC) (2011). National Water Initiative. Retrieved from http://nwc.gov.au/reform/nwi

Newmark, R. L., Friedmann, S. J., & Carroll, S. A. (2010). Water Challenges for Geologic Carbon Capture and Sequestration. *Environmental management., 45*(4), 651-661.

News.com.au (2012a). Farmers arrested in anti-gas protest. Retrieved from http://m.news.com.au/QLD/pg/0/fi944975.htm;jsessionid=27AD48AFDDC0B85C07A1F9DDD85535B1

News.com.au (2012b). Nine arrested at Queensland coal seam gas protest over Arrow Energy project. Retrieved from http://www.news.com.au/breaking-news/nine-arrested-at-queensland-coal-seam-gas-protest-over-arrow-energy-project/story-e6frfku0-1226242563730#ixzz1lkLqTouB

Ninemsn News (2010). Cougar Energy defends Kingaroy trial. Retrieved from http://news.ninemsn.com.au/national/8076242/cougar-defends-kingaroy-trial.

NSW Legislative Council (2011). Inquiry into Coal Seam Gas: Terms of Reference. Retrieved from http://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/29ae48525cfaea7cca2578e3001abd1c/$FILE/TOR%20Coal%20seam%20gas.pdf

O'Brien, R. (2001). An overview of the methodological approach of action research. In R. Richardson (Ed.), *Theory and Practice of Action Research*. João Pessoa, Brazil: Universidade Federal da Paraíba.

OECD Environmental Performance Reviews (2006) Water: the experience in OECD countries. Retrieved from http://www.oecd.org/dataoecd/18/47/36225960.pdf

Oishi, S., Diener, E., & Suh, E. (1998). The measurement of values and individualism collectivism. Society for Personality and Social Psychology, 24(11), 1177-1189.

Orcutt, M. (2010). The truth about the risks to freshwater aquifers posed by underground carbon sequestration. *Scientific American,* (November 29, 2010), Retrieved from https://www.scientificamerican.com/article.cfm?id=risks-underground-carbon-sequestration

Ormrod, J. E. (2004). *Human learning* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

Parsons, T. (1948). The position of sociological theory. American Sociological Review, 13(2), 156-171

Parliament of NSW (2011). Coal Seam Gas (Inquiry). Retrieved from http://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/29AE48525CFAEA7CCA2578E3001ABD1C

Paukovic, M., Brunsting, S., & de Best-Waldhober, M. (2011). *The dutch general public's opinion on CCS and energy transition*. CATO-2 Deliverable WP5.3-DO2a. CATO2 Program.

Pellizzoni, L. (2004). Responsibility and Environmental Governance. *Environmental Politics, 13*(3), 541 - 565.

Peters, E. & Slovic, P. (1996). The role of affect and worldviews as orienting dispositions in the perception and acceptance of nuclear power. *Journal of Applied Social Psychology, 26*(16), 1427-1453.

Pierre, J. (2000). *Debating Governance*. London: Oxford University Press.

Phillips, A. (2009). Kingaroy farmers fear gas plant impacts, ABC Rural. Retrieved from http://www.abc.net.au/rural/qld/content/2009/12/s2765380.htm.

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education: Theory, research, and applications* (2nd ed.). Upper Saddle River, NJ: Pearson Education, Inc.

Postman, L., Bruner, J. S., & McGinnies, E. (1948). Personal values as selective factors in perception. *Journal of Abnormal and Social Psychology, 43,* 142-15.

Powell, J. M. (1991). *Plains of promise, rivers of destiny : water management and the development of Queensland, 1824-1990*. Bowen Hills: Boolarong Publications.

Powell, J. M. (2000). Snakes and Cannons: Water Management and the Geographical Imagination in Australia. *Environmental History and Policy: Still Settling Australia (Oxford University Press)*, 47-71.

Proactive Investors (2010). Cougar Energy prepares Kingaroy pilot project for production. Retrieved from http://www.proactiveinvestors.com.au/companies/news/4717/cougar-energy-prepares-kingaroy-pilot-project-for-production-4717.html.

Prince-Gibson, E., & Schwartz, S. H. (1998). Value priorities and gender. *Social Psychology Quarterly, 61*(1), 49-67.

