DESERT KNOWLEDGE CRC

Institutions for allocating water resources in desert towns: The Alice Springs water resource strategy

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The Desert Knowledge Cooperative Research Centre is an unincorporated joint venture with 28 partners whose mission is to develop and disseminate an understanding of sustainable living in remote desert environments, deliver enduring regional economies and livelihoods based on Desert Knowledge, and create the networks to market this knowledge in other desert lands.

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Abbreviations/Acronyms

Action arena	Interactions of participants and an action situation that are affected by rules used by participants to order their relationships, the attributes of the underlying biophysical world and the structure of the more general community within which the action arena is placed.
Action situation	The social space where participants with diverse preferences interact.
ALEC	Arid Lands Environment Centre
ASWRS	Alice Spring Water Resource Strategy
COAG	Council of Australian Governments
CPR	Common-pool resource
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEET	Northern Territory Government Department of Employment, Education and Training
DKCRC	Desert Knowledge Cooperative Research Centre
FNPWA	The Far North Prescribed Well Area, an arid zone of South Australia
IAD	Institutional Analysis and Development framework
Institutional statements	The rules, norms, and shared strategies in an action situation; a set of shared linguistic constraints and opportunities that prescribe, permit, or advise actions or outcomes for participants in an action situation (Crawford & Ostrom 2005)
Minister	Northern Territory Government Minister for Natural Resources, Environment and the Arts
NRETA	Northern Territory Government Department of Natural Resources, Environment and the Arts
NT Water Act	The Northern Territory of Australia Water Act 1992
NTG	Northern Territory Government
NWI	National Water Initiative
P&WC	Power and Water Corporation of the Northern Territory, which provides electricity, water and sewerage services
ppm	parts per million
SWOT	Strengths, Weaknesses, Opportunities and Threats
3-Rs	Rights, responsibilities, and resources
WAC	Water Advisory Committee
Water Controller	An officer delegated by the Minister
WSAA	Water Services Association of Australia

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Executive summary

In this study, we analysed the development of institutions under a recent draft strategy for managing water resources in Alice Springs. We used the Institutional Analysis and Development (IAD) framework, which has been developed and tested internationally for managing common-pool resources.[1]

Water is a critical resource for the economic, social and ecological sustainability of desert towns. Effective and efficient water management is required, yet strategies are diverse even among the towns of Alice Springs, Coober Pedy, Roxby Downs, and the Goldfields of Western Australia, which share a similar type of groundwater resource.

The objectives of our study are to:

1. describe the recently developed Alice Springs Water Resource Strategy (ASWRS), and analyse its potential impact on desert water resource management institutions and outcomes
2. examine the validity and utility of the IAD framework as a guide for policy analysts and decision makers in describing and evaluating water resource strategies of desert towns
3. suggest simple methods for using the IAD framework to adapt and design institutions.

We first examined the resource condition, community characteristics, and relevant rules for water resource management by reviewing the literature, including relevant legislation and project reports. We interviewed nine people who had been involved in establishing, facilitating and drafting the ASWRS. We focused on the establishment, structure and function of the ASWRS Steering Committee, a focal 'action situation' in the IAD framework. We also described several other linked action situations at different levels, and explained participants' interactions within and among those action situations. We evaluated the ASWRS processes and outcomes using the IAD criteria, and presented scenarios of potential long-term outcomes. We compared the institutional design principles that emerged through the local process with the internationally validated IAD principles, which included the right to organise, and the value of nested enterprises. We then used the IAD principles to evaluate the potential of Alice Springs residents to be effective decision makers as part of a nested enterprise for water resource management. Finally, we examined the validity of the IAD framework for assessing desert water resource management strategies and we suggested complementary methods.

The National Water Initiative (NWI) (COAG 2004) provides for local participation in water resource planning. However, *The Northern Territory of Australia Water Act 1992* (NTG 2004a) leaves this participation to the discretion of the responsible minister or their delegate – the Controller of Water Resources ('the Water Controller'). Therefore, the involvement of desert water users in managing a critical resource depends on the goodwill of officials. This disproportionate vesting of power led to a mismatch of rights, responsibilities, and resources assigned to the people involved in drafting the ASWRS. The choice of strategy to involve the public meant that resources were not provided to engage a representative sample of local residents, such as Aboriginal traditional owners. In addition, the responsibility for drafting a strategy was not matched with the right

1 A common-pool resource is a limited resource which many individuals or entities can access, with or without rules to restrain overuse.

to implement that strategy. The Northern Territory Minister for Natural Resources, Environment and the Arts ('the Minister') retained the power to accept or reject part or all of the locally-drafted strategy.

Staff from the Northern Territory Department of Natural Resources and the Arts (NRETA) who were involved in organising the strategy process were committed to making the 'action arena' as participatory as the laws allowed. As a result, the Steering Committee that developed the majority of the draft water allocation strategy had well-facilitated and intensely interactive processes leading to consensus. However, some committee members were concerned that the law's provision for discretionary decision making would allow the more powerful members to influence officials and the final strategy.

The Steering Committee deliberations resulted in two key outcomes.

The first outcome was a draft strategy for allocating water. It included a set of institutional statements[2] that:

1. removed the 'unallocated' label for water held in reserve, to prevent that water being reallocated to a major new user
2. reduced the maximum allowable yield from 80% over 100 years, to 80% over 320 years, with the rate of depletion in the first 100 years to not exceed 25%. This allows time for more efficient water management strategies to be developed.

The second key outcome was a set of guidelines for establishing a Water Advisory Committee (WAC) for implementing the final water allocation strategy.

There are several challenges to implementing these outcomes. First, NRETA staff have different levels of confidence in knowledge of the water supply, and this affects their management decisions. As knowledge increases, the water strategy will need to be re-evaluated every five years, with a possible overhaul every 10 years. While these reviews are necessary to adapt to current conditions, basic precautionary principles must be in place to prevent overuse of water resources. The second challenge is the advisory role of the ASWRS Steering Committee. It is uncertain if part or all of their recommendations will be accepted by the Minister or the Water Controller. The committee's recommendations reflected this lack of power, in omitting any mention of enforcement. Implementation of any recommendations by the WAC will also depend on the Water Controller. It is difficult to have genuine participation in decision making without a much more empowered local entity than the proposed WAC.

We here present three brief scenarios for water resource management based on potential drivers – courses of action or inaction with capacity for significant consequences:

1. no change in the current decision making or water conservation practices
2. no change in the decision making, but water conservation practices introduced by many new residents migrating from cities with water restrictions
3. local governance through a WAC or other empowered local entity to make and enforce water allocation rules.

The scenarios propose that Alice Springs residents, if they are interested and have local capacity for water governance and conservation, can significantly improve current water management in their town.

2 'Institutional statements' is a broad term encompassing rules, norms, and shared strategies in an action situation. These statements are a set of shared linguistic constraints and opportunities that prescribe, permit, or advise actions or outcomes for participants in an action situation (Crawford & Ostrom 2005).

The IAD framework is validated because it captures the important generalisations with multiple and linked action situations. It is also reliable because our analysis of the different data sources (interviews, reviews, and observations) resulted in similar findings.

The IAD framework is complemented by a set of eight design principles that were developed from international studies of sustained common-pool resources. During our interviews, NRETA staff and Steering Committee members continually reflected on how to design institutions that could sustain the resource in the presence of threats. A similar set of principles emerged that focused on:

1. the right of a resource management group to organise
2. the right of a resource management group to develop clear rules for resource use
3. proportionally valuing the costs and benefits of each use
4. establishing local-level rules
5. nesting local-level rules in higher levels
6. having a WAC or other local entity to monitor
7. having a WAC or other local entity to establish realistic sanctions for local water use
8. having low-cost processes for resolving conflict.

Together, these emergent principles describe a 'polycentric' system of water governance, with a local node nested within a hierarchy of higher-level entities.

In the short term, the goodwill and commitment to public involvement shown by the participating agencies is needed for the Northern Territory government to accept the draft strategy. Over the long term, the national and Northern Territory rules need revising to enable polycentric governance of resources with mutual accountability among a hierarchy of responsible bodies.

We found the IAD framework useful for analysing the ASWRS in detail. It also has value for other desert towns. To increase public involvement, the IAD can be complemented by simpler methods, such as comparing the strengths, weaknesses, opportunities, and threats (SWOT analysis) of a water resources strategy, or comparing the rights, responsibilities, and resources of participants and their action situations (3-Rs analysis).

1 Introduction

1.1 Context

This report on water resource allocation in Alice Springs is one of four case studies on outback institutions for water resource management. The other three study areas are the Katherine-Daly region in the Northern Territory and the Etheridge and Birdsville Shires in Queensland. The case studies together form a joint 'Outback Institutions' project run by CSIRO, the Tropical Savannas Cooperative Research Centre and the Desert Knowledge Cooperative Research Centre.

Water is a critical resource for the economic, social, and ecological sustainability of all desert towns, where average annual rainfall is less than 400 mm and is extremely variable, and evaporation is often 10 times higher than average rainfall. While groundwater is important, there is a diversity of sources and management strategies (see Table 1).

Table 1. A comparison of water resources and institutions in three Australian desert towns

Profile **Criteria**	**Alice Springs** **Northern Territory** **30 000 population** **Government and tourism**	**Kalgoorlie/Coolgardie** **Western Australia** **30 000 population** **Gold mining**	**Coober Pedy** **South Australia** **5000 population** **Opal mining**
Water allocation strategy	The draft ASWRS was developed by a steering committee composed of skilled representatives of major sectors in the Alice Springs community. The NT Minister for NRETA, assisted by the Territory's Water Controller, has the discretionary power to approve the strategy. The Northern Territory Power and Water Corporation manages the Alice Springs town water supply and wastewater treatment.	There is no specific strategy on water allocation for Kalgoorlie. Kalgoorlie is part of the Goldfields region. The state department of Water Resources, with input from water users and key stakeholders, will be developing statutory management plans and regional plans. Regional plans are not binding and the state Minister for Water Resources has the final say on approval. The source of the Kalgoorlie town water supply is Mundaring Weir which is part of the state Integrated Water Supply Scheme. This scheme is managed by the Water Corporation. The corporation has plans to improve the water quality, double current Kalgoorlie-Boulder's water storage capacity to 880 million litres, and increase pumping capacity to the Eastern Goldfields towns, which include Kalgoorlie-Boulder. The Water Corporation manages the Kalgoorlie water supply. Since 2004, the effluent treatment plant has been administered by the Kalgoorlie City Council.	The Water Allocation Plan for the Far North Prescribed Well Area (FNPWA), an arid zone of SA, is under development by the South Australian Arid Lands Natural Resources Management Board. The board has consulted widely with stakeholders for different uses, including townships' water supplies. The overall capacity of the water resources in the FNPWA is considered to be sufficient to meet all existing demands for different uses. The draft plan allocates 5 ML/day, a 50% increase in the existing water demand of 3.2 ML/day, for all towns in FNPWA, including Coober Pedy. The Coober Pedy Council developed a water use plan from a consultancy study. The council manages the town water supply and wastewater treatment services. South Australia Water Corporation provides water quality tests.
Source of water	Rock aquifers of the Amadeus Basin and alluvial aquifers of the Todd River.	Town supplied by 550 km pipeline from the Mundaring Weir— a dam in the Darling Ranges of the Perth Catchment. The pipeline supplies 100 000 people, 6 million sheep, and agriculture. Goldfields are supplied by hypersaline groundwater.	A bore 25 km northeast of town.
Institutions for water management	The NT Government makes final decisions about water allocation and use.	The WA Government and the Water Corporation make major decisions about allocation of water from the state Integrated Water Supply Scheme to different uses and users in multiple jurisdictions along the pipeline.	The town council manages the supply and infrastructure, and sells the water to domestic users.
Sustainability concerns	Non-renewable source; limited certainty of amount and quality of water, and cost of new bore field. Low water pricing; absence of restrictions on water use.	Renewable but dependent on rainfall; potential scarcity with potential growth in resident population and in goldmine operation.	Slowly recharging resource; ongoing need for additional sources.

