Technologists in Remote Aboriginal Communities: A Regional Approach for Community-building Technology

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DECLARATION

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

[Signature]

Martin Anda
LIST OF PAPERS PUBLISHED

Papers published by the author leading to the completion of this Ph.D.:

1. **Referred papers**

1 (a). **Non-refereed papers**

2. **Referred conference papers**
   Anda M, Mathew K & Ho G (1990), Communal Ablutions Facility for Aboriginal Outstations, in Mansell DS, Stewart DF & Walker BW (eds), Proceedings of the UNESCO Regional Seminar on *Technology for Community Development in Australia, South-East Asia and the Pacific*, Alice Springs, 9-11 July. Development Technologies Unit, University of Melbourne/Centre for Appropriate Technology.

2 (a). **Conference papers**
   Anda M, Mathew K, McGrath D & Ho G (1989), *The Remote Area Hygiene Facility*, in Anda & Ho (eds), *ibid*.
   Anda M & Ho G (1991), *The Development of an Ablutions Block Design for Remote Communities - Appropriate Technology?*, Conference on *Environmental Health in Developing Communities*, October 2-4, Pundumurra College, South Hedland.
Technologists in Remote Aboriginal Communities


3. Reports.


4. Videos

Anda M (1991), *The Remote Area Hygiene Facility*, video - 30 minutes, Murdoch University, Perth.


Anda M, Bygott R & West M (in preparation), *Permaculture for Dryland Aboriginal Communities*, (video: 20 mins approx.), RADG/Bard Films, Murdoch University.
ABSTRACT

This study developed from technical research and development of an ablutions facility for remote Aboriginal communities by the author. The poor state of environmental health and essential services in these communities were the inspiration for the study and are described in the context of current and emerging approaches to service delivery in Western Australia. The fieldwork associated with the deployment of the ablutions facility provided the opportunity to conduct research into these approaches by technologists and has resulted in both the evaluation of the ablutions facility and formulation of Appropriate Technology approaches to service delivery using grounded theory methodology.

Contained within the ablutions facility, known as the Remote Area Hygiene Facility (RAHF), were several discrete technologies also under development by the author and associates: a plastic solar water heater, a pour-flush toilet and an evapotranspiration wastewater disposal system. The technical appropriateness of these artefacts was assessed through action research trials in Aboriginal town camps and there were both successes and failures in this dimension of technology-practice. The structural design of the RAHF changed considerably over the period to meet the requirements of the users. The trials found that the solar water heater was able to function as required in the short term, but further development was required to provide suitable plastic components for continuous operation at high temperatures and under ultraviolet irradiation. The pour-flush toilet met all of its technical objectives, but further development was required to produce a durable, low-flush cistern. The evapotranspiration trench performed entirely satisfactorily and was thereafter implemented at other sites throughout Western Australia.

The fieldwork combined with a review of Appropriate Technology, community development and aid projects in developing countries inspired a concept to address the social and cultural dimensions of technology-practice: Community-building Technology. Community-building Technology is a simultaneous process of service delivery and empowerment which introduces technology to a community by means of training programs, community participation in construction projects, or cultural activities. One RAHF project was able to validate this concept. As a result of the fieldwork becoming an exercise in service delivery the establishment of regional, Appropriate Technology, training and manufacturing centres was attempted. One centre was established, but the attempt was unsuccessful at the other two sites. Additional fieldwork was conducted by the author to determine the requirements for regional technology information services. This ongoing work with remote Aboriginal communities motivated the development of two further concepts complementary to the first: Community Technology and Regional Technology. The former required the establishment of an ensemble of integrated technologies within a community and could not be validated within the scope of the study. However, some
legitimacy could be shown for the latter through a review of approaches in central Australia, the aspirations of some regional organisations in WA, and the successful establishment of the Remote Area Technology Centre as a regional Appropriate Technology agency. Finally, the strength of these three concepts was found to be as components of an integrated framework for sustainable service delivery, management, and maintenance in remote Aboriginal communities which combined the resources of a number of communities in a region. This improved mode of technology-practice, the integrated framework, is termed Regional Technology.
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PREFACE

It was January 25, 1985 and our group of Australian *brigadistas* in the mountains of Nicaragua were about to finish our lunch and return to picking coffeebeans in the plantation. A young Australian from Tranby Aboriginal College in Sydney stood up and addressed the 40 or so of us. Back in Australia today, he told us, people were celebrating 'invasion day'; the day nearly 200 years ago when the oppression of indigenous Australians began and continues today.

I was shocked. This suburban boy from Perth had never heard of that term for Australia Day before. In school we were taught about the 'noble savage' of the past with loincloth and spear. In fact, I had been overwhelmed when only six months before, prior to flying to Central America, I had ridden my motorcycle to Sydney across northern Australia and was astounded at the vast numbers of Aboriginal people in places like Port Hedland, Darwin and Borroloola. Nobody had informed me of the massive numbers of Aboriginal people that remained. The bedraggled appearance of many and the poor housing in some places confused me.

As an engineer, disillusioned with conservative professional practice, I had travelled to Nicaragua to see if I could assist in community development and learn more of this vague concept of Appropriate Technology. As a naive, suburban boy I was infuriated at the military aggression launched against a new government that appeared to be involved in such a just project of reform for its country. But to say that Australia was 'invaded', and recalling those images of northern Australia was too confronting. Upon returning to Sydney I joined the Committee to Defend Black Rights and took up studies in history and sociology.

Two years later, with an empty wallet and bank account, I returned to Perth and joined the Remote Area Developments Group (RADG) in 1988 to conduct an Honours research project to develop a plastic solar water heater for Aboriginal outstations. This was my introduction to Appropriate Technology as an engineer in a practical capacity. At the same time research and development was being conducted within the Group on an evapotranspiration wastewater disposal system and pour-flush toilet. These three artefacts were included in an ablutions block design - the Remote Area Hygiene Facility (RAHF) - derived from the (Appropriate Technology Ablutions Facility) ATAF manufactured by the Centre for Appropriate Technology in Alice Springs. This could then serve as a vehicle to enter an outstation to conduct fieldwork with a people-centred approach, a philosophy that sought to involve the recipient community at each stage and my supervisors suggested that this could form the basis of Ph.D. research project. This was the point at which I enrolled for a Ph.D.
RADG was asked in 1990 to provide four of the units to a fringedweller camp at Kalgoorlie. Before this project was completed I was asked to build ten further units in a fringedweller camp at Halls Creek. In retrospect, I should have stayed in Kalgoorlie long enough to fully understand the community's social dynamics and to participate in further developments. I had begun to know some of the local Aboriginal people quite well. However, in excitement at the apparent success I charged up to Halls Creek and built a demonstration unit with camp residents and arranged prefabrication of the remaining units at Pundulmurra College.

During this time I also assisted Dr Bruce Walker of the Centre for Appropriate Technology with fieldwork for the Human Rights and Equal Opportunities Commission' National Water Study (Race Discrimination Commissioner, 1994). I supported Bruce on the visits to Punmu, Coonana, Doomadgee in Queensland and Boigu and Coconut Islands in the Torres Straits. This involvement provided me with insights on conditions in communities across Australia. Conditions varied considerably between communities, but there were similarities in the underlying approaches to technology and service delivery fostered by State and Federal Governments.

After the first RAHF had been built at Halls Creek I was offered a position at Pundulmurra College in 1991 as Pilbara Region Coordinator of the Aboriginal Environmental Health Worker Training Program (EHWTP). This was difficult to refuse, as the job would give me a vast amount of experience and exposure to Aboriginal communities. Again, the opportunity was lost to fully immerse myself in the Halls Creek community and see the process through to project outcomes several years down the track, but after leaving the EHWTP I visited the project several times to complete outstanding work and this provided an opportunity to interpret what had happened. After 14 months of very satisfying work with the Environmental Health Workers I returned to Perth in 1992 to start a family and commence writing this thesis.

I periodically visited Kalgoorlie, Halls Creek and Pundulmurra College to complete, evaluate and reflect on the RAHF projects while involved in other projects. For example, during 1992/93 my work with Manager of On-Site Programs at Pundulmurra College, Mark Simpson, continued as we prepared the Ngarda-Ngarli-Yarndu Regional Plan together. Friendships with senior Aboriginal people of the Pilbara who I'd come to know were deepened.

In 1993 I was awarded a World Health Organisation travel fellowship to the Americas where I was able to see first hand community development projects in action in both the Third World and Fourth World settings.
In 1994 I organised the National Conference on Technology Transfer in Remote Communities at Murdoch University as part of my efforts to present and gather information relevant to my thesis. The Aboriginal people at this well-attended event resolved that the information should be presented to remote communities in regional workshops, and that RADG should conduct a feasibility study to achieve this end. I convened meetings in Kalgoorlie, Geraldton, Kununurra, Derby and Port Hedland and completed the report in 1995.

The above is an outline of the major fieldwork contributing to this thesis. The broader fieldwork that I have been involved in during the term of my research project is tabulated in Appendix 1. In a way, this thesis documents a journey that I have only just begun. I have sought to understand what role a technologist such as myself can have in the developing Aboriginal community setting. I hope that I can use these experiences to work constructively with Aboriginal organisations in the future and that others may gain from analysis and interpretation of these experiences.

Upon submitting this thesis I took up a National Health & Medical Research Council (Public Health Research & Development Committee) post-doctoral fellowship of four years. Over its term I hope to advance the themes of Community Technology and Regional Technology that are formulated in this thesis. I envisage that this can be done by initially conducting regional workshops on Appropriate Technology followed by community-based technology trials under the control of the regional Aboriginal resource agencies. These activities will aim to foster an understanding of the implications of technology choice and control while also empowering Aboriginal organisations to effectively manage technological systems for the improvement of conditions such as environmental health and nutrition.

This thesis is concerned with the policies and practices of the period 1988 – 1996. Since then a number of policy changes have occurred at a national and state level – some positive and some negative – but the central idea of the thesis and much of the detail of the study still retain their relevance.
ACKNOWLEDGEMENTS

I would like to thank my supervisors Associate Professor Goen Ho and Dr Kuruvilla Mathew who have always encouraged me to persevere with this thesis. They have both facilitated an environment within RADG which is casual and flexible enough to allow members to largely discover their own research and development interests while guiding us appropriately in pursuit of the required academic ends.

During the RAHF fieldwork Preston Thomas and the team at Ninga Mia Village, Kalgoorlie were fabulous to work with and I was able to learn much from them while they tolerated my naivete and amateur behaviour. Harold Cox and Jimmy Deegan at Mardiwhah Loop were again great workmates and were able to help me bridge the cross-cultural gap.

The Aboriginal Environmental Health Workers across the state have always been excellent people to work with. Mark Jeffries at Jigalong, Phillip Wallaby and Flora Achoo at Halls Creek, and Cass Torres (deceased) were particularly supportive while engaged in their own difficult work. The regional Course Coordinators David Ross, Helen Wright and Greg McConkey have always been helpful and informative while engaged in a genuine community development approach to their work on the AEHP. Mark Simpson while at Pundulmurra College was a tremendous inspiration.

During discussions on my thesis with Peter Newman he suggested I use the term "community-building technology" to describe the approach taken in my fieldwork. I have used the term and I thank him for the idea.

I'd like to thank my brother Clive who gave so much of his own time to prepare the computer-drafted technical drawings for the RAHF. I extend posthumous gratitude to my friend, the late Tom Hibbs, who put together the final presentation of the RAHF construction manual. Early in 1996 he had his last great motorcycle ride into the Pilbara.

