Desert settlement typology: Preliminary literature

Prof. Peter Newman
Assoc. Prof. Dora Marinova
Ms Rachel Armstrong
Ms Margaret Raven
Dr Julia Marley
Ms Natalie McGrath
Mr Frederick Spring

Foreword by Dr Kurt Seemann

Report 35

2008
Desert settlement typology:
Preliminary literature

Professor Peter Newman
Associate Professor Dora Marinova
Ms Rachel Armstrong
Ms Margaret Raven
Dr Julia Marley
Ms Natalie McGrath
Mr Frederick Spring

Foreword by Dr Kurt Seemann

2008
Contributing author information

Institute for Sustainability and Technology Policy (ISTP), Murdoch University
Professor Peter Newman
Associate Professor Dora Marinova
Ms Rachel Armstrong
Ms Margaret Raven
Dr Julia Marley
Ms Natalie McGrath

Remote Area Development Group (RADG), Murdoch University
Mr Frederick Spring (RADG)

Reviewer of the proposed typology
Steve Kinnane, Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS)

DKCRC (Commissioning body)
Dr Kurt Seemann

Desert Knowledge CRC Research Report #35

Information contained in this publication may be copied or reproduced for study, research, information or educational purposes, subject to inclusion of an acknowledgement of the source.

ISBN: 1 74158 044 7 (Web copy)
ISSN: 1832 6684 (Web copy)

Citation

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.

Acknowledgements

The authors of the report wish to acknowledge the external reviewing efforts of Steve Kinnane.

The Desert Knowledge CRC receives funding through the Australian Government Cooperative Research Centres Programme; the views expressed herein do not necessarily represent the views of Desert Knowledge CRC or its Participants.

For additional information please contact

Desert Knowledge CRC
Publications Officer
PO Box 3971
Alice Springs NT 0871
Australia
Telephone +61 8 8959 6000    Fax +61 8 8959 6048
www.desertknowledgecrc.com.au
© Desert Knowledge CRC 2008
The study of human settlements is diverse in the literature. Research often focuses on core issues or aspects of human settlements rather than on advancing a coherent integrated body of knowledge of their general characteristics, patterns of development or types. It has become far more practical to attend to specific concerns that emphasise human social organisation, community dynamics, economic flow and capital value, demographic and cultural characteristics, or physical structures and spatial designs. Few articles have attempted to address coherency of human settlements across space and time, or to examine the degree to which types of settlements may not only be products of their natural advantage shaped by their inhabitants, but also as linked up systems that in their totality provide feedback effects on the ecology, economy and livelihoods of those who access and transform them. Where a deal of research has occurred, much pertains to what we may refer to as large settlements such as urban localities, major towns and cities. Very few articles exist that focus on the forms of settlement that may be described as very small and usually remote. Fewer still address typologies of remote desert settlements globally, let alone specific to Australia’s desert regions.

Sustainable Desert Settlements, Desert Knowledge Cooperative Research Centre (DKCRC) commissioned this report to capture the diversity of literature published in the field and to explore a rational approach to the possibility of a typology of desert settlements. A typology can facilitate the research challenge of representation and yet can also, if not done carefully, funnel thinking towards ideals that have minimal value to policy and inhabitants alike. This report has made an important first step to fill the above voids in the literature.

I have asked the partners of the DKCRC involved to set the scene and explore the case for settlement typology research. The report is extensive and has achieved its terms of reference to produce a preliminary assessment of the literature on settlement typology relevant to desert Australia.

Dr Kurt Seemann

Core Project Leader

Sustainable Desert Settlements

Desert Knowledge Cooperative Research Centre.
Contents

Foreword III

Section A: Approach 1

1. Sustainability of desert settlements 1
2. Preliminary desert settlements typology 1
   a. Settlements with a population over 1000 1
   b. Settlements with a population under 1000 4
3. Strengths and weaknesses of the preliminary typology 6
4. A typology of sustainability in desert settlements 7
5. Typology as a process for sustainability settlements 8
6. Methodology 9
   a. Sets of methods for the Sustainable Desert Settlements project 10
   b. Stages for the Sustainable Desert Settlements project 10
7. Generalisation of research 12

Appendix A: Socio-region and economic region clusters used to determine typology 13

References 14

Literature review 15
   Executive summary 15
   Part 1: Settlements 15
   Part 2: Sustainability 16
   Conclusion 18

Section B: Supporting literature review 19

1. Settlements 19
2. Sustainability and desert settlements 43

Appendix 62

References 63
List of tables

Table 1: Types of settlements with a population of 18,000–47,999 2
Table 2: Types of settlements with a population of 5000–17,999 3
Table 3: Types of settlements with a population of 1000–4999 4
Table 4: Types of settlements with a population under 1000 5
Table 5: Stages and methods for the Sustainable Desert Settlements project 10
Table 6: Ekistic logarithmic scale 22
Table 7: Summary key for Figure 3 25
Table 8: Population categories based on ARIA++ 25
Table 9: Indicators used by Maru et al. for mapping of outback socio-regions 26
Table 10: Summary of Memmot and Moran’s typology of Aboriginal and Torres Strait Islander settlements 30
Table 11: Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander population in remote areas, 2001 32
Table 12: Settlement sizes for discrete Indigenous communities 34
Table 13: Rural, Remote and Metropolitan Areas (RRMA) Classification 37
Table 14: Categories of remoteness by Accessibility/remoteness Index of Australia (ARIA) 37
Table 15: Settlements Types in the Australian Standard Geographical Classification (ASGC) 38
Table 16: Australian Indigenous Geographic Classification of regions 39
Table 17: A summary of Aboriginal and Torres Strait Islander settlement typologies used by Commonwealth, State and Territory Governments 39
Table 18: Desert Disconnections: E-Learning and Remote Indigenous Peoples Project 46

List of figures

Figure 1: Journey to service centres: discrete communities in remote Australia 5
Figure 2: Sustainability criteria spidergram for Indigenous settlements types 7
Figure 3: Sustainable Settlements Typology as a process 9
Figure 4: Extended urban metabolism model 21
Figure 5: Sustainable Livelihoods Framework 23
Figure 6: Maps showing: (A) Commodity; and (B) Amenity-oriented regions 24
Figure 7: Maps showing (A) UCL Hinterlands and (B) Journey to Service Centre data 26
Figure 8: Distribution of discrete Indigenous communities, 2001 35
Figure 9: Representative Locations of Rainfall Records Included in Spatial Averages 57
Figure 10: Australian Climate Variability and Change 58
Section A: Approach

This section sets out our suggested approach to the topic of Desert Settlement Typology. It is based on an extensive literature review presented in Section B.

1. Sustainability of desert settlements

‘Sustainability’ as a word in policy originated out of the Brundtland Commission in 1987. It was used to describe a particular kind of development that meets the needs of the present generation without compromising the needs of future generations. Despite having a multitude of different nuances in different disciplines (Pezzoli 2002, for example, suggests that there are five clusters of meanings), sustainability is essentially about enabling a long-term future. It generally assumes a broad view of the future encompassing economic, social and environmental factors in an integrated way.

In this study, sustainability in desert settlements is taken to mean the set of conditions which will enable a settlement to have a long-term future. This will also entail the development of a series of themes (economic, social and environmental) that can allow a settlement to be understood from this perspective.

The term ‘sustainability’ is used rather than ‘viability’ for a particular purpose. Viability is a term that assumes a primary economic purpose or function for settlements. It depends heavily on the size of a settlement due to the economics of scale. If a settlement is not considered viable, it is generally because it is either seen to be too small or to have lost its economic function in some way. However, in sustainability terms, settlements may have social, cultural or environmental reasons why they need to be given a long-term future. Thus attempts are made to improve their economic viability as well as advancing the other factors which impact on their development, as they are usually highly linked.

The Sustainable Desert Settlements study will be seeking to understand the set of conditions which will enable desert settlements to have a long-term future. To support the framing of this study, we have developed a preliminary typology of desert settlements based on existing literature and data that is, however, limited in its capacity to support a holistic understanding of desert settlement sustainability. We also suggest that the development of a desert settlements typology should be a process that is embedded within the Sustainable Desert Settlements Project, so that desert settlements and their sustainability are defined and classified by the people who live in them.

2. Preliminary desert settlements typology

Two different approaches are used for settlements with a population over 1000 and below 1000. They are explained below.

a. Settlements with a population over 1000

A settlement typology for settlements with populations over 1000 has been developed using the work of Maru et al. (2006) on Mapping Socio-Regions in Outback Australia, combined with Baum’s (2006) Typology of Advantage and Disadvantage in Australia’s Large non-Metropolitan
Desert settlement typology: Preliminary literature

Cities, Towns and Regions. Essentially, it is based on population size and a cluster analysis of sets of indicators at settlement (Baum 2006) and regional (Maru et al. 2006) levels. It reflects the demographic profile of settlements, their economic function and to a certain extent, socioeconomic outcomes. The population categories used are based on the ARIA++ population hierarchy, and are the same as those used by Maru et al. (2006) to determine a hierarchy of settlements based on the principle that larger settlements draw people from a larger catchment due to the services and functions that they provide. More detail about Maru et al.’s (2006) regionalisation are included in Appendix A and can be cross-referenced with settlement types described in the tables below.

The settlement types are developed based on population, economic function and a compilation of social and economic indicators. Much of the data currently available to support analysis of population and standard social and economic indicators are from the 2001 census and are therefore out of date. As the results of the 2006 census become available, there will be an opportunity to update. This is particularly important for settlements that have experienced significant change since the 2001 census.

These types do not reflect diverse cultural values or livelihoods, or support an understanding of these places from a sustainability perspective. We have also had ethical concerns with regards to defining desert settlements as external researchers, and without the input of desert people.

(1) Settlements with a population of 18,000–47,999

There are only five settlements of this size in the arid zone. Each has been classified by Baum (2006) in his typology of socioeconomic outcomes, and can be clearly identified in the socio-regionalisation articulated by Maru et al. (2006). The relative economic diversity for a town of this size, compared with other towns in the arid zone is high (see Table 1) and towns of this size act as a service centre for a wide catchment. A more detailed review of literature on desert settlements of this size is provided in the literature review that accompanies this typology.

Table 1: Types of settlements with a population of 18,000–47,999

<table>
<thead>
<tr>
<th>Place</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alice Springs</td>
<td>1a Tourism/Population Boom Advantaged City (Baum 2006)</td>
</tr>
<tr>
<td></td>
<td>Overall within a region placed better economically than other regions, and that performs better on a standard index of socioeconomic advantage. Compared with other settlements and regions in the desert, there is a lower proportion of Indigenous residents (Maru et al. 2006).*</td>
</tr>
<tr>
<td>Kalgoorlie</td>
<td>1b Income Advantaged Mining City (Baum 2006)</td>
</tr>
<tr>
<td></td>
<td>Overall placed within a region that performs better economically than other regions, and performs better on a standard index of socioeconomic advantage. Compared with other settlements and regions, there is a lower proportion of Indigenous residents (Maru et al. 2006).</td>
</tr>
<tr>
<td>Mount Isa</td>
<td>1c Old Economy/Employment Disadvantaged City (Baum 2006)</td>
</tr>
<tr>
<td></td>
<td>Regionally, there are mixed results in terms of relative socioeconomic advantage, with higher than average unemployment and lower economic resources. Compared with other settlements and regions, there is a lower proportion of Indigenous residents (Maru et al. 2006).</td>
</tr>
<tr>
<td>Whyalla</td>
<td></td>
</tr>
<tr>
<td>Broken Hill</td>
<td></td>
</tr>
</tbody>
</table>

* See Appendix A. Maru et al. (2006) locate Alice Springs, Kalgoorlie and Mount Isa in cluster 4 both for social and economic regionalisation. Whyalla and Broken Hill are located in socio-region cluster 4 and economic region cluster 3.
(2) Settlements with a population of 5000–17,999

There are only three settlements of this size in the arid zone. A typology for these settlements (Table 2) is derived in the same way as for settlements with populations above 18,000. The relative economic diversity for towns of this size, compared with other towns in the arid zone, is high and like towns in the previous population category, they act as service centres for a larger catchment of people.

Table 2: Types of settlements with a population of 5000–17,999

<table>
<thead>
<tr>
<th>Place</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karratha</td>
<td>2a Mining Advantaged Town (Baum 2006)</td>
</tr>
<tr>
<td>Port Hedland</td>
<td>Overall placed in a region that includes high population mobility and education index and a lower proportion of Indigenous people. The economic regionalisation shows lower scores against socioeconomic indicators and higher unemployment rates.*</td>
</tr>
<tr>
<td>Port Augusta</td>
<td>2b Old Economy Disadvantaged Town (Baum 2006)</td>
</tr>
<tr>
<td></td>
<td>Overall placed in regions that include high population mobility and education index, lower industry diversity and a lower proportion of Indigenous people.</td>
</tr>
</tbody>
</table>

* Maru et al. (2006) locate Karratha and Port Hedland in cluster 3 both for social and economic regionalisation, and Port Augusta in socio-region cluster 3 and economic region cluster 4.

(3) Settlements with a population of 1000–4999

Baum’s (2006) typology of relative economic advantage is not available for towns below 10,000 in population. The typology developed for these towns (Table 3) is based on size and location in particular regional clusters as undertaken by Maru et al. (2006). Overall, there is higher diversity across settlements of this size in terms of social and economic indicators, with a sustainability approach requiring a more fine grained understanding than that which can be developed in this preliminary typology.

---

1 NSW is excluded due to time constraints and recognition that it is not in DKCRC.
### Table 3: Types of settlements with a population of 1000–4999

<table>
<thead>
<tr>
<th>Place</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitzroy Crossing</td>
<td>3a Regionally, these towns are based around an industry cluster that includes health and community services; government, education; cultural and recreational services. Economically, there is a relatively low index of diversity but higher level of qualifications. In comparison to other socio-regions, there is a higher than average population, and a lower than average proportion of Indigenous people.*</td>
</tr>
<tr>
<td>Halls Creek</td>
<td></td>
</tr>
<tr>
<td>Tennant Creek</td>
<td></td>
</tr>
<tr>
<td>Hughenden</td>
<td></td>
</tr>
<tr>
<td>Longreach</td>
<td></td>
</tr>
<tr>
<td>Barcaldine</td>
<td></td>
</tr>
<tr>
<td>Exmouth</td>
<td>3b Regionally, these towns are based around an industry cluster that includes retail and wholesale trade; agriculture; construction; manufacturing; accommodation; finance; communication; utilities.**</td>
</tr>
<tr>
<td>Coral Bay</td>
<td></td>
</tr>
<tr>
<td>Denham</td>
<td></td>
</tr>
<tr>
<td>Mitchell</td>
<td></td>
</tr>
<tr>
<td>Cunnamulla</td>
<td></td>
</tr>
<tr>
<td>Blackall</td>
<td></td>
</tr>
<tr>
<td>Winton</td>
<td></td>
</tr>
<tr>
<td>Norseman</td>
<td></td>
</tr>
<tr>
<td>Coober Pedy</td>
<td></td>
</tr>
<tr>
<td>Yulara</td>
<td></td>
</tr>
<tr>
<td>Charleville</td>
<td></td>
</tr>
<tr>
<td>Cloncurry</td>
<td></td>
</tr>
<tr>
<td>Roxby Downs</td>
<td>3c Regionally, these towns are based around an industry cluster of mining and education. The regions that they are located within have a high diversity of industries, low unemployment and a high relative index of socioeconomic advantage. In comparison to other socio-regions, the region for these towns has higher than average population and a lower than average proportion of Indigenous people.</td>
</tr>
<tr>
<td>Leinster</td>
<td></td>
</tr>
<tr>
<td>Leonora</td>
<td></td>
</tr>
<tr>
<td>Kambalda West</td>
<td></td>
</tr>
<tr>
<td>Tom Price</td>
<td></td>
</tr>
<tr>
<td>Newman</td>
<td></td>
</tr>
<tr>
<td>Paraburdoo</td>
<td></td>
</tr>
<tr>
<td>Coolgardie</td>
<td></td>
</tr>
<tr>
<td>Dampier</td>
<td></td>
</tr>
<tr>
<td>Wickham</td>
<td></td>
</tr>
</tbody>
</table>

* Maru et al. (2006) locate these towns in cluster 2 both for social and economic regionalisation, with the exception of Fitzroy Crossing, which is located in economic cluster 1.

** Maru et al. (2006) locate these towns as follows – type 3bi in economic cluster 2 and social cluster 4, type 3bii in economic cluster 4 and social cluster 3, type 3biii in economic cluster 1 or 2, socio-region 2.

### b. Settlements with a population under 1000

Developing a typology for settlements in this population category is challenging. Data is inaccessible for settlements that have a recorded population under 200. With access to the data used by Maru et al. (2006), a similar description of types to that undertaken above for settlements with a population over 1000 would be possible. However, the accuracy and relevance of mainstream social and economic measures for desert settlements, particularly for Indigenous people, are questionable. This is a recurring issue that has been embedded in our thinking about the development of a desert settlement typology. Whilst it is important across all settlements, it is even more important for settlements in this category, which includes all discrete Indigenous settlements in the desert region.

Two population categories have been chosen for settlements with populations under 200 (under 50 and 50–199) to reflect the difference between small family based or pastoral settlements and larger settlements that have less than 200 people. The population categories for settlements under 1000 are more indicative than prescriptive, and population mobility and change as well as errors in counting mean that the numbers may actually be quite relative.

The preliminary typology suggested below (see Table 4) is based on the literature review undertaken for this project. It includes a composite of Memmot and Moran’s (2001) typology of Indigenous settlements, and ABS standard classifications for Urban Centres and Localities under 1000 people, as well as reference to pastoral homesteads as settlements inferred from Measham et al. (2006).

---

2 Taken here to mean all settlements where the population is more than 50% Indigenous, though this definition is fairly arbitrary.
Table 4: Types of settlements with a population under 1000

<table>
<thead>
<tr>
<th>Population</th>
<th>Type</th>
</tr>
</thead>
</table>
| 200–999    | 4a Rural town  
            | 4b Discrete outlying Indigenous settlement, population 200–999 |
|            | Defined in line with Memott and Moran’s (2001) typology of Indigenous settlements, these settlements are mostly on Aboriginal title land and in remote or very remote areas. There are only a few discrete Indigenous settlements of this type in the arid zone, though there are larger settlements. Governance varies and includes cultural governance as well as a range of institutional structures, such as local government or community councils. Many have a history as a government or mission settlement and/or a basis in traditional attachment to country. There is high mobility, including periodic influx of population from related settlements. |
| 50–199     | 4c Small rural town  
            | 4d Discrete town settlement |
|            | These places have a varied history. Formal titles include community title or multiple occupancy tenure or an aggregation of freehold allotments, often with a representative body. There are frequently multiple settlements in one town associated with traditional groupings, and high population mobility, including periodic influx of population from other settlements. |
|            | 4e Discrete outlying Indigenous settlement, population 50–199 |
|            | Similar definition to 4b. Most often discrete Indigenous settlements have a population under 200. |
| Less than 50| 4f Discrete town settlement, population less than 50  
            | 4g Outstation/Homelands Settlement  
            | Established around relationships with/between family and country, frequently on Aboriginal title land. There is high mobility between outstations and other settlements, which may or may not always be occupied (Memmott and Moran 2001). |
|            | 4h Pastoral homestead |
|            | 4i Transient people |

Overall, there are real problems in terms of the data availability and reliability for small settlements. Smaller settlements invariably show high mobility, including to use larger centres to access services. This is clearly shown in Figure 1.