Proctor, W., & Drechsler, M. (2006). Deliberative Multicriteria Evaluation. *Environment and Planning C: Government and Policy, 24*(2), 169-190.

Prosser, I. (2011). Chapter 1: Current water availability and use. In I. Prosser (Ed.), Water: science and solutions for Australia: CSIRO. Retrieved from http://www.csiro.au/resources/Water-Book.

Queensland Farmers Federation (2010). National Water Initiative – 2011 Biennial Assessment of Progress in Implementation Discussion Paper (December, 2010). Retrieved from http://nwc.gov.au/publications/publications-by-topic/water-reform/water-reform-publications/2009-biennial-assessment-of-implementation-of-the-national-water-initiative/2011-biennial-assessment

Reason, P., & Bradbury, H. (2001). *Handbook of Action Research: Participative Inquiry and Practice*. Thousand Oaks, CA: SAGE.

Reckwitz, A. (2002). Toward a theory of social practices: a development in culturalist theorizing. *European Journal of Social Theory, 5*(2), 243-263.

Reser, J.P. & Bentrupperbaümer, J.M. (2005). What and where are environmental values? Assessing the impacts of current diversity of use of 'environmental' and 'World Heritage' values. *Journal of Environmental Psychology*, 25(2), 125-146

Ricci, P.F. (2006). Chapter 3. Risk, Cost, and Benefit Analysis (RCBA) in Risk Assessment and Management. In *Environmental and Health Risk Assessment and Mangement: Principles and Practices*. Springer: Netherlands.

Ringwood, K. (2006). *The value of water to Rio Tinto*. Water in Mining Conference, Brisbane 14-16 November.

Roarty, M. (2011). Background Note: The development of Australia's coal seam gas resources, Australian Government Parliamentary Library (28 July 2011). Retrieved from http://www.aph.gov.au/library/pubs/bn/sci/CoalSeamGas.htm#_Toc299628485

Robertson, M., Nichols, P., Horwitz, P., Bradby, K., & MacKintosh, D. (2000). Environmental Narratives and the Need for Multiple Perspectives to Restore Degraded Landscapes in Australia. *Ecosystem Health, 6*(2), 119-133.

Rogers, P. (2002). *Water Governance in Latin America and the Caribbean:* Inter-American Development Bank.

Rohan, M. J. (2000a). A rose by any name? The values construct. *Personality and Social Psychology Review, 4*(3), 255-277.

Rohan, M. J. (2000b). *Investigations into "value fit"*. Paper presented at the meeting of the Unpublished manuscript. Sydney Australia, University of South Wales.

Rokeach, M. (1968). *Beliefs, attitudes, and values*. San Francisco: Jossey-Bass.

Rokeach, M. (1973). *Nature of human values.* New York: Free Press.

Rokeach, M. (1979). *Understanding human values.* New York: Free Press.

Runge, F. C. (1992). Common Property and Collective Action in Economic Development. Pp. 17-39 in D. W. Bromley (ed.), *Making the Commons Work: Theory, Practice, and Policy*. San Francisco, CA: Institute for Contemporary Studies.

Rose, D. B. (1996). *Nourishing terrains : Australian Aboriginal views of landscape and wilderness*. Canberra: Australian Heritage Commission.

Rosenau, J. N. (2007). Governing the ungovernable: The challenge of a global disaggregation of authority. *Regulation & Governance, 1*(1), 88-97. doi: 10.1111/j.1748-5991.2007.00001.x

Russell, S., & Hampton, G. (2006). Challenges in understanding public responses and providing effective public consultation on water reuse. *Desalination, 187*(1-3), 215-227.

Sagiv, L., & Schwartz, S. H. (1995). Value priorities and readiness for out-group social contact. *Journal of Personality and Social Psychology, 69*(3), 437-448.

Sarbin, T. R. (1995). Poetics of identity. *Henry A Murray award address at the annual convention of the American Psychological Association,* New York.