Most importantly I would like to thank my wife Jill Kempson and my daughter Min for putting up with me during this thesis. Their patience and support was a great relief in the intensive final four months followed by the several months of rewriting eight months later. Not only have they put up with me but while I read and wrote Jill was able to take on my share of the housework, childminding and cooking while having a sprained ankle, flus and headaches. My share was probably never as much as it should have been but once this thesis is completed there will certainly have to be more time spent at home making myself useful. I thank them deeply.
## GLOSSARY OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAD</td>
<td>Aboriginal Affairs Department (formerly AAPA), Western Australia</td>
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<tr>
<td>AAPA</td>
<td>Aboriginal Affairs Planning Authority (now AAD), Western Australia</td>
</tr>
<tr>
<td>ACDP</td>
<td>Aboriginal Community Development Program</td>
</tr>
<tr>
<td>ACEHW</td>
<td>Advanced Certificate of Environmental Health Work (Stage 2)</td>
</tr>
<tr>
<td>ACS</td>
<td>Australian Construction Services</td>
</tr>
<tr>
<td>AEHP</td>
<td>Aboriginal Environmental Health Program</td>
</tr>
<tr>
<td>AHB</td>
<td>Aboriginal Housing Board (Homeswest)</td>
</tr>
<tr>
<td>AHD</td>
<td>Aboriginal Health Division, HDWA</td>
</tr>
<tr>
<td>AHW</td>
<td>Aboriginal Health Worker</td>
</tr>
<tr>
<td>AMS</td>
<td>Aboriginal Medical Service</td>
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<tr>
<td>AOT</td>
<td>Aboriginal Organisational Training</td>
</tr>
<tr>
<td>AP</td>
<td>Anangu Pitjantjatjara</td>
</tr>
<tr>
<td>ASF</td>
<td>Australian Standards Framework</td>
</tr>
<tr>
<td>AT</td>
<td>Appropriate Technology</td>
</tr>
<tr>
<td>ATAF</td>
<td>Appropriate Technology Ablutions Facility</td>
</tr>
<tr>
<td>ATDU</td>
<td>Appropriate Technology Development Unit</td>
</tr>
<tr>
<td>ATSIC</td>
<td>Aboriginal &amp; Torres Strait Islander Commission</td>
</tr>
<tr>
<td>BIGWG</td>
<td>Environmental Health Needs Coordinating Committee (Intergovernment Working Group &quot;B&quot;)</td>
</tr>
<tr>
<td>BRAMS</td>
<td>Broome Regional Aboriginal Medical Service</td>
</tr>
<tr>
<td>CADT</td>
<td>Certificate in Applied Design &amp; Technology</td>
</tr>
<tr>
<td>CDEP</td>
<td>Community Development Employment Program, ATSIC</td>
</tr>
<tr>
<td>CEHW</td>
<td>Certificate of Environmental Health Work (Stage 1)</td>
</tr>
<tr>
<td>CHIP</td>
<td>Community Housing and Infrastructure Program</td>
</tr>
<tr>
<td>CRCESW</td>
<td>Certificate in Remote Community Essential Services Work</td>
</tr>
<tr>
<td>CPA</td>
<td>Community Phase Assessment</td>
</tr>
<tr>
<td>CTP</td>
<td>Community Training Program</td>
</tr>
<tr>
<td>DEET</td>
<td>Department of Employment, Education &amp; Training</td>
</tr>
<tr>
<td>EHA</td>
<td>Environmental Health Assistant</td>
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<tr>
<td>EHFSO</td>
<td>Environmental Health Field Support Officer</td>
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<td>EHO</td>
<td>Environmental Health Officer</td>
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<td>EHW</td>
<td>Environmental Health Worker</td>
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<td>EHWTP</td>
<td>Environmental Health Worker Training Program</td>
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<td>EKAMS</td>
<td>East Kimberley Aboriginal Medical Service</td>
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<td>ESMWTP</td>
<td>Essential Services Maintenance Worker Training Program</td>
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<td>ET</td>
<td>Evapotranspiration</td>
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<tr>
<td>HDWA</td>
<td>Health Department of WA</td>
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<td>HIPP</td>
<td>Housing and Infrastructure Priorities Program</td>
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<td>HREOC</td>
<td>Human Rights and Equal Opportunities Commission</td>
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<tr>
<td>IETC</td>
<td>Industry Employment &amp; Training Council</td>
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<tr>
<td>IGWG</td>
<td>Intergovernment Working Group</td>
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<tr>
<td>KABC</td>
<td>Keep Australia Beautiful Council</td>
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<tr>
<td>KAMSC</td>
<td>Kimberley Aboriginal Medical Services' Council</td>
</tr>
<tr>
<td>LGA</td>
<td>Local Government Authority</td>
</tr>
<tr>
<td>NAHSSWP</td>
<td>National Aboriginal Health Strategy Working Party</td>
</tr>
<tr>
<td>NHC</td>
<td>Nganampa Health Council Inc, Pitjantjatjura Council</td>
</tr>
<tr>
<td>NOOSSR</td>
<td>National Office of Overseas Skills Recognition</td>
</tr>
<tr>
<td>NTB</td>
<td>National Training Board</td>
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<tr>
<td>RADG</td>
<td>Remote Area Developments Group, Murdoch University</td>
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<tr>
<td>RAHF</td>
<td>Remote Area Hygiene Facility</td>
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<tr>
<td>RMT</td>
<td>Regional Management Team</td>
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<tr>
<td>SAC</td>
<td>State Advisory Committee (ATSIC)</td>
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<tr>
<td>SECW A</td>
<td>State Energy Commission of WA (now Western Power and Alinta Gas)</td>
</tr>
<tr>
<td>SESDA</td>
<td>State Employment, Skills and Development Authority</td>
</tr>
<tr>
<td>SSAB</td>
<td>Skills Standards and Accreditation Board</td>
</tr>
<tr>
<td>TAFE</td>
<td>Technical and Further Education</td>
</tr>
<tr>
<td>WA</td>
<td>Western Australia</td>
</tr>
<tr>
<td>WADOT</td>
<td>WA Department of Training</td>
</tr>
<tr>
<td>WAMA</td>
<td>WA Municipal Association</td>
</tr>
<tr>
<td>WAWA</td>
<td>Water Authority of Western Australia (now Water Corporation)</td>
</tr>
<tr>
<td>WDPAC</td>
<td>Western Desert Puntukurnuparna Aboriginal Corporation</td>
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CHAPTER ONE

Introduction: Technology-Practice in Aboriginal Communities

1.1 CONTEXT OF THE THESIS

This thesis was originally undertaken in order to determine the technical suitability of a prototype ablutions facility - the Remote Area Hygiene Facility (RAHF) - designed by the author for use in remote Aboriginal communities. The RAHF was a project of the Remote Area Developments Group (RADG) with whom the author was working. Elements of the design, namely the plastic solar water heater, had been developed as part of the author's Honours work (Anda, 1988).

RADG sought to combine activism with academia. Inspired by the principles of the Appropriate Technology movement the aim of the author and the group was to facilitate technology transfer, where the skills and knowledge base of trained engineers could be utilised by Aboriginal communities as part of a broader project towards self-management and community empowerment.

The project became a much deeper learning experience for the author. It is through the process of doing that social change can be experienced. Although the fieldwork sought to embody the tenets of a philosophy that came to be called Community-building Technology its conceptual structure in terms of a thesis was nonetheless technical. An assessment of the 'success' of technology for application in an Aboriginal community requires more than a technical assessment, but also an assessment of the context in which the service is delivered. Hence, this thesis is an outcome of an approach that incorporates both.

Such an approach requires an understanding of the history that has made the project necessary. It also requires an investigation and critique of many of the terms deployed in the service delivery field. The language of technology-practice in Aboriginal development deserves a thorough critique as has been provided for the Appropriate Technology movement (e.g. Willoughby, 1990). While this is not the objective of this thesis some of the key terms are examined in this first chapter so as to clarify their meaning and implications in the context of Aboriginal development and this thesis.
The basic research question remains the same: *was the Remote Area Hygiene Facility technically appropriate?* To address the other factors affecting 'appropriateness' this narrow question is couched within a broader framework of three concepts to enable the practice of Appropriate Technology in remote Aboriginal communities:

- Community-building Technology;
- Community Technology;
- Regional Technology.

The thesis elaborates the possibilities of these concepts by investigating issues affecting service delivery in the remote Aboriginal communities of Western Australia. Accordingly, the introduction which follows presents a brief history of the impact of European occupation on Aboriginal people, an overview of government policy, a critique of some of the terms used in the service delivery field, and the formulation of thesis objectives before indicating how these will be addressed in this thesis with an outline of each chapter.

The preference by many indigenous Australians to be identified by terms such as Koori, Martu, Murri and Nyungar for their specific clan, language group or region of association is acknowledged. However, due to the large geographical coverage in this thesis within which there are a number of these preferred terms the current, more popular terminology of 'Aboriginal person' or 'Aboriginal' is used. This is, unfortunately, the language of the coloniser. 'Indigenous', which is locally and internationally accepted, is also used. 'Aborigine' is no longer a term preferred by indigenous Australians even if this results in the normally incorrect use of an adjective, 'Aboriginal', in place of the noun.

### 1.2 SELF-DETERMINATION

The 'opening up' of inland Australia for 'settlement' and 'progress' saw the beginning of conflict over land and water which continues today. Two hundred years ago Aboriginal resistance was crushed by whites seeking control of river frontages and isolated waterholes, fertile soils and pasture for grazing. Today the descendants of the Aboriginal survivors are engaged in protracted negotiations to gain living area excisions, the most basic of housing or water supply and sanitation infrastructure in established, remote settlements.

McRae *et al.* (1991) explained that the policies of White Australia towards the Aboriginal peoples on the 'frontiers' passed through a number of general phases:

1. First contacts and conciliation;
These phases were by no means simultaneous or consistent across the country. Indeed, massacres have been recorded well into this century, with sporadic shootings occurring more recently in remote areas. The high rate of Aboriginal deaths in custody today indicate the lack of change in the country's social institutions (Johnston, 1991). The current, sixth phase is supposedly a combination of 'self-management' and 'self-determination' (House of Representatives Standing Committee on Aboriginal Affairs, 1990; Johnston, 1991). It is, perhaps, only now in this phase that the opportunity exists for technology choice with community control. However, many government programs for Aboriginal development are still control-oriented (Race Discrimination Commissioner, 1994). At a more extreme level is the persistent, aggressive stance of some state governments towards land rights and autonomy aspirations of Aboriginal groups. This, combined with a fierce, private enterprise, resource development approach can be considered to be the situation in Western Australia since occupation in 1829. Ironically, in this environment there was bipartisan political support for the so-called 'reconciliation' process in the early 1990's although more recently this has been shattered. Many expectations held by Aboriginal people for the self-determination phase may remain unfulfilled, yet their struggle continues through the reconciliation phase; a phase which now flounders.

The resumption of a traditional lifestyle relying on natural soaks and waterholes is no longer possible. They have either not been maintained for over 30 years, silted up, diminished by cattle, sheep, camels and feral animals or have been contaminated by mining, radiation or urban development. The nomadic aspect of traditional Aboriginal culture has been replaced by a mainly sedentary lifestyle in remote area town camps, large settlements and the smaller outstations. To support this new lifestyle Aboriginal people recognise the need for Western technologies, and indeed, look forward to many of these goods and services. This does not presuppose that an urban, mainstream approach to technology choice and service delivery is appropriate to all of their circumstances. Unfortunately, the possible impact of technology on culture, economy and lifestyle has gone largely unquestioned and the information on the variety of options has often not been given in a detailed or objective manner. The development, choice and delivery of technology can and should occur in an environment of community participation that fosters self-determination, self-management and community control.
The House of Representatives Standing Committee on Aboriginal Affairs (1990) sought to clarify the meanings of and differences between self-determination and self-management. The Committee considered self-determination to involve the devolution of political and economic power to Aboriginal and Torres Strait Islander communities within the legal structure common to all Australians. Self-management was more limited and concerned the efficient management and administration of Aboriginal communities and organisations often with the support of non-Aboriginal people who had an appreciation of Aboriginal culture.

In a submission to the Royal Commission into Aboriginal Deaths in Custody (Johnston, 1991) the National Aboriginal and Islanders Legal Services Secretariat asserted that self-determination:

- consists of a spectrum of possibilities accompanied by a few non-negotiable minimum standards. The spectrum of possibilities can be summarised as ranging from statehood, free association (with the colonial state), the creation of an international territory, autonomy or integration. The non-negotiable terms are:
  - indigenous people themselves decide what the substance of the definition of self-determination is;
  - indigenous peoples then make a free choice between the various options they have identified;
  - indigenous peoples themselves choose whether they wish to retain an independent connection to the international community or merge their international interests with the colonial state with which they are associated;
  - an economic base, through a means of subsistence provided to the indigenous self-determining people;
  - the exercise of one choice does not preclude further choices as circumstances change.

Self-determination was defined by Charles Perkins (1994) in more concise terms as:

...giving Aboriginal & Torres Strait Island peoples the space and resources to enjoy our culture, to work out our own solutions and control our own lives.

"Development is not a simple sanitary process of investing capital or introducing new technologies... It is a messy, conflict-ridden business of social change" explained Erick Eckholm (1976). Development has been defined as a process whereby people learn to take charge of their own lives and solve their own problems (Bunch, 1982). For Hunter (1993) 'development' was taken to describe the relationship between two systems characterised by an asymmetry of power. This relationship was dynamic with each system engaged in an open-ended process of adaptive change specific to the external demands constraining its own growth. The latter is evident in the ongoing struggle between Aboriginal organisations and government over service delivery around Australia.

The 'development' programs of government agencies were described as often being 'control-oriented' in both developing countries (Brinkerhoff & Ingle, 1989; Porter et al., 1991) and Australian Aboriginal communities (Lea & Wolfe, 1993; Walker, 1994). However, indigenous communities generally seek the opposite: independence and more control over their own affairs (Marra Worr Warra, 1995) - a people-centred orientation.
The bureaucratic, centralised approach utilises 'consultation' to gain approval for its programs. The community-initiated, people-centred, local or regional approach seeks 'negotiation'. The power relations for each are very different. In a consultation paradigm government officials are in the primary position of power often being in control of programs and large sums of money. In general, negotiation becomes possible when Aboriginal groups are either in a position to barter effectively due to some factor being under their control such as land with minerals, or legislation such as the Native Title Act endows them with certain rights in discussing conditions or demanding entitlements along with other stakeholders.

1.3 REMOTE ABORIGINAL COMMUNITIES

The strategies that Aboriginal people had to employ in order to survive colonisation and government policies were factors that determined the nature of the different types of settlements in existence today. While in the southern, temperate regions populations were decimated and the remainder largely integrated into urban and rural life, there continued to be isolated desert dwellers that continued a traditional nomadic lifestyle well into this century. Mainly, however, Aboriginal people in the north became pastoral station employees or were gathered into government settlements and missions. In the 1950's when these settlements began to close down, when equal wages were awarded in 1968 for station hands and when Aboriginal people were forced off the stations, town camps began to increase in size and number around the country. By the 1970's, however, Aboriginal people were beginning to re-establish themselves on traditional lands still vested in the crown or where access was permitted. This became the so-called 'outstation movement': the process of Aboriginal decentralisation (Blanchard, 1987).

The aim was to move away from town camps and large settlements and set up small, extended family communities. 'Assistance' first became available from the Whitlam Government in the 1970's for services in these emerging settlements. "Yet such 'assistance' remained subject to European ideologies and practice" (McGrath, 1995). Living excisions were gained by some who demonstrated "permanence" to government authorities. Living excisions allowed further funding from the Commonwealth Government and this enabled the establishment of permanent facilities. These later became larger settlements such as Yandeyarra in the Pilbara. The development of more essential services attracted more people from towns and larger settlements to come and live there, e.g. Punmu in the Western Desert and the many communities around Fitzroy Crossing.
At the same time as the outstation movement was starting missions still in operation were transferred to the management of Aboriginal Community Councils. However, many people remained in town camps on land tenure status known as 'Aboriginal reserve' (AAPA, 1993). Aboriginal groups argue that acquisition of such reserves as well as certain National Parks and vacant crown land should be expedited quickly through the Native Title Act process without expensive litigation so that negotiation towards self-management of these settlements can begin in earnest.

Thus, a range of 'community' types emerged. Each of these 'community' types raises different issues for development and service delivery and indeed each need to be approached differently. Context-specific support for self-determination and self-management is not a common theme of service delivery. Indeed, McGrath (1995) points out that assimilation is still the aim. A reappraisal of the total picture may reveal that an entirely new paradigm of service delivery is necessary for remote Aboriginal communities. In order to conduct such an assessment, however, it is necessary to clarify the term 'community'.