The primary sources of water for the Alice Springs township are the surrounding deep rock and shallow alluvial aquifers. The alluvial aquifers contain low-quality (>1000 ppm total dissolved solids) water, and are recharged through precipitation. The deep rock aquifers are estimated to contain large quantities of high-quality (<500 ppm total dissolved solids) water, but have a low recharge rate, and are therefore considered non-renewable (NRETA 2005b).

A desert aquifer such as the Amadeus Basin is a critical non-renewable common-pool resource (CPR). Managing this groundwater reserve for diverse current and future uses is a highly uncertain practice. It requires efficient, effective, and ethically acceptable coordination among stakeholders to deal with uncertainties in water supply and demand.

Institutions (rules) can play a significant role in reducing uncertainties for better allocation and use of CPRs. Institutions are stipulations with positive and negative sanctions that institute a regularised pattern of behaviour among a group of individuals and/or entities (Scott 1995; North 1997; Johnson 1997; Ostrom 2005). They are the principal mechanisms for dealing with social dilemmas[1] that arise as a result of individuals and entities acting 'rationally' when allocating and using CPRs, such as water in Alice Springs.

Most resource management institutions and entities in desert regions have been based on assumptions extended from resource governance policies for less variable, more predictable regions of Australia, such as the coasts (Stafford Smith et al. 2000). Historically, resource management institutions for desert resources such as water and minerals have leant more towards exploiting them for sustained economic growth. Contrary to the intended role of these institutions, this orientation may increase the long-term uncertainty and vulnerability of the natural and livelihood systems of desert regions.

Our study explores whether lessons can be drawn from the arrangement of institutions and entities in the ASWRS – lessons that are relevant to water resource management in other desert towns.

1.2 Objectives

Our research has three objectives:

1. Describe the draft Alice Springs Water Resource Strategy (ASWRS) and its development using the Institutional Analysis and Development (IAD) framework, identify proposed institutional changes, and explore their impact on water resource management processes and outcomes.
2. Examine the validity and utility of the IAD framework as a guide for policy analysts and decision makers in describing and evaluating water resource strategies of desert towns.
3. Suggest simple methods for using the IAD framework to adapt and design institutions.

1.3 Methods

We took a case study approach, using the IAD framework to analyse the 'institutional statements' relating to water resource allocation and management in the ASWRS.

1 'Social dilemmas are ubiquitous in natural resource management and economic, political, and social life. They arise whenever the short term private returns to each participant are greater than their share of a joint return no matter what others participants do' (Ostrom 2005:37).

1.3.1 Data

We analysed data from ASWRS-related documents and interviews with participants in the strategy process.

The documents we reviewed included:

1. published materials related to the ASWRS
2. relevant national, Northern Territory, and regional initiatives, Acts and legislation
3. studies of demand management of the Alice Springs water supply
4. studies of community attitudes toward water usage.

We interviewed six of the seven ASWRS Steering Committee members. The seventh Steering Committee member provided us with his views and also reviewed this document. We also interviewed one regional Water Controller, and two organisers and a facilitator of the Steering Committee meetings and public consultations.

Names of interviewees are not included, to ensure confidentiality of statements within such a small number of participants. However, because the committee's decisions were consensual, interviewee citations were evenly distributed among all members. The committee developed a separate confidential document that records dissenting views on details such as licence requirements and allocations for specific uses, but we did not use this document in our study.

1.3.2 The Institutional Analysis Development framework

We applied the IAD framework to the ASWRS, a document that presents recommendations for allocating water and for forming a new Water Advisory Committee (WAC) for Alice Springs.

The IAD framework provided a conceptual map for examining the key variables faced by the people involved in developing the strategy. The variables included the nature of the resource, the larger community, the institutions and situations created for water planning, the outcomes, criteria used to evaluate outcomes, and likely changes in those variables over time.

The IAD framework is a multi-scale conceptual map used to understand how the diversity of regularised human behaviours results from universal components organised at different scales (Ostrom 1990, 2005; Ostrom et al. 1994). The framework, shown in Figure 1, helped us to systematically analyse the structure of action situations, and how the biophysical and social environment – and associated rules – affect the processes and outcomes of the situations over time.

Guided by the universal components of the IAD framework, we describe and analyse the processes and outcomes of the ASWRS. The universal components are grouped in two sets of variables:

1. external variables – the biophysical and social environment, and the institutions that shaped and affected the ASWRS
2. internal variables – the action arena, which includes several linked action situations and sets of participants. These internal variables produce outcomes through patterns of interaction, and those outcomes in turn feed back to the external socio-biophysical and institutional environment (Ostrom 2005).

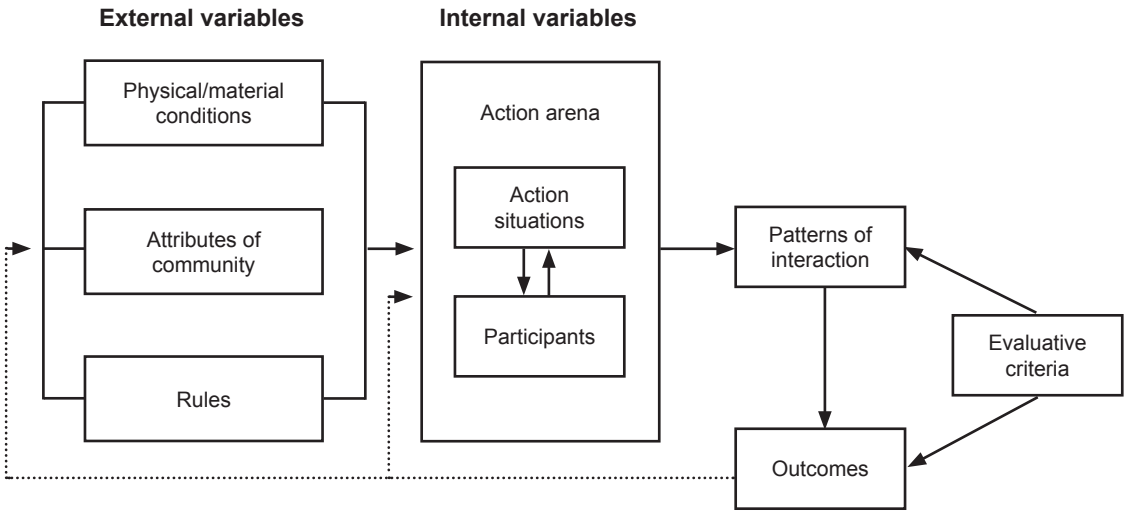

Figure 1: The IAD framework
Source: Ostrom 1990

The focus of our analysis is the set of linked action situations that produced the draft ASWRS. Participants in these situations include the ASWRS Steering Committee representing different sectors of the Alice Springs community; outside advocates for committee members and their sectoral interests; the public through consultation meetings; and Northern Territory Department of Natural Resources and the Arts (NRETA) staff who convened all meetings. These linked action situations at different scales shaped and set the boundary for the formation of the Steering Committee, its processes of interaction, and the draft ASWRS outcomes.

We used the framework to describe and analyse the action arena, the several linked action situations, the participants, their patterns of interactions (points of agreement and divergence), and the outcomes in the form of proposed changes in water management. We followed this with an evaluation of the processes and outcomes of the draft ASWRS using a set of criteria suggested by Ostrom (2005). We then compared the potential contribution of this theoretical analysis to the empirical approach that participants used to develop their draft water strategy. We used the analytical narrative method (Bates et al. 2000) to outline long-term scenarios that could result from the outcomes of the water strategy.

We compared a set of principles developed by the ASWRS Steering Committee for sustaining the Alice Springs water allocation with the IAD design principles that were developed over the last three decades from studies of successful and failed arrangements for managing CPRs (Ostrom 1990, 2005). We also compared the IAD design principles with participants' empirically-based design of new decision-making structures and processes for allocating and using water. We then used the IAD design principles as a theoretical tool to evaluate the potential of those entities to effectively function as a new node in a polycentric (multi-level) resource management system.

1.4 The structure of this report

This report has seven sections, followed by a reference list. In Section 2, we describe and analyse the structure, processes and outcomes of the draft ASWRS. In Section 3, we present potential scenarios for water management. In Section 4, we examine the validity of the IAD framework for capturing the important components of the entire action arena. In Section 5, we compare the

outcomes of the draft strategy with the institutional design principles. In Section 6, we suggest other simple tools to complement the more comprehensive IAD analysis. In Section 7, we recommend key institutions and structures for managing water resources in a desert town.

2 Description and analysis of the draft ASWRS and its outcomes

2.1 Physical conditions and attributes of the community

Water resource decisions are made in a complex socio-ecological context of interacting variables that decision makers cannot control: the physical conditions, the attributes of community, and the rules. Alice Springs is located at the centre of arid and semi-arid zones that cover about 70% of the Australian continent. Because most rain falls during the summer when the temperature averages

36.3^{o}C, the evaporation rate is 3000 mm/year, 10 times the mean rainfall of 282 mm/year. Due to very low rainfall and high evaporation losses, there are no permanent surface waters in the Alice Springs area, except for one intermittent river, one creek, and several waterholes.

Home to the Arrernte people for thousands of years, the site of Alice Springs was chosen for European settlement in 1870, mainly due to the presence of water. Until 1964, drinking water was supplied by the rapidly-recharged shallow aquifer in the alluvial sands under the intermittent Todd River. As the population increased, this source was replaced by a non-renewable source – the Amadeus deep rock aquifer, whose last major recharge is estimated to have been 32 000–100 000 years ago.

Alice Springs is now a town of 28 000 and is very transient at multiple temporal and spatial scales. The 2006 census data (see Figure 2) indicate that Alice Springs has large mobile and stable groups of residents (Australian Bureau of Statistics 2007). Approximately one-third of the population changes residence annually, with half of that group moving within Alice Springs or the NT. Over five years, 40% remained at their same address, while half of those changing residence stayed in Alice Springs or in the NT. This census data is complemented by 2005 surveys of the undercounted Alice Springs town camps, whose 39% mobile population increases their average population (Foster et al. 2005). In 2005, an average year, Alice Springs also received 465 000 tourists who stayed 1.8 million nights, resulting in an average of 5066 tourists per day or 21% of the resident population (Tourism NT 2006).

These large transient and resident sub-populations bring diverse experiences in water allocation and use. Aboriginal town camp residents and migrants bring understandings of the cultural values of water and of social norms for water usage across the arid zone. Long-term local residents have ‘corporate memory’, understanding of local norms, and sustained involvement, but their experience is influenced by the long history of unrestricted water use. Intrastate migrants have similar understanding, but, due to changes in residence, may not have incentives for investing in household water conservation technology. Interstate migrants bring experiences of more restrictive institutions for water allocation in Australian coastal towns. Finally, tourists bring their desire to experience desert Australia, and that experience may be enhanced by appropriate water use restrictions.