Figure 1: Journey to service centres: discrete communities in remote Australia

Source: Reproduced from Taylor 2002
3. Strengths and weaknesses of the preliminary typology

The Preliminary Typology provides a useful starting point. However, Indigenous considerations such as culture, language, mobility and resource use have not been incorporated, with lack of data and lack of on-the-ground community involvement being core issues. It may be that elements of this preliminary typology are incorporated in the typology that evolves through the life of the Sustainable Desert Settlements Project and with the involvement of desert people.

A number of weaknesses exist in this typology:

- The typology is biased towards characteristics for which the quantitative data sets already exist. We have noted in the literature review that these indicator sets can have limited relevance across culture and that the development of appropriate indicators requires participation. The indicator sets might also be different in different places. The framing of a typology in this way creates an uneven attention on quantifiable characteristics and thus unnecessarily leaves out a number of other important aspects, for instance, relationships to/between country, families, organisations and industries, and the role of governance. The reliance on data sets has problems due to consistency of data and the ability to use data sets which are compatible and can ‘communicate with one another’.

- The typology has been built from an amalgamation of typologies which have not necessarily had sustainability as a core focus. It is biased towards size, location and economics with some of the fundamental aspects of sustainability, such as access to clean drinking water, energy, transport, health services and governance being noticeably absent.

- The typology has a limited ability to accommodate mobility, aside from the inference that smaller settlements are often connected to larger ones in order to access services. The suggestion to use a multi-scale analysis combining settlements with socio-geographic regions (through the use of an amalgamation of cluster analysis, with Geographic Information System (GIS), and Demographic Information System (DIS)) can create a framework through which mobility can be understood in the context of sustainability.

According to an independent review to this typology, additional considerations include:

- There is a need for further research in larger regional towns and centres to reflect Indigenous governance, economic development and populations.

- Indigenous relationships with regional industries (such as mining, tourism, education, service delivery and a host of agricultural, manufacturing and primary industries) are central to their relevance to Indigenous settlement typology, particularly whether these relationships are economically or socially beneficial.

- Comparison of Indigenous governance structures, whether they be service delivery organisations, Prescribed Body Corporates, business developments, joint ventures with mining, partnerships in tourism or Indigenous owned and operated, would be a beneficial strand of classification, including relationships to current policy trends.
4. A typology of sustainability in desert settlements

There are many questions being raised about the preliminary typology that we have suggested. Sustainability requires a broader set of criteria to be considered as necessary conditions for enabling the long-term future of desert settlements. Therefore, as well as, demographic profile and economic function, it is necessary to consider additional criteria such as:

- Language
- Governance
- Cultural value
- Infrastructure
- Housing
- Mobility
- Environment.

A set of criteria like this can be used to develop a typology, portrayed in a more qualitative way such as the one shown in Figure 2 (which can also be used for self-assessment).

A more detailed list could include areas such as:

- hybrid economic activity
- projected youth employment profiles
- aspirations for settlement development
- adequacy of tenure arrangements and development proposals
- adequate infrastructure based on regional networks
- flexibility of education outcomes through partnership with TAFE (Technical and Further Education) systems and other adult education agencies
- alcohol management.

Access to quantitative and qualitative data becomes a major problem when categories are added for consideration in the formation of a typology. In addition, ethical questions are raised regarding the purposes of acquiring data and how this data may be used to assess the sustainability of a settlement. In order to overcome some of the ethical dilemmas associated with the use of this typology for sustainability assessment and the limitations of access to data, the methodology proposed is one based on iterative processes in partnership with settlements.

![Figure 2: Sustainability criteria spidergram for Indigenous settlements types](image-url)
5. Typology as a process for sustainability settlements

The typology being developed through this project will be used to inform site selection for a major Sustainable Desert Settlements project, which will address the following questions:

- What do people in desert settlements consider to be the conditions, decision processes and systems that characterise sustainable settlements and how can these characteristics be expressed in terms of governance and resource flows?
- How do settlement type and population mobility impact either positively or negatively on the sustainability of a settlement?
- What are the likely futures of different types of desert settlements and what are likely to be the main drivers of those futures? (DKCRC 2006).

Although the main focus of the Sustainable Desert Settlements Project is on sustainability, this sustainable settlements typology will play a major role in the way settlements are understood, studied and assessed. Our position is that a sustainable settlement typology should be a flexible tool that meets multiple aims of:

- allowing DKCRC (or any research or governance body for that matter) to select settlements to work with
- allowing key aspects of the sustainability in desert settlements to be identified
- creating spaces for dialogue on sustainability that allow settlements to undertake self-assessments regarding their own sustainability
- supporting livelihoods.

Most importantly, as people gain more understanding and knowledge about the sustainability of the settlements they live in, the typology needs to be able to change and evolve to meet these changing understandings. In line with the visions of DKCRC and the Sustainable Desert Settlements Project, the ultimate goal of a sustainable settlement typology would be to contribute towards creating better livelihoods for people in desert settlements.

In order to overcome some of the weaknesses pointed out in the previous section – lack of data, bias in the typology and ethical dilemmas – and to allow the typology to meet the changing levels of understanding and knowledge, the methodology in Section 6 is suggested.

We perceive the typology that we have derived from literature as preliminary for the following reasons:

- as a research team we relied only on desktop research, namely literature review, without original empirical data collection or analysis
- there was no direct input from the communities for which the typology is being developed
- there should be a process in place which allows for the typology to evolve throughout the life of the project and beyond.

The latter point is of particular importance, and in Section 6 we explore how the Sustainable Desert Settlements Project can allow for this preliminary typology to evolve. The process itself is presented in Figure 3. The flexibility of the typology concept (as presented in Figure 3) should be in its ability to change throughout its development and for this change to be built in as a feedback mechanism to the preliminary typology. The feedback loop can also reflect the iterative process of typology mapping throughout the project itself.
This position is in line with what Heppell and Hill (2005) describe as typologies which act as methodologies and drive further research activities. The Sustainable Desert Settlements typology should be evaluated according to the following:

- the purpose of the research, which flows from its design
- the research methods employed to underpin this research
- their subsequent research findings
- how this acts as a stimulus for further research (Heppell and Hill 2005)
- most importantly, the impact the above have for changes on the ground.

6. Methodology

Typology is intrinsically linked to methodology. The settlement typology suggested through the literature review must be viewed as a preliminary tool for site selection and assessment, and one that will continually evolve. The process suggested in Figure 3 is one that positions the sustainable settlements typology as a preliminary sustainable settlements typology (SST), changing to a sustainable settlements selection (SSS) and then becoming a sustainable settlements self-assessment (SSSA). The processes of the methodology allow the typology to change throughout its development. This change is built in as a feedback mechanism.

![Figure 3: Sustainable Settlements Typology as a process](image)

The Sustainable Desert Settlements Project has similar structures and processes to those used in the Measham et al. (2006) study that applied three sets of methods and a feedback mechanism in five stages. The three sets of methods (I, II and III) and the five stages (1 to 5) are presented in Table 5 and described below.
Table 5: Stages and methods for the Sustainable Desert Settlements project

<table>
<thead>
<tr>
<th>Stage</th>
<th>I Literature review and data analysis</th>
<th>II Participation and self-assessment</th>
<th>III Co-researchers and action research</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Data analysis and qualitative data gathering</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Sustainable settlements typology and working understanding</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3 Relationship building and qualitative data gathering to select case studies</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4 Rapid sustainability appraisal</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5 Livelihood projects (case studies)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

a. Sets of methods for the Sustainable Desert Settlements project

I. Review of literature and quantitative data analysis. This will combine existing data analysis on desert settlements with cluster analysis. To overcome weaknesses in the preliminary typology and gaps in the data, in particular the missing relationships between the themes of sustainability and mobility, a multi-scale analysis may be undertaken to combine a data analysis of settlements and regions. The DIS and GIS can be used in combination with cluster analysis. Qualitative information can be collected through interviews and workshops with leading researchers on outback socioeconomic issues.

II. Participation and self-assessment – this includes facilitation and participatory techniques to engage members of the settlements to articulate their views and issues surrounding settlements’ sustainability.

III. Co-researchers and action research – co-researchers will be employed to undertake workshops for self-assessment, understanding drivers and issues and visioning for the future. Action research through building partnerships will be an essential component of this set of methods. It is essential to find the necessary financial, intellectual, cultural and other resources as well as networks to support the action research. The main emphasis of these methods is that they ensure the development of community-based Indigenous researchers.

b. Stages for the Sustainable Desert Settlements project

Stage 1 Data gathering and analysis: This stage involves the literature review of typologies, analysis of existing research, cluster analysis, DIS/GIS use, and multiple scale analysis. We consider the current project to have contributed to Stage 1 as it provides the literature-based overview of desert settlements and the preliminary typology for Stage 2.

Stage 2 Sustainable settlements typology and working understanding: This stage is concerned with developing a working understanding of the settlements typology with participation from desert settlements, research, government and industry. The DKCRC Core Project 4 (Sustainable desert settlements) workshop on 1–2 August 2006 in Alice Springs can be used as a starting point for discussing the preliminary typology.
An important part of this stage is the original data analysis of the sustainability of desert settlements using cluster analysis and other data analysis tools, such as the spidergram based on sustainability indicators. Taylor et al. (2006) suggest the use of an enhanced demographic information system (DIS) to support the DKCRC research agenda, and emphasise five possible developments of the DIS:

- Geographic extensions
- Increasing data holdings
- Inclusion of socioeconomic indicators
- Enhanced graphics
- Incorporating analytical capabilities (decision support system).

The decision support system (DSS) proposed provides the capacity to incorporate a range of analytical tools (population projection, labour force projection, economic impact forecasting, expert local knowledge, etc). The key to the enhancement of the DIS will be to achieve geographic consistency with output from the 2006 Census when it is available.

It is clear that the typology will examine the relationships between settlements and their supposed functions, using their relative size, location, composition and the absence or presence of basic infrastructure and services as points of comparison between Indigenous and non-Indigenous towns of comparable size. It is also important that the typology can capture the expert views or aspirations of the people living in remote settlements on the conditions, decision processes and systems that influence the sustainability of their settlement.

Therefore themes can be applied to the typology hierarchy and these, as discussed in Section B, could be:

- Knowledge, language and communication (culture, history and tradition)
- Governance (degree of decision making, structure and community participation)
- Economy and livelihoods (opportunity and function)
- Demographics (population)
- Infrastructure, transport and environmental health (advantages and disadvantages)
- Health and education
- Mobility (temporal aspects)
- Natural environment (natural resources).

Further workshops and focus groups will also be required to refine the preliminary typology of desert settlements.

**Stage 3 Relationship building and qualitative data gathering to select case studies:** The main focus of this stage is to refine the sustainable settlements typology through interviews and workshops with people invited from a range of perspectives/regions/settlement types (based on stages 1 and 2). Crucial to this stage is the importance of existing and new relationship networks.

A major outcome of this stage is the selection of field locations and case study projects to be explored in further detail during Stages 4 and 5.
Stage 4 Rapid sustainability appraisal: Measham et al. (2006) used a rapid rural appraisal to determine the focus of their research and this is something that could assist in conducting case study projects on the sustainability of desert settlements. It will allow for the main sustainability issues and drivers in the selected case studies to be identified through participatory techniques and self-assessment. The contribution of co-researchers will be essential.

Stage 5 Livelihoods Projects (case studies): This is the stage where the research project aims at making a difference within the selected settlements and communities by furthering the development of livelihood projects for desert people in activities which require well-developed skills, such as research, industry or government employment.

The understanding of sustainability for the selected desert settlements will be constantly re-evaluated as will the original typology that would have driven the research so far.

It is hoped that at the end of the Sustainable Desert Settlements Project there will be a new typology emerging which will incorporate not just the geo-physical, socioeconomic and demographic characteristics of the desert settlements but also the issues, drivers, hopes and aspirations that the desert communities have.

7. Generalisation of research

The generalisation of research findings can be addressed in two ways:

- firstly, the evolving typology is a generalisation tool, as it will provide clear characteristics that define sustainable desert settlements
- secondly, the case study projects will offer a lot of empirical evidence with potential for theory development as well as practical improvements on the ground.

The second aspect deserves more explanation as there has been general criticism of case studies, including concern over a lack of rigour, preconceived bias and the validity of generalisations (Yin 2003; Flyvbjerg 2004). Case studies are best used to generalise theoretical propositions. This is exactly what the Sustainable Desert Settlements Project will be aiming to achieve. Case studies cannot be expected to provide quantified indicators or statistical frequencies applicable beyond the specific case study area.

The previously generated theory becomes the template for examining the empirical results of a case study. According to Yin (2003), each case study must predict similar results, or, for predictable reasons, predict contrasting results. The analysis of two or more case studies can be used to support the same theory and/or to differentiate between two rival but plausible theories (Yin 2003). This process is iterative. If the analysis does not match the theory, then the proposed theory may need to be changed (Flyvbjerg 2004). Failure to do this could result in the accusation that selective data is being reported to suit preconceived ideas (Yin 2003) and this is something that we have often witnessed in the policy arena.

Apart from the theoretical value of case study research, there is also a very important pragmatic value in generalising case study research, particularly positive examples. They generate confidence that good examples can be followed and build hope for the future.
Appendix A: Socio-region and economic region clusters used to determine typology

<table>
<thead>
<tr>
<th>Region</th>
<th>Definition of regional cluster</th>
</tr>
</thead>
</table>
| Socio region | Cluster 1 has the smallest average total population size (~ 475) with highest Indigenous proportion (88%), and the smallest median age and proportion of non-English background of all the clusters. Consistent with a high proportion of Indigenous residents, the cluster has a significantly higher number of people per dwelling and smaller proportion of people living alone. The measures of social advantage, average values of the index of education and proportion of qualified people are significantly lower. Again, consistent with a high proportion of Indigenous people, the cluster has a low mean value for the change in the number of residents in a year (for the year 2000/01).

Cluster 2 contains urban centres and localities (UCLs) with slightly higher than average population size and median age but significantly smaller Indigenous proportion. The cluster has a significantly higher proportion of people from a non-English speaking background, with higher values for qualifications and the index of education. At three people per house, the cluster has UCLs with significantly less crowded households, a slightly higher number of people living alone and a higher change in the number of residents than the combined average value for all the clusters.

Cluster 3 was distinctly different from the other clusters. It contains UCLs which have a significantly higher than average population size and slightly higher median age but a significantly smaller Indigenous proportion. The cluster has the highest proportion of people with non-English background, qualified people, index of education and change in the number of residents. At three people per dwelling, the cluster has UCLs with significantly less crowded households and a slightly higher number of people living alone than the combined average value for all the clusters.

Cluster 4 contains UCLs with the highest median age, the lowest Indigenous proportion and the smallest number of persons per occupied dwelling. The cluster also has higher proportions of people who are qualified, people living alone and with higher average index of disadvantage, and lower change in the proportion of residents than the combined average. |

| Economic region | Cluster 1 is a group of UCLs with relatively small values for most of the indicators considered for the economic dimension. Comparing its values to those of the other clusters, cluster 1 has the smallest diversity of industries, and the smallest percentage of qualified and potentially productive people. It consists of UCLs that have a higher proportion of households with smaller economic resources and lower rates of dwelling ownership than the average values of these indicators for the other three clusters. Relative to the other clusters, cluster 1 is more poorly placed economically as measured by this set of indicators.

Cluster 2 has the largest number of UCLs (96 or 43% of all UCLs). It has the second smallest values in all indicators except the indices for economic resources and advantage/disadvantage. Two indicators, potentially active ratio and unemployment rate, had no significant contribution to the formation of the cluster. Cluster 2 had a significantly higher percentage of qualified people, economic advantage and resources, but significantly smaller diversity of industries and household weekly income than respective combined averages. This cluster has UCLs with high economic potential.

Cluster 3 is a group of UCLs with low advantage/disadvantage and economic resources as well as the lowest median household weekly income. This may be attributable to a high unemployment rate despite a significantly large percentage of potentially productive and qualified people.

Cluster 4 has the smallest number of UCLs (30 – 14% of all the UCLs). Economically, this cluster is better placed than the other three clusters due to significantly higher values for advantage/disadvantage and economic resources and the percentage of qualified and potentially active people. The cluster has also the highest diversity of functioning industries and the lowest unemployment rate as well as the highest median household weekly income. |

Source: Reproduced from Maru et al. 2006
References

Large Non Metropolitan Cities, Towns and Regions’, Australian Geographer, 37(2): 233-258

Desert Knowledge Cooperative Research Centre (DKCRC) (2006) Desert Settlement Typology Research: A Literature Review and Summary, Invitation to Tender, Desert Knowledge CRC


Literature review

Executive summary

In July 2006 the Institute for Sustainability and Technology Policy (ISTP) accepted a tender from the Desert Knowledge Cooperative Research Centre (DKCRC) Core Project 4: Sustainable Settlements Project to review the literature on human settlements in the arid zone of Australia, and to develop a typology of desert settlements to support the identification of settlements.

The literature review comprises two parts. Part 1 provides a review of literature on human settlements in Australia, models to understand sustainability in human settlements, and arid zone settlements. This review includes existing settlement and regional typologies relevant to the study of arid zone settlements. Part 2 includes a brief review of literature relevant to understanding sustainability in desert Australia settlements.

It is our view that we can only do preliminary work for typology development; local and participatory involvement should begin the iterative process towards a typology of sustainability in desert settlements.

Part 1: Settlements

Arid zone settlements are affected by the broad trends and drivers that affect all Australian settlements, such as increasing population flows toward capital cities, and growth in the resources sector and tourism. However, many features of outback Australia, such as low population density, high Aboriginal population, remoteness from markets and high environmental variability, are not shared by the rest of Australia.

Previous approaches to settlement typology have been based on geographic, social and economic, or ecological and industry categories. Given the high regional mobility – particularly for Aboriginal people – in the arid zone, the interrelationship between settlements, and data limitations for small settlements, a regional approach to understanding desert settlements is required for the development of an arid zone settlement typology.