Smith (1989) explained that the term and concept 'community' was adopted in the 1970's by the Department of Aboriginal Affairs, which was created by the Whitlam administration, to reflect the change in national policy from assimilation to self-determination. The concept of 'community' was becoming popular in a wide range of fields, a reflection of the politics of the 1960's and 1970's, which included increasing political action for civil rights.

For some time, however, there was little change on the ground due to the fact that the same public servants moulded in the assimilation-protectionist era of settlement management were expected to implement the new policy. They were not trained in the new ideology and practice behind the label 'community' (Smith, 1989). Moreover, this construct in policy implementation reflected a geographically-defined community and failed to recognise the divisions, competing interests and family units with different aspirations within these localised settlements. The community as a locality was not always a democratically, socially-organised community. The policy effect in practice was again to huddle different groups altogether. The outstation movement was thus a breaking away from that mould. Smith (1989) argued that the blanket use of the concept 'community' could:

- act as a barrier to self-determination;
- deprive some residents of access to services, goods, jobs, training;
- set geographic communities up for administrative failure; and
- deny Aboriginal people the opportunity to work through the development process, with specialised professional support, and in their own time.
Smith (1989) concluded that policy development must be preceded by agreement between all parties on the meaning of the concept 'community'. If effective integration of community characteristics with the goals, objectives and strategies of the service to be delivered is proposed this must be shown as being able to occur. At the same time it must be ensured that the civil rights of the residents are guaranteed and equal access to services and facilities is enhanced.

The notion of 'community' is one that can be addressed from the point of view of scale (Sale, 1980) and demographics (Alexander et al., 1977; Mollison, 1988). The outstation movement was a self-motivated action to regain that sense of community with control over their lives and at an appropriate scale to live in harmony. While these small extended family settlements have grown to include other people not of the direct family they have often been related by kinship, and as the settlement size has grown the sense of community has been retained. This is, of course, in stark contrast to the larger mission or government settlements. Non-Aboriginals need only to look at their own cities to find the loss of community, as well as movements that have attempted to recreate community. Theorists of such movements such as Alexander et al. (1977), Sale (1980) and Mollison (1988) suggest that the harmonious kin or group size for day-to-day activities is in the order of 25. Interestingly, this is the nomadic clan size of the traditional Aboriginals and often the size of a contemporary outstation. Furthermore, the 'community' theorists argue that the optimal town or neighbourhood size is around 500 (typically the dialectal size of the traditional Aboriginal tribe and usually the largest of contemporary Aboriginal settlements) and the economically-viable city size or association of villages is around 5,000. The opportunity for a face-to-face, participatory democracy in settlements over 1,000 is limited. The use of the term 'remote community' in policy-making can therefore suggest political possibilities for self-determination and self-management.

Whereas other remote communities such as mining, pastoral or tourism centres are resource-based the remote 'Aboriginal' community is culturally-based. While the former are characterised by high mobility, the residents of an Aboriginal settlement may choose to stay there for life. Walker (1988) pointed out that the term 'remote community' was sometimes used as euphemism for an 'Aboriginal' community. Each of these remote communities is differentiated from large, primarily coastal, urban centres by:

1. distance from urban centres;
2. lesser infrastructure support and dependence on urban centres;
3. limited range of specialist skills;
4. the above lead to activities being less linked to deadlines;
5. their micro-economies are sensitive to outside economic and policy changes;
6. attitudes resist change but want the benefits of urban centres (Walker, 1988).
The remote Aboriginal community has been the recipient of Euro-centric, urban bias in policy development. This has affected technology choice in service delivery.

1.4 TECHNOLOGY IN ABORIGINAL DEVELOPMENT

At this point in time there is a massive need in remote Aboriginal communities for 'essential services' which are defined as shelter, safe water supplies, effective sewerage and stable roads. Allied to this is the need to improve management and maintenance of the living environment or more specifically to develop 'environmental health services'. 'Environmental health' has been defined by the World Health Organisation as being the control of all those factor's in man's [sic] physical environment which exercise, or may exercise, a deleterious effect on his physical development, health or survival. 'Health' in this context was a state of complete physical, mental and social well-being. 'Environmental health' is a broad concept but was, nevertheless, only one facet of public health: the science and art of preventing disease, prolonging life and promoting health through organised efforts of society (Bassett, 1992). The term 'environmental health services' generally refers to systems that cater for the monitoring and maintenance of drainage; sewage disposal; sanitary conveniences; rubbish and refuse removal; pest control; yards, ways and passages; houses (e.g. ventilation, floor gradients); water supply and pollution. It also concerns issues of nuisance avoidance (dust, noise, etc.); infectious disease control; venereal disease control and child safety. In the context of local government authorities, 'environmental health services' includes the statutory functions and responsibilities of a local government which enable it to establish and maintain satisfactory standards of environmental health throughout a municipal district (Barker, 1994).

Although it is unlikely that there will be a massive release of funds by any government department to provide the necessary services quickly, the search for technical solutions must still consider the social and cultural dimensions of 'technology-practice'. 'Technology-practice' refers to the ensemble of operations which involve technology to a significant extent (Willoughby, 1990). Technologists in Aboriginal communities can in the meantime develop ways of working effectively, with the limited funds available, to achieve technology transfer that has positive, longer-term outcomes.

The need for "appropriate technology" has been promoted by some of those involved in high level negotiations to secure resources for Aboriginal people. Former national ATSIC Commissioner Lois O'Donoghue (1994) argued that at one end of a spectrum is the stereotypical community of extreme technological dysfunction and poor health status.
At the other end is the outstation equipped with all modern technological amenities with an unlimited supply of funding. "Appropriate technology" is somewhere between the two or at numerous points along the continuum (O’Donoghue, 1994).

Dr Bruce Walker (1994), Director of the Centre for Appropriate Technology (CAT), also referred to continuums with extremes of life and death, self-determination and control. Technology can be taken to the point where a person can be kept alive even after all vital organs have failed. Similarly in a paternalistic mode of development all service delivery occurs within a framework of government control. At the other end of the spectrum is a pluralist-oriented approach to development which "relocates judgements about risk, uncertainty and options in the hands of the people most likely to bear the unforeseen consequences of such decisions."

In Chapter Two the dominant mode of technology-practice used in government service delivery programs is explained. In brief, the characteristics of technology-practice to date have generally been as follows:

- The provision of housing and services occurred in the past with a view to preparing Aboriginal people for assimilation into mainstream Australia. In missions and government settlements behaviour was strictly controlled and routines for washing, eating and cleaning strictly enforced. Later 'transitional' housing of a most basic nature was provided to discrete settlements with the same aims.
- People on pastoral properties had basic facilities provided, but later when they were forced to live in town camps they constructed their own facilities, as did people still living in remote areas relatively unhindered.
- Today a needs-based allocation of resources occurs with "consultation" determining the nature of the programs. However, the "needs" are still centrally determined even when ATSIC Regional Councils or their State Advisory Committees are involved. Technology choice is often limited to city-based architects offering minor options in house design.
- Technologies for domestic use were sometimes transferred with homemaker training, but no management or maintenance program was put in place upon completion.
- Technologies at the community scale were under the control of utilities with remote control from urban centres and supported by touring maintenance teams.
- Technology choice is largely influenced by non-Aboriginal, city-based technologists, and by what is generally supplied to urban centres with the associated design standards.

Meanwhile non-Aboriginal organisations such as the Centre for Appropriate Technology, Ecotech and Remote Area Developments Group have been advocating more community-controlled strategies for some years. Many Aboriginal organisations such as Pitjantjatjara
Council, Tangentyerre Council and Marra Worra Worra have established their own management systems, in-house design practice and some even control their own essential services and maintenance programs.

There is a niche for a new technology-practice in community development currently dominated by government agencies and large firms of consulting engineers in Australia. Some commentators have proposed that the structures of government delivering services need to be transformed (Race Discrimination Commissioner, 1994). Additionally, regional areas can be handed the reins for self-management perhaps in a similar manner as has already occurred in the Torres Straits and the Pitjantjatjara Lands. These new regional frameworks of community-control will offer the opportunity for a different approach to technology-practice.

Great strides have been made by Central Australian organisations towards a more autonomous mode of technology-practice that embodies many of the tenets of Appropriate Technology. Yet there are numerous misconceptions of "appropriate technology" around Australia. The following negative views of Appropriate Technology are prevalent:
- such choices are seen to involve an inordinate amount of physical labour;
- these choices are second rate or only suitable for the Third World;
- advocates of the approach are "Luddites" - technophobes;
- such choices put public health at risk with unsanitary and outdated technologies;
- these choices are only suitable, at times, for outstations.

Willoughby (1990) defined Appropriate Technology as "artefacts which have been tailored to function as relatively efficient means and to fit the psychosocial and biophysical context prevailing in a particular location and period" and is a "general principles" approach used in order to overcome some of the biases and stereotypes listed above. More background is provided in Chapter Three. Terminology used in this thesis follows that listed for technology-practice in Appendix Three.

Lack of acceptance of Appropriate Technology has even been reported in developing countries and blamed on the youth, back-to-the-land, counterculture of the 1960's (Francis & Mansell, 1988). These views reflected a level of understanding at the artefact or hardware level only. The approach to technology needs to take account of process and culture (Pacey, 1983; Willoughby, 1990). Given the rubric Appropriate Technology conjures negative connotations in some quarters it needs to be articulated differently because, as shown in this thesis, its tenets are relevant in Aboriginal development.
1.5 STATEMENT OF THE PROBLEM

Many Aboriginal communities and organisations have demonstrated their ability to successfully administer programs, arrange construction and manage maintenance systems when given the opportunity. For these communities the control-orientation of government programs was an impediment to self-determination and self-management. Government agencies were generally not able to develop approaches that satisfactorily established and maintained the services required for the contemporary sedentary lifestyle in remote areas. Too often different agencies with their specialised areas and limited budgets have had to focus narrowly on a specific service. The sick are healed in faraway, large, modern hospitals and sent back to dysfunctional communities hazardous to health. Houses are installed with all modern fittings but without a satisfactory water supply in place. Water resources are scarce and high-consumptive water-based sewerage systems are installed. Diesel power stations are installed by the State utility and then the community has to negotiate funds for a large, recurrent fuel cost. Lack of control over these processes of technology-practice result in no sense of ownership or desire to satisfactorily create and maintain a healthy, comfortable living environment.

Since 1988 the 'medical model' (diagnostic medicine and gathering of statistics) has been increasingly superseded, fortunately, by an 'environmental health model' which focussed on living conditions, 'health hardware' (fittings and appliances for water and wastewater), housing and community infrastructure. The establishment of community-controlled primary health care services in many communities was a positive outcome of the 'medical model' which, for the large part, concentrated on data-gathering. Communities themselves also began to place a higher priority on environmental health. Service delivery by government under the 'environmental health model' is only now moving out of the data-gathering stage and into implementation. Again there was a lack of political will to begin transferring environmental health programs and systems into Aboriginal control. Moreover, government agencies are restricted in various ways such as by internal procedure (public sector professional conduct, reporting and accounting), statutory requirements (State Health Act, building by-laws, NH&MRC water quality guidelines) and public liability insurance.

To date an approach to technology-practice in Aboriginal communities that integrates community values, regional commonalities, respect for culture, concern for nature and sustainable development has not been documented or implemented. Stressing the importance of technology choice is not a matter of privileging it above issues of land rights or health. Rather, it is to elevate the current status of the issue so that it can be recognised as a vital element of the holistic process that enables community development and enhances political power.
1.6 OBJECTIVE AND SCOPE OF THE THESIS

This study examines the control-oriented paradigm of technology-practice by government service delivery with the support of private consultants and large companies. Under this paradigm it is attempted to improve health statistics and satisfy needs in housing and infrastructure by enacting and enforcing certain standards. This is contrasted against approaches that attempt to achieve participation and control over technology for empowerment and self-determination.

The first question this thesis seeks to answer is:

*Was the technology of the Remote Area Hygiene Facility technically appropriate?*

The second question relates to other factors surrounding the technology - social, cultural and environmental appropriateness - recognising that technology is not neutral and cannot be experienced in isolation from the other factors. Three concepts were developed in order to interpret the outcome of the technology with regard to these factors: Community-building Technology, Community Technology and Regional Technology. These three concepts, integrated into a framework and termed Regional Technology, are developed for a holistic mode of technology-practice in the Fourth World setting of Australia with its unique community and regional characteristics. The second question thus becomes:

*Does the concept of Regional Technology provide an appropriate mode of technology-practice in remote Aboriginal communities?*
1.7 CHAPTER OUTLINES

Chapter One introduces the reader to the historical context that has led to service provision today and some of the terms used in this field.

In Chapter Two the environment, history and health status of Australian Aboriginal communities, particularly of Western Australia, are described. The dominant paradigm by which service delivery occurs is also described and shown to be assimilative. Case studies of successful non-government projects are given where there has been greater community-control over technology choice and management.

Chapter Three provides an overview of international theory and practice in technology choice and sustainable development. Modes of technology-practice used in developing countries and other Fourth World settings are investigated for applicability in Australia. Appropriate Technology concepts and their international history are described. The international development theory is examined for its relevance. The concepts of Community-building Technology, Community Technology and Regional Technology are developed and their function together in a holistic framework is proposed.

Chapter Four describes the prototype development and fieldwork by the author. Several projects were coordinated around the prototype development of a plastic solar water heater, an alternative type of toilet and a new wastewater disposal system and their trial as parts of the Remote Area Hygiene Facility (RAHF). The fieldwork trialed the so-called "appropriate technology" devices as a basis for "research and development". The demand for greater numbers of RAHFs led to the establishment of a regional training and manufacturing centre. The goal was to achieve the higher order outcomes of 'community development' and improved health. This became impossible as implementation demanded submission to the requirements of standards. A feasibility study investigating the technical information needs in regional areas was conducted by the author. Four projects are thus described separately: the RAHF in Kalgoorlie, the RAHF in Halls Creek, the manufacturing and training centres and the Feasibility Study.