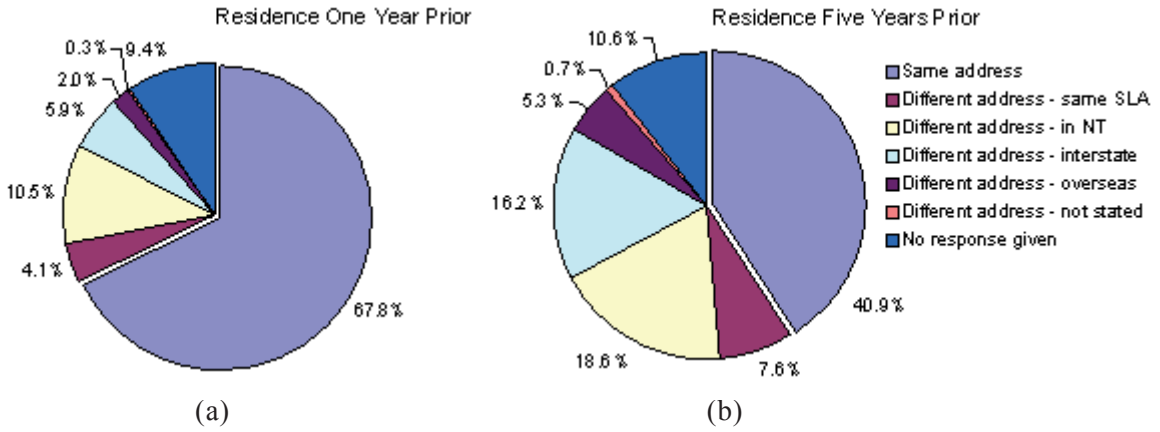

Figure 2: Alice Springs residence: one year (a); and five years (b) before the 2006 census

Alice Springs has some of the lowest-cost water in Australia, with no restrictions on water use. Current water use is 10,500 million litres a year, which is about 959 litres per person per day. An Alice Springs household uses more than twice as much water (535 kilolitres per household per year) as the average Australian urban household (213 kilolitres per household per year), which places the town near the top of the water consumption range (113–552 kilolitres per year) for all cities and towns (WSAA 2007a, 2007b). Bore levels have dropped 50 metres since 1964, and continue to drop at slightly over one metre per year. There is a moderate level of confidence among the NRETA staff that the Amadeus aquifer can supply the town's future water needs, and a second bore field in the aquifer has been planned.

Two hundred years ago, the Arrernte people used substantially less water than Alice Springs residents today. They got water from rock holes and other surface sources, by digging shallow wells and seepages, and by covering shallow aquifers to prevent evaporation. Their water demand was low, through reliance on native plants and animals, and they primarily used water for drinking (Rolls 2006). In contrast, 58–65% of current domestic water use is to support residential gardens. These differences in water use suggest that the value of water in Alice Springs is distinct from its volume, and that the economic and cultural benefits of water can be realised with less than current per capita use. Alice Springs water may therefore be under-valued economically and culturally. Recently, local organisations and agencies have introduced strategies to develop sustainable practices, such as DesertSMART, but they have not been widely communicated (ALEC 2005).

2.2 Rules

The IAD literature identifies three major levels of rules (institutions):

- constitutional
- collective
- operational.

As shown in Table 2, the three levels of rules are linked functionally.

Table 2: IAD rules and levels of analysis

Rules	Constitutional	Collective	Operational
Levels of analysis	Constitutional choice	Collective choice	Operational choice
Processes	Formulation Governance Adjudication Modification	Policy making Management Adjudication	Appropriation Provision Monitoring Enforcement

Source: Ostrom 1990, p. 53

Operational level rules directly affect daily decisions made by the participants in any setting. The rules can change relatively rapidly—from day to day. Collective-choice level rules determine who is eligible to participate in operational-level activities, and the rules for changing operational rules. Constitutional-choice rules determine who is eligible to participate in collective-choice activities, and the rules for crafting the collective-choice rules. The higher the level, the slower the rules change.

We analysed two sets of nested rules. The first set of nested rules was from the linked action situations that shaped the development of institutional propositions contained in the draft ASWRS. We asked the following questions to analyse this set of nested rules in this section:

- Did the Steering Committee members (or others who participated in the linked action situations) have the power to change the rules affecting those situations?
- Did they have the power and access to change the rules at the collective-choice or constitutional-choice levels?
- How much opportunity did they have to change the operational rules for water resource management in Alice Springs?

The second set of nested rules are contained in the draft ASWRS and are discussed in Section 2.5. They are the proposed institutional statements and the changes to existing rules governing water resource allocation in Alice Springs. These changes are mainly at the collective-choice level. In the draft strategy, collective-choice rules are propositions to determine current and future water allocation in Alice Springs, and how to enforce those allocation rules. This process of drafting collective-choice rules is constrained at the upper level by the constitutional-choice rules contained in national and Northern Territory water acts, and at the lower level by operational rules that govern day-to-day water allocation and water supply activities.

2.2.1 Constitutional rules

Two constitutional-level institutions are of interest: the National Water Initiative of the Council of Australian Governments (COAG), and The Northern Territory of Australia Water Act 1992 (‘the NT Water Act’).

The National Water Initiative (NWI)

The NWI (COAG 2004) vests decision making in governments and allows others to use water in a framework that:

> *... attaches both rights and responsibilities to water users – a right to a share of the water made available for extraction at any particular time, and a responsibility to use this water in accordance with usage conditions set by government. Likewise, governments have a responsibility to ensure that water is allocated and used to achieve socially and economically beneficial outcomes in a manner that is environmentally sustainable.* (COAG 2004, p. 1)

Relationships between rights and responsibilities can vary significantly in practice. Due to this variation, in 1994 the COAG developed a framework for 'the efficient and sustainable reform of the Australian water industry'. In 2004, due to continued 'variation in progress with water reforms between regions and jurisdictions, and the expanded knowledge base', the COAG created the NWI to:

> *... increase the productivity and efficiency of Australia's water use, the need to service rural and urban communities, and to ensure the health of river and groundwater systems by establishing clear pathways to return all systems to environmentally sustainable levels of extraction. The objective of the Parties in implementing this Agreement is to provide greater certainty for investment and the environment, and underpin the capacity of Australia's water management regimes to deal with change responsively and fairly.* (COAG 2004, p. 1)

The clear objective is to reduce uncertainty and increase sustainability of the resource. One of the eight key components of the NWI is to develop community partnerships to engage water users and other stakeholders in achieving the objectives of this agreement by:

1. improving certainty and building confidence in reform processes
2. enabling transparency in decision making
3. ensuring sound information is available to all sectors at key decision points. (COAG 2004, p. 20)

The goals of the community partnerships are to consult stakeholders to return 'overdrawn surface and groundwater systems to environmentally sustainable extraction levels', to periodically review water plans, and to make other decisions that affect 'the sustainability of water use, including the science underpinning the identification and implementation of environmental and other public benefit outcomes' (COAG 2004, p. 20). Public involvement, however, is limited to consulting and informing local residents about the actions of government.

The Northern Territory Water Act

The NT Water Act (NTG 2004a) is recognised as complying with the NWI, but includes no plan for community partnerships, other than that the Minister may establish a Water Advisory Committee (WAC) to:

> *... advise the Controller on the effectiveness of the water allocation plan in maximising economic and social benefits within ecological restraints; and is to carry out any other functions that the Controller may from time to time direct the Advisory Committee to perform ... An Advisory Committee shall consist of such members as the Minister thinks fit and the members shall hold office at the Minister's pleasure.* (NTG 2004a, pp. 17–18)

In summary, these constitutional-choice level institutions allow the public to participate in water resource planning and decisions at the discretion of the Minister or the Water Controller (Environmental Defender's Office 2005). With their goodwill, local residents can be involved in developing a water resource strategy, such as the ASWRS. However, without institutional support that goodwill can be withdrawn.

2.2.2 Collective rules

A few regional NRETA staff recognised that in 'the National Water Initiative, there's a commitment to go through a participatory process to involve people, but it's broad enough that it can be done in different ways.' They interpreted the NWI in a way that allowed them to have more active public involvement in the ASWRS, and this decision was supported by the Minister. One of the interviewees said:

> *We put options to the Minister early in the piece which said we can form a full blown Water Advisory Committee now, and then proceed with developing the strategy, or we can do it all internally within the Department and then when it's pretty much finalised produce it, or we can have an interim Steering Committee that works with the department to bring in those external viewpoints and when it's finalised then form the full Water Advisory Committee. Here are three options, and the Minister said I'll take that one: the Steering Committee.*

The NRETA staff developed a community engagement strategy – Community Strategy Phase 2, 2005 (NRETA 2005c) – in accordance with the NT Government Community Engagement Implementation Guide (NTG 2004b). It directs consultation involving the general community, stakeholders and the Steering Committee in drafting the ASWRS (NRETA 2005b).

The guiding principles for consultation were as follows:

1. Consultation will be transparent.
2. We will maintain openness and take new ideas on board.
3. We will ensure respect for the diverse range of interests that may be represented.
4. We will make reasonable attempts to resolve conflicts, if they arise, and reach a suitable solution.
5. Information relating to the consultation can be accessed easily by everyone involved.
6. Participants will receive feedback about inputs received and how the final decision was reached.
7. If a difference occurs between the input and the final decision, the reasons for this will be clearly documented (NRETA 2005b, p. 9).

The NRETA staff recognised that these principles for community engagement were innovative, and this innovation presented challenges for implementation:

> *The commitment to genuine participation shown by the Northern Territory government was not standard practice yet. We did a lot of work to bring people in the Department along with this process of participatory decision making because it's quite threatening to people, a threat to their feelings of their role. We were trying our best to incorporate what we recognise as being better practices into our engagement with the community, and one day toward building best practice.*

The legislation provides discretionary options which can easily create social dilemmas among NRETA staff and the public representatives. However, the goodwill and commitment of the local NRETA staff to genuine consultation helped create opportunities for the general public. Representatives of cross-sections of the Alice Springs community were also actively involved in developing the draft ASWRS. The ASWRS Steering Committee even had an opportunity to discuss and suggest improvements to the NT Government's guiding principles for consultation (NRETA 2005b).

The main collective-level rules of concern are the national and Northern Territory legislation that sets the functional boundaries of the Steering Committee, the roles and positions of its members, its internal decision-making process, and its links with other action situations. The IAD framework groups these rules into seven types, which are shown in Table 3 (Ostrom & Crawford 2005, p. 294).

Table 3: Types and examples of collective-level rules affecting the ASWRS

Type of rule/institutional statement	Example/comment
Position rules: create positions (e.g. member of a committee, voter).	The Minister agreed to establish a committee to help draft a strategy as allowed by the NT Water Act. (The Minister endorsed the seven representative and skill-based organisations who nominated the ASWRS Steering Committee members.)
Boundary rules: affect how individuals are assigned to or leave positions, and how one situation is linked to other situations.	Each of the key sectors of the Alice Springs community and other major water stakeholders were assigned a position for membership in the Steering Committee. Each had to take the position and assign a skilled representative, or else miss an opportunity to influence the ASWRS. The Steering Committee can only: assist with determining water allocations and beneficial uses under the NT Water Act review the draft strategy and the community consultation report which will be submitted to the Minister and Cabinet advise on the proposed membership and operating arrangements for a ministerially appointed WAC to represent the interests of Alice Springs water users throughout the life of the strategy.
Choice rules: affect what a participant occupying a position must, must not or may do at a particular point in the decision process.	The Steering Committee should come to a consensus view with other members or else risk hostility in other arenas where they live and work. While accommodating others, each Steering Committee member made choices that affected the final outcomes of the ASWRS depending on active or passive influence from their constituencies. The NRETA staff have choice rules about putting forward Steering Committee views to the Minister or to his/her territory-level delegate on water control.
Aggregation rules: affect the level of control that individual participants exercise at a linkage within or across situations.	A Steering Committee member may put forward a dissenting view for inclusion in the consultation report, or else the Steering Committee view will be assumed to be consensus. The Power and Water Corporation (P&WC) has ministerial representation at the territory level and they can shift levels to attempt to achieve their desired outcomes in the final ASWRS. Although to a lesser extent, the other Steering Committee members can also exert influence on the final outcomes through the Alice Springs Town Council, the horticultural lobby, Central Land Council, and environmental groups.
Information rules: affect the level of information available in a situation about the allowed actions and the links between actions and outcomes.	NRETA must provide the Steering Committee with technical information or else the Steering Committee can not proceed with drafting the ASWRS.