The dispersed Aboriginal settlement patterns in the arid zone differ significantly from non-Aboriginal settlements, which are focused in regional centres. The distinct features of Aboriginal settlements require further consideration: governance, household size and structure, mobility, the significance of discrete Aboriginal settlement, and settlement based on attachments to country. Demographic factors – such as population size, growth rate (or rate of change), permanence (or mobility), the proportion of settlement population that identifies as Indigenous, and population projections – are also important considerations.

Research in South Africa illustrates that whilst typology can be used as tool for systematic, representative analysis of settlements and their sustainability, it cannot reflect the complexity or diversity of interactions occurring within settlements. From a sustainability perspective, the
reviewed literature is inadequate for understanding settlements. We have therefore provided a brief review in areas that are important to desert sustainability and sought to draw them into our understanding of typology.

Part 2: Sustainability

Most of the work on typology of settlements is about ‘viability’ in an economic sense, and has not picked up the diverse nature of sustainability across culture and place. Almost all the work assumes that the critical variable is the size of a settlement and that various other factors, frequently economic, can be layered around that. Sustainability attempts to help us define what the ‘other’ elements are and how they are linked closely to viability. To this end, we have reviewed literature in the areas of:

Economics and livelihoods
A significant economic challenge for remote settlements in Australia is the uneven distribution of economic opportunity across space. A sustainability approach may be able to address this by integrating social, cultural and ecological concerns alongside economic ones at local and regional scales using a participatory approach. A range of emerging opportunities for economic development with varying degrees of market integration are being explored in remote areas, such as art, tourism, bushfoods and conservation economies, and customary economies continue to exist. However, these are rarely considered in economic accounting. The hybrid economic framework, developed by Jon Altman merges state, market and customary sectors, and has been suggested as one way to understand economies on remote Aboriginal lands. It recognises the value of Aboriginal people remaining on their country, where that is the preferred choice. Understanding sustainable economies that work for Aboriginal people is central to the sustainability of desert settlements and requires a local, contextual and participatory approach.

Knowledge, language and communication
Aboriginal, local and scientific knowledge are key components in defining and understanding sustainability and sustainable settlements. Knowledge is stored and communicated through language, and there is a diversity of language in desert regions. Building partnerships based on good communication will be crucial for understanding sustainable settlements. Basic communications access is taken for granted by coastal regions and is only just becoming available to many Aboriginal peoples across desert Australia. Overcoming a digital divide related to ICT infrastructure, and using the internet to overcome the ‘tyranny of distance’ in communication will be important to sustainability in the desert.

Governance
Governance is culturally contextual, and tension exists between western and Aboriginal systems. In DKCRC projects, consideration must be given to Community Councils, regional governing structures, and to the resource agencies that provide managerial and administrative support to Aboriginal communities. The projects must also recognise the many different forms of traditional governance that remain healthy and the hybrids that exist between western and traditional systems of governance.
Health and education
All settlements need basic health care, which is central to enable a sustainable future. In remote areas, access to health services requires longer travelling distances and increased waiting times, which can reduce early diagnosis and treatment. Health is also very closely associated with other key elements of social infrastructure, such as housing, education and employment.

Access to education services (primary, secondary and tertiary) in desert settlements is severely constrained, with the smallest settlements least likely to have access to a range of educational facilities. There is also need for education and training that connect to the livelihoods of Aboriginal people living in remote areas, which includes recognition of local people, local issues and local opportunities.

Infrastructure and environmental health
Many rural and remote communities have limited access to services such as environmental health (water, power and sanitation), health, education, transport, police, welfare, banking and shopping. The rationalisation of these services has a disproportionately negative impact on desert communities. The provision of basic services to Aboriginal communities has long been a contested issue with local councils frequently not providing environmental services to discrete Aboriginal settlements. Nearly 30% of Aboriginal people in remote desert Australia report difficulty in accessing transport to the places needed. Transport is the necessary link back to many important services that are not provided locally. Increasing local services would reduce the need for transport.

Natural environment
Deserts have key characteristics, including remote and sparsely dispersed population, low rainfall, desert vegetation and landforms. Government jurisdiction impacts on the way environmental information is packaged, understood and the kind of policies that are then established. There are significant differences in understandings of the environment, including the seasons, and ways of classifying and managing country. Climate change is also a crucial factor to consider, particularly in scenario planning. As rainfall is likely to increase in the arid zone over the next 100 years, there will be changes in the biota and thus on desert settlement livelihoods. Further work as a result of this project might investigate ways that individuals, families and organisations monitor rainfall.

Data and sustainability in desert settlements
Data is important to understanding the context for sustainability and as a baseline from which to monitor change. Yet issues remain with regards to the accuracy, cultural relevance, access and ownership of data as well as ethics and research protocols. Current social indicators do not necessarily represent the social and economic wellbeing of Aboriginal people meaningfully. Aboriginal peoples are diverse across Australia, therefore it is likely that no single set of particular indicators can be defined. Rather, a negotiated process towards the development of appropriate indicators is required.
Conclusion

Overall, the task of suggesting a typology for site selection for the Desert Knowledge Cooperative Research Centre Sustainable Settlements Project has been a complex one. There is not enough data available to suggest a typology that can support an understanding of sustainability, and we are strongly of the view that to do this requires participation and negotiation with desert people. Our methodology for developing the preliminary typology sets out a process for doing this. We have also identified additional themes, including knowledge, language and communication. While a review of literature provides more detail around these themes, data availability complicated their application in our preliminary typology for site selection. Further quantitative and qualitative data sourcing and analysis either prior to or following site selection could help to rectify this.

In conclusion, it is imperative to highlight the importance of Aboriginal, local and scientific knowledge as key components in defining and understanding sustainability and sustainable settlements, and communication and dialogue are required across these knowledges. Aboriginal co-researchers are central to this process of communication.
Section B: Supporting literature review

In July 2006, the Institute for Sustainability and Technology Policy (ISTP) at Murdoch University accepted a tender to review the literature on human settlements in the arid zone of Australia, and to develop a typology of desert settlements to support the identification of settlements to partner with for the Desert Knowledge Cooperative Research Centre (DKCRC) Sustainable Desert Settlements Project. According to the Invitation for Tender document:

*A typology of desert settlements for the purpose of understanding the drivers of sustainability will assist the rigour of this project, and potentially future research, because it will provide some basis for generalisation across a limited number of case studies.*

(DKCRC 2006)

The literature review has been undertaken in two parts. Part 1 provides a review of literature on:

- Human settlements in Australia
- Models to understand sustainability in human settlements
- Desert settlements.

This part includes a review of existing settlement and regional typologies relevant to the study of desert settlements. It also examines a South African typology found to be relevant to this study and outlines some considerations about typology.

Part 2 includes a brief review of literature relevant to understanding sustainability in desert Australia. It covers issues related to:

- Knowledge, Language and Communication
- Economics and Livelihoods
- Governance
- Health and Education
- Infrastructure, Transport and Environmental Health
- Natural Environment
- Data and the Sustainability of Desert Settlements.

The literature review concludes with a discussion of the relevant insights towards the development of a preliminary desert settlements typology (or typology of viability in desert settlements) to support site selection for the DKCRC Sustainable Desert Settlements Project.

1. Settlements

After briefly examining the main drivers and shapers of Australian settlements and models helping to understand their sustainability, this section focuses specifically on the literature on desert settlements which is reviewed from the point of view of:

- regional approaches to understanding the arid zone
- Aboriginal settlements
- arid zone demography
- Australian standard classification frameworks
- other Aboriginal settlement typologies
- relevant international typology.
1.1 Human settlement in Australia

Core trends in human settlement in Australia, identified in the 1996 and 2001 State of the Environment reports (Newman et al. 1996; Newton et al. 2001) include:

- Australia is highly urbanised, with over 60% of people living in mega cities of over 1,000,000 people
- Most settlement (83%) occurs along the coastline
- Migration flows show a general trend towards growth of capital cities and regional centres alongside decline of small towns
- Increasing socioeconomic disparity is also observed to have spatial dimensions within settlements and across settlement of different types, associated with economic transition from an industrial to a post-industrial economy.

Drivers influencing the sustainability of human settlements in Australia into the future include:

- population aging
- issues relating to land degradation, fresh water and waste
- sustainable energy and climate change
- ongoing development in the resources industry
- increasing tourism
- increasing importance of information and communication technologies
- globalisation and the attendant global flows of people, capital, goods and information
- deregulation and the removal of barriers to trade
- global diffusion of ideas such as sustainability (Newman et al. 1996, 3.6).

Desert settlements exist within the context of Australia’s settlement system. These trends and drivers provide the general framework for their future development, however, arid settlements also experience other influences which shape their long-term perspectives in terms that are distinctively different from the rest of Australia. They are discussed in the later sections of this report after examining the general models of human settlements from a sustainability perspective.

1.2 Models of human settlements

In order to understand sustainability, settlements have often been viewed as systems which allow synergies between different elements, interactions and functions. Two models that explain settlements from a systems approach are reviewed below.

1.2.1 The extended urban metabolism model

The model used through the State of the Environment reporting system for understanding settlement sustainability from a systems approach is the extended urban metabolism model (see Figure 1), which assesses liveability (social amenity, health and wellbeing) as well as resource inputs and waste outputs. In this model, lower resource inputs and waste outputs, as well as increased liveability, make settlements more sustainable.
Seemann (1998), Walker (1973), and Doxiadis (1968) highlight the value of ekistics theory for understanding settlements. Ekistic theory is built around a concept of change, suggesting that all settlements move towards death or transformation. This depends on the internal processes of the settlement, its relationship to the natural environment and the organisational structures through which it negotiates its own existence, including in response to external factors. While the lifespan of a settlement may be indeterminate, the things that make up a settlement have finite lifespans: houses fall down, people come and go. There are essentially three different elements to ekistic theory:

(1) Developmental criteria – people in the settlement operate to:
   1. maximise potential contacts
   2. minimise effort
   3. optimise protective space
   4. optimise the quality of the environment
   5. achieve an optimum synthesis of needs – optimising the overall quality of life’ (Seemann 1998, p. 35).

However, these developmental criteria are relative rather than easily definable.

(2) Integrating elements – settlements are built of the following integrating elements:

   1. Nature – both in terms of being located in nature, and also using natural resources
   2. Anthropos – people and individuals, their behaviour, income generation, physical and social needs
3. Society – ‘socio-cultural, organisational and socioeconomic characteristics’ (Seemann 1998, p.35), e.g. demography, beliefs, laws
4. Shells – physical structures as well as ‘spaces with conceptual boundaries’ (Seemann 1998, p.35), e.g. hunting areas
5. Networks – transport and communication systems.

(3) Ekistic logarithmic scale – the third element of the ekistic theory is the ekistic logarithmic scale that seeks to understand likely settlement functions in relation to the size of that settlement (see Table 1).

<table>
<thead>
<tr>
<th>Ekistic units</th>
<th>Ekistic population scale</th>
<th>Unit</th>
<th>Community scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthropos</td>
<td>1</td>
<td>1</td>
<td>i</td>
</tr>
<tr>
<td>Room</td>
<td>2</td>
<td>2</td>
<td>ii</td>
</tr>
<tr>
<td>House</td>
<td>5</td>
<td>5</td>
<td>iii</td>
</tr>
<tr>
<td>House group</td>
<td>40</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>Small neighbourhood</td>
<td>250</td>
<td>5</td>
<td>II</td>
</tr>
<tr>
<td>Neighbourhood</td>
<td>1,500</td>
<td>6</td>
<td>III</td>
</tr>
<tr>
<td>Small polis</td>
<td>10,000</td>
<td>7</td>
<td>IV</td>
</tr>
<tr>
<td>Polis</td>
<td>75,000</td>
<td>8</td>
<td>V</td>
</tr>
<tr>
<td>Small Metropolis</td>
<td>500,000</td>
<td>9</td>
<td>VI</td>
</tr>
<tr>
<td>Metropolis</td>
<td>4 million</td>
<td>10</td>
<td>VII</td>
</tr>
<tr>
<td>Small megalopolis</td>
<td>25 million</td>
<td>11</td>
<td>VIII</td>
</tr>
<tr>
<td>Megalopolis</td>
<td>150 million</td>
<td>12</td>
<td>IX</td>
</tr>
<tr>
<td>Small eperopolis</td>
<td>1,000 million</td>
<td>13</td>
<td>X</td>
</tr>
<tr>
<td>Eperopolis</td>
<td>7,500 million</td>
<td>14</td>
<td>XI</td>
</tr>
<tr>
<td>Ecumenopolis</td>
<td>50,000 million</td>
<td>15</td>
<td>XII</td>
</tr>
</tbody>
</table>

Source: Seemann (1998 p. 38)

Seemann (1998) combined systems theory with ekistics to understand settlements as nested systems and their inputs, outputs and internal metabolism. He argues that this forms a good classification of settlements, but is limited in its capacity to support a systems understanding of them.

1.2.2 The sustainable livelihoods framework

Work on the sustainable livelihoods framework dates back to the 1980s and 1990s with the original contributions by Chambers and Conway (1992). The Framework has been further developed recently by Fisher for the Australian Aboriginal context (e.g. Fisher 2001) as part of the Livelihood Opportunity Project of the Centre for Appropriate Technology (CAT). This model is also used by the DKCRC. It is a resource flows framework that focuses on assets/strengths to capture settlement dynamics and which fits with the overall aim of DKCRC Core Project 4 of supporting settlement sustainability.

Within the Sustainable Livelihoods Framework (see Figure 2), capital assets are broken down into the five capitals of human, natural, financial, social and physical. Human capital is the quality, capacity, education and health of the people who live in the settlement, as well as the amount of labour available. Natural capital sees the relationship of Aboriginal people to country as a fundamental characteristic of their way of life. Financial capital sees remote settlements’ financial resources as being limited and constrained by lack of opportunities to access financial services or generate income streams. Physical capital sees access to basic services and infrastructure – which are variable in quality and reliability – as key considerations in arid Australia. Social capital sees remote settlements as characterised by informal networks and social obligation.
A key principle of the sustainable livelihoods approach is that outside interventions will only be effective if they are consistent with the existing livelihood strategies, assets and ability of the settlement to respond to change. Therefore, a thorough understanding of these aspects is a prerequisite to planning any kind of external support to the settlement.

The sustainable livelihood framework is a useful tool to understand the complexities of settlements rather than as a solution for the difficulties of planning. It is particularly valuable because it promotes linkage between micro- and macro-level analysis. This allows a participatory process where people can express their aspirations and gauge for themselves the impact of external interventions. The disadvantages are cost (time and money), and that its application may need to be limited to a selected number of settlements. Furthermore, it is potentially counterproductive in the sense that it can be seen as applying simple analytical frameworks to complex issues. Therefore, the livelihoods framework needs to be combined with a number of other analytical tools.

1.3 Arid settlements overview

The arid zone of Australia covers around two-thirds of Australia’s land and is all classified as remote, or very remote through the ARIA (Accessibility/Remoteness Index of Australia) remoteness index (Guenther et al. 2005). Most remote settlements have a historical basis around tourism, mining, pastoral industries or Aboriginal settlement, with regional centres having high functional diversity as service centres as well as forming a connection with the rest of Australia and the world (Newman et al. 1996; Newton et al. 2001). Baum (2006) highlights the context of economic adjustment due to changes in global and national level trade relations which has created ‘winners’ and ‘losers’. Economic prosperity and viability are frequently associated with connection to industry. Industry trends impacting on remote settlements include:

- Rationalisation in the pastoral industry, leading to larger properties, as well as some movement towards post-productionist landscapes including increased landcare
- Tourism growth and an increased need for tourism management
Many features of outback Australia, such as low population density, high Aboriginal population, remoteness from markets and high environmental variability, are not shared by the rest of Australia. The social area of sustainability is least understood, compared with the economic and ecological areas, and requires a dynamic, systems type understanding. Outback areas are under-represented nationally, and include diverse perspectives, meaning that sustainability has multiple understandings building on different knowledges. Processes are therefore required to facilitate understanding across knowledges, and partnership and social capital are crucial (Measham et al. 2006).

1.3.1 Regional approaches to understanding the arid zone

Two different approaches to defining regions relevant to the arid zone of Australia are reviewed. They support a more fine-grained interpretation of the vast area that is arid Australia. The first approach, Holmes’ regionalisation, has an economic focus, in particular in highlighting transitions from a productionist to a post-productionist economy. The role of Aboriginal land ownership and self-determination are highlighted in Holmes’ regionalisation (Holmes 1997). The second approach by Maru et al. (2006) maps regions according to social, economic and environmental dimensions, industry clusters and urban hinterlands for settlements of different sizes. Given the high regional mobility, particularly for Aboriginal people in the arid zone, the interrelationship between settlements and the data limitations, particularly for smaller desert settlements (as discussed further on), a regional approach to understanding desert settlements is important to the development of an desert settlement typology.

Holmes’ outback regions

Holmes’ regionalisation is based on a geographic typology of resource use/livelihoods. Regions are mapped according to their potential for tourism, pastoralism, mining and Aboriginal self-determination. They are mapped according to an index based both on data analysis and inference that identifies commodity or amenity orientation. Holmes’ regions are reproduced on Figure 3 with Table 2 providing the reference key to the maps in Figure 3.

Figure 6: Maps showing: (A) Commodity; and (B) Amenity-oriented regions

Source: Holmes 1997
Table 7: Summary key for Figure 3

<table>
<thead>
<tr>
<th>Pastoral region</th>
<th>Family-based owner operated pastoral enterprise dominates land use. Changes in the structure of the pastoral industry leads to the seeking of alternative economic opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote pastoral regions</td>
<td>Absentee owned, very large pastoral properties dominate. The pastoral homestead complex is the basic settlement type</td>
</tr>
<tr>
<td>Stressed pastoral regions</td>
<td>Endemic economic and environmental problems, leading to questionable sustainability of pastoral enterprise</td>
</tr>
<tr>
<td>Urban dominated amenity regions</td>
<td>Tourism, recreation, urban infrastructure orientation, with a need to understand and guide rapid growth</td>
</tr>
<tr>
<td>Mining regions</td>
<td>Mining orientation with a need to understand and guide rapid growth</td>
</tr>
<tr>
<td>Aboriginal homelands</td>
<td>Characterised by Aboriginal land ownership – this area has likely grown since Holmes’ regionalisation</td>
</tr>
<tr>
<td>Frontier regions in flux</td>
<td>The viability of pastoral industry has always been in flux, including changes towards Aboriginal land or national park. There is space for negotiation over land use, and probably has been since these maps were made.</td>
</tr>
</tbody>
</table>

Source: Holmes 1997

Mapping Socioregions in Outback Australia

According to Maru et al. (2006, p. 7):

*Outback settlements are markedly different from their coastal counterparts, in terms of their socio-cultural, economic, demographic and environmental characteristics. Differences are also strong between outback settlements, although they share some basic characteristics. The population size distribution of outback settlements is markedly clumped. There are a small number of major service centres (population 20,000–30,000) as well as a much larger number of settlements that are two orders of magnitude smaller (i.e. population <200–500) and which have very different socioeconomic characteristics. Standard regionalisation procedures mask this pattern and its significance for analysis. Standard procedures also take state/territory borders and hard boundaries, disguising the significance of cross-border similarities and relationships. These differences have been a major challenge to regional policy making, research and investment decisions.*

There are two aspects of this work that are useful to understanding desert settlements. The first is the settlements themselves; the second is the regions that are mapped across the arid zone.