Saunders, M. (2011a). Coal seam gas inquiry is underway. ABC North Coast News (22 September 2011). Retrieved from http://www.abc.net.au/local/stories/2011/09/22/3323222.htm

Saunders, M. (2011b). Hollow Victory for coal seam gas protesters. ABC Rural (19 December 2011). Retrieved from http://www.abc.net.au/rural/news/content/201112/s3393819.htm

Scanlon, J. (2006). *A hundred years of negotiations with no end in sight: Where is the Murray Darling Basin Initiative leading us?* Canberra: Murray-Basin Basin Committee.

Scanlon, T.M. (1998). *What we owe to each other*. Cambridge: Harvard University Press.

Standing Committee on Regional Australia (2011). *Of drought and flooding rains: Inquiry into the impact of the Guide to the Murray-Darling Basin Plan*. Retrieved from http://www.aph.gov.au/house/committee/ra/murraydarling/report/fullreport.pdf.

Schatzki, T. R. (2002). *The site of the social: A philosophical account of the constitution of social life and change.* University Park, PA: Penn State University Press.

Schwartz, S. H. (1992). Universals in the content and structure of values. In M. Zanna (Ed.), *Advances in Experimental Social Psychology* (Vol. 25, pp. 1-65). Orlando, FL: Academic Press.

Schwartz, S. H. (1996). Value priorities and behavior: Applying a theory of integrated value systems. In C. Seligman, J. M. Olson, M. P. Zanna (Ed.), *The Ontario symposium: the psychology of values* (Vol. 8 ed., pp. 1-24). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Schwartz, S. H., & Bardi, A. (2001). Value hierarchies across cultures: Taking a similarities perspective. *Journal of Cross-Cultural Psychology, 32,* 268-290.

Schwartz, S. H., & Bilsky, W. (1987). Toward a universal psychological structure of human values. *Journal of Personality and Social Psychology, 53*(3), 550-562.

Schwartz, S. H., & Sagie, G. (2000). Value consensus and importance: A cross-national study. *Journal of Cross-Cultural Psychology, 31*(4), 465-497.

Schwartz, S. H., Melech, G., Lehmann, A., Burgess, S., Harris, M., & Owens, V. (2001). Extending cross cultural validity of the theory of basic human values with a different method of measurement. *Journal of Cross Cultural Psychology, 32,* 519-542.

Seligman, C., Olson, J. M., & Zanna, M. P. (Eds.). (1996). *The psychology of values: the Ontario symposium* (Vol. 8 ed.). Hillsdale, NJ: Erlbaum.

Shove, E. (2010). Beyond the ABC: climate change policy and theories of social change. *Environment and planning. A, 42*(6), 1273-1285. doi: 10.1068/a42282

Simmons, R. T. & Schwartz-Shea, P. (1993). Method, Metaphor, and Understanding: When Is the Commons Not a Tragedy? Pp. 1-11 in T. L. Anderson (ed.), *The Political Economy of Customs and Culture: Informal Solutions to the Commons Problem*. Lanham, MD: Rowman and Littlefield Publishers.

Slovic, P. (1987). Perception of risk. *Science*, 236(4799), 280-285

Slovic, P. & Peters, E. (2006). Risk perception and affect. *Current Directions in Psychological Science*, 15(6), 322–325.

Slovic, P. & Västfjäll, D. (2010). Affect, moral intuition, and risk. *Psychological Inquiry: An International Journal for the Advancement of Psychological Theory*, 21(4), 387-398.

Sollars, J. (2011). Gas trial bungle slammed by judge. Retrieved from http://www.warwickdailynews.com.au/story/2011/12/23/gas-trial-bungle-slammed-by-judge/.

Sonnekus, I. P., & Schulze, S. (2002). Values education of adolescents in South Africa. *Journal of Psychology in Africa, 12*(2), 131-146.

Sofoulis, Z. (2011). Skirting complexity: The retarding quest for the average water user. *Continuum (Mount Lawley, W.A.), 25*(6), 795-810.

St. Aubin, E. (1996). Personal ideology polarity: Its emotional foundation and its manifestation in individual value systems, religiosity, political orientation, and assumptions concerning human nature. *Journal of Personality and Social Psychology, 71*(1), 152-165.

Stephens, J. C., A. Hansson, et al. (2011). "Characterizing the international carbon capture and storage community." *Global Environmental Change 21*(2): 379-390.