Type of rule/institutional statement	Example/comment
Scope rules: establish what outcomes can be affected by the decisions made by participants.	On behalf of the Alice Springs community the Steering Committee shall assist with the determination of water allocations under the Water Act, or else views of the community on water allocation will not be incorporated. The draft ASWRS proposed by the Steering Committee shall follow the definitions of sustainable maximum yield and categories of beneficial use prescribed by the NT Water Act and the NWI to determine allocations for each beneficial use, or else it will be revised The Steering Committee shall provide advice on membership and operating arrangements for the WAC, or else miss this opportunity for influence
Pay-off rules: assign rewards or sanctions to outcomes, given the actions chosen	The members of the Steering Committee shall strive for consensus on water allocation, WAC membership and operating arrangements, or risk dissent from other Steering Committee members, constituents and town residents. If the draft strategy is endorsed by the Minister, its water allocation plan will slow depletion and reinforce public calls for more efficient demand management, and the proposed structure for an empowered WAC will build trust among the different parties

Other collective-level institutional statements are addressed in Section 2.5.1.

2.3 Exploring the action arena

An action arena has two components: the action situations and the participants. The actors and interactions that contributed to drafting the strategy form the primary action arena. As shown in Figure 1 and in Table 3, the action arena is shaped by external rules. The Steering Committee is the focal action situation, where representatives bargain over the allocation of water and develop a draft strategy. The final strategy will include public views, and both consensus and dissenting views of the Steering Committee. The draft will be submitted to NRETA for final editing, and then to the Water Controller, the Minister, and, at his/her discretion, to the Cabinet. The final strategy will then be implemented with the advice of a separately constituted local review panel, the Alice Springs WAC. The final strategy will be reviewed in five years, and a new water allocation plan will be declared every 10 years. Though these rules shape the action situation, the Steering Committee had a significant opportunity to comment on rules, including the terms of reference and the guiding principles for the WAC.

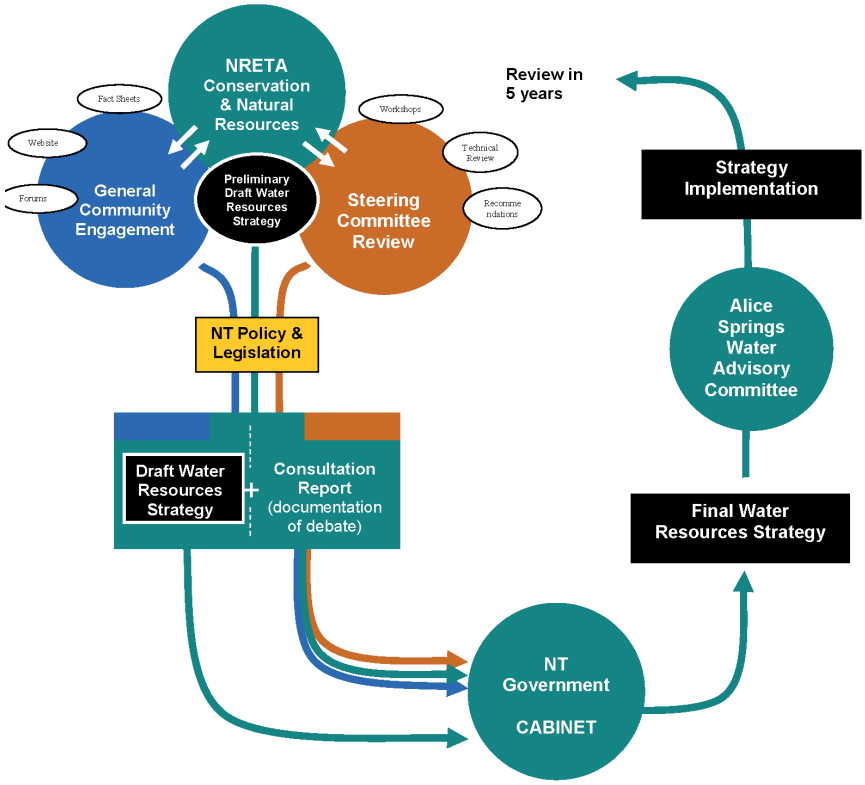

Figure 3: NRETA community consultation process
Source: NRETA 2005a

2.3.1 Linked action situations

Goodwill and commitment, mainly by local NRETA staff, led members of the public and a Steering Committee to develop the ASWRS, following the process illustrated in Figure 3. Effective consultation was achieved within current institutional constraints, but final decision making is still concentrated at higher levels in the set of linked action situations.

This action arena shows the nested and linked action situations through which outcomes from the Steering Committee and the public consultation form only a portion of the draft strategy document for consideration by the Minister, or, if the Minister wishes, by the Cabinet. This nesting and linking of action situations is important because it creates outside opportunities to control outcomes, which can change the distribution of power among the Steering Committee members, Members who use those outside opportunities can thus have a disproportionate influence on the final strategy.

2.3.2 Participants and positions

Local NRETA staff sought extensive involvement of the Alice Springs public and intensive input from the Steering Committee. There were two community forums. The first forum provided background information about water issues and 45 people attended. The second forum was on key consultation questions and 22 people attended (NRETA 2005b).

The IAD framework distinguishes between positions in an action situation that are authorised to take particular actions, and the participants who can move in and out of those positions. Steering Committee positions were determined by NRETA, based on their requirements for sectoral representation and skills relevant to water resource usage in and around Alice Springs. Each position was thus authorised to act as a representative and to contribute specific skills. The proposed structure was endorsed by the Minister, and each organisation nominated one participant for each position (Table 4).

Table 4: Steering Committee positions and participants

Skills	Representation	Participant
Scientific	Desert Knowledge CRC	Mark Stafford Smith
Community	Alice Springs Town Council	Ald Murray Stewart
Environmental	Arid Lands Environment Centre	John Brisbin
Public water supply	Power and Water Corporation	Alan Whyte
Indigenous	Central Land Council	Patrick DuPont
Commercial*	Chamber of Commerce and Industry	Don McDonald
Horticulture industry	NT Horticultural Partnership Group	Vin Lange

* The only change in the original proposal for organisational representation was the substitution of the Regional Development Board by the Chamber of Commerce and Industry because the Regional Development Boards had gone into recess.

(Source: NRETA 2005b)

The terms of reference for the Steering Committee were as follows:

1. Assist with the determination of water allocations and beneficial uses under the NT Water Act.
2. Review the draft strategy and the community consultation report to be incorporated into a submission to the Minister and Cabinet.
3. Provide advice on the proposed membership and operating arrangements for a ministerially appointed WAC for Alice Springs, which will then represent the interests of Alice Springs water users throughout the life of the strategy.

Because Steering Committee membership was based on sectors and skills, NRETA consulted additional key users separately.

> *Given that some members of the Steering Committee were also stakeholders, it's relevant to consider what other stakeholders were consulted. They included the lessees of all of the pastoral properties which overlapped with the planning area ... We also worked within agencies to talk to the biodiversity and parks groups to ensure that the sort of information they had was taken into account.*

The degree of public representation varied substantially among the seven members. The horticulture and environment members actively communicated with their constituents.

> *When I knew that this strategy was on, that we had a seat, what the starting point was, we sent out media to establish an early negotiating position. So we hammered the bulk policy and said it was not going to be a good thing and asked people to start talking to us and they did. And in the middle of it we reported on the progress, and asked people to talk with us and they did. And at the end we said this is what happened and people talked to us. The process of the strategy was reported to the community.*

In contrast, there was less involvement in the commercial and Indigenous areas.

> *The reporting mechanism is back to the Chamber Executive ... I'm involved in another area at the moment and there's not much direct feedback to the members. They have a newsletter but in these sorts of terms and these sorts of activities they're generally just reported back to the Executive.*

> *We made one presentation to the Native Title holders which really wasn't enough but it's all we could do time-wise. We also had a representative from the Central Land Council within the decision making group. However we don't believe he would have had the time and the resources to consult with traditional owners of the region with the time that we had.*

All members of the Steering Committee felt comfortable about the composition of their committee.

> *I think the makeup of the Steering Committee represented all facets of Alice Springs. We had people from the environmental lobby, we had business, people from government, we had Indigenous people represented by the land council; I think it was very well put together.*

2.4 Examining interaction patterns

Our analysis in this case study focuses on patterns in the interactions among Steering Committee members, the public, and NRETA staff. The ideal patterns of interaction build trust and reciprocity, which helps resolve social dilemmas and reduces the uncertainty of outcomes. When the outcomes are productive for participants, they increase their commitment to maintaining the situation and continuing to receive positive outcomes. When outcomes achieved are less productive than other possible outcomes, participants may try to change the structure of the situation by changing the external variables – particularly the rules at higher levels. When participants view rules as unfair, they may change their strategies, even when they are receiving positive outcomes (Fehr & Gächter 2000).

2.4.1 Information

As shown in Figure 3, the NRETA team was a hub for information among the participants. Background information on water issues in Alice Springs was presented through fact sheets, diagrams, maps, media, and a draft strategy, all of which were available on the NRETA website. At community meetings, NRETA also presented their engagement principles and consultation questions which they developed to help the public provide informed advice.

> *We looked at past efforts of the NT government to do community consultation, particularly with some of these submission forms. We looked at the types of questions they asked, and we thought, well all of these questions are irrelevant really, they're asking questions that either lead people into some sort of an answer, or they're questions about things we can't change ... or they're questions that people are very unlikely to have the information or the knowledge or background to give their opinion on in a meaningful way.*

Their analysis resulted in seven key consultation questions:

1. What principles and values should underpin decisions made in the strategy?
2. How long do we want/expect the Amadeus aquifer water supplies to last?
3. What are the beneficial values and uses for water around Alice Springs? What values should be protected?
4. How adequate are the proposed water allocations for the Amadeus aquifers?
5. What guidelines and rules should apply to water licensing and trading?
6. What should be the role and who should be a member of a WAC?
7. What key projects should be undertaken through the ASWRS work plan?

The community engagement process began with two public forums that some Steering Committee members also attended:

1. 22 October 2005. 'Myths, Facts and Future of Alice Springs Water' focused on presenting background information about water issues and the draft strategy to the public. It was attended by 45 people.
2. 29 October 2005. 'Water Use & Sustainability' focused on facilitating feedback against the key consultation questions. It was attended by 22 people.

Community forum attendees received new information about Alice Springs water resources and engaged in discussion to identify their preferences, but their responses were inconsistent. For example, at the second forum, 'Water Use & Sustainability', attendees were presented with scenarios concerning 'the maximum allowable volume of water available over a ten year period (the life of the strategy)' (NRETA 2005b, p. 13). Nine options were presented, expressed as a multiplier of the current usage rate, from current use x 7 to use x 0.13, and as an estimate of the life of the aquifer, from 100 years to forever. Ten of the 13 responses clustered around the current use rate.

In contrast, when attendees were asked, 'In your opinion, do you think it is acceptable to take water from the Amadeus rock aquifers at a rate that will one day cause the aquifers to run out of accessible and useable water?', 14 of the 19 responses were to sustain the aquifer indefinitely, at a usage rate much lower than the current rate. Statements on values about the relative importance of conservation and economic growth also emphasised conservation, with a priority on public participation in decision making.

A lot of people said this in the community consultation: 'Why don't we have water restrictions, in the centre of Australia where we have one of the lowest rainfalls in the country and we're the only place in the country where we can waste as much water as we like, without any kind of problems?' But unfortunately those sentiments weren't able to be incorporated into the policy.

Both the community forums and an independent survey (McGregor Tan Research 2005) concluded that the community needs more information to be able to actively participate in the water resource action arena, and to have control over their desired outcomes. This supports the decision by NRETA to both increase information available to the public and to form a committee to learn more about the issues.

However, the information that NRETA made available to the ASWRS Steering Committee was also uncertain.