Building at least partly on the methodological approach developed by Hugo et al. (2001), the study by Maru et al. (2006) maps hinterlands around outback settlements. Data availability limits this study to settlements with a population over 200 people; as data for settlements below 200 in population are not available these are incorporated in the ‘rural balance’. Settlements are classified according to population size (see Table 3).

Table 8: Population categories based on ARIA++

<table>
<thead>
<tr>
<th>Population category</th>
<th>Number of settlements</th>
</tr>
</thead>
<tbody>
<tr>
<td>200–999</td>
<td>145 settlements</td>
</tr>
<tr>
<td>1000–4999</td>
<td>60 settlements</td>
</tr>
<tr>
<td>5000–17,999</td>
<td>12 settlements</td>
</tr>
<tr>
<td>18,000–47,999</td>
<td>5 settlements</td>
</tr>
<tr>
<td>48,000–249,000</td>
<td>1 settlement*</td>
</tr>
</tbody>
</table>

* Darwin was excluded from this study.

Source: Maru et al. (2006)

1 The rural balance is a category that includes Australian Bureau of Statistics (ABS) data from all settlements with a population below 200 at the state level.
Population-based hinterlands for settlements in each size category are mapped using population-weighted gravity modelling and an industry diversity (livelihood activity) index. Based on the principle that larger settlements draw people from a wider catchment as they offer more services, the outcome is that smaller settlements and their hinterlands fall within the hinterlands of larger settlements in a nested way.

Figure 4 compares two maps. Map A shows the hinterlands (urban centres and localities – UCLs or centroids) around settlements based on population-weighted gravity modelling and an industry diversity index (Maru et al. 2006). Map B shows journey to service centre data (based on the 1999 Community Health and Infrastructure Survey from discrete Indigenous communities) as mapped by Taylor (2002, p. 10). Reviewing these maps alongside each other demonstrates that the different research methodologies generate different outcomes in terms of understanding the catchments’ service centres. This type of comparison is also instructive for building awareness of the imperfect reflection that different methods of data gathering and analysis can generate.

Socio-regions mapped by Maru et al. (2006, p. 7) are based on a cluster analysis of data in economic, environmental and social dimensions and dominant industry. The result is a series of maps showing how clusters of results in these areas are distributed across space. Table 4 lists the indicators used for mapping the socioeconomic regions in Outback Australia.

Table 9: Indicators used by Maru et al. for mapping of outback socio-regions

<table>
<thead>
<tr>
<th>Social indicators</th>
<th>Economic indicators</th>
<th>Environmental indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total persons</td>
<td>Median household income</td>
<td>Total impact aggregate rank</td>
</tr>
<tr>
<td>Median age</td>
<td>Dependency or potentially active ratio</td>
<td>Environmental sensitivity aggregate rank</td>
</tr>
<tr>
<td>% Indigenous people</td>
<td>% persons qualified</td>
<td>Threatened species aggregate rank</td>
</tr>
<tr>
<td>% Non-English speaking background</td>
<td>Index of business diversity</td>
<td>Normalised Difference Vegetation Index</td>
</tr>
<tr>
<td>% Persons living alone</td>
<td>% unemployment rate</td>
<td>(NDVI)</td>
</tr>
<tr>
<td>% change in number of residents</td>
<td>SEIFA – Index of relative socioeconomic</td>
<td>Rainfall variability</td>
</tr>
<tr>
<td>% persons with no schooling</td>
<td>advantage/disadvantage</td>
<td></td>
</tr>
<tr>
<td>Number of persons per occupied dwelling</td>
<td>Index of economic resources</td>
<td></td>
</tr>
<tr>
<td>SEIFA2 – Index of relative socioeconomic disadvantage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Maru et al. (2006)
There is a lack of correspondence between standard spatial classification methods (ARIA, state boundaries, etc) and the socio-regions developed. Additionally, non-contiguous socio-regions emerge around similarity in regional typologies as opposed to geographic proximity:

The outcome is a very different geography of desert Australia than is represented through standard regionalisation, but one that better represents its characteristics. A geography based on these characteristics is likely to be invaluable when selecting case study areas for research projects, and, in the long term, other investment initiatives (Maru et al. 2006, p.7).

This study provides a mechanism to classify desert settlements according to similarities in clusters of social, economic or ecological indicators, and the dominant industry present, and within a hierarchy based on settlement hinterlands. It includes the most detailed current work on desert settlements and regions and has been instrumental in informing the preliminary typology developed through this project. In fact, this suggested preliminary typology includes the types from Maru et al. for settlements above 1000 people.

However, there are a number of reasons to be cautious with the application of this work to a settlement selection typology. Firstly, the indicators chosen have limited capacity to be culturally relevant to Aboriginal people as they are based on mainstream data sets. Data for settlements with populations below 200 people could not be included, and many Aboriginal people in the desert live in settlements with populations less than this. Secondly, the research is based on data modelling and is an imperfect reflection of reality – that said, this is likely to be the result of any typology. Lastly, data provides less insight into the dynamics of settlements with a population under 5000 than it does for settlements over this size, and there is a gap in research and understanding for smaller settlements.

1.3.2 Typology of socioeconomic outcomes

Baum (2006) has developed a typology of non-metropolitan socioeconomic outcomes based on a cluster analysis of selected indicators for statistical local areas (SLA) outside metropolitan areas. All regions chosen have a population greater than 10,000, which is more than 50% urbanised. There are 6 types of cities and regions identified:

1. Income advantaged mining cities, towns and regions
2. Tourism and population boom advantaged cities, towns and regions
3. Service-based advantaged cities, towns and regions, with diverse socioeconomic characteristics servicing a larger population and hinterland
4. Agricultural based disadvantaged cities, towns and regions
5. Old economy employment disadvantaged cities, towns and regions, i.e. suffering from demise of manufacturing industry
6. Welfare/retirement migration disadvantaged cities, towns and regions, i.e. sea change migration seeking amenity with affordability.

The study by Baum (2006) provides clear connection between the industry base of a town and various indicators of advantage/disadvantage. As such, it adds some analysis to discussions on changing regional population and economic prosperity. The scale at which the study was undertaken precludes most desert settlements, as only settlements above 10,000 in size are included
The dispersed Aboriginal settlement patterns in the arid zone differ significantly from non-Aboriginal settlement, which is focused in centres such as Halls Creek or Alice Springs (Maru et al. 2006). There are an estimated 457 discrete Indigenous communities in the arid zone with a combined population of 28,053 people. Of these, 72% (or 329) have a population of less than 50.

4 A discrete Indigenous community is defined in CHINS (Indigenous Community Housing and Infrastructure Needs Survey) as: ‘A geographic location, bounded by physical or cadastral (legal) boundaries, and inhabited or intended to be inhabited predominantly (i.e. greater than 50% of usual residents) by Aboriginal or Torres Strait Islander peoples, with housing or infrastructure that is managed on a community basis. In some cases there was a degree of subjectivity in deciding whether a location met the definition of a discrete Indigenous community. In cases of doubt, locations were included as discrete communities. Locations which had no usual population at the time of the survey, and were not expected to be reoccupied within the 12 months following enumeration, were not included’ (Trewin 2001, p. 87).
and none has a population over 1000. Compared with remote Aboriginal and Torres Strait Islander settlements outside the desert, desert settlements are more disadvantaged in terms of education and employment opportunities; this is particularly the case for the Northern Territory (Guenther et al. 2005).

Guenther et al. (2005) highlight the connection between the history of Aboriginal dispossession and resettlement, government policy (protection, assimilation, welfare) and the location of many discrete Aboriginal settlements, which contrast to the association with market forces – resource development, employment or other market opportunity – for most other desert settlements. The outstations movement, facilitated by change in government policy as well as by increased recognition of Aboriginal title, has led to the (re)establishment of settlements reflecting traditional ties to land. This has been associated with difficulties and gaps in service delivery (e.g. education and health), but has also facilitated development of the customary economic sector and the maintenance of traditional connections to country. Altman (2006) connects the homelands movement with rejection of the assimilation era and its attendant modernist development paradigm.

Memmot and Moran (2001) highlight some of the distinct features of Aboriginal and Torres Strait Islander settlement as follows:

- Aboriginal and Torres Strait Islander governance structures underlying imposed western structures
- Differences in household size and structure, including location of households, use of space, etc
- Mobility and migration according to a range of factors (including across social networks, connection to country, use of land resources, education and health, employment/income, shopping)
- A preference to live in rural or remote areas
- Discrete settlement in urban settings
- Attachment to place built on descent.

Moran (2006) provides a comprehensive review of research on Aboriginal and Torres Strait Islander settlements, which highlights that they have frequently been the setting for research, rather than the topic of research in terms of systems, functions or types. The study also developed a typology of Aboriginal and Torres Strait Islander settlement in Australia. It is based on the size of settlements (dimensional criteria), the percentage of Aboriginal and Torres Strait Islander residents, and whether or not the settlement is a discrete Aboriginal and Torres Strait Islander settlement or a settlement that includes dispersed Aboriginal and Torres Strait Islander settlement within it, and remoteness. A range of factors – typical of each type of settlement, though to some degree context dependent – are suggested.

Additionally, the implications of mobility across settlements provides contexts for the interpretation of the typology. Mobility regions connect kin across different settlements, with kinship links providing continuity across towns within a region. While context dependent, some of the identified mobility dynamics include:

- Connections between outstations and larger discrete Aboriginal and Torres Strait Islander settlements
- Connections between discrete Aboriginal and Torres Strait Islander settlements outside regional centres and the discrete Aboriginal and Torres Strait Islander settlement (town camps) that are located within them.
Mobility means that arid settlements need to be understood in relationship with the other settlements to which they are connected (Memmott and Moran 2001; Moran 2006). A summary of Memmott and Moran’s typology is shown in Table 5.

Table 10: Summary of Memmott and Moran’s typology of Aboriginal and Torres Strait Islander settlements

<table>
<thead>
<tr>
<th>Type</th>
<th>Common factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a Discrete bounded settlement separate from other settlement</td>
<td>These settlements are mostly on Aboriginal and Torres Strait Islander title land in very remote (67%) or remote areas. Most have a small population (most under 200, many under 50). Formal governance status of settlements of this type varies. Some settlements have local government status, others community councils. Cultural governance structures are also present. Often, there is high population mobility, including a periodic influx of population from related settlements. These settlements are frequently based on traditional attachment to country, as well as a history connected to government or mission settlement.</td>
</tr>
<tr>
<td>1b Discrete town settlement – type defined by boundedness as an Aboriginal and Torres Strait Islander settlement, and geographic location relative to other settlements</td>
<td>These are discrete Aboriginal and Torres Strait Islander settlements within or alongside a larger town. Often there is formal land title, such as community title or multiple occupancy tenure. There may be a history associated with the location as a fringe camp, ration depot, or government reserve. Representative bodies are commonly an Aboriginal and Torres Strait Islander housing authority, land trust or other Aboriginal and Torres Strait Islander organisation. There are frequently multiple settlements in one town associated with traditional groupings. High mobility, including periodic influx of population of related settlements, is also experienced.</td>
</tr>
<tr>
<td>1c Outlying discrete settlements</td>
<td>These settlements are Aboriginal and Torres Strait Islander homelands established on a social, cultural, or political basis, frequently associated with the ‘homelands movement’. There is high mobility between outstations and other settlements, and they may be seasonally occupied. These settlements may or may not have permanent dwellings and have varied infrastructure provision.</td>
</tr>
<tr>
<td>2a Dispersed housing in major centres</td>
<td>These settlements are not discrete Aboriginal and Torres Strait Islander settlements. They include all settlements with an Aboriginal and Torres Strait Islander population over 1000 and a total population of not less than 5000. In the arid zone, this includes Mount Isa, Alice Springs, Port Hedland, Broome and Alice Springs among others. As with other types of Aboriginal and Torres Strait Islander settlements identified, there is high mobility and kinship links within and outside these settlements are frequently maintained.</td>
</tr>
<tr>
<td>2b Dispersed Housing in Rural Centres</td>
<td>These settlements are not discrete Aboriginal and Torres Strait Islander settlements. They include all settlements where there are less than 1000 Aboriginal and Torres Strait Islander people and there is a presence of a mainstream local government authority. The proportion of Aboriginal and Torres Strait Islander population in these settlements varies widely. It is suggested that where Aboriginal and Torres Strait Islander people make up 30–70% of the population there is potential for significant Aboriginal representation in local government structures. In the arid zone, this includes Halls Creek, Meekatharra, Mullewa, Tennant Creek, Fitzroy Crossing, Marble Bar, Wiluna, and Roebourne.</td>
</tr>
</tbody>
</table>

Compiled from Memmott and Moran (2001)

This typology is the only settlement typology identified in this literature review that seeks to understand Aboriginal and Torres Strait Islander settlements in detail across the whole of Australia. It is relevant to the development of a desert settlement typology, as most of the settlements in the desert area are discrete Aboriginal settlements. Memmott and Moran’s typology has been incorporated in the preliminary desert settlement typology suggested for settlements with population below 1000.

A recent dialogue on outstations provided by Altman (2006) highlights the role of people as well as place in this type of settlement. Outstations are defined both:

- as places set up by small groups on land that is held in Aboriginal title, or that the group has traditional affiliations with
- people who are connected, through traditional affiliations with a particular outstation but at any given time might reside there or somewhere else.

Altman (2006) views outstations as infrastructure nodes on Aboriginal land providing for a mobile population. As such, they cannot be understood in the same way as other settlements. Essentially, he argues that data snapshots in time and settlement hierarchies have limited meaning over time for a mobile population, and mainstream indicators are not designed to pick up measures that are likely to be meaningful to outstation residents. In providing a broad commentary on outstation policy and sustainability, Altman (2006) highlights the following points:
• The need for a genuinely open policy dialogue on the future of outstations that includes input from people on outstations
• That as the Aboriginal estate expands, land owners are more (rather than less) likely to want to reside on their land
• That some larger Aboriginal settlements (e.g. Wadeye in the Northern Territory) are experiencing more problems, partly due to lack of economic base, than smaller ones, and that this may lead to decentralisation towards outstations as a livelihood choice;
• While service delivery to small remote populations is a core concern for government, any overall movement away from smaller or outstation settlements will further increase pressure on infrastructure in larger discrete and town-based Aboriginal settlements.

1.5 Arid zone demography and settlements
The main typology issues coming out of the demography literature are:
• size of population
• growth rate (or rate of change)
• permanence (or mobility)
• share of Aboriginal population
• population projections.

1.5.1 Size of population
Taylor et al. (2006) found that the main demographic problem of settlements in arid areas is low population size, and hence density, which constrains:
• market demand (or economic aspects of sustainability)
• social livelihoods (e.g. distorted high sex ratios with influx of workers from a single industry from fly-in/fly-out operations, provision of services)
• research on settlements (particularly in relation to the robustness of any statistical analysis, including demographic measures, e.g. demographers often consider amalgamation of areas in order to have larger population sizes and achieve statistically robust analysis which detracts from the usefulness of the data).

In general, larger statistical local areas’ (SLA) populations are better estimated than small SLA populations, which represents a problem for desert settlements. Under-reporting is a concern for any census, but errors from underreporting are more pronounced and have a bigger impact in remote, sparsely settled areas. The study by Foster et al. (2005) of the town camps of Alice Springs shows a discrepancy of 75% (i.e. the estimated population was 75% larger than the ABS census data).

Another major problem in dealing with population size is population mobility. For example, at a national level the differences between Census counts, estimated resident population (ERP) and place of usual residence (UR) are relatively small. It is at the small area levels and, again, in the small SLAs, that these differences are the most pronounced.

Taylor et al. (2006, p. 31) recommend three population totals to be considered when analysing settlements:
• a base population, defined as the sum of people (residents and visitors) counted by the conventional means of recording the numbers resident at each dwelling at the time of a survey
• a potential population, defined as the sum of the largest number of persons ever to have been accommodated in each dwelling in the course of the year
• a service population, defined as the average population likely to be present at any given time. This is assumed to lie somewhere between the base and potential populations and is estimated from data on visitor numbers and duration of stay.

They also use a rank-size rule (where the population of the second ranked settlement has half of the population of the first-ranked/largest settlement, etc.) to identify a four-tiered settlement hierarchy for settlements in the arid zone according to size, with each tier stepped by a factor of ten, namely:

- 1st tier – above 10,000
- 2nd tier – between 1000 and 10,000
- 3rd tier – between 100 and 1000
- 4th tier – below 100.

Another possible size categorisation of desert settlements is the ARIA (Accessibility/Remoteness Index of Australia) adopted by Maru et al. (2006) for the Australian outback. The applicable ARIA categories are:

- F – 200–999
- E – 1000–4999
- D – 5000–17,999.

Table 6 presents data on Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander population in remote and very remote areas. Only 2.6% of total Australian population (just over half a million people) live in remote and very remote areas compared with 26% of the Aboriginal and Torres Strait Islander population. Although the non-Aboriginal and Torres Strait Islander population still prevails in absolute numbers, this gap is closing fast, particularly in very remote Australia.

Table 11: Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander population in remote areas, 2001

<table>
<thead>
<tr>
<th></th>
<th>Total population</th>
<th>Non-Aboriginal and Torres Strait Islander population</th>
<th>Aboriginal and Torres Strait Islander Population</th>
<th>% Aboriginal and Torres Strait Islander of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote areas</td>
<td>324,324</td>
<td>284,160</td>
<td>40,161</td>
<td>12.4</td>
</tr>
<tr>
<td>Very remote areas</td>
<td>178,475</td>
<td>97,473</td>
<td>81,002</td>
<td>45.4</td>
</tr>
<tr>
<td>Total remote</td>
<td>502,796</td>
<td>381,633</td>
<td>121,163</td>
<td>24.1</td>
</tr>
<tr>
<td>Australia</td>
<td>19,413,240</td>
<td>18,954,720</td>
<td>458,520</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Compiled from ABS (2003a) in Taylor (2006b)

1.5.2 Growth rate (or rate of change)

According to standard demography, the growth rate of a settlement is affected by: (1) fertility rates; (2) mortality rates; and (3) any in- and out-population movements. With small population size, rates of change can easily appear to be too big, due to the small figures in the denominator.