Strang, V. (2002). *Life down under: water and identity in an aboriginal cultural landscape*. London: Goldsmith's College.

Strang, V. (2005a). Common Senses: Water, Sensory Experience and the Generation of Meaning. *Journal of Material Culture, 10*(1), 92-92-120.

Strang, V. (2005b). Knowing Me, Knowing You: Aboriginal and European Concepts of Nature as Self and Other. *Worldviews: Environment, Culture, Religion, 9*(1), 25-25.

Strang, V. (2005c). Water Works: Agency and Creativity in the Mitchell River Catchment. *The Australian Journal of Anthropology, 16*(3), 366-366-381.

Strang, V. (2009). *Gardening the world: agency, identity, and the ownership of water*. New York: Berghahn Books.

Sugarman, J. (2009). Historical ontology and psychological description. *Journal of Theoretical and Philosophical Psychology. 29*(1): 5-15.

Sydney Morning Herald (2011a). Fracking can release cancer chemicals, experts warn. 18 July 2011. Retrieved from http://www.smh.com.au/environment/fracking-can-release-cancer-chemicals-experts-warn-20110718-1hkuk.html#ixzz1loZepnZz

Sydney Morning Herald (2011b). Police dismantle Tara blockage. 4 April 2011. Retrieved from http://news.smh.com.au/breaking-news-national/police-dismantle-tara-blockade-20110404-1cyld.html

Syme, G. J., & Hatfield-Dodds, S. (2007). The role of communication and attitudes research in the evolution of effective resource management arrangements. In K. Hussey & S. Dovers (Eds.), *Managing water for Australia: The social and institutional challenges* (pp. 11-22). Collingwood, Vic.: CSIRO Publishing.

Syme, G. J., Porter, N. B., Goeft, U., & Kington, E. (2008). Integrating social well being into assessments of water policy: meeting the challenge for decision makers. *Water Policy, 10*, 323-343.

Tatto, M. T. (1996). Examining values and beliefs about teaching diverse students: Understanding the challenges for teacher education. *Educational Evaluation and Policy Analysis, 18*(2), 155-180.

Terwel, B. W., Harinck, F., Ellemers, N., & Daamen, D. D. L. (2009). Competence-Based and Integrity-Based Trust as Predictors of Acceptance of Carbon Dioxide Capture and Storage (CCS). *Risk Analysis,* 29(8), 1129-1140.

Thomsen, C. J., Lavine, H., & Kounios, J. (1996). Social value and attitude concepts in semantic memory: Relational structure, concept strength, and the fan effect. *Social Cognition, 14,* 191-225.

Thorton, A. (1985). Changing attitudes toward separation and divorce: Causes and consequences. *Journal of Sociology, 90,* 856-872.

Thomas, P. (1997). The water that blesses, the river that flows: Place and the ritual imagination among the Temanambondro of southeast Madagaskar. In J. Fox (Ed.), *The poetic power of place: Comparative perspectives on Austronesian ideas of locality.* (pp. 22-41). Canberra: The Australian National University, Research School of Pacific and Asian Studies.

Tomkins, S. S. (1965). Affect and the psychology of knowledge. In S.S. Tomkins & C. E. Izard (Eds.), *Affect, cognition, and personality* (pp. 72-97). New York: Springer.

Toowoomba Regional Council (2006). Toowoomba Water Futures Project Retrieved from http://www.toowoombarc.qld.gov.au/environment-and-waste/water-supply-and-dams/archived-recycled-water-project/media-releases/5430-toowoomba-water-futures-project.html

Tsohou, A., Karyda, M., Kokolakis, S. & Kiountouzis, E. (2006). Formulating information systems risk management strategies through cultural theory. *Information Management and Computer Security* 14(3), 198-217 doi 10.1108/09685220610670378

United Nations World Water Assessment Programme. (2003). *Governing Water Wisely for Sustainable Development.* New York: United Nations.

Vance, A. (2011). Trial fears after toxins found in Aussie plant. Retrieved from http://www.stuff.co.nz/waikato-times/news/5695896/Trial-fears-after-toxin-found-at-Aussie-plant.