Information about the key exogenous variable – the amount of water – was highly uncertain. I think the picture we got was, we were talking to trusted sources – the government and the scientists – and they were saying here's the best we know, and here's the things we don't know. And what they didn't know was a fair amount.

Uncertainty in key information about water availability and about usage rates is an outcome of the linked action situations. This information imbalance increases the potential for discretionary decisions to be made outside of the focal action situation of the Steering Committee.

Much of the information we initially received was [based largely on one person's judgement]. The department subsequently re-visited and collated a technical report based on the existing literature on the volumes and recharge and discharge and presented us a report with quite different estimates.

A history of centralised information and decision making has engendered a departmental culture in which public participation is considered a threat to the status quo. The local NRETA staff developed a plan for an extensive media campaign to increase public awareness and involvement in the consultation process, but the campaign was not implemented:

There's a lot of inertia in that culture of the department toward making decisions the way they always have, which is through this hierarchical system, these bottlenecks of people who have the power to make decisions, and we copped a lot of criticism from the Minister's advisors, particularly, because of our media campaign ... but we only got to the first step and the Minister's office put a media block on it.

It seems that one major concern of NRETA was that 'having people involved in community consultation, they might get the impression that they were making the decisions' and pre-empting the role of government, 'and that was a big threat to them'. This path dependency can be an obstacle to any change toward a more polycentric resource management system.

2.4.2 Interaction

Immediately after the public forums, the Steering Committee began a series of six meetings (see Table 5).

Table 5: Schedule of the Steering Committee

Meeting number	Date	Meeting focus
1	Thursday 3 November 2005	Introduction to the preliminary draft ASWRS and critical discussion of beneficial uses
2	Thursday 10 November 2005	Critical discussion of maximum allowable yield, water allocations and licensing and trading guidelines
3	Thursday 17 November 2005	Decisions and recommendations for beneficial uses and licensing and trading guidelines
4	Thursday 25 November 2005	Decisions and recommendations for water allocation
5	Thursday 1 December 2005	Dialogue and recommendations for the ASWRS, a WAC and a work program
6	Thursday 15 December 2005	Review of updated draft ASWRS, Cabinet submission and community consultation report

Source: NRETA 2005b

At the first meeting, the Steering Committee challenged the beneficial use categories in the NWI.

> *The concept of beneficial uses, that came from the National Water Initiative, was something we couldn't mess with because it was common to the whole national initiative ... It says you can't use water for aquaculture but you can use water for horticulture. We looked at them at first and thought, both are largely private enterprises, largely for-profit and for export. And those are the commonalities of those uses. And we don't necessarily have a concern about those activities taking place, unless they take place in a very ineffective manner that returns no value to the community. Those are our major concerns. But those concerns aren't served well by a simple categorisation of usage type, rather than quality of usage or other attributes of usage. So we found no place in the framework to lodge those concerns efficiently, in terms of process.*

The committee challenged the inflexibility of the beneficial use categories, when they tried to apply those categories to their context. However, there was no procedure for such a challenge. A proper procedure for shifting levels, such as within a polycentric governance system, would allow for more adaptive institutions.

At the second meeting, committee members were asked to stand on a timeline representing their position on resource sustainability. Some members focused on increasing the sustainability of the town, while others tried to come up with a strategy to increase the sustainability of their constituent group. Regardless of their focus, responses were clustered at a point that was significantly different from the contingent NRETA policy (see Figure 4).

> *The outcome wasn't an artificial result of how NRETA presented the options. The Steering Committee didn't just pick the midpoint between extremes presented, but was quite clear and consistent about choosing a specific conservative value ... There were conscious and thoughtful discussions on the trade-offs between sustained water supply/having water for inhabitants indefinitely, and sustaining the economy of the town in the sense of having sufficient going on that there was a reason for people to want to live there to use the water in the first place!*

> *The reality was there wasn't a great deal of difference between myself – and I was saying we should be using more than anyone else – and the environmentalist. There was only a little, when you look at the big picture. And I think I took a very conservative view in terms of water use.*

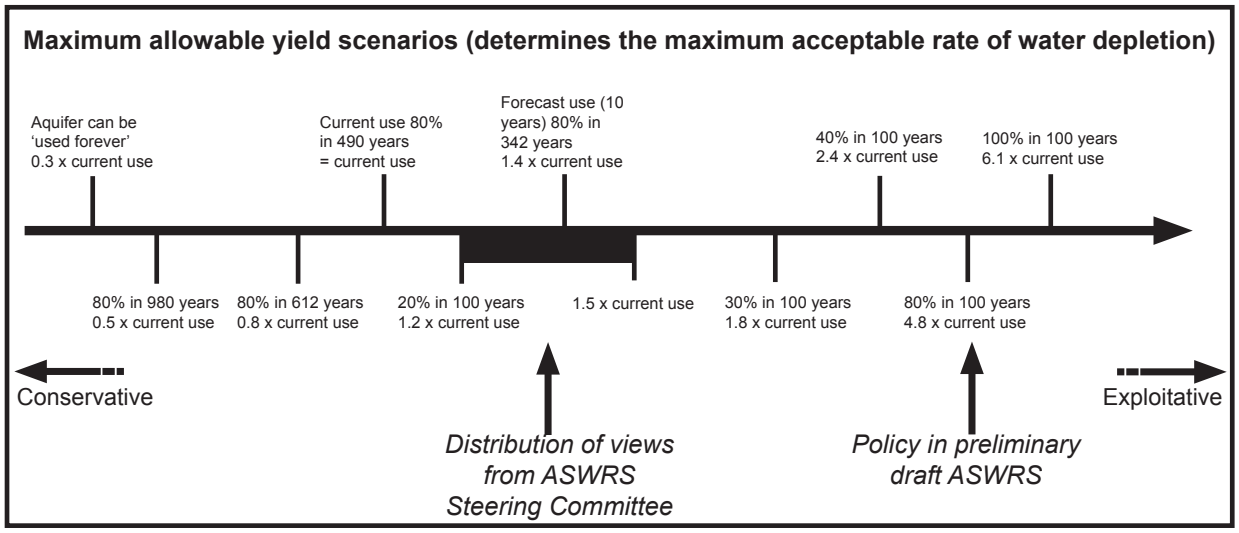

Figure 4: Comparison of NRETA and Steering Committee water use scenarios
Source: NRETA 2005b

These participant interactions were guided by a set of formal and informal operational-level rules to increase the probability of outcomes from the action arena.

> *We were heavily dependent on the quality of the people around the table. There was no mechanism you could have put into place to ensure a better outcome, I think, other than the mechanism of choosing good people and hoping they are in a good mood that day and you get a good outcome.*

2.4.3 Tension

As in other CPR situations, the tension between collective long-term outcomes and short-term organisational (and individual) interests was the reason for social dilemmas in the Steering Committee. Both NRETA staff and members of the committee continually reflected on the importance of rules in addressing this conflict.

> *Certainly the representative for the horticulturists would like a little bit more water allocated to horticulture but he was being realistic. I think people were working together genuinely rather than trying to fight against each other. People were trying to come together cooperatively to produce an outcome people would feel reasonably happy about at the end of the day. It wasn't like open conflict, it was pretty cooperative process.*

Through this reflection, the IAD design principles (described more fully below) began to emerge. These principles began to be expressed in the Steering Committee interactions about:

1. their right to organise
2. the need for clear rules for water use
3. proportionally valuing the benefits of each use
4. establishing local-level rules
5. nesting institutions in layers
6. establishing a WAC to monitor rules
7. establishing realistic sanctions for local water use
8. developing low-cost conflict resolution processes.

The major challenges to the IAD design principles were uncertainties that arose from the limited responsibility of the Steering Committee for drafting a strategy without having the right to make the final decision to implement it, and threats resulting from power differentials among committee members.

> *As far as a community representative process ... there was [an organisation] in the meeting room with us that has all the influence and power in a single entity.*

The major water licensee is the Power and Water Corporation. The Steering Committee tried to develop rules for licensed entities that reflected community values of resource sustainability.

> *As part of their licence, it [saving water] needs to be one of their major targets: water reduction, water efficiency and per capita reduction. We mentioned in one meeting the possibility of putting some kind of restriction on the extraction license. Twelve hours later a note came from Darwin: 'We accept no conditions whatsoever on our extraction license.' But in our cover letter recommendations the committee said we really should consider putting some kind of conditions on that extraction license. But I don't know how to sort the power differentials, from the position of the committee.*

The Power and Water Corporation responded by presenting its own dilemma: a dual role that presented a conflict of interest between business profits and public good within one organisation.

> *Power and Water is in the business of selling power and water in a commercial sense. Even though we're a government owned corporation we have to pay a dividend to our Minister and we have to have a positive rate of return. So for us to be going out and promoting water conservation we're actually potentially losing revenue. So unless somebody says, Here's some money for you to run the water conservation programs or to offer rebates or to put in rainwater tanks or all the good things that people want, unless we are given that money or we're allowed to undertake that work by pushing our tariffs up, then why would we do it, why would any commercial business do that?*

Other Steering Committee members identified this as a threat.

> *In a sense they get a chance to double dip. They can act like a business, an independent business. At the same time they can play a role as if they're a government agency, and so they will juggle between the two, whatever is in their best interest.*

The regulatory agency also recognised it as a risk.

> *The question about relative input and power is one that lies a little bit outside the Steering Committee in that once they'd sort of reached the end of their work and provided all of that input, one of the members, the Power and Water Corporation, then engaged with us directly in a very detailed fashion about their view ... presumably in the hope that more of it would prevail. And that's always a risk when a participant is also a government agency.*

2.5 The outcomes

The discussions among the general public, the submissions of stakeholders, and the intensive deliberations of the Steering Committee had significantly amended the preliminary NRETA resource strategy document and led to two broad outcomes:

1. a strategy – the draft ASWRS
2. suggestions on the structure and functions of a WAC to advise on implementing that strategy.

The draft strategy and the suggested WAC are intended to reduce the problems of uncertainty in the external variables of the physical resource, rules, and community that affect water resource management. However, they are only theoretical at this point because there is no certainty that they will be adopted, as they are subject to the discretion of the Minister.

2.5.1 Institutional statements

The consultation process provided key institutional statements. These statements are:

1. Water use should deliver sufficient environmental, social and economic benefits to Alice Springs to validate depletion of the water resources.
2. The needs of future generations should be considered by extending the life of the non-renewable Amadeus aquifers through conservative water use (NRETA 2005a, p. 1).

These two statements are within the Steering Committee's terms of reference. They took these statements further and decided unanimously that:

1. a policy for maximum allowable yield of 80% depletion in 100 years is not acceptable
2. the maximum allowable yield should be 'conservative' and should not give rise to a large proportion of unallocated water (NRETA 2005a, p. 24).

The Steering Committee also expressed its concern about the relevance to local conditions of the 'beneficial use' categories prescribed in the NT Water Act (NTG 2004a) and suggested that flexibility and innovation be applied in their use as management tools.

> *That is quite a shift in policies for allocation in terms of determining what a sustainable yield is. Also, how we approach the allocation of alluvial aquifers is quite a departure from the existing Northern Territory policy.*

All of these institutional statements are designed to create expectations that regularise human behaviour in water allocation, and thus reduce uncertainty about the resource. The IAD framework includes a method for analysing statements to determine their effectiveness in reducing uncertainty. This method is to parse the statements using the 'institutional grammar' in Table 6. Parsing categorises statements to determine their role as strategies, norms or fully-fledged rules.

Table 6: The five components of institutional grammar

1	ATTRIBUTES	A holder for any variable that distinguishes to whom the institutional statement applies.
2	DEONTIC	A holder for the three modal verbs: 'may' (permitted), 'must' (obliged), and 'must not' (forbidden).
3	AIM	A holder that describes particular actions or outcomes in the action situation to which the deontic is assigned
4	CONDITIONS	A holder for those variables that define when, where, how and to what extent an AIM is permitted, obligatory, or forbidden.
5	OR ELSE	A holder for the institutionally assigned sanctions for not following a rule.