The Aboriginal and Torres Strait Islander population tends to have higher fertility and mortality rates which result in a much younger population than the non-Aboriginal and Torres Strait Islander counterpart, and a population pyramid with a relatively wide base (Taylor et al. 2006). Such
populations are usually growing due to the high share of young people and higher fertility rates (2.45 for Aboriginal and Torres Strait Islander people compared with 1.96 for non-Aboriginal and Torres Strait Islander people in arid areas in 1996–2001, according to ABS data).

However, the overall growth of the Aboriginal and Torres Strait Islander population does not necessarily translate into settlement growth. A phenomenon that has been observed and well described in arid zones (see Fletcher 1990 in Taylor 2006b) is that settlements do not grow in size. They seem to reach a ceiling after which they either stabilise, fragment spatially, or decline in size. The reasons for a brake on the continued growth of many Aboriginal towns and the expansion of outstation residence include a preference to ‘live in smaller, more politically manageable social units away from the social pathologies of overcrowded centralised settlements’ (Taylor 2006b, p. 45). However, it is often the case that the main settlement continues to provide services to its satellites.

There is a substantial flow of migration out of the arid zone to the rest of Australia but the rate of loss of non-Aboriginal and Torres Strait Islander people is 5 times that of Aboriginal and Torres Strait Islander population (Taylor et al. 2006), which is the key demographic reason why the Aboriginal and Torres Strait Islander share of total population in these areas continues to rise.

1.5.3 Permanence (or mobility)

Migration, mobility or population movement is a common demographic event. In fact, issues such as usual residence or even single place of residence are difficult to identify for all population groups. While Aboriginal and Torres Strait Islander populations have high mobility, this mobility is often local or regional, and the trend toward movement from the desert zone to coastal population centres is much more pronounced for non-Aboriginal people. (Taylor et al. 2006). A lot of the perceived mobility of Aboriginal and Torres Strait Islander people can be explained by its younger age structure; when mobility rates are standardised for population age structure (see Taylor 2006b) the difference with non-Aboriginal and Torres Strait Islander people is barely noticeable – 42.8 for Aboriginal and Torres Strait Islander people between 1996–2001 compared with 42.2 for non-Aboriginal and Torres Strait Islander for the same period.

However, short-term mobility is what is perceived as ‘fundamental to an Aboriginal’s social identity’ (Peterson 2004, p. 224). Frequent population mobility of Aboriginal and Torres Strait Islander people over the short-term, which is well acknowledged in the literature (Taylor 1998; Taylor and Bell 2004), characterises the demography and functions of desert settlements. The impacts of population mobility are stronger in smaller communities; for example, to access the services that are only available in larger centres. (Taylor et al. 2006). Taylor et al. (2006) emphasise that the impact of temporary movement is more significant as in-migration (rather than out-migration) as it adds pressure on selected local services, such as banks, hospitals, government offices, employment opportunities, public housing, sporting events, education and training.

Generally, economic factors (e.g. employment opportunities or income prospects) are the main reason for people’s internal migration within Australia. Mobility of Aboriginal and Torres Strait Islander people is caused mainly by socio-cultural reasons for which there does not seem to be a lot of statistical information. As Taylor et al. (2006, p. 57) point out, ‘Indigenous people in these regions (including arid zones) are not migratory (in the sense of involving residential relocation) even though they are mobile’. Taylor and Bell (2004, p. 17) describe this as circular mobility, i.e. ‘population movement between places which combine to form functional regions’. A study of the
19 town camps of Alice Springs (Dixon 1985 in Foster et al. 2005) revealed that 80% of their adult population have lived at town camps for at least five years (with 60% of them indicating that they had always lived at town camps). Altman (2006, p. 1) concludes that overall ‘there is too little research and understanding of culturally distinct, but evolving, patterns of Indigenous mobility and migration in remote and very remote Australia’.

1.5.4 Share of Aboriginal and Torres Strait Islander population

According to Taylor et al. (2006), the size and spatial distribution of Aboriginal and non-Aboriginal resident populations vary substantially in the arid zone due to a concentration of non-Aboriginal people in large regional settlements and mining settlements. Knowledge of population composition is an important element in determining, to a certain extent, population change. For instance, Taylor (2003b) projects Aboriginal population to rise across the arid zone while non-Aboriginal population in many instances is projected to decline.

Community Housing and Infrastructure Needs Survey (CHINS) uses the term ‘discrete Indigenous communities’ to describe the estimated service population of Aboriginal and Torres Strait Islander settlements (with more than 50% Aboriginal and Torres Strait Islander population) in arid zones. These settlements include the formerly constituted government and mission settlements, or reserves, as well as special purpose lease areas within towns, and excision communities on pastoral stations. A total of 1216 such communities were identified in 2001 (see Figure 5), with Taylor et al. (2006) identifying 365 such localities of less than 200 persons in the arid zone.

Following ABS and CHINS, Taylor (2006b) uses the following settlement size categories for discrete Indigenous communities:

<table>
<thead>
<tr>
<th>Settlement size</th>
<th>Remote</th>
<th>Very remote</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–19</td>
<td>33</td>
<td>577</td>
</tr>
<tr>
<td>20–49</td>
<td>36</td>
<td>228</td>
</tr>
<tr>
<td>50–99</td>
<td>17</td>
<td>64</td>
</tr>
<tr>
<td>100–199</td>
<td>9</td>
<td>51</td>
</tr>
<tr>
<td>200–499</td>
<td>11</td>
<td>77</td>
</tr>
<tr>
<td>500–999</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>above 1000</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>1030</td>
</tr>
</tbody>
</table>

According to Gray (1998 in Taylor 2006b), the Aboriginal and Torres Strait Islander population will continue to grow in size because of: (1) high natural increase; (2) improved enumeration; (3) increased self-identification; and (4) a growing pool of people who would potentially identify themselves as Aboriginal and Torres Strait Islander due to the expansionary effects of ancestry through parenting. Taylor (2006b, p. 1) also stresses that demography in remote Australia is increasingly characterised by the demography of Aboriginal and Torres Strait Islander people. The Aboriginal and Torres Strait Islander share of the resident population of settlements continues to grow (he uses the term demographic ‘hot spots’), and ‘many former mission and government settlements are growing to become sizeable country towns’.
1.5.5 Population projections

Taylor et al. (2006) present Aboriginal and Torres Strait Islander population projections for the arid zone using the component method (based on total fertility rate of 2.45, Northern Territory experimental survival ratios, and zero net migration). The projected change in the period 2006–2021 is 7,562 people or a 19% increase (compared with 10,396 or a 8% decrease for the non-Aboriginal and Torres Strait Islander population). This means that overall the population of the arid zone will be decreasing with the share of Aboriginal and Torres Strait Islander population increasing. Areas projected with a relatively large population increase in the arid zone are central Australia, the north of South Australia and the Pilbara coastal regions; the areas of population decline include the entire arid zone in Western Australia.

1.5.6 Other demographic variables

Evidence supports the view that morbidity and mortality rates in remote Australian areas are, and continue to remain, higher than those of the total Australian population (e.g. Freemantle et al. 2006; Zhao et al 2004). This demographic variable is also discussed in Section 2.4.

1.5.7 Demographic data sources

- ABS is the main source of demographic data. This includes:
  1. Census data (generally with problematic quality for desert settlements and particularly under-reporting of young children)
  2. ERP data through post-census estimates (which include adjustments for those missed because of undercount); this becomes the official population of each SLA in Australia
3. intercensal adjustments based on regression model which takes into consideration a number of population indicators.

Taylor et al. (2006) and Foster et al. (2005) discuss the deficiencies associated with ABS data.

- Taylor et al. (2006) propose an online Demographic Information System (DIS) for arid and savanna Australia which will contain the key demographic data and derived indicators. It is expected to be a data depository as well as an analytical tool with the data stored in a GIS framework. They argue that DIS should have the following data:
  1. demographic data (by biogeographic zones and SLAs). A possible extension is data on settlements
  2. socioeconomic data
  3. physical boundaries (e.g. rivers)
  4. special networks (roads and railways)

The logical successor of the DIS is a decision support tool.

- Data sets from other administrative services, e.g. health and community services. Foster et al. (2005) use the Population List Database in the Northern Territory Department of Health and Community Services (NTDHCS) to better quantify population mobility.
- Indigenous Community Housing and Infrastructure Needs Survey (CHINS). It is conducted by the ABS and records the nearest town that members of remote communities travel to in order to use services.

1.5.8 Concluding comments

The use of language is a very important aspect in communicating ideas about sustainability. Researchers should be careful in selecting the most appropriate words when conveying certain research (e.g. statistical) considerations to a wider audience. There are many examples in the demographic literature where this is not the case.  

1.6 Review of standard classification frameworks

In addition to the development of regional and settlement typologies, there is a range of standard classification frameworks used for presenting and analysing data at different scales. Given the complexity of studying settlements in arid zones, standard classification frameworks are likely to be important tools in simplifying and developing this preliminary typology (and indeed are incorporated at some level in the above typologies). It is therefore important for them to be considered. The value of seeking some coherence with these boundaries either in any data collation through the DKCRC project time, or in the site selection typology, is that certain types of data are readily available at these scales. Some standard classification frameworks are reviewed briefly below for consideration in the development of a desert settlement typology.

1.6.1 Rural, Remote and Metropolitan Areas (RRMA) classification

The RRMA typology was developed in 1994 as a remoteness classification based on the 1991 Population Census data and the 1991 SLA Boundaries. It was the first classification system to define key target areas such as rural and remote areas. The classification consists of three zones (Metropolitan, Rural and Remote) and seven classes, and combines a distance measure with a population density measure (see Table 7).

---

6 The following quote is such an example: ‘If we take mortality as an example, as a rule of thumb an SLA population of around 10,000 is required to sustain sufficient male and female deaths at different ages in a given year for robust mortality analysis, although this threshold could be reduced for the Indigenous population given higher mortality’ (Taylor et al. 2006, p. 16). What comes across to the non-expert reader is that the deaths need to be sustained.
The RRMA has been used by governments as a simple research tool and in allocating funding to SLAs. However, it has not been officially updated and is therefore out of date. The characteristics and needs of many regions throughout Australia have changed since 1991. Its relevance as a contemporary typology is also limited because it is essentially a geographic classification. It is based on SLAs, and all areas within are afforded the same remoteness score. The accessibility measure is defined by the distance 'as the crow flies', not by actual road distance to service centres. The lack of capacity to take into account specific factors, for example, Aboriginal population mobility, makes its applicability to arid Australia settlement typology limited.

Table 13: Rural, Remote and Metropolitan Areas (RRMA) Classification

<table>
<thead>
<tr>
<th>Zone</th>
<th>Class</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metropolitan zone</td>
<td>Capital cities</td>
<td>RRMA 1</td>
</tr>
<tr>
<td></td>
<td>Other metropolitan centres</td>
<td>RRMA 2</td>
</tr>
<tr>
<td>Rural zone</td>
<td>Large rural centres</td>
<td>RRMA 3</td>
</tr>
<tr>
<td></td>
<td>Small rural centres</td>
<td>RRMA 4</td>
</tr>
<tr>
<td></td>
<td>Other rural areas</td>
<td>RRMA 5</td>
</tr>
<tr>
<td>Remote zone</td>
<td>Remote centres</td>
<td>RRMA 6</td>
</tr>
<tr>
<td></td>
<td>Other remote areas</td>
<td>RRMA 7</td>
</tr>
</tbody>
</table>

1.6.2 Accessibility/Remoteness Index of Australia (ARIA)

In 1999 ARIA was released by the Commonwealth Department of Health and Aged Care (DHAC) and the National Key Centre for the Social Applications of Geographic Information Systems (GISCA). The index used GIS technology to combine road distance to population centres of various sizes – as a measure of service access – in developing a standard measure of remoteness. Scores range from 0 to 12 and ARIA defines five categories of remoteness (see Table 8).

Table 14: Categories of remoteness by Accessibility/remoteness Index of Australia (ARIA)

<table>
<thead>
<tr>
<th>ARIA score</th>
<th>Category – Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 1.84</td>
<td>Highly accessible (relatively unrestricted accessibility to a wide range of goods and services and opportunities for social interaction)</td>
</tr>
<tr>
<td>&gt;1.84 – 3.51</td>
<td>Accessible (some restrictions to accessibility of some goods, services and opportunities for social interaction)</td>
</tr>
<tr>
<td>&gt;3.51 – 5.8</td>
<td>Moderately accessible (significant restrictions to accessibility of goods, services and opportunities for social interaction)</td>
</tr>
<tr>
<td>&gt;5.81 – 9.08</td>
<td>Remote (very restricted accessibility)</td>
</tr>
<tr>
<td>&gt;9.08 – 12</td>
<td>Very remote (locationally disadvantaged – very little accessibility)</td>
</tr>
</tbody>
</table>

1.6.3 Australian Standard Geographical Classification (ASGC)

The ASGC is a classification system designed and maintained by the Australian Bureau of Statistics (ABS) and issued in 1984 with its latest edition released in 2005. It sets out a hierarchy of Australian settlements, based on population size criterion (see Table 9). Settlements under 200 people fall into the category ‘rural balance’ which significantly limits the informative value of the classification for the arid zone.

In 2001 the ASGC Remoteness Areas was released. The ASGC includes an improved version of ARIA, based on an enhanced measure of remoteness known as ARIA+ (released in 2003 by GISCA). ASGC Remoteness divides areas into ‘major cities’, ‘inner regional’, ‘outer regional’, ‘remote’ and ‘very remote’. A current Australian Housing and Urban Research Institute research project (AHURI 2006) confirms the application of the ASGC in different jurisdictions. For example, the New South Wales (NSW) Government has selected ‘inner regional’ and ‘outer regional’ from ASGC for the Aboriginal Community Housing Provider (ACHP) sector, while the Northern Territory (NT) Government has added ‘Very, Very Remote’ and ‘Very, Very, Very Remote’ to ASGC for use by the Indigenous Community Housing Organisation (ICHO) sector (AHURI 2006).

The measure for remoteness is the road distance from a locality to the nearest service centre in each of the five classes of population. The criteria for Remoteness Areas do not attempt to incorporate road condition, travel time or the broader issues of accessibility, which is influenced by many factors such as the socioeconomic status or mobility of the population. The ASGC is a purely geographic approach to measuring remoteness and access and as such does not take into consideration the specific characteristics and needs of settlements in arid Australia.

### 1.6.4 ARIA++ (Levels of Relative Isolation (LORI))

The ARIA++ scale is a modification of the original ARIA+ classification for very remote. This modification is used to describe the difference in access to basic services, health outcomes, lifestyles and cultures of Aboriginal and Torres Strait Islander people. The ARIA++ scale has five additional categories of isolation, referred to as ‘Levels of Relative Isolation’ (LORI): None, Low, Moderate, High and Extreme.

### 1.6.5 Australian Indigenous Geographical Classification

The Australian Indigenous Geographic Classification (or AIGC) distinguishes between three types of regions, namely: Indigenous areas, Indigenous locations and Collection districts (see Table 10).
For various reasons, the data management from these regions means that they are inaccurate sources of information at the settlement level, and while useful for data at the level of a (previous) ATSIC region, it is of less relevance to smaller units of analysis and for building on existing data sets (Moran 2006).

1.7 Summary of other Aboriginal and Torres Strait Islander settlement typologies used in Australia

There is a number of other Aboriginal and Torres Strait Islander settlement typologies used by Commonwealth, State and Territory Governments throughout the years. They represent past and present attempts by governments to collect reliable data sets from which funding decisions can be made. These are summarised in Table 11.

Table 16: Australian Indigenous Geographic Classification of regions

<table>
<thead>
<tr>
<th>AIGC Region</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigenous areas</td>
<td>Aggregations of locations, ideally reflective of cultural or language groupings</td>
</tr>
<tr>
<td>Indigenous locations</td>
<td>Made up of collection districts</td>
</tr>
<tr>
<td>Collection districts</td>
<td>Smallest unit of statistical analysis, combined to make all other units</td>
</tr>
</tbody>
</table>

Source: ABS 2003

Table 17: A summary of Aboriginal and Torres Strait Islander settlement typologies used by Commonwealth, State and Territory Governments

<table>
<thead>
<tr>
<th>Typology</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Aboriginal Affairs 1984</td>
<td>1. Aboriginal townships on Aboriginal land/reserves</td>
</tr>
<tr>
<td></td>
<td>2. Outstations and other small groups</td>
</tr>
<tr>
<td></td>
<td>3. Towns (Aboriginal and Torres Strait Islander population up to 500)</td>
</tr>
<tr>
<td></td>
<td>4. Fringe camps</td>
</tr>
<tr>
<td>Housing and Infrastructure Needs Survey 1992</td>
<td>1. Discrete communities in a capital city</td>
</tr>
<tr>
<td></td>
<td>2. Discrete community near or within a major urban centre</td>
</tr>
<tr>
<td></td>
<td>3. Residential housing in town</td>
</tr>
<tr>
<td></td>
<td>4. Other identified location or camp near or within town</td>
</tr>
<tr>
<td></td>
<td>5. Discrete community township</td>
</tr>
<tr>
<td></td>
<td>6. Outstation/Homeiland with resource organisation support</td>
</tr>
<tr>
<td></td>
<td>7. Outstation/Homeiland without resource organisation support</td>
</tr>
<tr>
<td>Proposed typology from ATSIC for Community Housing and Infrastructure Needs Surveys (not fully adopted)</td>
<td>1. Discrete community in a capital city or major urban centre</td>
</tr>
<tr>
<td></td>
<td>2. Community housing in a capital city or major centre</td>
</tr>
<tr>
<td></td>
<td>3. Community housing in a rural centre</td>
</tr>
<tr>
<td></td>
<td>4. Discrete community within a rural centre</td>
</tr>
<tr>
<td></td>
<td>5. Discrete community on the outskirts of a rural centre</td>
</tr>
<tr>
<td></td>
<td>6. Discrete community in a remote area</td>
</tr>
<tr>
<td></td>
<td>7. Outstation/Homeiland/cattle property/emerging community (less than 50)</td>
</tr>
<tr>
<td>Community Housing and Infrastructure Needs Survey 1999</td>
<td>1. Discrete community in a capital city or major urban centre</td>
</tr>
<tr>
<td></td>
<td>2. Community housing in a capital city or major centre</td>
</tr>
<tr>
<td></td>
<td>3. Community housing in a rural centre</td>
</tr>
<tr>
<td></td>
<td>4. Discrete community within a rural centre</td>
</tr>
<tr>
<td></td>
<td>5. Discrete community on the outskirts of a rural centre</td>
</tr>
<tr>
<td></td>
<td>6. Outstation/Homeiland/cattle property/emerging community</td>
</tr>
<tr>
<td>NT Settlement typology for mapping (limited to remote areas)</td>
<td>1. Large discrete Aboriginal settlements</td>
</tr>
<tr>
<td></td>
<td>2. Small discrete Aboriginal settlements</td>
</tr>
<tr>
<td></td>
<td>3. Family outstations</td>
</tr>
</tbody>
</table>

Compiled from Moran 2006
1.8 Relevant international typology

In addition to a review of literature on settlement typology in Australia and in arid Australia, a brief review was carried out of international typologies relevant to the study of sustainable settlements. A settlement typology that was developed for the South African Human Settlement Policy Framework by CSIR South Africa is of particular interest as it seeks to understand settlements within a sustainability context (Du Plessis 2002). The team highlights the complexity of this task, citing methodological as well as data problems as challenges, and concluding that (Du Plessis 2002):

... until such a time as appropriate benchmarks had been agreed on, and information collection has become a lot more sophisticated, and we have found a way of including human behaviour in the calculation, a study of this type can only provide speculative answers based on intuitive interpretations of the relationships within settlements and the presence of certain key determinants of sustainability.