Vasek, L. (2011). Tony Abbott changes tack over coal seam gas on farms. The Australian, 21 October 2011. Retrieved from http://www.theaustralian.com.au/national-affairs/tony-abbott-changes-tack-over-coal-seam-gas-on-farms/story-fnaxx2sv-1226172642421

Verplanken, B. (1991). Persuasive Communication of Risk Information: A Test of Cue Versus Messaging Processing Effects in a Field Experience. *Personality and Social Psychology Bulletin*, 17(2), 188-193

Verplanken, B., & Holland, R. W. (2002). Motivated decision making: Effects of activation and self-centrality of values on choices and behaviour. *Journal of Personality and Social Psychology,* 82*,* 434-447.

Victoria State Government Department of Sustainability and Environment. (2011). My Victorian Waterway: The State of Victoria Department of Sustainability and Environment

Victorian Women's Trust. (2007). *Our water mark: Australians making a difference in water reform*. Melbourne: Victorian Women's Trust.

Visschers, V.H.M & Siegrist, M. (2008). Exploring the triangular relationship between trust, affect, and risk perception: A review of the literature. *Risk Management*, 10, 156 – 167

von Korff, Y., d'Aquino, P., Daniell, K. A., & Bijlsma, R. (2010). Designing participation processes for water management and beyond. *Ecology and society, 15*(3), 1.

Wallquist, L., Visschers, V. H. M., & Siegrist, M. (2009). Lay concepts on CCS deployment in Switzerland based on qualitative interviews. [doi: DOI: 10.1016/j.ijggc.2009.03.005]. *International Journal of Greenhouse Gas Control, 3*(5), 652-657.

Wasimi, S. (2010). Planning for a Large Dam Project: The Case of Traveston Crossing Dam. *Water Resources Management, 24*(12), 2991-3015. doi: 10.1007/s11269-010-9591-2

Whitmarsh, L., Seyfang, G., & O'Neill, S. (2011). Public engagement with carbon and climate change: To what extent is the public 'carbon capable'? [doi: 10.1016/j.gloenvcha.2010.07.011]. *Global Environmental Change, 21*(1), 56-65.

Webb, T., Burgin, S., & Maheshwari, B. (2008). Action research for sustainable water futures in Western Sydney: Reaching beyond traditional stakeholder engagement to understand community stakeholder language and its implications for action. *Syst Pract Action Res, 22*, 1-14.

Webler, T., & Tuler, S. (2006). Four Perspectives on Public Participation Process in Environmental Assessment and Decision Making: Combined Results from 10 Case Studies. *Policy Studies Journal, 34*(4), 699-722.

Wilderness Society (2011). Campaigns: Coal Seam Gas. Retrieved from http://www.wilderness.org.au/campaigns/coal-seam-gas

Wildlife Tourism Australia (2012). Coal Seam Gas, Fracking Coal mining and Australian wildlife. Retrieved from http://wildlifetourism.org.au/discussions/threats-to-australian-wildlife/coal-seam-gas-and-australian-wildlife/

Williams, R. M. (1979). Change and stability in values and value systems: A sociological perspective. In M. Rokeach (Ed.), *Understanding human values* (pp. 15-46). New York: The Free Press.

Woolly Days (2010). BTEX throws a spanner in the Queensland CSG works. Woolly Days, 23 October 2010. Retrieved from http://woollydays.wordpress.com/2010/10/23/btex-throws-a-spanner-in-the-queensland-csg-works/

Woolmington, E., & Burgess, J. S. (1983). Hedonistic water use and low-flow runoff in Australia's national capital. *Urban Ecology, 7*(3), 215-227.

Wovoka, J. and Bullock, S. (2012). Australians line up to defend land against CSG. GreenLeft. 28 January 2012. Retrieved from http://www.greenleft.org.au/node/49843 7/

Xiao, Hong (1999). Independence and obedience: An analysis of child socialization values in the United States and China. *Journal of Comparative Studies, 30,* 641-657.

Zhai, H., Rubin, E.S. & Versteeg, P.L. (2011). Water Use at Pulverized Coal Power Plants with Postcombustion Carbon Capture and Storage. *Environmental Science & Technology*, 45, 2479–2485.

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