Source: adapted from Ostrom 2005, pp. 213–14

Statements that explain strategies contain Attributes, Deontic and Aims; norms add Conditions; and rules have all five components.

Restating the key institutional statements using this syntax shows that none of them are yet an enforceable rule. The Steering Committee also recognised that their institutional statements lacked conditions and sanctions.

> *We never got around to talking about penalties. What kinds of penalties happen if you violate your extraction licence? So even if Power and Water had conditions on their extraction license and they violated them, what then? That whole principle wasn't even explored. Where does the WAC sit in a legislative or legal term? What powers does it have that aren't available for overriding by the Water Controller or the Minister?*

The institutional statements in the draft ASWRS are either shared strategies with no specified condition and sanctions, or norms with no specified sanctions. The following are some examples.

Strategy:

- The Water Controller should make all Beneficial Uses to 'encourage flexibility for innovation and good ideas'.

Norms:

- The Water Controller must make sure that allocation shall not exceed 80% the maximum allowable yield from the Amadeus aquifer over 320 years.
- The Water Controller must also make sure that the depletion rate shall not exceed 25% of maximum allowable yield from the Amadeus aquifer in the first 100 years.
- The Water Controller together with other water allocation entities must make sure the Alluvial aquifer Management Zones shall be used for the following beneficial uses and values: Environmental, Cultural, Industrial, Agricultural and Rural, Stock and Domestic uses.
- The Water Controller together with the water allocation entities must make sure the Roe Creek Management Zone must be used for the following beneficial uses and values: Public water supply and Rural, Stock and Domestic uses.
- The Water Controller together with the water allocation entities must make sure the Rocky Hill/Ooraminna Management Zone must be used for the following beneficial uses and values: Environmental, Cultural, Agricultural and Rural, Stock and Domestic uses.
- The Minister or the Water Controller will declare all waters (excluding existing agricultural entitlements) with salinities under 500 mg/L for beneficial use as public water supply.

The syntax helps compare the different institutional statements (rules, norms and shared strategies), and shows how adding or subtracting components changes statements from one type to another. It is also a tool for evolving strategies or norms into rules (Ostrom 2005, p. 214).

If the key institutional statements in the draft ASWRS are implemented, water allocation will improve through changes in the definitions of sustainable maximum yield of unallocated water, and of beneficial uses (NTG 2004a). Of course, there is no guarantee that the draft ASWRS and the institutional statements within it will be accepted.

Who knows what happens to it from now? We have no ownership over it at this point. The committee has done its draft, we have signed off on it and it's gone. It's not like the minutes have to have our approval in the final version. We don't get to see the draft that comes back before it gets signed into law.

However, per their consultative principles and notwithstanding considerable subsequent delays, the regional NRETA has been fairly good at keeping everyone informed.

2.5.2 Structures

As permitted by the NT Water Act (NTG 2004a), NRETA developed a preliminary draft document describing the establishment and role of a WAC. The preliminary draft document included the following institutional statements:

1. The Minister may:
   a. in writing, establish and appoint the members of a WAC for the Alice Springs Water District
   b. prescribe the powers and functions of a WAC.
2. The WAC:
   a. shall consist of such members as the Minister thinks fit and the members shall hold office at the Minister's pleasure
   b. shall advise the Water Controller on the effectiveness of the water allocation plan in maximising economic and social benefits within ecological restraints
   c. shall carry out any other functions that the Water Controller may from time to time direct the WAC to perform.

The Steering Committee suggested amendments to the structure and function of the proposed WAC that would empower the WAC while increasing its accountability to the community, to create a more polycentric governance structure.

They should be involved in helping to vet the science, helping to monitor the licence, helping to look at water issues and all kinds of stuff related to strategy, [but] without any powers of enforcement it's got no teeth.

The Steering Committee also recognised that oversight of both allocation and use is necessary to manage a critical and non-renewable resource, and that 'people are concerned about water use, and they want water use to be more efficient'. However, they believed that a separate entity from the WAC should address local water demand.

2.6 Evaluating the draft ASWRS

Evaluation focuses on valuing the outcomes of the action situations, and the relationship between the outcomes and the processes of achieving those outcomes.

In evaluating the draft ASWRS, we used the following evaluation criteria to measure the key outcomes and processes:

- **Efficiency**: the relationship between water allocation and associated benefits in Alice Springs

  The draft strategy, if approved, provides allocations that benefit the viability of the town economically, socially and environmentally. However, because the Alice Springs groundwater resource is non-renewable, regulating allocation separately from use is

less beneficial. Indeed, if water allocation is not accompanied by significant water use efficiency and demand management measures, its sustainability is in doubt. Most local residents that we surveyed recognised that they could reduce their water use with little hardship. However, most also considered that their water use was not excessive. The Steering Committee tried to address this dilemma by changing the definition of 'maximum allowable yield' to identify the contribution of a specific allocation of water to sustainability.

- **Equity**: fairness between individuals' different contributions and benefits, considering different abilities to pay

  Many of the residents we surveyed recognised that the price of water does not reflect its real cost, and are willing to follow new rules if they are fair. The two-tier pricing system proposed in the draft strategy will maintain a baseline of low water costs for all residents, with increased costs only for those who choose to use more. The Steering Committee was concerned that conflicts between the dual roles of the Power and Water Corporation – as a for-profit business and a public agency – may impact water conservation strategies.

- **Adaptability**: the ability of individuals to learn from experience and adapt to new circumstances by maintaining a system's performance (robustness) or by shifting to a new stable domain (resilience)

  The NT Water Act provides for adaptability by requiring re-evaluation of the water strategy every five years and a possible overhaul every 10 years, to develop new institutions based on new information. However, there is no process for local residents to easily access that information, or to change those institutions.

- **Accountability**: the responsibility of officials to local residents, to restrict the officials' engagement in any opportunistic behaviour

  The Steering Committee asked for accountability from the Water Controller, the Power and Water Corporation, and any major user. The Steering Committee also recommended forming an accountable but empowered WAC for Alice Springs. Local residents also stated in responses to our survey that increasing their accountability by increasing their participation in decision making was a high priority.

- **Conformance to general morality**: the presence of rules that improve relationships over time, such as rewarding kept promises over free riding and cheating

  The Steering Committee, in its design of the WAC, was explicit about rules that clearly linked restrictions on water allocation to benefits for all stakeholders. Some local residents also expressed their willingness to accept water restrictions if everyone else did.

- **The need for trade-offs**: the comparison of rules using performance criteria within and between levels

  Trade-offs that emerged through the ASWRS process include:

  - changing current norms vs. maintaining current norms. Current norms suit current lifestyle practices, in contrast to a DesertSMART set of practices that promotes lifestyle changes
  - accurately assessing the probability of future water quantity, cost and availability vs. maintaining current uncertainties about those probabilities
  - accurately valuing future uses vs. discounting future uses

- developing and enforcing low-cost operational-level sanctions for minor local violations vs. the current practice of enabling only high-cost court-issued sanctions for major offences.

An example of a major political power trade-off is between the current decision-making structure and an empowered WAC or other local entity as proposed by the Steering Committee. The performance criteria at each level differ substantially. For example, in the NT Water Act the WAC has a purely advisory role and is expected to increase economic efficiency, with no trade-off in political power:

> *I think the major advantages, from my point of view, of having gone through that process was two-fold ... They did come up with some additional recommendations about the way in which we would make judgement in the future when a new application for a water entitlement came to the Department, and some of those involved greater rigor in terms of the future Water Advisory Committee being able to call for advice from a broader range of professionals. [And they] introduced the concept that, when the Controller of Water Resources ultimately makes a decision under the Act, the reasons for that decision and the reasons for any difference with the advice that came out of the Water Advisory Committee should be documented and made public.*

In contrast, Steering Committee members see the WAC as being a local representative body with the potential for increasing accountability if the political trade-offs can be resolved:

> *Where does the Water Advisory Committee sit in a legislative or legal term? What powers does it have that aren't available for overriding by the Water Controller or the Minister? What kind of penalty happens if you violate your extraction licence? So even if Power and Water had conditions on their extraction licence and they violated them, what then? That whole principle wasn't even explored ... [The Water Advisory Committee] should be involved in helping to vet the science, helping to monitor the licence, helping to look at water issues and all kinds of stuff related to strategy. If the Committee is not funded, it's totally useless. And no funding mechanism is guaranteed. So without resources that whole process is lame. And without any powers of enforcement it's also got no teeth. So it's an unknown quantity how the Water Advisory Committee will prosecute the mandate of the committee I was on.*

If the Northern Territory government establishes the WAC or some other local entity empowered to monitor and enforce the strategy, it will devolve some of its authority over Alice Springs water planning to the local residents of the town. There are no indications that this devolution of power will happen or that the government will establish the polycentric system necessary for sustainable resource management.

> *I think probably the biggest threats are administrative will from the department, political will from the government, and will in terms of the participation of each of the stakeholders involved in the process. If that will isn't there it would be quite easy for the Water Advisory Committee to fall apart.*

The IAD framework clearly articulates criteria for evaluating costs and benefits between different processes and the desired outcomes. In the ASWRS, these criteria can help achieve the negotiated outcomes by improving the design of water management rules.

3 Scenarios for water management

Scenarios focus on uncertainties as drivers of change. The Steering Committee identified three areas of uncertainty, or scenarios, that are likely to influence change:

1. 'No institutional change' describes the continuation of current conditions with current uncertainties.
2. 'User transience' describes change in user behaviour driven by the current high immigration rate of water users from states with water restrictions, who wish to reduce uncertainties
3. 'Local governance skills' is driven by changes in rules as suggested by the Steering Committee, to reduce uncertainty about resource allocation.

3.1 No institutional change

In this scenario, the driver is path dependence – there are no institutional changes, and the WAC is constituted in an advisory role without the authority or budget to design and enforce rules. This is the scenario created by the NT Water Act that provides for discretionary decision-making.

3.2 User transience

In this scenario, the driver is the large transient population, which over five years nearly equals the size of the resident population. Water restrictions and lower per capita use in other states and overseas have educated migrants who are proposing water conservation in Alice Springs:

> *Years and years ago ... the people who came to town were spraying more water than the locals were, you know, green gardens and rose gardens and veggie gardens and hosing cars out in the driveway and all that. And now my observation is that the people coming from interstate have actually turned that over and they're the ones that are lobbying when they arrive here to say, 'Why is this? Why is Alice Springs using all this water and why have we got green everywhere? This is criminal because over in Sydney we have water restrictions, why aren't there water restrictions in Alice Springs?'*

The NT government recognises that skilled migrants fill labour vacancies in the 'extremely transient population' of Alice Springs – positions that are vital to the town's basic infrastructure (NTG 2007). Similarly, engaging the contributions of this large transient population is essential for developing effective strategies for changing user behaviour.

3.3 Local governance skills

In this scenario, the rules change, driven by resource uncertainty. Local governance is increased based on institutions and entities (e.g. the WAC) that allow for adaptive learning and leadership on resource availability and usage strategies. However, current decision making is highly centralised and provides few arenas for local residents to develop the skills to design rules and govern resources in a changing socio-ecological environment.

> *Why didn't more people come out? We ran workshops on water waste, energy and the built environment and consistently pulled 40–50 people. People feel disempowered and uninterested so they don't show up.*

IAD analysis recommends beginning with lower-cost, lower-level actions – such as informed participation in agency decisions or watchdog groups – that can build capacity for local governance (Ostrom 1990).

4 Validity of the IAD framework

The IAD framework is composed of 'universal components organised in many layers' that result in 'the diversity of regularized social behaviour that we observe at multiple scales' (Ostrom 2005, p. 6) (see Table 7). A small set of universal components enables people to understand a complex system to effectively plan ways to achieve desired outcomes within that system. We can validate the IAD framework by asking if it captures the universals in the diverse patterns of interactions that comprise the Alice Springs water allocation system.