In Chapter Five the fieldwork is evaluated in order to firstly determine the appropriateness of the devices and approaches used in their implementation. Secondly, the evaluation seeks to validate the concepts of Community-building Technology, Community Technology and Regional Technology.

Finally, Chapter Six provides conclusions and recommendations for further research.
CHAPTER TWO

Service Delivery in Remote Aboriginal Communities

This chapter reviews the history and current approaches in delivery of essential services to remote Aboriginal communities, so that the dominant mode of technology-practice used can be explained. Its inadequacies are examined and opportunities for improvements within the current practice are investigated. The chapter is a combination of literature review and documented insights of the author during fieldwork, employment on the Environmental Health Worker Training Program and subsequent field visits. This background provides some of the data within which Chapter Three grounds the development of a mode of technology-practice which could be controlled by Aboriginal people and organisations.

2.1 ARRIVAL OF WESTERN TECHNOLOGIES & VALUES

Modern, 'reliable' technologies for water supply, sewerage, transport and housing have become the norm for the majority of Australians who are found in urban centres on the coast. The introduction of these technologies to early European industrial society in the last century brought massive improvements to public health (McManus, 1994). However, the social upheaval and cultural changes resulting from this technology choice being imposed on people and cities, e.g. large, buried pipes for conveyance of effluent, were comparable to the forced transfer of serfs into the cities for factory labour (Engels, 1969).

The sanitary conditions in the Swan River Colony of the last century were appalling until the implementation of septic tank technology (Parker, 1983). Well into this century the stench of raw sewage disposed into houseyard soakpits was still notorious in some suburbs with people often drawing drinking water from nearby wells. The anaerobic treatment of septic tanks followed by disposal of the effluent to leach drains gave a vast improvement to public health conditions. However, the long term environmental impacts were not understood and this technology contributed to the eutrophication of the Swan River. The persistence of the engineering profession with water-carriage methods of sewage disposal led inevitably to the choice of extending deep sewerage to replace septic systems in all suburbs of Perth. Today, the marine impact of ocean outfalls for treated
sewage is worsening (WAWA, 1994a). The cultural and environmental legacies of these technology choices will live on for some time.

There were ideological battles and vested interests driving these technology choices. The paradigm governing sewerage engineering today arose in the last century when the 'water carriage' lobby defeated the 'dry conservancy' advocates. Today engineers deal with shortcomings in the existing technology and infrastructure by adding or relocating elements of the system. The system is too huge to contemplate rapid change. A major crisis may be necessary to bring about a new paradigm that suits modern times (Beder, 1993). These technologies are now enshrined in State Health Acts, building codes, professional practice, university education, technical training and armies of technicians. Sewerage engineering has shaped our lives in much the same way as motor cars have and as information technology is now doing.

These technologies are having slow but sure repercussions on those most recently introduced to Western society: the small, isolated Aboriginal communities of the arid interior. Massacre followed by environmental impact from grazing and feral animals were enough to make the subsistence hunter-gatherer culture of the desert nomads tenuous even without the "Native Protection", missionary, Blue Streak missile testing, assimilation and integration periods. The extent of the carnage that did occur was explicit in figures such as those for Victoria (McGrath, 1995). The earlier destruction of traditional life and environment in southern areas is beyond the scope of this thesis (see e.g. Bates, 1938; Rowley, 1968; Reynolds, 1982; Mulvaney & White, 1987; Brock, 1993; McGrath, 1995). But suffice to say that all of these lands were cleared for farming, fenced off for grazing or exploited for timber extraction rendering them untenable, impassable or too dangerous for traditional subsistence activities. This is not to say that the remnants of these people did not visit important sites, conduct ceremonies or maintain kinship relations at the settlements in which they were interned. They adopted many strategies to enable their survival and, in certain settings, took on aspects of Western culture and technology that would ensure survival (Brock, 1993). Elements of traditional culture and language were retained right down to their descendants today.

Landscape inscribes meaning on our psyche - in town and country (Thayer, 1994). While we can perhaps understand this for traditional Aboriginal people it is also true for those of us non-Aboriginal. Similarly, technology imbues our lives with meaning (Callicot, 1994). We may choose to modify and create landscape and technology but as we live amongst them, if only as passive observers, we too are affected by their appearance, nuances and demands on us. Hence, we may want to reflect upon the cultural impacts of rows of similar houses, identical diesel power stations, cars, planes and so on in Aboriginal communities. We have seen the socio-political impacts of these
in Western, industrial society and elsewhere (Mander, 1991; Beder, 1993a; Sale, 1995). It is worthwhile considering these impacts on Aboriginal people.

Traditional activities of indigenous people such as burning-off the spinifex plains were done to "look after the country", to hunt game moving ahead, attract kangaroos to the new grass shoots and were a form of environmental stewardship (Flood, 1983). It explains how many ecosystems have evolved today, for example, the Mulga woodlands of the Pilbara are diminishing as a result of uncontrolled burning and spinifex is taking over now that traditional firing patterns have ceased. The people of the desert also cleared their campsites in fear of snakes, scorpions and centipedes, dug holes for yams, pulled down trees and dug out waterholes. They hunted game and threw the remains over their shoulders and abandoned shelters made of logs and leaves. These would all decompose in a natural cycle (Berndt, 1964; Tonkinson, 1978; Biernoff, 1979).

2.2 CHARACTERISTICS OF REMOTE ABORIGINAL COMMUNITIES

The Aboriginal population of WA is 42,000 or 2.7% of the total with some 257 discrete Aboriginal communities (Daube, 1994). The variety of the remote, culturally-based communities that exist today include the former, comparatively large missions (e.g. Mt Margaret, Kalumburu); government settlements (e.g. Coonana, Jigalong); town or 'fringedweller' camps (e.g. at Newman, Halls Creek, Port Hedland, Kalgoorlie) and the more self-determined outstations or homeland centres (e.g. Tjuntjun Tjarra, Puntawarri, Yagga Yagga, Purnulu). The population and services in all WA communities were documented in the 1994/95 Aboriginal Environmental Health Survey and are available in IGWG (1995). Massive disadvantage was evident in terms of lack of services and disrepair to much of what existed.

Remote communities were classified as permanent, transient or emerging by agencies such as ATSIC and WAWA (1994). This was the basis on which funds for capital works were allocated. In 1986 the Commonwealth and WA Governments had negotiated the Aboriginal Communities Development Program (ACDP) for WA to provide infrastructure and deliver services (water, sewerage and power) for five years to 48 of the larger, remote, permanent communities as well as retaining responsibility for all town-based reserves. These are listed in Table 2.1 and can be located on the map provided in Appendix 2. However, after the ACDP expiry in 1992 and restructure of the utilities SECWA and WAWA into corporations these arrangements were thrown into doubt. The many remaining communities, usually small outstations and town camps, had to negotiate separately or through their regional organisations to secure services.
Table 2.1: List of 48 Communities Serviced and Respective Populations

<table>
<thead>
<tr>
<th>Bardi (350)</th>
<th>Irrunytju (Wingellina) (170)</th>
<th>Mt Margaret (150)</th>
<th>Tjurkarli (77)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayulu</td>
<td>Jigalgan (280)</td>
<td>Mowanjum (240)</td>
<td>Upirl Upirla (Coonana) (205)</td>
</tr>
<tr>
<td>Beagle Bay (242)</td>
<td>Kadjina</td>
<td>Munul (200)</td>
<td>Wangkajungka (325)</td>
</tr>
<tr>
<td>Bidiyadanga (La Grange) (600)</td>
<td>Kalumburu (370)</td>
<td>Muludja (101)</td>
<td>Wanarn (80)</td>
</tr>
<tr>
<td>Blackstone</td>
<td>Kiwirrkura (100)</td>
<td>Nganganawili (100)</td>
<td>Warakurna (280)</td>
</tr>
<tr>
<td>Burringurrah (101)</td>
<td>Kundat Djaru (123)</td>
<td>Ngumpar (25)</td>
<td>Warburton (385)</td>
</tr>
<tr>
<td>Cheeditha (52)</td>
<td>Kupungarri (110)</td>
<td>Ngurawaana</td>
<td>Warmun (450)</td>
</tr>
<tr>
<td>Cosmo Newberry (120)</td>
<td>Lombadina (50)</td>
<td>Noonkanbaha</td>
<td>Warralong</td>
</tr>
<tr>
<td>Djarindjin (248)</td>
<td>Looma (500)</td>
<td>Oombulgari (136)</td>
<td>Wirrimanu (Balgo) (550)</td>
</tr>
<tr>
<td>Djugerari</td>
<td>Lundi (Red Hill)</td>
<td>Pandanus Park (50)</td>
<td>Woolah</td>
</tr>
<tr>
<td>Guda Guda</td>
<td>Mantamaru (Jameson) (110)</td>
<td>Purmu</td>
<td>Yandeypara</td>
</tr>
<tr>
<td>Imintji</td>
<td>Mindibungu</td>
<td>Tjalka Warra (80)</td>
<td>Yiyili (170)</td>
</tr>
</tbody>
</table>

Source: (Stewart, 1994 and IGWG, 1995)

This brief history of communities is provided to give the background to the need for a special technology transfer process in these communities. More detail can be found in Kolig (1977, 1987), Blanchard (1987), House of Representatives Standing Committee on Aboriginal Affairs (1987, 1992), Hunter (1993), Brock (1993). The location of major Aboriginal communities in WA are shown in Appendix Two. Town camps and outstations are explained in further detail below because of their unique characteristics which make them different from larger, established communities. These were the focus of the RADG effort and each required different approaches to technology transfer.

2.2.1 Town Camps

Aboriginal Hostels Limited (AHL) had traditionally been responsible for providing accommodation for the transients, homeless, frail and aged Aboriginals and Torres Strait Islanders in cities and towns. However, in places such as Kalgoorlie and Halls Creek there were a number of town camper groups of different cultural background, level of transience and others seeking permanent residence but on a group basis. Some would just be visiting town from outlying communities to collect cheques, visit relatives or buy goods but had nowhere to stay as a group. In Kalgoorlie, where Ninga Mia Village and the Trilby Cooper hostel in town existed for this purpose either their capacity was too small, the groups preferred not to stay together and there was not a program in place to maintain permanent facilities used intermittently by the transients. In Australia town campers generally referred to people that had established almost permanent shelter on vacant sites in and around towns, whereas fringedwellers generally referred to itinerants visiting from other towns or communities for access to banking, medical or shopping services and often to consume alcohol (House of Representatives Standing Committee on Aboriginal Affairs, 1982).
"Fringe camps have existed throughout Australia since James Cook dropped anchor in Sydney Harbour, and we are still living on the outskirts of white society" (Shaw, 1993). Consequently, many reserves were established. 'Fringedweller' camps began to develop *en masse* around towns after the 1950s when 'feeding depots', missions and cattle stations began to turn out their Aboriginal residents, inmates and workers. People arrived in droves at rural towns where they built shacks from old bits of tin and scrub, defecated in the surrounding bush, obtained water from creek beds and town supplies. Since the 1970's access to Social Security benefits enabled people to purchase food, clothing and other minimal services. The education, health and social services increasingly available in country towns attracted many Aboriginal people. The lack of meaningful employment, little purpose in life and sense of despair upon being isolated from their traditional country drove many to alcohol. "Wrong way" marriages, loss of language, and family groups traditionally antagonistic towards each other forced into close proximity contributed to a breakdown in culture. An unsympathetic, mostly racist, white population in country towns that appropriated jobs for themselves by means of family and established networks did not lend improvement to the situation. Jackamarra (1992), for example, described these problems for the Parnpajinya town campers at Newman.

However, town camps on Aboriginal reserves were sometimes the preferred place of residence by many people particularly after having resided there for more than one generation. In Roebourne, where one reserve had been closed after many years, old people expressed the wish to be buried there instead of the distant and alien town cemetery. Compared to the adjacent white township they often had substandard housing and services, but there was a sense of belonging and community and aspects of culture, particularly kinship, were still practiced.

The House of Representatives Standing Committee on Aboriginal Affairs (1982) identified strategies that it thought would overcome the problems of Aboriginal town camps. Over a decade later the Daube Report (1994) identified key service provision problems that still faced fringedwellers. Recommendations included:
• an Aboriginal Health Worker dedicated to each community;
• improved coordination of service delivery between government agencies;
• development of management systems;
• provide effective on-the-ground services including housing; and
• investigate the potential for transient centres.

However, Daube (1994) failed to recognise that it was a long-term issue, and a corresponding long-term consistency and dedication was needed that had not occurred in the past. A dedicated Aboriginal Health Worker was needed but more important was the need for an Environmental Health Worker in each community to organise and attend to
the cleaning and maintenance of housing and ablutions facilities - preventative measures - before they became health hazards requiring the Aboriginal Health Worker.

The last recommendation above by Daube showed insight. It recognised that fringedwellers were not merely a "problem" but a cultural practice, i.e. Aboriginal people were still mobile between their settlements to visit kin and regional centres to obtain certain goods and services. However, at the latter they may not have always had any conventional form of accommodation. Hostels were vitally important though not always acceptable to all Aboriginal people for a variety of reasons (House of Representatives Standing Committee on Aboriginal Affairs, 1992). The establishment of transient centres managed by Aboriginal organisations in a context acceptable to the visitors would not only enable them to fulfil their cultural practices, as is their right, but to do this in a dignified manner. For those who had become alcoholics or suffered mental health problems an environment could be established that would be sensitive and caring of their needs and wishes for rehabilitation.

The case of the Tangentyerre Council and Alice Springs town camps is provided later in this chapter to offer some ideas. The fieldwork by this author was conducted with ablutions facilities' construction in town camps and is described in Chapter Four. The evidence suggested that a new approach to technology-practice in WA fringedweller camps was necessary.