The study outlines the diversity of settlements and settlement types, and argues that sustainability is dependent on the context of the individual settlement. However, they suggest that identifying a range of particular settlement types – even though there will be differences among settlements categorised as the same type – can help identify sustainability considerations that are particularly relevant to them. That is, it is a tool for systematic, representative analysis of settlements and their sustainability, but does not reflect the complexity or diversity of interactions in settlements. The authors warn:

Thus the sustainability profile would be very different for each of the different settlement types found in South Africa, and even for settlements of the same type, depending on a range of contextual factors. Understanding different settlement types in South Africa therefore becomes crucial to the sustainable development debate in this country. It is not always easy to identify and distinguish these different settlement types because of a multitude of complex factors that play a role in differentiating one settlement from another, such as topography, location, size, proximity and management structures.

(Du Plessis 2002)

Criteria chosen for the settlement typology in the study were:

- dimensional – settlement size
- geographical – settlement location
- institutional – type of institutional governance/management.

Notably, the type of institutional governance is described contextually – that is, for particular case study settlements, rather than associated with a particular type of settlement.

In addition to developing a typology for classifying settlements, a ‘Driver, Pressures, State, Impact, Response’ model is used to assess sustainability, which, according to this study, can be understood through the core factors of:

- quality of life offered to each member of society
- the interaction between the settlement and its biophysical environment and whether this interaction will continue to support an adequate quality of life
- the ability of the institutional systems responsible for creating, operating and maintaining the settlement to continue providing an adequate quality of life, and to do this sustainably.
Du Plessis (2002) concludes:

*The sustainability of settlements is a multidimensional problem, dealing not only with settlement dimensions, but also with spatial characteristics, geographical location, environmental conditions, economic viability, institutional ability and structure, human development, social relationships, and local values and aspirations. The infinitely complex set of issues that determine sustainable development and settlement sustainability, and the recognition that these issues are interconnected and interdependent, identify sustainability as a systemic concept that requires a systems approach to problem solving and planning.*

### 1.9 Additional considerations for typologies

Based on the literal meaning of the word typology (in Greek ‘typo’ means ‘type’ and ‘logos’ means ‘word’, the latter also implying ‘science’), a settlement typology is the study of different settlement types. A typology can be seen as a process which analyses and interprets the various characteristics of settlements to provide a classification, as well as the outcome from this process. In its latter meaning, the typology also becomes a tool which informs further study and interpretation of settlements and their characteristics, including setting up and selecting categories to organise and analyse new data. All settlements are complex and undergoing processes of ongoing transformation. A settlement typology is a tool that can support representative study across a range of different settlements, rather than something that can provide ultimate definition of any particular settlement (Du Plessis 2002).

The Working Party on Territorial Indicators of the Organisation for Economic Cooperation and Development (OECD n.d.) provides a review of both the development and limitations of regional typologies. They highlight the role of typologies as a tool for categorising regions by similarities in particular criteria for the purpose of comparison, whilst acknowledging that this approach is inherently reductive. The purpose is to seek transferable knowledge across regions of a similar type. They identify two particular forms of typology:

- Typologies for the purpose of directing policy to places fitting certain criteria or to link similar places via classification for policy advice and development
- Typologies that develop a classification framework to better understand development patterns in particular places. An example given here is to support understanding the impact of a particular policy on places of a particular type, on places of different types, as well as understanding disparate impacts on places that the typology classifies as the same.

To this point, the literature review has focussed on literature on settlements, arid settlements and typologies associated with them. It is important to note that typology can be thought of as simply a classification framework, and that a typology can be made about anything.

For instance, the *Services to Indigenous Peoples in the Shire of Wiluna: Mapping and Gap Analysis* study by the Department of Indigenous Affairs, Western Australia (DIA 2004) was a sectoral analysis of services. They were classified as follows:

1. Health and community services
   - Primary health care and provision of medical services
   - Health promotion and nutrition
   - Alcohol and drug abuse
   - Mental health
   - Family and social support
2. Housing and infrastructure
   • Housing and tenancy support
   • Essential services and environmental health
   • Transport issues
   • Community facilities and amenity
3. Justice, safety and security
4. Employment and economic development
   • Comparative employment participation and income in Wiluna
   • Economic development
   • Employment programs and opportunities
   • The way forward
5. Land, heritage and culture
   • Relationship of land, heritage and culture
   • Supporting land, heritage and culture.

Mitchell et al.’s (2005) *Indigenous Populations and Resource Flows in Central Australia: A Social and Economic Baseline* used a regional approach based upon administrative boundaries. The analysis was sectoral, with the following categories:

- Demography
- Participation in the regional labour market
- Employment and welfare income
- Education
- Infrastructure
- Housing
- Health
- Regional involvement in the criminal justice system.

Maru et al. (2005), through a systems analysis, listed a number of groups of issues that affected all livelihood groups and communities in the Outback. The aim of the research was to develop indicators for people to track changes in their issues. The attributes which emerged from asking the community through a set of workshops included: access to country; ability to manage change; clear aspirations; effective infrastructure; balanced population profile; access to basic services; access to healthcare; spectrum of employment; functional and effective business networks; commitment to place; viable property size; and certainty of tenure (Maru et al. 2005).

It is clear that once the focus is broadened from what seems to normally be considered in a settlement typology, a range possibilities with regards to criteria to include in the typology emerge.

1.10 Conclusion

It is possible to develop a typology based on existing literature on desert settlements, and the social and economic regions that they have been placed in. Ultimately, this is what we offer as a preliminary typology of arid settlements that may inform site selection for the DKCRC Sustainable Settlements Project. However, from a sustainability perspective there is much left out in doing this. Therefore we have also reviewed literature that is relevant to sustainability in the arid zone, and
sought to consider it in our approach to developing a typology for site selection for the DKCRC sustainable settlements study. This includes recognising the need for participation from desert people in defining sustainability.

2. Sustainability and desert settlements

The core focus areas of the Sustainable Desert Settlements Project, as stated in the Invitation to Tender (DKCRC 2006) are:

- What do people in desert settlements consider to be the conditions, decision processes and systems that characterise sustainable settlements?
- How do settlement type and population mobility impact either positively or negatively on the sustainability of a settlement?
- What are the likely futures of different types of desert settlements and what are likely to be the main drivers of those futures?

As sustainability academics and practitioners, we have all been challenged by the idea of a sustainable settlements typology, and have sought to bring our understanding of the diverse aspects of sustainability in the desert to our consideration of it.

As set out in Section A of this report we have outlined an approach that suggests most of the work on typology of settlements is about ‘viability’ in a economic sense, or, where drawing on a wider set of indicators (such as the work of Maru et al. 2006) is not tuned to the diverse nature of sustainability across culture and place. Almost all the work assumes that the critical variable is the size of a settlement and that various other factors, frequently economic, can be layered around that. The scale of a settlement does indeed shape its viability but there are many settlements that are threatened in their viability due to population decline but which are considered to have a future for other reasons. Sustainability attempts to help us define what the ‘other’ elements are and how they are linked closely to viability.

In many respects there is a cultural clash between the ‘typology’ concept and the ‘sustainability’ concept. Typology is a reductionist and modernist idea where settlements are reduced to a few simple parameters, primarily economic in nature. Sustainability, on the other hand, is a holistic and post-modern concept that tries to embrace difference and diversity and show the linkages at a broad level. It attempts to show that if economics alone is considered much will be missed.

The issue for us is: What are the factors that matter? If they can be specified, is it possible to put them into some kind of broad-based sustainability-oriented typology?

The literature reviewed below outlines some of the suggestions around drivers of sustainability in the arid zone, as well as issues across a number of core theme areas. It is based on a literature review undertaken over a very short time frame, and does not claim to cover all the relevant issues and aspects of them that are contained in the literature. It is also recognised that participation of desert peoples is central to determining sustainability issues, which may ultimately be context specific. The literature review covers the following areas:

- Knowledge, language and communication
- Economics
- Governance
• Health and education
• Infrastructure, housing and environmental health
• Transport and remoteness
• Natural environment.

A much deeper understanding of settlement sustainability is being sought, which cannot even be provided by an intensive literature review. The areas discussed, however, are indicative of the types of themes that we think will emerge.

Kinnane (2002) highlights that sustainability means different things to different people and different communities, and needs to include a holistic approach that addresses economic, environmental, and social issues. For Aboriginal and Torres Strait Islander communities this also includes governance, culture and country. Inherent Aboriginal and Torres Strait Islander rights are embedded in a collective Aboriginal and Torres Strait Islander whole-of-community approach, and are both obligatory and beneficial. The obligatory responsibility of looking after country impacts on community wellbeing (Kinnane 2002). Key issues for Aboriginal and Torres Strait Islander sustainability are autonomy and self-determination, empowerment in the decision-making process, resource distribution, provision of a clear and just place in society and politics, and a change in social values such as social, political and gender imbalances (Robinson 1998; Jacobs 1999; Kinnane 2002). Stafford Smith et al (2003, p. 2) suggest key sustainability drivers for the Tropical Savanna region, which may also be relevant to the desert (Measham et al. 2006):

1. Intrinsic biophysical and socioeconomic structural constraints on what options are open to different regions. Understanding of these needed to allow regional communities to be realistic about what they can control or change, and where they need to design systems to live with constraints (e.g. environmental variability, externally driven markets, low and mobile populations, significant Aboriginal population, rapidly changing ICTs (Information and Telecommunications Technologies).

2. Extrinsic economic forces that limit options or demand special design considerations (i.e. changing international markets, energy costs, labour costs, globalisation).

3. Political trends towards decentralisation and local empowerment with potential for conflict between demands for cost-effectiveness (agglomeration) and socially desirable outcomes (devolution) if the drivers of each are not understood.

Within this context the indicative sustainability issues of settlements are explored below.

2.1 Knowledge, language and communication

Aboriginal, local and scientific knowledge are key components in defining and understanding sustainability and sustainable settlements. Knowledge is both stored and communicated through language. Measham et al (2006) recognised this fundamental link in outback regions when they proposed a communicative approach put forward by Meppem (1999). A communicative approach needs to also be mindful. As McConvell and Thieberger (2001, p. 1) state: ‘Indigenous languages of Australia represent a great storehouse of knowledge and tradition about the environment and ancient culture of Australia, both for the Indigenous people themselves, and for all Australians’. Language is an important component in understanding sustainability; but it can also be a barrier
to gaining mutual agreement and benefits. We do not all speak the same language. The greatest concentration of people speaking Aboriginal languages is in the Central Desert regions of Australia (McConvell and Thieberger 2001).

The diversity of language in desert regions is an important factor in understanding sustainability and sustainable settlements. Even people who share the same language (whether it be English or Pitjantjatjara) can have different understandings of the same word. Pastoralists, scientists, Aboriginal people, miners, managers and bureaucrats, among others, all have relationships to the places they live and work, but they may not express this relationship in the same way, or indeed use the same words. For instance, the CSIRO Centre for Arid Zone Research (CAZR) refers to the desert regions as arid lands, semi-arid lands and as the rangelands. The use of the term rangelands refers to the recognition of the extensiveness of pastoralism. These differences are best understood through good communication and dialogue aimed at understanding the differences and the similarities. Aboriginal co-researchers are central to this process of communication.

Building partnerships based on good communication will be crucial for understanding sustainable settlements. Solutions to complex problems cannot be achieved by one sector. A more integrated approach to problem solving and scenario planning for sustainability can be achieved through what Wakerman and Mitchell (2005) call ‘intersectoral collaboration’. Under their discussion of intersectoral collaboration, they use the term communities, and define them as a sector highlighting that successful collaborations need joint appreciation of values. The process they suggest leads to the identification of stakeholders, with the role of the various partners being defined at the beginning.

Given the diversity of settlement types in the desert regions of Australia and the distances that people need to travel to access basic services, the internet is a useful tool in overcoming the ‘tyranny of distance’ in communication. Young et al. (2005) discuss communication networks and infrastructure in the desert. Only half of all discrete communities have access to one public payphone. In an effort to overcome this, funds from the Networking the Nation (NTN) scheme were used to establish a UHF radio repeater network across Ngaanyatjarra lands in Western Australia. The network is used to arrange meetings, broadcast social news, and report emergencies. Basic communications access is taken for granted by coastal regions but is only just becoming available to many Aboriginal peoples across desert Australia. There are an increasing number of Aboriginal media organisations, including Pitjantjatjara Yunkunytjatjara Media (PYMedia), where this has lead to an expansion from television and radio services to computer-based cultural databases and internet-based information and news service for Pitjantjatjara Lands in South Australia. Table 12 below summarises the structure, method, data source and data constraints encountered in the Desert Disconnections: E-learning and Remote Indigenous Peoples project (Young et al. 2005). It demonstrates a process to understand information and communication technologies (ICT) in the desert in more detail. Given the vast distances across the desert, overcoming a digital divide related to ICT infrastructure and culturally appropriate training and use of ICT is important to sustainability in the desert (Young et al. 2005).

8  http://www.cazr.csiro.au/home.htm
Language has grown from a landscape and is the single most important link between traditional cultures and their country. People from nomadic traditions have settled in the arid zone over the past few decades of the homelands movement, wanting to be reconnected to land that their language group is associated with. This link can decrease over time as languages diminish in their use but it generally will take many generations for it to become unimportant. As well, there is a strong movement in sustainability to try and facilitate this link between cultural traditions and land as the motivations to manage the land sustainably and to act as stewards are much higher than if there is no cultural or language link. Measuring the extent of a settlement’s language link to land can be done by finding the proportion of people in the settlement whose language is closely related to that area.

2.2 Economics and livelihoods

In its broadest sense, an understanding of desert economies in Australia begins in the context of economic globalisation. One of the most pressing economic challenges for remote settlements in Australia is uneven distribution of economic opportunity across space, with the global economy favouring urban hubs, and remote regions experiencing economic challenges as a result. This is not only relevant to Australia but is a worldwide trend (Douglass 2001). A sustainability approach offers some potential in addressing this through the integration of social, cultural and ecological concerns at local and regional scales with a participatory approach (McGrath et al. 2004) leading towards local solutions to sustainability.

National economies are increasingly intertwined in global economic forces (Hurst and Thomson 1997), and how national economies negotiate this impacts on the way that places are located in national and global economies (Wiseman 1988). Increasingly, local places can connect globally and this is particularly the case for highly differentiated products that may find niches in global markets.
more than in local or national ones. This has implications for how emerging desert enterprise may interact at a global level (Karra and Phillips 2004). Australia’s response to globalisation has included market deregulation and privatisation of state-owned enterprise as well as a changed approach to the welfare state (Botsman 2001). This economic policy connected to global economic trends influences remote economies, both in terms of the restructuring of welfare as mutual obligation (for discussion see, for example Cass 2005) as well as impacts on service provision and particular industries. For example, structural adjustment in the agricultural and pastoral industries has led to the absorption of small properties into larger ones. This is connected to population loss, particularly of youth, in some rural areas, aging of the population engaged in agriculture, and service withdrawal from small towns. However, this is a complex, rather than a simple phenomenon and the pull of urban areas to attract population for services and lifestyle choice has a role to play (Rogers and Collins 2001).

Statistics demonstrate that most non-Aboriginal and Torres Strait Islander people living in the remote areas of Australia do so because of the employment opportunities offered (Taylor 2002). Where Aboriginal and Torres Strait Islander people are residing on or close to their traditional country, a range of values outside employment opportunities are important (Taylor 2002). This is clearly demonstrated in the Pilbara region where mining wealth and high income employment opportunity attract comparatively short term or fly-in/fly-out workers from outside the region (Newman, Armstrong et al. 2006). The connection between local Aboriginal people and mining employment is complex. Appropriate training and cultural sensitivity are central to increasing the opportunities for people who want to be employed in mining, and factors such as the location of opportunity and the places where people choose to live, aspirations, demographics and more, suggest that mining employment is one part of a much broader area (Newman, Stanton-Hicks et al. 2005; Taylor and Scambury 2006).

Understanding desert economies also requires considering factors that may be outside the market economy, or not yet included in it. Holmes (1997) discussed this as a transition from a productionist to a post-productionist economy, such as a move from mining and agriculture towards conservation and biodiversity, cultural heritage and tourism. There is a range of emerging opportunities for economic development outside the productionist economic paradigm (including mining and pastoral industry) with varying degrees of market integration (Holmes 1997). These include:

- Art production, which is the largest source of non-government income for many communities as well as being important culturally
- Tourism, with tourists increasingly interested in authentic Aboriginal and Torres Strait Islander cultural experiences (Northern Territory Government 2003; Reconciliation and Social Justice Library no date)
- Emerging markets, in harvesting of plants for bush foods, the nursery trade and traditional medicine, wildlife harvesting (native and feral) including for the pets trade and for consumption, and the farming of native animals such as magpie geese and crocodiles for meat and other products (Altman 2004)
- Opportunities through the negotiation of Indigenous Land Use Agreements, especially with the mining industry – including around land access, compensation, exercising of native title rights, employment and business development (O’Faircheallaigh 1999)
- Linkages to quarantine, surveillance and defence (i.e. biosecurity)
• Conservation economies based on Aboriginal and Torres Strait Islander land management practices that provide conservation value, and protect biodiversity, and are of national benefit (Armstrong et al. 2006)

• Engagement in what Altman terms the customary economic sector, including customary harvesting or land management, is not accounted for in mainstream economic measures (Altman 2005).