Table 7: Universal components of the IAD framework and the diverse behaviours they capture

Universal components	Diverse behaviours
Physical conditions	Non-recharging aquifer determines life span of town; significant uncertainty in data about resource quantity, quality and future extraction costs.
Attributes of community	Community has little accurate information on water costs and usage patterns; unrestricted water usage; conflict between new residents' desire for restrictions and profits for the major licensee. Town characterised by transient, uninformed and disempowered local residents with unrealised desire to conserve aquifer; no local power to allocate water.
Rules	Conflicts between public benefits and private licensee profits; laws provide discretionary decision-making to Water Controller; no rules for local decision-making. Collective and constitutional-level rules establish Steering Committee as an advisory group having responsibility without rights.
Action situation	The Steering Committee formed by NRETA and at the Minister's discretion is a new focus for several linked action situations that affect water allocation. Water allocation outcomes are contingent on interactions between the different action situations.
Participants	Steering Committee representatives from diverse sectors and action situations: regulatory agencies, licensees, local government, business, and environmental organisations.
Patterns of interaction	Steering Committee analysed rules and interactions of all linked action situations; achieved consensus on key decisions internally, while recognising that outcomes are contingent on decisions in other action situations, based on diverse evaluative criteria.
Outcomes	Local consensus on a draft water allocation strategy, and an empowered WAC. However, these draft outcomes are contingent on higher-level decisions.
Evaluative criteria	All criteria have been addressed. A significant criterion is the trade-off between public and private benefits.

Although the IAD framework was not used to examine processes and develop the draft ASWRS, the Steering Committee members and other interviewees used each component of the IAD framework separately and in subsystems, but did not use all components as a unified system. This indicates the value of the IAD framework as a conceptual framework. One Steering Committee member said that the IAD framework can provide a framework for planning.

> *A prior analysis, particularly identifying areas of rules at constitutional and collective levels, could have considerably helped the Steering Committee ensure that it was giving due weight to all aspects ... and perhaps an analysis near the end would have helped to check comprehensiveness.*

5 The IAD design principles

The IAD design principles are guidelines for designing institutions for governing resources, while the IAD analysis focuses on action situations. The design principles were developed through the collaborative efforts of many researchers who examined long-enduring institutions for self-governance of CPRs (Ostrom 1990). The researchers refute the notion that a 'tragedy of the commons' is inevitable. However, because human institutions are so diverse and complex, using these principles in a prescriptive process – such as outside consultants developing blueprints, checklists or models – has repeatedly been shown to be ineffective (e.g. Korten 1980, Mukand & Rodrik 2002, Pritchett & Woolcock 2003).

> *Examination of a number of Asian programs suggests that the more successful grew out of village experience. Consequently they were able to achieve an unusual degree of fit between beneficiary needs, program outputs, and the competence of the assisting organisation. The key was not preplanning, but an organisation with a capacity for embracing error, learning with the people, and building new knowledge and institutional capacity through action. (Korten 1980, p. 480)*

All eight IAD design principles became apparent during the Steering Committee's analyses of their linked action situations. The principles also captured the key challenges to resource sustainability identified by the committee:

1. their right to organise to develop rules for water use
2. having clear rules for water use
3. proportionally valuing the costs and benefits of each use
4. establishing local-level rules
5. nesting local-level rules in higher levels
6. establishing a WAC to monitor local water use and allocation
7. establishing realistic sanctions for local water use
8. establishing low-cost processes for resolving conflict.

This correlation between the IAD design principles and the Steering Committee analysis is presented below. It suggests that the IAD design principles can be used to formalise the local principles that emerge through a planning process, by contextualising them within the IAD literature. Formalisation can extend the applicability of those principles beyond the immediate problem, as presented below.

5.1 Clearly defined boundaries

Steering Committee analysis

The resource boundary is not clearly defined, and the Power and Water Corporation has the major role in determining the borefield, the number of bores in the field, and their pumping rate. There is an additional undeveloped borefield, with likely lower quality and quantity of water. The Power and Water Corporation also controls information on the cost of pumping water and on strategies to limit water use. Uncertainty in the resource boundaries is increased by the Power and Water Corporation's conflict of interest – as a corporation that receives increased income from aquifer depletion, and as a public utility that decreases the sustainability of the town through increased aquifer depletion.

> *One of the things they wanted to change was from demand management to water efficiency ... Demand management implies managing demand, probably reducing demand, whereas water efficiency you can develop new uses of water where you use an enormous amount ... and one of their underlying concerns was who is responsible for demand management? Should it be them [Power and Water Corporation], who are a business, a corporation, or should it be NRETA who are the regulator?*

Formalisation

The boundary of a resource, and hence of the action arena, is fundamental to sustainability. Uncertainty about resource quality and quantity is always present, and the only sustainable way to address uncertainty is to define current boundaries based on known quantities, and to change those boundaries as the degree of certainty increases. The alternative has been to allow boundaries to be undefined based on an uncertain resource, which increases the vulnerability of the resource to exogenous variables.

5.2 Proportional equivalence between benefits and costs

Steering Committee analysis

There is not enough information about resource availability and impact to determine costs for licensing new uses such as horticulture. In addition, water usage rates generally for Alice Springs are very high, with high potential for water conservation. This potential resulted in the horticulture representative proposing conservation measures, and that conserved water be reallocated to them. However, final decisions on the costs vs. benefits of water are made by the Water Controller, and there is no local market or other method to identify the real value of water to Alice Springs. In addition, lack of information on costs renders them invisible, or biases current use at the expense of future demand.

> *The stakeholders were very considered and saw the importance of regulating the use of water – both industry and from the environmental sides of the platform – and we were amazed at how similar their views were. Those views were far more conservative than the views that were presented by the government as reflected by our policy ... I think the department is still operating on that assumption that the only good news story for the community in terms of water is that there's lots of water and we should be developing it, and I think things have moved on since then.*

Formalisation

The challenge is to proportionally value the costs and benefits of using ancient (<80 000-year old) and non-renewable water. Rules for such a fully-subtractible resource must require conservation by current users so water is available for future users. However, the price of water is hidden by subsidies, so accurate decision-making based on price is impossible. As a result, the financial costs are disconnected from the actual value of the water. For example, one value of water for Alice Springs is as an incentive to attract and retain people from other places, which is a contingent valuation[2] by one set of users. One method for pricing may be to compare the age, renewability and cost of Alice Springs water with that of other water supplies in Australia. This method may be meaningful to the many transient residents. Another method may be to value ancient water against the cost of replacing that water using other local methods, such as recycling.

5.3 Collective-choice arrangements

Steering Committee analysis

Steering Committee members stated that they would be 'greatly disappointed' if their recommendations were not accepted by the Minister. Participants consistently stated that they want user participation to be valued in the decision-making process through the following actions:

2 Contingent valuation refers to a method in environmental accounting that is dependent or conditional on presenting a hypothetical market to a representative sample of the relevant population in order to elicit statements about how much the population would be willing to pay for specific environmental goods and services (United Nations 1997).

1. NRETA submits the draft as submitted by the committee.
2. The Minister approves the draft as submitted by the committee.
3. The Minister empowers the proposed WAC with a budget, staff, stipends and authority.
4. The WAC develops user sanctions and water licensing requirements.
5. The WAC empowers a separate organisation to promote conservation measures.
6. Power and Water Corporation 'fills the science gaps' through a transparent process.
7. Power and Water Corporation and NRETA develop and maintain a transparent process for making decisions and sharing information.

However, committee members are concerned that no members of the public or other users can modify collective-choice rules, because the Minister or Water Controller has discretionary decision-making power.

> *There would have been an advantage in having within a future version of the Water Act principles that specify community consultation and community decision making as a key component of the development of a water allocation plan.*

Formalisation

Most of the water users should be able to democratically make and modify their rules, to be able to respond to changing local circumstances and to design locally meaningful rules. Discretionary decision making by a few people has responded slowly to changes in local experience, values, costs and benefits. Users and the resource can benefit from changes in collective-choice rules that increase local decision making in a polycentric system.

5.4 Monitoring the rules

Steering Committee analysis

The primary duty of the Steering Committee was to establish rules for water allocation, and to develop procedures for monitoring and enforcing those rules equitably. Institutions for water allocation were major achievements of the Steering Committee, in response to the current absence of such restrictions on licensees.

> *There's certainly a lot more that can be done about increasing efficiency in horticulture, pastoral, and domestic use around town as important prerequisites. We talked about imposing licence conditions on Power and Water to say that to ensure your license to extract the current water you need to reduce use over time, and there are various different ways, and that would require Power and Water to roll out a water efficiency program if that was a licence condition. And so far they haven't been good at meeting that licence condition.*

Formalisation

Establishing a basis for clear rules that restrict water allocation by licensees, and that restrict usage, is necessary to extend the life of the aquifer. This must be followed by procedures to monitor and enforce those rules. Local monitoring and enforcing of rules is strongly associated with increased resource sustainability.

5.5 Graduated sanctions

Steering Committee analysis

Local residents (e.g. as expressed in the DesertSMART document (ALEC 2005)) want conservation-related sanctions on water usage, and are willing to follow those rules if they are enforced fairly. People violate existing rules because those rules are unclear and enforcement is costly.

> *The Act allows for specified penalties for non-compliance, however, there is no infringement notice ... There's no capacity for those easy penalties, we have to actually construct a case and take it to court and that's an impediment to using the formal penalties under the Act for minor matters or small matters. In fact the only ones under the Act so far that have been taken to prosecution have been significant pollution events.*

Formalisation

Graduated sanctions reduce enforcement costs by involving all users as enforcers. Users have stated they would conditionally cooperate with low-level informative rules, such as monthly reports comparing household water usage. This experience of voluntarily restricting water use may then increase their motivation to socially enforce similar behaviour by other users. This can support cooperation with:

- a tiered pricing system
- sanctions against waste
- narrowly-defined beneficial uses
- allocation restrictions for major licensees, as a system of graduated sanctions.

5.6 Conflict-resolution mechanisms

Steering Committee analysis

Alice Springs residents are concerned about the lack of usage rules, which promotes highly variable usage among users, which conflicts with their shared interest in a sustainable resource. The Steering Committee has also expressed concerns about conflicting public and private interests of the Power and Water Corporation, about the accountability of the Northern Territory government to Alice Springs residents, and about the need for clear mechanisms to resolve conflicts in the current system of discretionary decision making. The Steering Committee recommended an empowered WAC as the focal action situation for low-cost conflict resolution.

> *Maybe through another consultative group we could have that impact. That group would be saying, as a community we would have a common set of principles of usage and conservation. To have them implemented, they would need to interface with Power and Water at a mechanical level to enact that mandate, and that's a can of worms nobody even got close to.*

Formalisation

Efficient conflict-resolution mechanisms enable participants to easily identify the rules governing water allocation and usage, to identify conflicts between rules and behaviours, and to inexpensively resolve those conflicts. Having clear rules linked to low-cost mechanisms can more easily standardise practices and increase resource sustainability. These collective-choice rules can be developed by users, such as through the proposed Water Advisory Committee. Without such a

process, resolving resource conflicts has high transaction costs, because rules are difficult to identify, are technically unclear, and access to decision makers to address conflicts is only through lengthy bureaucratic processes.

5.7 Minimal recognition of the right to organise

Steering Committee analysis

The NT government does not permit Alice Springs residents to develop their own institutions for limiting water allocation or use, or to change legislation. The NT Water Act allows users to organise only to advise decision makers. The change proposed by the Steering Committee was for government to recognise the rights of locals to create an organisation that is properly resourced, with clear functions that define its advisory role, and separate from the regulatory, educational or lobbying roles of other organisations.