### 2.2.2 Outstations

Several key motivating factors lay behind Aboriginal peoples' return to traditional lands (or homelands) since the early 1970s. There was the cultural motivation in that by establishing 'outstations', 'country camps' or 'homeland centres', as they are variously known, they became well-placed to protect sacred sites and carry out the ceremonial life associated with them (Blanchard, 1987). Socially, there was a strong desire to reinforce traditional family structures and often outstations were primarily composed of small extended family groups. In these outstations, removed from larger Aboriginal communities, former missions and town fringes, it became possible to exercise political autonomy. A further notion was related to Aboriginal community politics - the struggle to obtain resources had motivated the move away from larger settlements where a certain leadership or family group may have had lesser control over the limited funds and amenities (Gerritsen, 1982). Outstations were small, relatively permanent, decentralised communities consisting of closely related individuals which had been established by Aboriginal people with a strong traditional orientation (Blanchard, 1987).
Change in Government policy was a factor in allowing Aboriginal people to realise their aspirations. In 1972 the policy of 'self-determination' introduced by the Federal Government gave Aboriginal people the freedom to return to their lands and shortly afterwards cash grants of up to $10,000 were made available for essential services to establish the communities (Blanchard, 1987). In 1979 unemployment benefits were made available to outstation dwellers. This meant that access to consumer products (four-wheel drives, televisions, videos, radios, rifles, etc.) were still available while being engaged in informal employment - subsistence activities - hunting, gathering, fishing, artefact production, processing bush foods, cleaning camps and small-scale horticulture. These were typically not recognised by the mainstream cash economy as 'employment'. Often an outcome in outstations was a better quality of life, physically and emotionally, compared with life in the larger towns (Coombs, 1978; Altman & Dillon, 1986; Blanchard, 1987; Saggers & Gray, 1991).

Large Aboriginal settlements where the people lived an essentially sedentary lifestyle had seen significant degradation of the surrounding environment due to uncontrolled vehicle access through the bush, collection of firewood, garbage disposal, clearing and burning off. There was immense pressure on fragile, arid ecosystems which would take many years to restore. The impact was pronounced where people relied largely on the community store, where traditional subsistence food gathering and hunting practices were minimal (Tauss, 1990) and 'caring for country' decreased. However, community stores were a major socio-economic enterprise in many large and small communities and could act as a key institution to the future well-being of Aboriginal people (Roberts, 1994). Movement to outstations represented a decentralisation of the population and typically involved some subsistence activity on the land. Consequently, this lifestyle pattern resulted in reduced environmental impact. The land would once again be in receipt of Aboriginal stewardship and ceremonial activity.

Concern began to rise on the viability of outstations, and alternative service provision arrangements were suggested (Ashe, 1984). Questioning the paradigm of mainstream service delivery had begun. The former Department of Aboriginal Affairs commissioned the Remote Area Developments Group in 1987 to investigate options for water supply and sanitation facilities in remote Aboriginal communities. The results of this study are given in Chapter 4. What had become clear in the debate over the roles and responsibilities of government for essential services to remote communities was that a new approach to technology-practice was necessary. However, the debate was polarised between more community control (Allbrook & Kicket, 1994; Marra Worra Worra, 1995) and continued government control (Daube, 1994; Hames, 1995).
2.2.3 Cultural Characteristics

There are aspects of culture still practiced that the technologist needs to learn to successfully work in the cross-cultural setting. Many remote Aboriginal communities have the following characteristics which, as culturally-based communities, set them apart from other remote settlements:

- The people usually have a strong emotional and spiritual connection to the place especially if it is an outstation and even if it is a larger, former mission or government settlement to which their parents or grandparents may have been forcibly relocated from distant lands;
- Distinctive spatial relationships may be preferred in the siting of different groups' camping areas or houses for purposes of observation, avoidance or communication in relation to the overall camp or community layout;
- At certain times of the year ritual ceremonial activity can be in full swing with many people attending at one community. The community is often off-limits to outsiders during this time.
- There is a different attitude towards time. Perhaps as a result of many years of unfulfilled promises, or lack of priority on Western concerns, lesser emphasis is placed on targets and deadlines. Outcomes are of greater interest.
- While there is often a desire for many of the goods and services of technological society, such as televisions, cars, guns and houses, a different value system may place lower priority on them in day to day activities. Individual possessions may not be so important as group possessions.
- Introduced technologies can pale into insignificance for a community that still seeks to attend to traditional land-based activities from time to time. These may include women departing to gather edible bush resources, visits to important rockholes or other significant sites, hunting or burning off.
- The kinship system is often still strong. Outsiders residing in a remote community for long periods of time may eventually become co-opted into this system, and need to observe some protocol when dealing with various people. If the traditional kinship system is not completely intact Aboriginal people will still have a strong sense of community. The shared family experience is generally much stronger than in the fragmented, suburban lives of urban Australians.
- These strong family, community, kinship, clan, 'hearth', 'mob' or regional bonds may see folk leave and go to other nearby communities for extended periods.
- The death of a family member may result in a house in a community remaining empty for long periods while others are overcrowded.
- There will often be certain areas in and around the community of cultural significance. These may be off limits to outsiders, sometimes to the extent that one should not
openly look upon these areas (Biernoff, 1979; De Hoog & Sherwood, 1979; Walker, 1988; Memmott, 1988; Crawford, 1989; Folds, 1993; Pholeros et al., 1993).

For a people-centred approach to development by the technologist these and other cultural practices will need to be understood and respected. Some aspects of tradition may not be so important now. For example, the highly localised, tribal or clan identities may have dissolved to be replaced by a stronger regional identity (Brock, 1993).

The selective adaptation of foods and technologies by Aboriginal people in the past (Flood, 1983) demonstrated the durability but also the dynamism of their culture that would be equally effective in the period following European occupation. The activities of the Pindan mob (McLeod, no date) in the Pilbara earlier this century constructing roads with minimal tools and mining for tin and copper with yandees before the mining boom of the 1960s are extraordinary. The use of the internet, video production and marketing of artworks at Yuendumu for substantial economic gain had a subtle ulterior motive on the part of senior Aboriginal women artists in wanting to teach whitefellas their significance attached to the land (Wilson, 1996). Such examples give hope for a "two-way" technology transfer process that was at other times criticised as disguised assimilation (Folds, 1993).

2.3 THE HEALTH STATUS OF ABORIGINAL PEOPLE

Observations made by the early colonists almost always recorded an extremely positive impression of the health status of the indigenous people. A range of these impressions are presented in Berndt & Berndt (1964) and Sagers & Gray (1991). While infectious diseases such as yaws and trachoma and parasitic diseases such as hookworm were probably endemic or introduced by pre-European contact the good health and nutrition of the people prevented these from contributing to morbidity. Life expectancy was reported to often be in excess of eighty years. The few studies that allude to traditional water and sanitation practices (e.g. O'Connell, 1979; Biernoff, 1979) indicate that management of environmental living conditions was the norm. Berndt & Berndt (1964) explain toilet training for children, defecation and urination. As with many facets of traditional life, to govern behavioural patterns, defecation was done privately away from a camp as the material could be used against the individual for purposes of sorcery. No public health hazard existed under such a regime because of the absence of contagious diseases and the nomadic way of life resulting in a living area not burdened with waste accumulations.

The small family groups in the desert would fan out from the best waterholes hunting and gathering as they went relying on smaller, seasonal soakages further afield until the return
of the hot dry weather brought them back within range of the reliable source. They would camp some distance from the water so that animals could still come to drink and pollution from defecation would be unlikely. An ecological symbiosis dictated an environmental balance over generations roaming the same 'estates'. It has been argued that the limited technology at their disposal prevented wholesale environmental destruction rather than an ethic of care (Palmer, 1991). Others disagree and argue that an ethic of care was part of their highly refined spiritual culture (Tonkinson, 1978; Christie, 1993). Moreover, opportunities had arisen over thousands of years to adopt and reject foreign technologies (Flood, 1983).

Today there exists in Australia a very wide margin between the standard of health of Aboriginal people, particularly in remote communities, and other Australians. The life span that an Aboriginal person can expect is 20 years less than a non-Aboriginal person. While Aboriginal death rates in infancy are lower than those for developing countries the position is reversed for young adults who suffer from so-called lifestyle diseases. "In a sense, they are affected by the diseases of two cultures" (Daube, 1994). The health status of Aboriginal Australians was well documented (Thomson, 1984; Hollows, 1986; Gracey & Spargo 1987; National Aboriginal Health Strategy Working Party, 1989; Van Buynder et al., 1992; Daube, 1994).

Up until recently approaches to Aboriginal health had been dominated by a medical model. There was a preoccupation with health statistics and diagnostic methods as evidenced by Thomson (1984) and Gracey and Spargo (1987). A positive outcome of this was improved access to hospitals and medical services which dramatically reduced infant mortality rates. This was followed in the 1970s by establishment of community-controlled Aboriginal medical services around the country offering primary health care directly in the communities. Community-based clinics reduced the rates of hospitalisation, although in WA they continued to be high: 2.8 times higher than those for the rest of the population. Torzillo et al. (1993) showed that while these two strategies brought improvements they would not be enough to reduce the rates of attack of infectious diseases, particularly in infants. For the latter to be achieved environmental health living conditions needed to be improved. The 'environmental health model' thus emerged.

Conditions leading to poor health had arisen from Local Government authorities neglecting to provide adequate municipal services, particularly garbage collection, inspection procedures (Penman, 1991), garden services, sanitation facilities and road construction; from lack of expenditure on capital infrastructure by the State Government; lack of coordination between Commonwealth, State and Local Government authorities;
and failure to allocate resources for subsequent maintenance or upgrading of facilities (Davis, 1990).

The Northern Territory had given attention to environmental health in its primary health care programs much earlier than other states (Linco, 1976; McNamara et al., 1978) and an environmental health worker training program was established (NT Dept of Health, 1979). The Environmental Health Worker Training Program (EHWTP) commenced in WA at Pundulmurra College in 1985. Its significance is explained in section 2.4. Trachoma was an indicator of poor environmental and behavioural conditions, and was found at extremely high rates in the Pilbara where the EHWTP had been in operation for about five years (Van Buynder et al., 1992). The provision of 'health hardware' had been recommended but "material improvements alone are insufficient without behavioural change" and this was also found in developing countries (Yacoob & Whiteford, 1994). Improvements to health in some Kimberley communities were reported through the EHWTP and self-motivation in environmental health (Saddler, 1992) but more work was needed.

Penman (1991) explained causes of ill health and proposed possible methods and processes to be adopted to overcome these problems using the history of the septic tank as a case in point. This technology, while responsible for immense health risks and problems in Aboriginal communities, is not necessarily "inappropriate". Simply, the support networks of agencies and individuals that revolve around its successful operation in Australian towns and cities had not evolved in Aboriginal communities. He proposed that local government authorities become involved to enforce standards in the communities and that the community members themselves ought to place a higher priority on maintenance and hygiene. Later it was found that the State Health Act could be enforced on Aboriginal reserves (Barker, 1994) and a system of environmental health networks were proposed (Holman & Jolley, 1994).

The 1991 Report of the Royal Commission into Aboriginal Deaths in Custody (Johnston, 1991) was the most comprehensive study of disadvantage experienced by Aboriginal people. The range of disadvantages as documented by the Royal Commission, the most recent Census and other statistical indicators were integrated by O'Donoghue (1995) into a description which included appalling unemployment, high rates of incarceration, low education, lack of housing and infrastructure and poverty. The Federal Government had expended increasing amounts of money on housing and infrastructure in remote Aboriginal communities since the 1980s under the Community Housing and Infrastructure Program (CHIP) and particularly since 1989 under the National Aboriginal Health Strategy (NAHS) with health improvement as a central motivation. However, the
chronic and endemic diseases characteristic of remote Aboriginal communities did not disappear.

NAHS had failed to deliver the sought after outcomes due to a range of factors. The per capita spending on Aboriginal health was still less than that on non-Aboriginal Australians (Public Health Association, 1994). For a portfolio budget that was subject to restraint by the Senate Budget Committee there was still roughly a $2 billion backlog of need for housing and essential services in Aboriginal communities (Gordon, 1994). There was also lack of accountability of Ministerial resolutions, lack of political support to the strategy, lack of community participation and inadequate development of maintenance capability to accompany provision of housing and essential services. Some cases studies undertaken as part of the NAHS evaluation (Gordon, 1994) where successful outcomes had occurred indicated the following:

- a lack of coordination between various State and Commonwealth authorities which threatens the capacity of projects to realise their potential in improving health outcomes;
- while all projects appear to have generated positive outcomes, there were serious concerns in remote communities which were either not being addressed, or were under-resourced at present;
- the case study projects related to improving the standard of housing or water supply and, as such, represented appropriate priorities when compared with environmental health models such as those presented by "Housing for Health"; and
- the success of some projects has been directly related to integration of environmental health projects with complementary approaches to the range of health problems facing the community.

Daube (1994) recommended that the new WA State Government focus on environmental health for its Aboriginal program. The main findings of the subsequent 1994/95 Aboriginal Community Survey in 151 communities by the Aboriginal Health Policy & Programs Branch (subsequently called the Aboriginal Health Division) of HDWA were as follows:

- 109 communities had no local Environmental Health Worker;
- 37 communities had serious water problems;
- 86 communities had only communal toilets;
- 13 communities had serious drainage problems;
- 105 communities had unsealed, undrained roads;
- domestic waste disposal is a widespread, serious problem;
- more than 40 communities have no rubbish removal and tip;
- pest control and dog health are serious issues.

Target communities were identified for immediate action and ongoing development was proposed to improve living standards. The Aboriginal Health Division, the Aboriginal Housing Board and the Aboriginal Affairs Department were making a determined effort for a coordinated State Government response. After some 20 years since efforts began the environmental health model, combined with community-controlled primary health care, was on the way to succeeding the medical model in dominance. However, this did not mean that the necessary resources would automatically become available to support the new model.
Findings such as those by Torzillo et al. (1993) which showed that the environmental health model needed to supersede the medical approach were met with agreement from government. Unfortunately, there was not the political will to provide funds for the amount of community housing and infrastructure needed according to Gordon (1994) or Hames (1995). Moreover, it seemed that an approach emphasizing more monitoring and change of behaviour (Holman & Jolley, 1994) would not even be fully funded in the near future.