Altman’s hybrid economy framework describes remote Aboriginal and Torres Strait Islander economies as a hybrid of market, state and customary components and linkages. In many cases, the contribution of the state to Aboriginal and Torres Strait Islander economies is high, but is too strongly focused on state welfare provision and not active enough in supporting innovative development (Altman 2005). Approaches such as the hybrid economy framework, as well as emerging opportunities such as those above, are important to understanding economies on Aboriginal and Torres Strait Islander title land. The close-to-18% of Australia’s land mass that is held under Aboriginal and Torres Strait Islander title is mostly in the Northern Territory and the remote rangelands regions are disadvantaged in terms of location and mainstream economic opportunity (Pollack 2001; Taylor 2002). However, opportunities like those presented above offer potential towards understanding an economic framework that supports Aboriginal people to remain on their country, where that is the preferred choice. Maintenance of culture and language, opportunities for jobs, income or business development and a recognition of the ongoing benefits from customary management of land and seascapes provide a much more holistic approach to understanding remote economies on Aboriginal land (Armstrong et al. 2006). Further, such opportunities are facilitated by the re-establishment of settlement on country – even though there are tradeoffs with regards to provision of/access to services and infrastructure (Kalit and Young 1997). Finding data in this area would only be possible in close dialogue with the people involved. Finally, even though most of the Aboriginal settlements in desert areas are small, they are in most cases growing quite rapidly (Sutherland and Pritchard 2001). This is the only part of inland Australia that is seen to be increasing in population. The development of sustainable economies that work for Aboriginal people is therefore central to the sustainability of desert settlements and this must require much more consideration than simplistic economic parameters.

2.3 Governance

Governance is an ambiguous term, particularly across culture. Tension exists between western and Aboriginal systems of governance. Western governance systems have been perceived as the hierarchy of local governments, state and federal governments and the departments and policies/strategic plans that they prescribe. Obviously, consideration in the Desert Knowledge CRC projects context must also be given to community councils, regional governing structures including structures such as native title prescribed bodies corporate and also importantly to the resource agencies which provide both managerial and administrative support to Aboriginal communities. Additional consideration is also necessary to the lack of available information in regards to the many different forms of traditional governance that remain healthy, as well as the hybrids that exist between western and traditional systems of governance.

Governance is required for any settlement to work, and across culture this will require respectful attention to the changing interface between western and Aboriginal governance systems. Resource agencies have become highly skilled at this task as has been well discussed by Sullivan (1996). Shared resources need to be provided and priorities determined for infrastructure and services on an ongoing basis. This requires people to be involved in decision-making and for links to be
established to other levels of governance, especially for the funding of the settlement. In this context, it is important to highlight the distinction made by Saunders (2002) between governance as process and governance as structure. The relationships between governing bodies are critical for effective governance.

Traditional Aboriginal and Torres Strait Islander governance systems in Australia have not been formally acknowledged by mainstream society and governments due to widespread ignorance of Aboriginal and Torres Strait Islander culture (Broome 2002). The top-down approach to programs and the cycle of short-term grants limit Aboriginal and Torres Strait Islander self-governance and do not provide long term solutions (Kinnane 2002). Barriers to Aboriginal and Torres Strait Islander sustainability include ‘ingrained institutional politics, a lack of resources, and a lack of capacity building’ as well as the lack of sustained, long-term commitment (Kinnane 2002, p. 17). Aboriginal and Torres Strait Islander governance can therefore not be decoupled from a wider governance framework.

Some considerations for a broad context for discussions on governance include:

- Policy changes including the abolition of ATSIC (Aboriginal and Torres Strait Islander Commission) and the replacement of a policy of self-determination with shared responsibility
- A history of imposed governance structures
- Community confusion with regards to the above
- Limited resources for governance with too much to do.

Since the dismantling of ATSIC there has been little attention to alternative governance arrangements (Mowbray 2005). The ‘new arrangements’ in ‘Indigenous affairs’ have witnessed a move away from relying on Aboriginal and Torres Strait Islander community organisations that represent ‘sectional interests’ towards organisations such as local government which represent the mainstream (Lange 2005). Newman (2006), for example, argues that local government should be assigned to these settlements to ensure they have access to mainstream services and resources. Local government does form an institutional basis for some discrete Aboriginal and Torres Strait Islander settlements, though the relationship between the Local Government Act and Aboriginal and Torres Strait Islander governance varies across jurisdictions (Memmott and Moran 2001). Mowbray (2005) provides a comprehensive discussion about local governance arrangements for Aboriginal and Torres Strait Islander people. He notes that:

*A major risk in viewing Indigenous political representation within the paradigm of local government is the relatively circumscribed and subservient way in which that institution is conceived in Australia.*

(Mowbray 2005, p 5)

He considers the current dominant discourse about Aboriginal and Torres Strait Islander governance to be localist. This can be compared with regional discourse which has been a feature of Aboriginal and Torres Strait Islander leadership claims for some time and has also received substantial attention in academic literature. A model of regionally dispersed, layered community governance was discussed by Rowe (1994) and remains relevant. Examples of regional models are reviewed by Hunt and Smith (2005).
A major study of relevance is the Indigenous Community Governance Project (ICGP) – (http://www.anu.edu.au/caepr/governance.php). Ten key messages from the preliminary findings of the project are as follows (Hunt and Smith 2005):

1. Relationships and representation are key
2. No ‘one size fits all’: but not all sizes are equal to the task
3. Cultural match is about legitimacy in many domains
4. The cultural geography of regions forms a basis for governance
5. Institutions of governance matter
6. Leadership, leadership, leadership and succession
7. Governance matters for sustained socioeconomic development
8. The governance environment can enable or disable
9. Enhancing governance capacity requires a systems and developmental approach that is place based but acknowledges interdependence
10. Governments and Indigenous people have different criteria for evaluating governance effectiveness.

Hunt and Smith (2005) in an appendix outline the results of a self-assessment that was done by an organisation participating in the ICGP. They note that these results conclude that the organisation had developed effective and legitimate governance institutions and practice. This is exhibited by the following characteristics:

- Good role clarity and clear lines of accountability
- Experienced, honest and visionary leadership
- Strong board capacity, role modelling and consensus skills
- A culture of commitment to a shared future direction
- Positive working relationships between the Board, Chair, Executive Director, management and staff
- A harmonious working environment where staff contributions are valued
- Processes for planning and monitoring the achievement of objectives
- A balance achieved between stability and flexible responses to environmental changes
- A willingness to manage and resolve disputes within the organisation, and having procedures and appeal processes to use in such situations
- Successful consensus decision-making, followed by efficient implementation of decisions
- Respect for the organisation’s values and goals
- Adherence to a code of behaviour by Board Members, management, and staff
- A commitment to maintaining a clear balance between the organisation’s economic development goals and its community development work to ensure that enterprise success is fostered and sustained
- A high degree of stakeholder support for the organisation’s governance credibility and reputation
- Hard-working leaders, hard-working management and hard-working staff – creating a capacity to deliver.

Relationships for good governance require trust and leadership, which are both a feature of the governance culture in the case study community (Hunt and Smith 2005). Measham et al (2006) speak about the importance of partnerships in governance.

9 A Canadian assessment model was adapted for this process.
Research findings from the Harvard Project in the United States support the findings of the ICGP. The five key characteristics that enable success for Indigenous governance identified through the project include:

- Sovereignty: as a necessary but not sufficient condition
- Good governing institutions: a stable bureaucracy that separates politics from business management and is efficient and effective
- Cultural match: institutions that match and have legitimacy with contemporary Indigenous cultures are more important than institutions that have legitimacy with State and Federal governments
- Strategic orientation: a move away from welfare band-aid approaches is necessary for the creation of long-term vision
- Leadership: investment in leadership to take responsibility for decision making (Cornell and Kalt, 1998).

McGrath’s (2006) conclusions outlined below are of particular relevance:

- Governance is needed for both local and regional scales for Indigenous people in arid regions. An analysis must include both these levels.
- There is need to also consider the wider governance environment that affects both process and structure of local and regional Indigenous governance.
- The diversity of governance forms arising from hybrids of diverse Indigenous customary governance and imposed Western forms complicates the analysis of types of governance. This also makes comparison between regions difficult. However, the sharing of analysis between regions is useful in terms of learning. It may be possible to compose general types but this could only occur through a participatory approach in communities and in analysis.

2.4 Health and Education

The well-known link between health and education is the justification for putting them together within the same section, but the individual issues that require particular attention for the arid zones are discussed separately.

2.4.1 Health

All settlements need basic health care which is central to enable a sustainable future. Scougall (2006) locates health at the basis of a pathway towards sustainability for Aboriginal and Torres Strait Islander communities, as part of the requirements for a safe community:

To be safe and secure is to be protected from harm. In a safe community the most vulnerable (especially children) feel loved, nurtured and healthy. They are well fed and clothed and free from deprivations such as cold, hunger and the worst consequences of abject poverty. People are protected from preventable environmental health diseases and illnesses and there are measures in place to ameliorate the more destructive forms of social behaviour, such as substance abuse and all forms of violence. A community where anxieties about personal safety are beginning to diminish provides an environment that is more conducive to the development of trusting interpersonal relationships (Scougall 2006, p. 4)

Prior to European settlement, Aboriginal and Torres Strait Islander Australians had good environmental health management and health practices (Jardine-Orr et al. 2003). However, since then, housing and environmental health have become inextricably linked, as inadequate housing
has contributed to poor health (Urbis Keys Young 2002; Jardine-Orr et al. 2003). Furthermore, Aboriginal and Torres Strait Islander Australians are socially marginalised from access to services, including health care. Small communities generally do not have health clinics as their small population means that they do not meet the funding criteria. However, these communities are not always aware of the disadvantages they experience; for example, only 4% of small communities in Western Australia listed inadequate health services as a major health concern (Environmental Health Needs Coordinating Committee 2005).

Australians in rural and remote locations have higher rates of mortality, homicide, suicide and diabetes, than those living in metropolitan areas (ABS and AIHW 2003). There are also higher levels of health risk factors (e.g. smoking, alcohol misuse) and increased risk of injury due to dangerous primary industry occupations and driving long distances on poorly maintained roads. These rates tend to increase with remoteness. The inaccessibility of health services, especially specialised health services, often results in longer travelling distances and increased waiting times, which can reduce early diagnosis and treatment.

Health is also very closely associated with other key elements of social infrastructure. The key factors that influence health are housing, education and employment outcomes (Alice Springs Town Camps Review Task Force 2006). Employment opportunities are also linked to education, language, health and social issues such as substance dependence and criminal conviction.

According to the review of the Alice Springs Town Camps Task Force (2006), the large number of visitors and poor living conditions lead to overcrowding. This, in addition to high unemployment levels, alcohol misuse and youth truancy, fuels family tension. Until these underlying issues are dealt with, the high levels of violence that occurs will continue. Effective community patrol programs in conjunction with regular policing can potentially contribute to early intervention and prevention of anti-social behaviour and conflict. The Tangentyere Council has suggested that alternative service delivery arrangements are required to improve access to health and education for Alice Springs town camp residents (Alice Springs Town Camps Review Task Force 2006).

In contrast to the significant improvements in the health of Indigenous peoples in New Zealand (NZ) and North America (Ring and Elston 1999), Aboriginal and Torres Strait Islander Australians have three times the illness and mortality rates of non-Aboriginal and Torres Strait Islander Australians (ABS 2006). The success of the NZ Maori health service has been attributed to it being embedded within a wider range of holistic services, such as education, culture, social and economic issues (Ring and Elston 1999). A successful Australian example of this is the ‘school means pool’ program in remote Aboriginal WA communities, which links education, recreation and social issues to health (Marley and Burke 2006). The World Health Organization (WHO) has also found that health outcomes that increased life expectancy by 15 – 20 years in some countries were achieved at relatively little cost (WHO 2000). These programs focused on providing a minimum level of all health services, food, education, an adequate supply of clean water and basic sanitation.

Most health factors of importance are measured. The main sources of information are available from surveys carried out by the ABS, the Australian Institute of Health and Welfare (AIHW), and the Telethon Institute for Child Health Research (TICHR). The AIHW is Australia’s national health and welfare statistics and information agency, and provides information on the availability of health services and health professionals. They have recently compiled a comprehensive report of rural health issues compiled against indicators (AIHW 2005). These include social issues, risk factors, health aspects and available health services. This report attempted to disentangle the effects
of Aboriginal and Torres Strait Islander health from the effects of remoteness on the health of populations in different areas. Where differences occurred due to sex or age, and when permitted by available data, these details were reported separately. The data derived for this report were obtained from national data sets and surveys (e.g. ABS Census of Population and Housing, National Health Labour Force Surveys, the National Health Survey, the Survey of Mental Health and Wellbeing of Adults, the National Nutrition Survey, the Child Dental Health Survey) and administrative data sets (Medicare, Pharmaceutical Benefits Scheme, Hospital Morbidity and Hospital Establishments data). The shortcomings of the data include restricting the analysis to remoteness categories, and in some cases, as with the use of the ABS National Health Survey (ABS 2006), data were only available for regional and not remote areas, as well as having a lot of unavailability of data and out of date data.

2.4.2 Education

Access to education services (primary, secondary, tertiary) in desert settlements is severely constrained. Only a little over half of the 125 communities across the desert with populations over 50 or more have access to a primary school in their community. Half of the 332 communities with populations fewer than 50 have a primary school within 50km of the community. Generally, the higher the level of education, the less likely it is available for discrete desert settlements – only eight of the 125 communities with populations over 50 have access to a senior secondary school (Trewin 2001).

Even when educational services are available, school attendance falls short of expected levels. In Alice Springs town camps, the key factors that contribute to poor school attendance by Aboriginal children are overcrowded and inadequate housing, poor nutrition, social issues (e.g. domestic violence, alcohol misuse and substance abuse), language barriers and absence of parental involvement in education (Alice Springs Town Camps Review Task Force 2006). The ‘school means pool’ program in Jigalong, WA resulted in higher school attendance with a concurrent decrease in crime and substance abuse, when the pools were open in summer (Education and Health Standing Committee 2005).

Guenther et al. (2005) reviewed Vocational Education and Training (VET) and Adult and Community Education (ACE) across the desert region. They highlight the need for pathways that do not block people who cannot meet particular literacy standards, especially in education and health areas. They also point to the need for education and training that connect to the livelihoods of Aboriginal people living in remote areas. This may include a focus on broad skills rather than specialised ones, with small scale economies offering fewer opportunities for specialisation, as well as recognition of local people, local issues and local opportunities. They highlight high engagement in creative arts training programs which is linked to both economic and cultural recognition of the value of creative arts. They also emphasise the need for an enhanced capacity to integrate western and Aboriginal understandings in the VET and ACE education systems (Guenther et al. 2005, p. 30).
2.5 Infrastructure, transport and environmental health

Many rural and remote communities, both non-Aboriginal and Torres Strait Islander and Aboriginal and Torres Strait Islander, are disadvantaged due to limited access to services such as environmental health (water, power and sanitation), health, education, transport, police, welfare, banking and shopping. These services have been lost or rationalised in rural and regional Australia due to the centralisation of government agencies and businesses (e.g. banks) to areas of greatest population demand, which has a disproportionate negative impact on these communities (Barraket 2001; Taylor 2002; Mission Australia 2006). Poor roads and a lack of transport options also impact directly and indirectly on health, employment and education (Mission Australia 2006). The settlement size threshold of provision of a store or administrative building appears to be a population of at least 50 people (Taylor 2002). In 1999 there were 62 remote and 553 very remote discrete Indigenous communities with total estimated populations of 2610 and 41,700, respectively, that are located over one hour’s drive from the service centres that banking is accessed from (Taylor 2002). Alice Springs in particular is the service centre for 260 central Australian communities (Alice Springs Town Camps Review Task Force 2006).

Nearly 30% of Aboriginal people in remote desert Australia report difficulty in accessing transport to the places needed (Trewin 2001). This has an impact on school attendance rates (given distance between communities and schools) and ultimately on the long-term future of these settlements. It takes two and a half hours to reach a major centre from a desert community on average – affecting access to all services. Remote Aboriginal people have high mobility. According to the Community Housing and Infrastructure Survey in 2001, 25 to 30% of the people in a settlement, on average, were mobile within a one-year period (Trewin 2001). Remoteness and transport are obviously linked. Transport is the necessary link back to many important services if they are not provided locally. The reverse is also true – if more services were provided locally then there would be less need for transport. At present the repair and maintenance of roads in remote areas is a highly contentious topic. For long-term sustainability this will need to be worked out with a proper governance structure and funding. Part of the solution is the better provision of services so that travel is needed less.

2.5.1 Housing and community facilities

Most housing infrastructure on discrete Indigenous communities is owned and managed by Indigenous Housing Organisations. Around one in ten houses are in need of replacement and one in seven in need of repair. Significant issues to do with homelessness and overcrowding – with impacts on health and wellbeing – are well documented (see, for example Jardine-Orr et al. 2002). Furthermore, the highest single cause for dwellings to be unoccupied is the need for major repairs. This would help relieve the housing shortages (Environmental Health Needs Coordinating Committee 2005).

Presence of community facilities varies across settlements and across jurisdictions (Trewin 2001). The majority of larger desert communities have at least one community facility, usually as part of the administration. Other facilities may include meeting halls, training centres, childcare centres, arts centres and youth facilities. Many small desert communities are still in need of such facilities.
2.5.2 Environmental health

The National Environmental Health Strategy (1999, p. 3) defines environmental health as ‘(t)hose aspects of the human health determined by physical, chemical, biological and social factors in the environment’. The provision of basic services to Aboriginal and Torres Strait Islander communities has long been a contested issue. In most Aboriginal and Torres Strait Islander communities, including Alice Springs Town Camps, environmental health services are not provided by the local council. Approximately 30% of the Northern Territory’s central Australian population live in remote and very remote communities that lack adequate access to a range of services (Alice Springs Town Camps Review Task Force 2006).

In 2004, a survey was carried out to determine the environmental health needs of 274 discrete Aboriginal communities in WA. This measured indicators relating to housing, water supply, electricity, sanitation, dust, dog control, disposal of solid waste, emergency management, telecommunications, disabilities, nutrition and language (Environmental Health Needs Coordinating Committee 2005). This survey provides detailed information at a community as well as at a regional level. Some of the major findings are:

- In WA, 85% of Aboriginal communities are not connected to a town water supply, with 87% of small communities (usual population below 20) without water treatment for their drinking water.
- While nearly all of the communities surveyed had access to electricity, those not connected to a town supply (78%) suffer regular power interruptions.
- Out of a total of 2451 permanent dwellings that were surveyed, 93% were classified as ‘adequate’ as they were connected to the three essential services of water, power, and sanitation, an improvement on the 68% in the 1997 survey.
- It is more likely that households in smaller communities are dissatisfied with their dwellings, than large communities (58% versus 36%).
- Adequate sewage was not available in 20% of communities, which was more likely to be in smaller communities.
- Very few communities have programs or infrastructure to reduce dust levels, which can exacerbate ear, nose and skin infections.