> *Regarding the Water Advisory Committee, I think the Steering Committee was a good model for how that could work ... I think it should have an independent chair, that's what we agreed to, that the chair wouldn't be a government person. It was also agreed that the government's role in that group would be as providing information and not be voting or decision-making members of that group ... and another thing they felt was important was they had executive support, and they do have a budget because they're very busy, and having sitting fees.*

Formalisation

Good organisations involve users in multiple activities: identifying the resource boundaries; identifying costs and benefits for using the resource; and then developing, monitoring and enforcing rules for using the resource. An organisation is an action situation that enables users to design principles to achieve desired outcomes from resource governance, by interacting with each other around operational-level issues such as licensing and usage rules, in a nested enterprise. The long-term benefit is the ability of users to be more responsive to the resource, thereby increasing its sustainability.

5.8 Nested enterprises

Steering Committee analysis

Members are concerned that final decisions on water allocation, conflict resolution and governance are made by one person at the collective-choice level. This high-level position vested with discretionary decision-making power is susceptible to influence and error. Members wished to be more involved in the final decisions for modified collective-choice rules, and in operational procedures such as licensing requirements. They recognised the need for enterprises at different levels to monitor each other. The committee identified the need and demonstrated the capacity for an empowered WAC to be one level in a nested enterprise.

> *If that committee is local and representative, there's a good chance they will make good decisions. There's always that tension – if it is stacked with real- estate agents and fruit growers and they make an idiotic decision but it's local, we want to have the power for somebody at a higher level to override it and do the right thing. But then you have the opposite situation, if the local people make the wise choice and the idiotic proponents go to the administrator and they override it for the wrong reason. So which do you pick? All of our constituents have been around long enough and are clever enough to see that it's the same either way. It can be exploited either way. We didn't have a solution to that problem.*

Formalisation

The IAD design principles address this problem by proposing a polycentric system. In that system, the functions of appropriation, provision, monitoring, enforcement, conflict resolution and governance exist at the local level with user control, and the effectiveness of that process is monitored at the collective-choice level. Such a system increases transparency and accountability so that all affected participants are aware of and can participate in an action arena to 'do the right thing'.

Currently, the opposite situation exists. Users have no action arena. Therefore, ad-hoc local groups, with incomplete and imperfect information, monitor governance activities at the collective-choice level. At the same time, these ad-hoc groups have excellent information and skills for governance at the local level, but cannot exercise authority. A polycentric system engages the capacities at all levels.

In the early development of the IAD framework in the 1950s, Vincent Ostrom and colleagues developed the concept of polycentricity in response to the trend toward centralisation of government for presumed efficiency. He argued that differentiated authorities and jurisdictions defined a polycentric order 'as one where many elements are capable of making mutual adjustments for ordering relationships with one another within a general system of rules where each element acts with independence of other elements' (Ostrom 1972, p. 21).

A key attribute of polycentricity is the capability of individuals to 'organize elements in a polycentric order, initiate self-enforcing arrangements and alter basic rules'. Then governance can occur.

> *So long as no single set of decision makers is able to gain dominance over all decision-making structures ... A polycentric political system will be one where each actor participates in a series of simultaneous games and where each act has the potential for being a move in simultaneous games. (Ostrom 1972, p. 21)*

Twenty-four analyses of polycentric governance in local communities and metropolitan areas are collected in McGinnis' three volumes on polycentric governance (McGinnis 2000, 1999a, 1999b). In addition, research continues in many countries on the contribution of polycentricity to IAD analysis, such as to advance the modernisation of China (Wang 2002), and to develop adaptive water management strategies for the European Union (Pahl-Wostl et al. 2005).

Throughout the studies, the emphasis is not on identifying optimal rules but on creating action situations. The diversity of rules is so vast that 'those most directly affected can use trial and error (as well as limited design) to adapt rules over time. Experimentation and feedback regarding performance and voice in making rules is key, rather than relying entirely on analysis and searching for optimality' (Ostrom 2006, p. 28).

6 Complementary analytic methods

As a tool, the IAD framework has helped to explain the diverse patterns of interactions in linked action situations that developed the ASWRS. While it helped to identify the universals in linked action situations and multilayered institutions, the IAD analysis remains complex. A standard technique to clarify this complexity is to animate it through computer modelling. However, this technique requires repeated interactions. Therefore it is not appropriate for this study, because

drafting the ASWRS has been a once-off collective effort. Modelling, thus, may not be suitable for exploring the development of similar collective-choice level institutions. The structural power relations of the participants and decision nodes in collective-level interactions can be explored using network analysis techniques.

Because of the complexity involved, simpler techniques than IAD analysis may be helpful for participants to understand the universals in their action situations. Two simple methods are the SWOT analysis and the 3-Rs mapping.

Developed in the mid-1960s, the SWOT analysis is still a commonly-used tool for analysing both internal and external environments of a business strategy (Turner 2002). In a participatory SWOT analysis, groups of people who desire similar processes and outcomes deliberate on the strengths, weaknesses, opportunities and threats of the strategy in question.

The 3-Rs analysis is another diagnostic tool that provides a broad picture of the match between responsibilities, rights and resources given to a community when developing and implementing a strategy (Stafford Smith 2000; Maru & Woodford 2005).

7 Conclusions and recommendations

7.1 Conclusions

Our key conclusions are developed around our three objectives:

1. Describe the draft ASWRS and its development using the IAD framework, identify proposed institutional changes, and explore their impact on water resource management processes and outcomes.
2. Examine the validity and utility of the IAD framework as a guide for policy analysts and decision makers to describe and evaluate water resource strategies of desert towns.
3. Suggest simple methods for using the IAD framework to adapt and design institutions.

7.1.1 Describing and analysing the ASWRS using the IAD framework

IAD analysis enables identification of the important variables within this complex set of linked action situations: goodwill, uncertainty, trade-offs, nested rules, discretionary and centralised decision making, integration of water allocation and use, and local capacity for polycentric governance.

The goodwill of NRETA staff enabled the Steering Committee to be actively involved in drafting the ASWRS. The strategy suggested institutional statements and proposals for empowered local advisory and implementation structures. Because the town of Alice Springs depends for its existence on non-renewable groundwater, the most important institutions are the rules determining the length of time the resource lasts.

The strategy also suggested ways of addressing: a) uncertain knowledge of the water reserve and its long-term allocation among relevant ‘beneficial uses’; and b) allocation-related trade-offs and social dilemmas. Examples of trade-offs were between allocations for social, economic and ecological benefits; between social and financial objectives of the Power and Water Corporation; and between generations. Social dilemmas included tensions between private and social benefits of water allocation.

In addition, the Steering Committee indicated the need to integrate allocation and use strategies, and supply-demand management, but its terms of reference did not allow it.

The Alice Springs community was involved in several concurrent processes to give its opinion on current and future water uses. These included public consultations, NRETA's Water Use Efficiency Study, and the Arid Lands Environment Centre's DesertSMART Road Map. IAD analysis of these documents, and the public and Steering Committee processes, indicate that Alice Springs has the capacity for local governance of its water resources.

However, the fate of the draft ASWRS is uncertain and approval depends on a decision of the Minister, as provided by the NT Water Act. The opportunity for the Minister to allow genuine community participation in the process, as suggested in our analysis, is available through the NWI.

In this decision-making environment, communities can only suggest unenforceable institutional statements or propose structures for implementing a water strategy. Community involvement can also be constrained by the limited time and other resources that agencies allocate for developing a strategy. As a result, mismatches can easily emerge between the responsibilities, rights and resources available for community participation in water management.

Discretionary decision making also creates uneven opportunities for stakeholders to influence the final strategy. High staff turnover – a major challenge for desert towns – increases transaction costs for decision making. This perversely increases decision making by staff with the longest tenure, and reduces accountability to the community and the resource. High staff turnover also threatens corporate memory, such as detailed resource knowledge.

Our research has found that centralised decision making and inadequate agency accountability to communities can prevent local participation in:

1. decision making
2. managing rewards and sanctions for increasing effective water supply through conservation
3. developing licence requirements for the Power and Water Corporation to implement programs that decrease water consumption and water allocation
4. empowering the WAC as a local rule-making body, and creating a local entity to enforce and monitor rules for water allocation and use.

The IAD framework suggests that local empowerment requires integrated management of water allocation and use. However, in this case allocation and use were separated by NRETA, and the Steering and Water Advisory Committees can only advise on allocation. The Steering Committee was not able to advance its proposal for water use efficiency as a requirement for renewal of all allocation licences.

7.1.2 Validity and utility of the IAD framework

The IAD framework is valid and useful for analysing the development of a water resources strategy for Alice Springs, and is also relevant for other desert towns. Through applying the framework, we were able to identify the universal components in the ASWRS, such as the constitutional- and collective-level rules that created and shaped the action arena, which then shaped the draft strategy. The framework was also useful for identifying the opportu-

nities and threats to the draft strategy, vis-à-vis the institutional design principles. It was also reliable because IAD analysis using different sources – interviews, documents, and observation – resulted in similar findings.

7.1.3 A simple guideline for using the IAD framework

The IAD framework provides a systematic guide for institutional analysis of common-pool resources (CPRs) such as water. However, it is complex and can benefit from simpler and complementary techniques. These include a SWOT analysis of the water resources strategy, and a 3-Rs analysis of the participants and their action situations.

7.2 Recommendations

1. Rules for managing common property water resources can reduce drivers of uncertainty such as opportunistic behaviour, or unequal power and information access among stakeholders. IAD and user analyses suggest that the agencies design rules that require: transparency about water availability, sustainability of usage rates, different criteria for evaluating the price of water, and strict sanctions with a low administrative cost for overuse of allocated water.
2. There is no strong link between water allocation and use, and between supply and demand management. These strategies should be linked to ensure a sufficient long-term supply of water for beneficial uses. This link can be created through:
   - rules that make extraction licences conditional on ethical, efficient and effective usage of the allocated water
   - structures that promote mutual accountability among agencies, licensees and local users.
3. Goodwill by agency staff is important, but is not sufficient to ensure long-term community participation in resource decisions. Community participation requires institutional backing, such as amending the misfit of rules between the NWI and the NT Water Act for community participation. This amendment also needs to allow the creation of a local entity with rights, resources and responsibilities for the governance of local water resources.
4. Key water resource stakeholders in Alice Springs are accountable to different entities, some of whom are not directly affected by the long-term condition of the resource. Rules can make these stakeholders accountable to those who are directly affected by the resource. Components and interactions of the IAD framework can be used to help identify critical areas of accountability that reduce uncertainty and promote effective and efficient management of water:
   - Agencies can increase accountability by disseminating information on water availability, allocation, use and the relevance of rules; different evaluative criteria for policies, such as resource sustainability; and the policy options available for evaluation.
   - Licensees can increase accountability by providing information on the quantity and quality of available water, usage rates, and the relevance of rules; market and non-market costs for allocation and use, and how price is calculated; options for changes such as limits on allocation, changes in pricing, or strategies to reduce usage; and how stakeholders can participate in key operational planning processes, and monitor progress and outcomes.

- A local user entity can improve community participation, accountability to the stakeholder community, and access to decision-making processes about the allocation and use of the water resource.

5. All IAD design principles emerged through the steering committee process, demonstrating that users have the capacity to govern their most critical resource. However, current decision-making processes need to be updated to include Alice Springs as a locally adaptive decision-making entity within the polycentric resource governance system of the Northern Territory government. These processes must also engage the diverse groups of short- and long-term residents who characterise the Alice Springs regional population, to enable their distinctive contributions to institutional design.

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WSAA—see Water Services Association of Australia

DKCRC Partners

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Department of Families, Community Services and Indigenous Affairs

ANU
THE AUSTRALIAN NATIONAL UNIVERSITY

Centre for Remote Health
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CHARLES DARWIN UNIVERSITY

CSIRO

Curtin
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desert peoples centre

Government of South Australia
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