Trigger et al. (1983) had established that introduction of modern water and sewerage technologies to rural Aboriginal settlements in Queensland did not necessarily reduce mortality rates associated with infectious diseases. The policies of the Queensland Government, and administration of the reserves by non-Aboriginals, had a bearing on mortality rates. Technical solutions were often imposed with no community participation or control and were not followed by the necessary operation and maintenance systems. Hence, the benefits that one would normally expect from these technologies were not derived (Race Discrimination Commissioner, 1994).

Environmental health management skills would probably only develop in a climate where Aboriginals had self-esteem, control and empowerment. This was expressed by Hollows (1986) with no uncertainty... "unless Aboriginals develop the ideologies and build group structures that will enable them to work together to change their lifestyle, health and hygiene they are destined to die out". This should be read as referring to cultural identity. Aboriginal culture has survived European invasion and domination for two hundred years and will continue to survive for a long time yet. With the increasing use of modern amenities and information systems significant Westernisation is inevitable in terms of lifestyle (Lantzke, 1988), but the value base of the Aboriginal consumer may not immediately become Western. Moreover, Aboriginal culture has shown a capacity to adapt even before the permanent arrival of Europeans (Flood, 1983). If cultural difference is not understood and selective integration of some Western technologies while retaining an Aboriginal value base is not accepted, then the supposed policy of self-determination is merely a continuation of the former one of assimilation (Folds, 1993). It is against this scenario that Aboriginal intellectual and cultural assertion is vital and technologies appropriate to lifestyle and environment in remote areas have a role to play.

Access to mainstream medical services and primary health care brought some improvements to health status, but still a high rate of ill-health persisted (Torzillo et al., 1993). The environmental health model would also lead to improvements, if the necessary funds can be secured and community participation ensured. But the appropriateness of technological artefacts used in housing and essential services needed to
be considered. The technological fix would not be the answer to health problems, and the service delivery mechanisms were not necessarily part of a process of self-determination (Race Discrimination Commissioner, 1994).

The following sections consider key areas of service provision to remote Aboriginal communities to characterise the dominant mode of technology-practice. Strengths and weaknesses are identified before the new concepts in technology-practice are proposed in Chapter Three.

### 2.4 SERVICE DELIVERY TO REMOTE COMMUNITIES BY GOVERNMENT AGENCIES

With the change from a nomadic existence to sedentary settlements modern technologies were adopted yielding some conveniences and public health benefits, but they have also demonstrated various social and environmental impacts. The intensive, localised use of vehicles has resulted in denuded landscapes around the now sedentary communities (McGlew, 1992a). Relatively new and complicated water treatment plants designed to produce water quality to National Health & Medical Research Council standards lie dormant in states of disrepair because a local operation and maintenance program was not in place or residents preferred rainwater from roof tanks anyway (Race Discrimination Commissioner, 1994). Modern flushing toilets deep sewered to huge, expensive evaporation ponds dispose unproductively of precious water (Mathew & Ho, 1993). Perished cistern valve seals and leaking taps intensify this wastage. Lightweight, prefabricated houses from the city are vacant and crumbling in the harsh conditions, while people live under loose bits of tin because there was not holistic design around a total living environment. The associated technologies such as solar water heaters, stoves and septic tanks have all suffered from extreme natural elements and their application under lifestyles different to those they were designed for (Pholeros et al., 1993). The new food and consumer products that replace traditional nutrition and preoccupations respectively have their copious quantities of packaging strewn across the landscape. Yet this time they will not decompose (Seeman, 1992). Ironically, and sadly, the health status of indigenous Australians was reduced to that of the nineteenth-century English working class (Engels, 1969).

For a people that have seen such rapid change to their lives and environment Aboriginal communities in remote areas have often been the recipients of technologies, programs and infrastructure where there has been no choice, no participation and no control in the means of production (Walker, 1994). This is perhaps not surprising for a people who
have only just begun to see a tangible process of decolonisation with the Mabo High Court decision (Crough & Christophersen, 1993; Yu, 1996). While government tends to focus on tangibles such as health problems and housing needs, Aboriginal people are often more concerned about access to land and retaining their culture.

2.4.1 Administration of Aboriginal Affairs

The early or colonial history of the administration of Aboriginal affairs with particular reference to Western Australia is given by authors such as McLeod (1984), Haebich (1988) and Hunter (1993). The early policies since European occupation were variously concerned with dispersal, integration or assimilation. Control of development in remote Aboriginal communities varied between the church, pastoralists and the state over time and location, but by the 1980's was firmly in the hands of government.

The transformation of the Federal Department of Aboriginal Affairs (DAA) into ATSIC in 1991 saw considerable devolution of decision-making power to Aboriginal people (Lea & Wolfe, 1993). Restructuring of State Aboriginal Affairs departments has occurred but not to the same extent as DAA to ATSIC. The State departments exist essentially as support service, data gathering, coordination and planning bureaucracies. In Western Australia, the Aboriginal Affairs Planning Authority (AAPA) became the Aboriginal Affairs Department (AAD) in 1994 incorporating several other statutory bodies (such as the Department of Aboriginal Sites), terminating most community funding responsibilities and limiting itself largely to policy and coordination functions (AAD, 1995).

The effectiveness of the Federal and State departments to facilitate community development programs, even in recent times, is questionable, including where the responsibilities for service provision have been subcontracted to State Government utilities or private consultants and contractors. This ineffectiveness, and in fact
inappropriateness, occurs on a policy and personnel level. In contrast, the rigour applied to selection of volunteers for overseas aid postings is awesome. While the Commonwealth is perhaps moving forward on a community development approach, State governments are probably doing the reverse in the rush to privatise their utilities and operate on a purely fee for service basis. The control-orientation of governmental "community development" models has been raised by others (Walker, 1986, 1994; Race Discrimination Commissioner, 1994; Young, 1995).

There has been a general understanding and practice for the Australian Government to fund infrastructure development in remote communities, and the Western Australian Government to coordinate and deliver services to the 48 remote communities mentioned earlier, town reserves and urban Aboriginal dwellers (AAPA, 1992). The State Government has consistently refused to fund the development of outstations (AAD, 1995). These arrangements have been fraught with difficulties for many years as the two Governments, whether they are Labor or Liberal Coalition in Canberra and Perth, have never been able to negotiate a bilateral agreement satisfactory to both sides. This partly demonstrates the autonomy of commonwealth, state and local governments in the federal structure. Thus, top-down activity within the Aboriginal affairs decision-making apparatus cannot be assumed (Fletcher, 1992). In the political processes of policy formulation of single agencies, Aboriginal community organisations have exerted influence as well as the interactions of other agencies.

The National Commitment to Improved Outcomes in the Delivery of Programs and Services for Aboriginal Peoples and Torres Strait Islanders by the Council of Australian Governments in December, 1992 sought to achieve greater coordination in the delivery of services through bilateral agreements with improved outcomes. The National Commitment recognised the preferred role of Aboriginal organisations in service delivery, but if not possible through government agencies with consultation and adaptation to Aboriginal community needs. Bilateral agreements had not been reached with the WA State Government.

Apparently, there are some advantages to the plethora of agencies being involved in the process of Aboriginal development (Sanders, 1993). From the range of mainstream services some are of great benefit to Aboriginal communities. However, the rationalisation of funding routes with a view to simplifying administration and the increased role of Aboriginal regional resource agencies will be beneficial. Both will decrease the burdens on remote communities already suffering disadvantage.
2.4.2 Federal Government Responsibilities

The Commonwealth Government first became involved in Aboriginal Affairs administration on a national scale after the 1967 referendum. "State reluctance to service Aborigines, and state willingness to formally sign over the chattels of the Western Australian Aboriginal Affairs Planning Authority to the Commonwealth in 1974, accelerated the growth of the then Commonwealth Department of Aboriginal Affairs" (Fletcher, 1992). During "the period 1973 to 1984... the Commonwealth assumed pre-eminent responsibility for services and programs in Aboriginal communities" (AAPA, 1991). However, since then negotiations have continued for the WA Government to assume increased financial and functional responsibility for service delivery, as has occurred in other states.

The change from the Federal Department of Aboriginal Affairs (DAA) into the Aboriginal & Torres Strait Islander Commission (ATSIC) in 1990 saw the introduction of an elected wing of Regional Councillors while retaining the former, albeit restructured, bureaucracy as the administrative wing. This allowed for a more participatory but formalised approach to community development, if only on the macro planning and budgetary levels. This restructure called for the preparation of Regional Plans through "community-based planning" (ATSIC, 1993) by each of the 60 regions on which all future local programs and spending would be based. In addition, each individual community was urged to develop their own "community plan". The planning approach had vehement criticism from sections of the Aboriginal community for the huge burden it placed upon individual communities, its centralist origins and continuing control. But while numerous inadequacies and contradictions were identified (Lea and Wolfe, 1993) it was seen by some as a constructive part of the overall process.

Wolfe (1994) described cases where the planning process had been constructive. Each of the three West Kimberley resource agencies (Mamabulunjin, Marra Worra Worra and Winun Ngari) instituted a Community Development Unit which was Aboriginal-controlled and largely Aboriginal-staffed, and these units were particularly effective in the planning process. A Community Building Working Framework had been developed to assist the process (McCauley, 1990).

The reduction in the number of Regional Councils in 1992 from 60 to 30 across Australia as a cost-cutting exercise had a major impact on the effectiveness of democratic and cultural representation. In WA this resulted in a reduction to 9 Regional Councils and four Zones (a map in Appendix Two defines ATSIC regions). This had major repercussions for the Fitzroy Valley region where the Marra Worra Worra management committee and the Regional Council had been elected as one and the same allowing for an
efficient determination of needs and allocation of funds. After the change the Fitzroy region was absorbed into the larger Malarabah region and had to compete for resources against other West Kimberley communities and organisations (Marra Worra Worra, 1995).

An important program funded by ATSIC in many Aboriginal communities was the Community Development Employment Program (CDEP). For those communities that opted for this scheme and satisfied the criteria the social security economy was redirected into meeting the needs of capital development and maintenance with the aim of providing local employment. Allbrook & Kickett (1994) described the numerous benefits of CDEP. Importantly, CDEP often filled the gap in services normally provided by Local Government or other agencies.

Another centrally-driven national ATSIC program was the National Aboriginal Health Strategy (NAHS, 1989). In the 1994/95 Federal budget NAHS was funded for another five-year period, which included funds for the ATSIC Community Housing and Infrastructure Program (CHIP) managed by Australian Construction Services (ACS) nationally. The Health Infrastructure Priority Program (HIPP) was established as a sub-program of NAHS and would be managed nationally by engineering consultants Ove Arup and Partners with $20 million over three years (Ove Arup, 1995). HIPP would target communities most in need of water, sewerage, housing, power and internal roads. Once it was underway in WA it began to establish linkages with regional initiatives such as the ATSIC Wunan Regional Council, which had developed a regional housing and infrastructure committee, and statewide initiatives such as the community town plans pilot project by AAD and ATSIC.

2.4.3 State Government Responsibilities

The Aboriginal Affairs Planning Authority was effectively abolished in October, 1994 and the Aboriginal Affairs Department created in November generally in accordance with the recommendations of Task Force on Aboriginal Social Justice (Daube, 1994). The reasoning was that the expectations for achievement on the former AAPA were far beyond its staff numbers, financial resources, statutory powers and its level of influence in inter-departmental policy formulation. A new department was necessary with the power to more effectively carry out the functions of planning, advice, coordination and monitoring. Land administration was to remain a strong program element but should eventually be transferred to the Department of Land Administration. Regional Offices were to be established in the Kimberley, Pilbara, Goldfields, Gascoyne/ Murchison, South West and Perth with the roles of "identifying local need, coordinating government
agencies, and management of local programs and also provide local support for consultative processes and allow for greater participation by Aboriginal people in local service provision" (Daube, 1994). The resultant apparatus and its roles were outlined in the first Annual Report (AAD, 1995).

Marra Worra Worra (1995) found the supposed necessity of a coordination focus by a new department of 100 staff and a $20 million annual budget while providing no actual services or grants-in-aid to communities incredible. The need for coordination only became necessary as a result of the government's sectoral approach to service delivery. Marra Worra Worra proposed a regional approach as an alternative with four models suggested by which this could be done. These are explained in section 2.5.

It is apparent from the restructure and Daube (1994) that the focus clearly is on a continuation of former practices with similar funding arrangements but with greater efficiency as the main objective. There was no mention of empowering existing Aboriginal regional organisations to become more capable of delivering more services to communities. One would think that this would be a reasonable expectation given the government's commitment to privatising the utilities and putting all essential service provision to Aboriginal communities out to tender. It had already been found that the preferential tendering system for Aboriginal enterprises had not worked effectively (Gordon, 1994). It was later recommended that a massively increased injection of funds was necessary to bring communities up to standard and offset future increased costs to the people of WA (Hames, 1995). In attempting to act on this recommendation the AAD submitted a budget request of $26 million to start the Hames process. They were advised that they would be lucky to receive $3 million (Collins, 1996).

State Government arrangements for service delivery are elaborated in section 2.5.

2.4.4 Local Government Responsibilities

In Western Australia numerous studies have highlighted the poor nature of essential services provision to Aboriginal towns and outstations (Rumley 1986, Rumley 1988, Davis 1990, Daube, 1994) which resulted in the squalor and human degradation experienced. Nationally, the inadequacy of Local Government authorities (LGAs) was pointed out in the Miller Report (1985), the Self Report (1986), 'Proposed Policy for Aboriginal Participation and Equity in Local Government' (DAA, 1988), and Davis (1990).
Local Government avoided providing services to Aboriginal communities, both town camps and isolated settlements, on the basis that they did not pay rates, there were not the resources to do so, the funding structure placed higher priority on ratepayers, the Commonwealth was responsible. Local Government was not consulted about development that occurs on communities, they were on land not under their jurisdiction and a range of other reasons as found by Davis (1990) and Allbrook & Kickett (1994).