While this survey shows significant improvements, mainly in the larger communities (with population above 100) since the 1997 survey, many communities still do not have access to officers that provide environmental health services, basic maintenance services and maintenance of essential services (Environmental Health Needs Coordinating Committee 2005). While mainstream town councils use rates generated from residents and businesses to help pay for their employees and provision of services, Aboriginal settlements have no rate monies to draw from, and other funding is sporadic and often difficult to obtain, meaning that they cannot pay for the equivalent council workers and municipal services (Gardener 2005). However, many local authorities receive a large proportion of their funds from state and federal government sources and just do not direct them to Aboriginal settlements. Therefore, communities often rely on staff whose wages are subsidised by CDEP (Community Development Employment Projects) to provide environmental health and other services.
2.5.3 Energy

More than half of discrete Indigenous communities with populations over 50 were connected to the State/Territory electricity grid at the time of the 2001 Community Housing and Infrastructure Survey (Trewin 2001) with most of the remainder having diesel generators. By contrast, one in ten smaller communities had no generators, with the remainder using solar/alternative energies (Young et al 2005). The availability of energy is a critical issue, not only for technologies such as computers, but also for water, cooling, heating, cooking, and lights. Interruptions to supply and the quality of energy in desert settlements are notoriously bad, with many desert settlement reporting significant interruptions to power supply over the previous year. The quality of power is crucial for sensitive technologies such as computers. ‘Dirty’ power impacts on this, but power quality and impacts on ICT infrastructure and maintenance are generally overlooked (Trewin 2001; Guenther et al. 2005)

2.5.4 Water

In discrete desert communities the majority of discrete Aboriginal settlements rely on bore water which in turn relies on access to generators or solar pumps. More than one-third of discrete communities with populations over 50 reported experiencing water restrictions in the last 12 months (Trewin 2001). Shortage was attributed to equipment breakdown. Issues with respect to water supply include:

- distance from service suppliers
- access to parts
- lack of readily available technical expertise
- institutional governance regimes compound the issues – complex myriad of State/Territory, federal, private and local agencies assuming various degrees of responsibility for varying aspects of essential services infrastructure and maintenance regimes (Trewin 2001).

2.6 Natural environment

Historically the natural environment had been the key factor in establishing any settlement in the first place and determines to a large extent what settlements are. The physical state of the environment which supports all functions of a settlement is a critical aspect of sustainability. The natural environment also has a spiritual dimension for the people who are born or live there, which is felt particularly strongly by Aboriginal and Torres Strait Islander people. The connection to ‘country’ also brings rights, aspirations and obligations to the land. According to Kinnane (in Murdoch University 2006, p. 2), it is ‘a model with similar concepts of stewardship and localised responsibility as related within sustainability’.

The fragility of the natural environment and the fact that it can easily be irreversibly and negatively affected by inappropriate human activities is not a new concept but we still witness developments and projects that strain nature’s physical boundaries. The desert region of Australia is particularly susceptible to this. Aboriginal concepts of country often act as a counter-point to mainstream economically driven development. Understanding the physical link between the functions of settlements and the characteristics of the natural environment should provide the starting point for their sustainability.
2.6.1 Defining the desert region

Deserts are classified by a number of key characteristics including low rainfall, desert vegetation and landforms as well as remote and sparsely distributed human population. The most commonly recognised boundary for the desert is based on average annual rainfall bound between 250mm in the south, up to 800mm in the north, and 500mm in the east ¹⁰ (see Figure 6).

Figure 6: Average Rainfall Annual


Rainfall data is collected from an extensive network of locations on behalf of the Bureau of Meteorology¹¹ (refer to Figure 6). This data is then categorised into a ‘regional rainfall time series’ and is available in regions based on states and the following six regions:

- South – south of 26°S
- Northern – north of 26°S
- Northwest – southwest of line adjoining 30° S, 115° E and 35° S, 120° E
- Southeastern Australia – south of 33° S, east of 135° E
- Eastern – Qld, NSW (including ACT), Vic, Tas
- Murray Darling Basin.

Data for this is available as ‘raw data’ and ‘sorted data’ for the purposes of research and education. However, this data must be used with a few considerations in mind. Firstly, the Bureau of Meteorology’s webpage states that these regions are based on ‘climatological distinct’ regions. For instance, the Southeastern Australia region is based on state governance regimes alone. While government jurisdiction may not have a direct impact on how the information is collected, it does have impacts on the way it is packaged, understood and the kind of policies that are then established. Secondly, rainfall does not fall consistently but occurs sporadically; an average annual rainfall can occur in a 24-hour period. Rainfall, along with fire, is also a major determinant of the amount and composition and vegetation type.¹² Rainfall and fire are key indicators for desert environments (Landlands et al. 2006; Westbrooke et al. 2005). Thirdly, this information is based on a northern European approach to understanding the environment; one which relies heavily on the seasons of summer, autumn, winter and spring. In an attempt to integrate western scientific knowledge and Aboriginal and Torres Strait Islander knowledge systems, the Bureau of

Meteorology has established an Indigenous Weather Knowledge section. Intellectual property issues are handled through the insertion of text on the webpage which indicates that permission to use the seasonal calendar is vested in the community, and in some cases an individual person’s name appears.

2.6.2 Ways of classifying and managing country/environment/natural capital

There are different ways of classifying and managing country. Under a western scientific classification system desert landforms range between: foothills and alluvial planes; timbered planes; salt lakes and spinifex grasslands. In the desert regions of Australia, European settlement has had a great impact, including through the introduction of exotic species (Barrett 2006). In addition, classification systems, policies and governance regimes have also influenced the biota and the way it is understood. For example, the Lake Eyre Basin ‘covers approximately 1,170,000 square kilometres of arid and semi-arid Central Australia, which represents 17% of the continent’ (Department of the Environment and Heritage 2004, n.p.). It stretches across New South Wales, South Australia and Queensland. Information for this needs to be collected and managed. Given the importance of the drainage system, The Lake Eyre Basin Intergovernmental Agreement was established with the state governments of Queensland, South Australia and the Federal government signing it. The influence of recognising the importance of the Murray–Darling Basin is evidenced in its inclusion as a climatologically distinct region in the Bureau of Meteorology’s rainfall regions. The Lake Eyre Basin does not have such distinction, and nor does the Gascoyne–Murchison catchment in Western Australia.

Given the diversity of knowledge systems of desert regions of Australia, the establishment of partnerships based on good communication is an essential element in creating livelihoods. CSIRO CAZR has an extensive research history of arid lands, has a working relationship with pastoralists and with DKCRC, and should be considered in the negotiation of stakeholders.

2.6.3 Scenario planning and climate change

In scenario planning, climate change is a crucial factor to consider. The impacts of climate change are not uniform over the Australian landscape. As the map on Figure 7 indicates, for the last 100 years some of the southwest region of Western Australia, Tasmania, and western parts of Queensland have all seen a decline in rainfall, while most of the desert regions have seen an increase in annual rainfall.

Figure 10: Australian Climate Variability and Change

From this data, it is scientifically safe to assume that rainfall is likely to increase over the next 100 years. Such a significant increase in rainfall would have significant changes on the biota and thus on desert settlement livelihoods. The selection of livelihood projects from the sustainable settlement typology aimed at understanding sustainability from a settlement scale might investigate ways that individuals, families and organisations monitor rainfall. The establishment of a project based on the installation and use of settlement rain gauges, for example, may prove a useful tool for capacity building, with education as a common ground for bringing together different knowledge systems.

2.7 Data and the Sustainability of Desert Settlements

Taylor (2003a) highlights the importance of data in order to have a baseline from which to monitor change. A ‘shift in public policy towards evidence-based, outcome-oriented, equity-driven planning’ which ‘has highlighted the need for accurate demographic data and small area levels’ is emphasised (Taylor 2003a, p. 9). Yet there are some core issues with regards to the accuracy, cultural relevance, access and ownership of data as well as ethics and research protocols that need to be considered (Taylor 2003a, p. 13):

Standard social indicators only report observable population characteristics. They reveal nothing about more behavioural population attributes such as individual and community priorities and aspirations for enhancing quality of life, or attitudes to education, health and employment. Nor do they adequately capture the complexity of social arrangements between individuals, families and households.

A brief review of relevant literature identifies the following as some of the core issues with regards to data accuracy:

- Comparability of different data sets when the scales at which they are collected and collated do not necessarily correspond (Taylor 2003a; Maru et al. 2006);
- Accuracy of data such as census data for Aboriginal and Torres Strait Islander people is questionable due to factors such as interpretation of questions, choice to self identify as Aboriginal and Torres Strait Islander, a mismatch between mobility in Aboriginal and Torres Strait Islander settlement systems creating a false snapshot in time, and undercounting (Taylor 2003a; Guenther et al. 2005);
- Questionable value of many data sets that are only collated at the national, state and remoteness area level in informing policy and holding policy makers accountable, when the current policy focus is very much on individuals, families and communities (Taylor 2006a).

Taylor (2003a) highlights the limited capacity of social indicators to represent the social and economic wellbeing of Aboriginal and Torres Strait Islander people meaningfully. The census is designed to provide a measure of mainstream Australian life, and this is not able to correspond directly to Aboriginal and Torres Strait Islander livelihoods. An example with regards to economic status is expanded as follows. Taylor (2006a) provides a review of some of the cultural issues around indicators of wellbeing and Aboriginal and Torres Strait Islander people. He highlights the importance of ‘improving representations of Indigenous culture in formal reporting frameworks’ (2006a, p. 4). Taylor also notes that Aboriginal and Torres Strait Islander peoples are diverse across Australia, therefore it is likely that no single set of particular indicators can be defined. Ideally such indicators would be relevant to policy as well as to Aboriginal and Torres Strait Islander people.
Whilst a negotiated process is most appropriate for determining indicators within this recognition space, some examples of the types of indicators that might be included are:

- Aboriginal and Torres Strait Islander cultural studies in curricula, and Aboriginal and Torres Strait Islander involvement in design and delivery of curricula
- Participation in cultural activities
- Access to traditional lands
- Governance – leadership, self-determination, capacity building, cultural match
- Aboriginal and Torres Strait Islander language use
- Observance of Aboriginal and Torres Strait Islander protocols
- Cross cultural training programs
- Caring for country
- Level of support for Aboriginal and Torres Strait Islander housing preferences.

Following such an approach requires both ‘more than just a recognition of difference – it requires the development of models of bi-cultural or partnership research involving negotiated design, methodologies and outcomes’ (Taylor 2006a, p. 9), with measures of success based on Aboriginal and Torres Strait Islander frameworks: ‘part of the means to this lies in ensuring effective full participation of Indigenous people in all stages of data collection and analysis as an essential component of participatory development practice’ (Taylor 2006a, p. 9). There will always be reductionism and a translation in cross-cultural settings, but ‘what is important to ensure is that this reductionism is negotiated and that the sets of indicators developed are seen as legitimate and appropriate by all stakeholders’ (Taylor 2006a, p. 9).

Data accessibility and ownership are also important considerations in the use of indicators. There is a requirement to gain consent to access from non-government and increasingly so for government information, which in turn relies on consent from community representatives. Confidentiality issues, under-reporting and bureaucratic systems mean that there are core problems in accessing data for basic indicators at finer scales (Taylor 2006a) and ‘confidentiality, ethics and access issues need to be dealt with up-front as a key element of partnership discussion regarding the formation of information systems’ (Taylor 2003a, p. 14). In addition, there is an increasing awareness of the need to develop locally based and locally controlled data sources to support Aboriginal and Torres Strait Islander governance (Taylor 2006a). There is clearly a power dynamic here with capacity to access and analyse data sets greater for government and other institutions, than it is for Aboriginal and Torres Strait Islander individuals or community organisations. Also, with the demise of ATSIC there is a loss of a national Aboriginal and Torres Strait Islander bureaucracy to maintain and analyse relevant data sets.

Any notion of data compilation has distinct ethical implications. According to Taylor (2006a, p. 8):

*We should be mindful that from an Indigenous perspective the very notion of measurement may carry with it the spectre of state control, and that the implications of who is measuring what, for whom, and to what end is crucial.*

As Taylor highlights, overall there has been too much information gathering and interpretation from outsiders to Aboriginal and Torres Strait Islander communities. Aboriginal and Torres Strait Islander control in the development of indicator sets that seek to reflect their wellbeing, as well as support for Aboriginal and Torres Strait Islander capacity to develop, maintain and control local data sets where relevant, are central to ethical practice. The capacity of government (external) indicator frameworks to understand socioeconomic conditions in the most remote settlement is
questionable – within their own terms of reference, let alone from the perspective of Aboriginal and Torres Strait Islander people who choose to live there. A broader question is whether freedom of choice and self-determination or the achievement of statistical equality should be the aim of such frameworks (Taylor 2006a). These issues were stressed at a recent international Conference on Poverty and Indigenous peoples where it was asserted that:

Conventional economic indicators used to measure poverty reflect neither the true extent of poverty nor the degree of Indigenous peoples’ wellbeing. These indicators, for example, do not capture Indigenous peoples’ values. The formulation of development indicators is a very sensitive and subjective issue and should be taken with the full participation of Indigenous peoples. It may prove more meaningful to develop ‘indicators of wellbeing’ rather than ‘indicators of poverty’.

(Schrader 2006)

There are no national indicators that inform settlement sustainability in arid Australia or of the health and wellbeing of a region in arid Australia. Ideally, settlement sustainability would be measured on a settlement by settlement basis, taking into account relevant factors that are unique to each settlement. Incorporating all possible relevant factors would mean that the impact of any specific factor is likely to lessen; however, the aim is to achieve an optimal representation of sustainability.

2.8 Conclusions

Overall, the task of suggesting a typology for site selection for the Desert Knowledge Cooperative Research Centre Sustainable Settlements Project has been a complex one. There is not enough data currently available to come close to suggesting a typology that can support an understanding of sustainability, and we are strongly of the view that to do this requires participation and negotiation with desert people. The methodology that we have proposed for the iterative development of the preliminary typology sets out a process for doing this. The invitation to tender for this project states that:

... literature suggests that key characteristics of a sustainable desert settlements typology include settlement size, proximity to a major town and associated resources and infrastructure, good governance arrangements, stability of population, health status and livelihood opportunities. The absence of any of these attributes can signify settlement fragility or vulnerability. The history of a settlement and sense of place are also important influences on settlement sustainability.

(DKCRC 2006)

We have also identified additional themes, including knowledge, language and communication. Whilst a review of literature provides more detail around these themes, data availability complicated their application in our preliminary typology for site selection. For example, data on health is only available at remoteness levels, and governance is difficult to accommodate into the framework of a typology. Further quantitative and qualitative data sourcing and analysis, either prior to or following site selection, could help to rectify this, and is discussed in the methodology that we suggest for iterative development of the typology.

In conclusion, it is important to highlight the importance of Aboriginal, local and scientific knowledge as key components in defining and understanding sustainability and sustainable settlements, and communication and dialogue is required across these knowledges. Aboriginal co-researchers are central to this process of communication.
<table>
<thead>
<tr>
<th>Category</th>
<th>Capital City (CC)</th>
<th>Identifiers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>URBAN (U)</strong></td>
<td>Metropolitan Developed (D)</td>
<td></td>
</tr>
<tr>
<td>Population more than 20,000</td>
<td>Part of an urban centre of more than 1,000,000 or population density more than 600/m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small (S)</td>
<td>Up to 30,000</td>
</tr>
<tr>
<td></td>
<td>Medium (M)</td>
<td>30,001-70,000</td>
</tr>
<tr>
<td></td>
<td>Large (L)</td>
<td>70,001-120,000</td>
</tr>
<tr>
<td></td>
<td>Very Large (V)</td>
<td>More than 120,000</td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td>Regional Town/City (R)</td>
<td></td>
</tr>
<tr>
<td>Population density more than 30 persons/km²</td>
<td>Part of an urban centre with population less than 1,000,000 and predominately urban in nature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small (S)</td>
<td>Up to 30,000</td>
</tr>
<tr>
<td></td>
<td>Medium (M)</td>
<td>30,001-70,000</td>
</tr>
<tr>
<td></td>
<td>Large (L)</td>
<td>70,001-120,000</td>
</tr>
<tr>
<td></td>
<td>Very Large (V)</td>
<td>More than 120,000</td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td>Fringe (F)</td>
<td></td>
</tr>
<tr>
<td>99% or more of LGA population is urban</td>
<td>A developed LGA on the margins of a developed or regional urban centre</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small (S)</td>
<td>Up to 30,000</td>
</tr>
<tr>
<td></td>
<td>Medium (M)</td>
<td>30,001-70,000</td>
</tr>
<tr>
<td></td>
<td>Large (L)</td>
<td>70,001-120,000</td>
</tr>
<tr>
<td></td>
<td>Very Large (V)</td>
<td>More than 120,000</td>
</tr>
<tr>
<td><strong>RURAL (R)</strong></td>
<td>Significant Growth (SG)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>An LGA with population less than 20,000</td>
<td>Average annual population growth more than 3%, population more than 5000 and not remote</td>
<td></td>
</tr>
<tr>
<td><strong>AND</strong></td>
<td>Agricultural (A)</td>
<td></td>
</tr>
<tr>
<td>Population density less than 30 person/km²</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small (S)</td>
<td>Up to 2,000</td>
</tr>
<tr>
<td></td>
<td>Medium (M)</td>
<td>2001-5,000</td>
</tr>
<tr>
<td></td>
<td>Large (L)</td>
<td>5,001-10,000</td>
</tr>
<tr>
<td></td>
<td>Very Large (L)</td>
<td>10,001-20,000</td>
</tr>
<tr>
<td><strong>AND</strong></td>
<td>Remote (T)</td>
<td></td>
</tr>
<tr>
<td>Less than 90% of LGA population is urban</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extra Small (X)</td>
<td>Up to 400</td>
</tr>
<tr>
<td></td>
<td>Small (S)</td>
<td>401-1,000</td>
</tr>
<tr>
<td></td>
<td>Medium (M)</td>
<td>1,001-3,000</td>
</tr>
<tr>
<td></td>
<td>Large (L)</td>
<td>3,001-20,000</td>
</tr>
</tbody>
</table>
References

ABS — see Australian Bureau of Statistics
AHURI — see Australian Housing and Urban Research Institute
AIHW — see Australian Institute of Health and Welfare


DIA — see Department of Indigenous Affairs (Western Australia)

DKCRC — see Desert Knowledge Cooperative Research Centre


Desert settlement typology: Preliminary literature


Jardine-Orr A, McGrath N, Spring F and Anda M 2002, Indigenous Housing and Governance in WA and NT, Bibliography, Australian Housing and Urban Research Institute, Melbourne and Remote Area Developments Group, Murdoch University, Perth.


OECD — Organisation for Economic Co-operation and Development


WHO — World Health Organization