The WA Government in conjunction with the then Department of Aboriginal Affairs devised a number of options for interaction between Local Government and Aboriginal towns for participation and delivery of municipal services (Wood, 1989). This really was only a beginning. Once Local Government had become committed to expending funds in Aboriginal communities it would then need to realise that the standard technologies implemented in non-Aboriginal towns for essential services may be inappropriate. Some existing Local Governments may be incapable of providing the required services. Their organisational structures may not be able to deal with requirements of Aboriginal public health (Penman, 1990), for example.

Aboriginal people have become increasingly aware of the potential of Local Government to contribute to the development, maintenance and wellbeing of most community types, while being well aware that the level of service received was well below that for people in gazetted country towns within the respective shires. Many municipal-type services in remote communities are provided through CDEP, resource agencies or Environmental Health Workers (HDWA, 1992).

While it was determined that there is a statutory responsibility for LGAs to deliver certain services, e.g. environmental health monitoring as per the State Health Act (Barker, 1994), it is generally argued that service delivery is dependent on the availability of funds. Even then it may not be possible to adequately resource some local government authorities to provide the full range of normal services to the most remote communities (Allbrook and Kickett, 1994) which was the aim of Penman's Working Party (Holman & Jolley, 1994).

A number of alternative models of local government were suggested (Allbrook and Kickett, 1994) and are listed in Table 2.2.
Table 2.2: Possible Alternative Models to Local Government

<table>
<thead>
<tr>
<th>Alternative LGA Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gazettal of towns</td>
<td>This was seen as a possible option to give Local Governments a presence in the community. In Jigalong it was noted that non-Aboriginal towns smaller than Aboriginal communities were gazetted, and had municipal services provided by the Shire. Some immediate difficulties with such an option concern the status and ownership of land, and their status as Aboriginal towns, presumably mainly for the use of Aboriginal people.</td>
</tr>
<tr>
<td>Creation of new LGAs</td>
<td>The example of the splitting of the Shire of Wiluna was cited as providing a possible precedent for the creation of new LGAs centred on Aboriginal towns. The State Government had been willing to support the splitting of existing LGAs to accommodate ‘communities of interest’, as in the case of Wiluna and the more recent split of the City of Perth. Other factors in the creation of new LGAs included the economic feasibility of the proposed area, and factors such as common culture and language. A number of Aboriginal communities were interested in exploring this option further, including Jigalong and Balgo. An advantage would be the development of services to homelands and outstations of the community. Community Councils would be much better placed to develop services than current Local Governments.</td>
</tr>
<tr>
<td>Amendment of Local Government legislation</td>
<td>It was suggested that the State Government should explore the systems of Aboriginal Local Government adopted in the Northern Territory and Queensland. In the NT, governing community councils are empowered to make submissions to the Local Government and to receive allocations along with other Local Governments. Although this system operates within the context of Commonwealth Land Rights legislation, it serves as a possible model for WA, particularly as the recent Commonwealth Native Title Act may present an avenue for some communities gaining title to the land they occupy.</td>
</tr>
</tbody>
</table>

The relationships between State and Local Government were problematic for Aboriginals in their efforts to gain essential services. In the following section the actual mode of technology-practice in available service delivery is characterised.

2.5 TECHNOLOGY-PRACTICE IN SERVICE DELIVERY BY GOVERNMENT

In this section the design and delivery of housing, water supply, sewerage, power, environmental health services and training programs to support these systems are examined to define the dominant paradigm of technology-practice.

2.5.1 Housing

In WA the measures of housing disadvantage to Aboriginal people varied, and perhaps the only serious attempt to accurately quantify this was by the ATSIC Housing Needs Survey in 1992. This national survey combined other sources of information to estimate the backlog of demand, including water, sewerage and power requirements, to cost in the order of $2 billion to bring up to standards expected. In the Kimberley, for example, it was not uncommon for up to 30 people consisting of 4 families to be using a single house in some locations (Machell, 1994).
In Western Australia Aboriginal community housing was provided through both the State Government Housing Commission (Homeswest) and ATSIC through CHIP, NAHS and most recently HIPP. In Homeswest this work was known as the Remote Area Program through the Aboriginal Villages Section. Once housing had been built the asset was handed over to the local or regional community organisation for management, and maintenance was expected through collection of rental monies. It has been shown continually that this was never enough for total maintenance, and different programs have subsequently had to fund capital upgrades to degraded housing stock (Memmott, 1992; Kickett, 1993). The Aboriginal Rental Housing Program with Commonwealth-State Housing Agreement funds allowed specific housing to be set aside for Aboriginal tenants. It was a Homeswest asset to be managed and maintained by Homeswest.

Within Homeswest an Aboriginal advisory capacity was established through the Aboriginal Housing Board (AHB). The AHB comprised Aboriginal representatives from around the State. The Management Support Program is a recent initiative of the AHB to assist community organisations more effectively take control of management and maintenance of community housing stock. The AHB became increasingly proactive to move away from a mere advisory capacity within Homeswest to have a more managerial role with the goal of forming a separate statutory authority that would have a complete coordinating responsibility for housing and essential services to Aboriginal communities across the State. Negotiations to this end continued and the AHB retained a strong vision for what should be achieved (Kickett, 1993). This centralised approach to housing had its critics (e.g. Jackamarra, 1992) but the AHB attempted to steer the program into greater autonomy for centralisation with more Aboriginal control as an improvement. With the new State Government the Hames (1995) Report into essential services was commissioned which also recommended a central authority be established to coordinate all service delivery to Aboriginal communities. This too was criticised by some sections of the Aboriginal community who demanded regional control (Marra Worra Worra, 1995).

The inappropriate use of Western technology and design process in Aboriginal community housing is well documented (Heppel, 1979; Memmott, 1988; Walker, 1990a; Pholeros et al., 1993). Nevertheless, there has been much progress in the approach to housing and there are now numerous experienced architects, builders, Aboriginal housing associations and Aboriginal building companies. The biggest drawbacks that remain are:

- the political will to allocate the necessary funds to meet the backlog of need;
- allocation of funds in blocks large enough for a community to build several houses at once to achieve economies of scale;
• provision of funds over a longer accounting cycle that takes into account climatic factors (e.g. the wet season) and cultural factors (e.g. ceremonial activities);

• provision of information on the range of designs and technologies available for housing and associated services;

• recognition of the relationships between housing and conventional services (diesel power station, deep sewerage and lagoons) that may give rise to town plan layouts contrary to the culturally-preferred spatial layouts;

• and the devolution of power and management to Aboriginal organisations for the planning, design, construction and maintenance of housing (Spring, 1995).

Machell (1994) detailed an effective community housing process for Aboriginal clients not entirely familiar with living in conventional housing and using AHB funds. The consultation and design process made use of visits to existing houses in other communities by the clients, cardboard models and incorporated a number of cultural and climatic design considerations - a range of activities not always deployed in Aboriginal housing by agencies, architects or builders.

The experience of South Australian builder, Nomadic Enterprises, was the need to supply relatively large constructions with a number of bedrooms and wide verandahs. This reflects not only big families wanting to occupy the one home but also a more outdoor lifestyle with the house being used more for its wet area, shelter during the wet season and lockable storage amenity. Certainly, low-cost buildings are desirable and sometimes essential with limited funds, but generally the cost of housing in remote areas, particularly when of a conventional nature, is high. Durable long-lasting designs at higher cost may be more cost effective in the long term.

In many cases Aboriginal people have lived on town fringes and cattle stations in European housing and, even if substandard, seek such shelter upon returning to traditional lands. There is no doubt that such housing with all the modern amenities will vastly improve environmental hygiene, but only if it is supported by understanding of the technology and maintenance. While the people are showing a self-motivated attempt to resume more traditional lifestyles the imposition of modern housing and services, without participation in design or construction, may impinge on their culture and push them into being 'black whites'. "In other words the new housing that is provided should not require from the Aborigines the kinds of changed behaviours that may threaten their law" (Tonkinson, 1979). Or as Lantzke (1988) has said it is possible to use a different technology and retain, if only to some extent, the same value base.
Ross (1987) found that incompatible living conditions imposed on people already suffering from high levels of stress became overwhelming, and proposed the following consultation and planning sequence for the design of new settlements and housing:

1. *...discuss with Aboriginal people as many of the management and associated factors as possible, pointing out the likely effects on decisions to be made later in the design process...*;
2. *...discuss the location of the settlement as a whole, in relation to natural features such as hills and bush, and to man-made features such as towns, services, roads and other Aboriginal communities or camps;*
3. *...work out in consultation the basic elements of a town plan, paying particular attention to intergroup and interhousehold distances and their positioning relative to one another...*;
4. *Only after the other criteria and town plan have been discussed, is it appropriate to work through the details of the house design. By this time the need for social control and protection through architectural barriers, versus the desire for openness, should be nearly established...*

The success of the above approach is contingent upon siting on or available access to nearby traditional homelands. The AAD and ATSIC commenced a town plans pilot project in 1996 through the Intergovernment Working Group/Environmental Health Needs Coordinating Committee. The aims of this appeared reasonable - once developed in consultation with the communities they would serve as the basis on which development would be negotiated. It was not clear whether the intention was for government to control the type and rate of development, whether government would convince communities that layout was dictated by services (power, sewerage, etc.) into grids or cul-de-sacs or whether cultural preferences on the spatial arrangement would prevail requiring on-site waste disposal and renewable energy, for example, instead of centralised systems. It was hard to see that this would put in place a process that was able to be managed by small, individual communities. No mention was made of involving regional resource or housing organisations who could support the planning for small, dispersed communities.

Housing is a key factor which provides an insight into the social dynamics of the residents. A study by Memmott (1992) of the collapsed community and dilapidated housing stock at the Yaji (Yardgee) housing estate by Homeswest in Hall’s Creek reveals some of these dynamics. Different bureaucrats advocated solutions such as removal of the problem from the Homeswest sphere of influence by complete bulldozing; a 'salt and pepper' mix of Aboriginal and non-Aboriginal residents to provide stability; and demolition with components salvaged for other nearby town camps. However, Memmott recommended a solution on the basis of the aspirations of the Kija people who historically had most consistently occupied this housing estate. Given that lack of control by these people had resulted in destruction of housing stock in various ways, a process of self-determination by hopeful Kija occupants for the housing refurbishment would mean empowerment and community development. It was proposed that this be achieved through direct negotiation between the Kija and government. The long term benefits to
the housing estate through the sense of ownership generated would probably flow on into an easing of racial tensions in the wider town community. This must be considered as an objective rather than mere short-term cost-effectiveness. It is unreasonable to expect different groups of people's value systems to change in the short term. The concept of creating communities based on common value systems as advocated above by Memmott still allowed for interaction and respect in the wider township.

Around Australia self-help projects for permanent housing have occurred in a number of Aboriginal and Torres Strait Islander communities either self-motivated, through CDEP or innovative programs and various styles and materials have been tried (Davies, 1994). Haar (1992) explained that different Community Councils have different social and political structures and therefore approaches to self-help need to be carefully tailored to suit the local needs, but generally they can be accommodated by "community-based housing", "group self-build", "individual self-build" or a combination of these. In most cases community-based housing or communal self-help is where the Community Council runs the building program which employs local labour and some external tradespeople on wages to produce rental housing stock for the general community. In group self-build a number of families pool their labour and skills, and with the assistance of council resources build homes for one another collectively. The motivation is towards home ownership. Individual self-build is where families independently design and construct their own houses at their own pace with financial, technical and resource assistance from council where required. Again the motive is home ownership. Haar (1992) also described ways in which environmental technologies could be incorporated into the housing projects such as climate sensible design, renewable energy, composting toilets, wastewater reuse and a variety of building construction techniques and materials.

Surprisingly, some 25% of Australian homes are individual owner-built. As a proportion of the total number of houses built since the 1940's this represents a substantial decrease, but the actual numbers have remained the same at about 30,000 per annum (Holland, 1993). Due to personal preferences, building codes and local government requirements the great majority of these are conventional suburban housing. The opportunities for Aboriginal people in Western Australia for the various approaches to owner-building are still wide open, even moreso given the non-applicability of the Building Code of Australia on Aboriginal land (Barker, 1994). However, a point in time is approaching whereby this loophole may be closed for Aboriginal people if the Government of Western Australia acts on the recommendation to prepare a set of remote area guidelines (Barker, 1994). Barker recognised the need for communities to be involved in the setting of standards. Unless the Aboriginal representatives were able to secure agreement in this formulation process for autonomous, community-based design development, it is unlikely that
Aboriginal communities will have the option of a model for full control over design: construction.

Paternalism was most clear in the continued difficulties in securing land title and living areas for Aboriginal people. If Aboriginal people do not see themselves with secure title to land, as with anyone, they will be disinterested in self-built housing. There will be nothing more empowering for Aboriginal people than land rights. Not just individual title, which may be satisfactory for people in Western society, but common title for a group that have cultural affiliation with the land. This will be the underlying asset which then provides a base on which to build motivation and housing. As far as community housing is concerned, whether it is built by individual community members, collectively under say CDEP or by outside contractors will depend on the level of skills and technical support available to the community. The experience from a number of atypical Western Australian housing projects suggested that this almost always had a "community-building" effect (Anda & McGrath, 1990). Lack of skills, a community of frail and aged or other priorities may discourage self-build. Accessible information, community participation in planning and design, and community or regional ownership of the stock were essential for acceptable and sustainable housing. The housing debate for years comprised of, at one end of the spectrum, the view that all Commonwealth funds should bypass the State and go direct to local or regional community organisations (e.g. Marra Worra Worra, 1995) and, at the other end, the view that one single State authority should be responsible for all housing provision (e.g. Hames, 1995).

2.5.2 Water Supply

The Water Authority of Western Australia (WAWA) carried out the establishment and maintenance of community-scale water supply and sewerage facilities in Aboriginal settlements. This was done on a fee for service basis for DAA and ATSIC for the capital works, and the same with maintenance for AAPA. The WAWA was restructured and split into the utility, the Water Corporation, and the regulator, the Office of Water, in 1995. The Water Corporation decided it would not continue to provide the service to Aboriginal communities under the previous arrangements, and the AAD began preparations to coordinate the contracting out of maintenance for water supply and sewerage systems by tender.

The WAWA consultancy and contract service in 1994 extended to approximately 50 remote Aboriginal communities and over 80 newly emerging communities as shown in Table 2.3:
Table 2.3: Communities Serviced by WAWA (WAWA, 1994)

<table>
<thead>
<tr>
<th>Geographic area</th>
<th>Number of communities:</th>
<th>Remote</th>
<th>Emerging</th>
<th>Projected</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Kimberley</td>
<td></td>
<td>11</td>
<td>17</td>
<td>29</td>
</tr>
<tr>
<td>West Kimberley</td>
<td></td>
<td>17</td>
<td>19</td>
<td>30</td>
</tr>
<tr>
<td>Goldfields</td>
<td></td>
<td>12</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Pilbara</td>
<td></td>
<td>5</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Mid West</td>
<td></td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>47</td>
<td>50</td>
<td>87</td>
</tr>
</tbody>
</table>

Apparently for ease of standardisation of engineering design the WAWA categorised Aboriginal settlements into Community Types 1 to 7 which represented a population range of less than 10 (a single family say) to greater than 100 (a stable, large settlement). WAWA compiled characteristics of generic community types and defined the level of water supply service to be provided at each. Across the WAWA settlement spectrum infrastructure development ranged from a camping area only with a handpump to a fully serviced community with a wide variety of established facilities such as housing, school, clinic, postal agency. 'Newly emerging' communities were categorised as Community Types 1 to 3 while 'remote communities' were categorised as Community Types 4 to 7 (WAWA, 1994). However, "In practice the distinctions between community types are blurred. Many Aboriginal people have interests in more than one settlement within their traditional estate thus accounting for extensive and regular travel" (AAPA, 1991)

The WAWA organised its activities around a number of regions, each with an Aboriginal Communities Coordination Officer and a central office for remote areas in Karratha. The officer would visit communities on a regular inspection cycle and note capital upgrade and maintenance works required. Otherwise the officer would respond to calls direct from the community for assistance. The officer would arrange for the necessary fitters or mechanics to visit the community and conduct the work required (Anda, 1992).

In virtually all communities the water supplies are taken from groundwater sources with the WAWA conducting the drilling programs. A variety of methods are used for extraction depending on the site and availability of funds. For example, at Punmu and Mambaltjari (Woodstock) pumping is by windmills. At Jigalong diesel motors are used. A number of communities in the Kimberley have solar water pumping. There are generally a number of bores for safety particularly in communities like Yandeyarra and Jigalong where groundwater supplies are extremely limited and, in fact, can reach their limit when large numbers of people arrive at the community, for example, at times of traditional ceremonies (Anda, 1992).
Coonana is an example of where groundwater was not located by the drilling program. Water supply was by rainwater catchment in a number of dams installed at strategic points in the topography. However, the preferred source of drinking water for the residents was from the 7,000-litre rainwater tanks installed on each house. Many people were not at ease drinking the dam water which was often treated with alum to reduce turbidity. Severe water shortages had occurred over the years as a result of the complete water supply system not having been installed as promised after the community was relocated from Cundeelee (Anda, 1991). The problems associated with water supply at Coonana led to its inclusion in the Human Rights and Equal Opportunities Commission national water study (Race Discrimination Commissioner, 1994).

In most cases drilling is conducted until a supply is found that requires little or no treatment and meets NH&MRC standards. In most communities only chlorination is carried out. Some communities prefer not to do this as they dislike the taste. At Punmu one water supply received ultraviolet disinfection (Race Discrimination Commissioner, 1994).

The WAWA would normally be involved in installation up to and including the ring mains around the community. After this the housing contract would make connections from the ring mains to houses. Even this level of coordination was sometimes too difficult with some houses at Punmu, for example, not ever having been connected (Race Discrimination Commissioner, 1994).

The range of water supply options available to remote communities was well documented in the study by the Australian Water Resources Council (AWRC, 1989).

2.5.3 Sewerage

In recent years with Federal funding the preferred technology for sewerage by the WAWA was below ground pipework to sewage lagoons via pump stations. It is worth considering the basis of this technology choice, because the same rationale put forward for its adoption over 100 years ago as the predominant solution for human waste disposal in Western society (Tarr et al, 1984; Beder, 1993) is now applied to remote Aboriginal communities. For a water-based sewerage system the lagoon method has been said to be the most reliable, cost-effective and easiest to maintain with a high quality effluent, if any, leaving the last lagoon (Cairncross & Feachem, 1983). In other locations a drawback can be the amount of land required although there is generally not a shortage in remote communities. The number of lagoons installed appeared to be on the basis of population, with some communities having only one, e.g. Tjalka Warra, Pipunya (Marble Bar).
Normally however, the basis was treatment optimisation with one facultative pond followed by at least one maturation pond (WAWA, 1994). With population and/or influent increase an anaerobic lagoon could be added before these. Further still a mechanically aerated lagoon can then be installed after the anaerobic lagoon, although it was unlikely for this to be necessary in a remote Aboriginal settlement.

There are certain advantages of the deep sewerage and lagoon systems:

- after a certain number of houses the conventional 'economies of scale' argument comes into effect against individual on-site systems;
- the system lends itself well to the cultural differences in Aboriginal communities - where some houses may go empty for certain periods others may be overcrowded with visitors at the same time or at ceremonial times overloading on-site leach fields but having little impact on lagoons;
- overall the system can be reliable, and operation and some maintenance is possible with trained community-based staff and regional support from a technical agency such as WAWA;
- the opportunities for wastewater reuse from the lagoons have not been exploited (Mathew & Ho, 1993);
- with a reliable electricity supply for pump stations the system is relatively passive.

Deep sewerage with pump stations are expensive and, although the systems can be designed to accommodate future expansion for population growth, incremental installation is not possible requiring a large capital outlay at the beginning.

The range of sewerage options available to remote communities was well documented in the study by the Australian Water Resources Council (AWRC, 1988).

Outstations or town camps often had self-built pit toilets and VIP toilets still remained in established communities, e.g. Punmu, Parnngurr, Goodabinya, Ngarrawaana (Anda, 1992).

Remote communities with a small number of houses or ablutions facilities generally disposed of effluent from laundry, showers and flushing toilets to on-site systems comprising septic tanks and leach drains. These were installed as part of the housing contract and the maintenance became the responsibility of the householder or community. Systems were standard size for 6-8 people and were not adequately designed to correspond with the living characteristics of Aboriginal families. The disposal systems worked well under normal circumstances, however, houses were often overcrowded resulting in increased effluent volumes and normal maintenance requirements were not undertaken. In remote areas if the local government was not supportive, the regional
resource agency was limited in capacity, there were no Environmental Health Workers or the knowledge of the residents was limited, these on-site systems would often fail.

Dual leach drains had a diverter valve to alternate between them when saturated, however, this operating procedure was usually not known to householders or Community Council. The systems had usually been installed by outside contractors without rigorous community participation and no follow up maintenance programs. Some communities had sludge pumps and trailers so desludging of septic tanks occurred sometimes. The septic tanks were often not protected against vehicle traffic and thus lids were broken. In some cases septic systems were located, along with the entire settlement, on flood plains resulting in severe public health risks during pronounced wet seasons. Lack of toilet paper resulted in other objects placed in toilet pans causing blockages in sewers and overflows into houses. The rubber seals in toilet cisterns and pans often perish without replacement leading to wastage of water and wet floors (Anda, 1992; HDWA, 1992).

In a review of Western Desert communities (Brown, 1994), the value of a regional approach to wastewater disposal was understood. Even though the communities were large distances from each other they identified with each other culturally and were represented under a single ATSIC Regional Council. There were collective approaches to negotiating for resources. The communities were supported by their regional resource agency - Western Desert Puntukurnuparna Aboriginal Corporation (WDPAC). Brown recommended that WDPAC:

- appoint a Coordinator to oversee the disposal of wastewater within the communities with responsibilities;
- oversee the wastewater disposal operations at all communities;
- appoint and advise the Community Wastewater Disposal Representative;
- develop education programmes and maintenance capacity within the communities in liaison with Pandalurra College;
- coordinate the activities of external plumbing contractors.

Brown also recognised the value of retaining on-site disposal at Punnumu, which had been recommended in earlier independent studies also, as well as in the other seven Western Desert communities. However, they were to be rebuilt into larger systems to cope with overcrowding in houses, and septic tanks were to be protected by bollards from motor cars. The sewered, centralised system worked well in Jigalong, the largest Western Desert community in WA, and was to be retained with connection of the two outstanding houses.

The environment of 19th century England in which the water-based sewerage engineering paradigm became institutionalised was totally different to that of remote Aboriginal communities today. While it brought many public health benefits with its introduction to unsanitary conditions there were other technologies then and many more today that could
serve as the basis for an alternative paradigm that provided economic, social and environmental as well as public health benefits.

### 2.5.4 Electricity Supplies

The arrangements for electricity supplies were similar with DAA/ATSIC purchasing services from the State Energy Commission of WA (now Western Power) for remote communities. Western Power installed and maintained diesel power stations through its Village Power Branch. Maintenance was conducted on a cyclical basis with a touring team of technicians. AAD and ATSIC funded the recurrent fuel bills. It was difficult to correctly size the generator sets because of the growing or fluctuating populations that characterised remote communities. Undersized power stations would never be able to satisfy demand for electrical energy, and oversize systems would idle away inefficiently at below optimal load. Battery banks were added for low, steady energy demands with diesel engines only operating at full load for charge-up or high demand. Nevertheless, lead-acid batteries required liquid monitoring, gel batteries did not have as long life expectancy and operation at higher temperatures was a problem (Anda, 1992).

Only in rare cases were RAPS (remote area power supply) systems installed and these were often fraught with difficulties as there had not been adequate maintenance back-up nor any technology transfer through training programs or otherwise. Synergy Power Corporation provided case study costings of different solar-wind-diesel hybrid systems in different community settings. It was shown that where diesel fuel costs reached $2.50/litre, which could occur where fuel had to be trucked in to remote locations, the payback period of a renewable energy system could be less than 12 months. Village Power Branch had supplied solar-battery-diesel packages to some communities, e.g. La Djudarr Bay north of Broome, but these had been problematic in terms of reliability. The inhibiting factors against renewables were that they required a higher up-front capital cost and diesel was a familiar technology (Anda, 1995).

### 2.5.5 Environmental Health Services

During 1991 consultants employed to conduct a review of the Aboriginal Environmental Health Program (AEHP) (Lewin & Jamrozik, 1993) asked staff, Aboriginal Environmental Health Workers (EHWs) and trainees what 'adequate' environmental health was for Aboriginal communities. The question went largely unanswered. At that time, neither the Health Department of Western Australia (HDWA) (e.g. HDWA, 1990) nor the independent Aboriginal health services (e.g. Wronski & Smallgood, undated)
could define 'adequate' environmental health. However, the latter understood that mainstream environmental health services may not necessarily be "appropriate" for Aboriginal communities.

The complexities of the situation were summarised by Andrew Penman (1991), at the time HDWA Assistant Commissioner:

Consider now the difficulties that community management faces in its interaction with external agencies and services. Who can deny that they face a procedural and jurisdictional nightmare. The sheer number of agencies with which they must deal is bewildering and I doubt that even the most informed person would understand the differences in their responsibilities. Indeed, there is uncertainty in the minds of the agencies themselves, usually resolved in the direction of limiting their own responsibility. The Health Department, you may well assume, is responsible for Health - or is it? On the other hand, the responsibility for enforcing the provisions of the Health Act for environmental sanitation and for providing sanitary services rests with Local Government. On the other hand, Local Government may claim its responsibility for sanitary services does not extend beyond gazetted town sites. On the other hand, it is required to approve all proposals to install septic tanks and assess the adequacy of their construction. On the other hand, as developments in Aboriginal communities are on Crown Land and frequently auspiced by the Commonwealth or State, the agencies may claim that they are exempt from the provisions of the Health Act which does not specifically bind the Crown.

The Health Department of Western Australia, however, did not feel that environmental health services should be any different to those provided to mainstream communities after receiving legal opinion on the matter. NAHS (1987), on the other hand, had recommended that a technical/advisory group representative of Aboriginal interests and appropriate technical expertise be appointed to define standards for environmental conditions in Aboriginal communities. Understanding that a different approach to standards and enforcement may be necessary in Aboriginal communities the review of the AEHP (Lewin & Jamrozik, 1993) recommended that the main objective of the program be changed to read as follows: "To ensure that adequate and appropriate environmental health services and standards exist in Aboriginal communities through the application of the Health Act in consultation and cooperation with the local public health services as well as the Aboriginal communities and their representatives". This was a broader statement that attempted to involve all and appease all but would give rise to a complex set of procedures best handled representatively by a regional Aboriginal organisation rather than placing inordinate administrative burdens on individual, smaller communities. More Aboriginal control of the process would also ensure that "adequate" could be defined (Reid, 1982).

A concerted collaborative approach to the improvement of environmental health commenced with the first meeting in July, 1995 of an Inter-Governmental Working Group (IGWG) comprising officers from ATSIC, AHB, Department of Human Services & Health, AAD, HDWA and WAMA. IGWG was to "systematically map out the range of programs delivered into communities with the broad aim of identifying opportunities
EHWs to operate the backhoe and lack of time during the one-week module to learn backhoe operation (Anda, 1992).

Wages for EHWs has always been a major area of concern. Initially, the only remuneration was provided by communities through CDEP or by Commonwealth-funded AMSs. In 1991 Andrew Penman, Assistant Commissioner, Country Operations HDWA was able to convince the State Government to provide $750,000 pa recurrent funding for EHW wages. After this had been divided up amongst the regions it provided 8 full-time waged positions and 4 half-time in the Pilbara. A good start but a requirement for more fully funded positions remained. Several models existed in the Pilbara for disbursement of funds for EHW wages, perhaps making it difficult for defining a clear career structure. However, given the complexity of public administration and factionalism amongst Aboriginal people in the Pilbara some flexibility was probably needed (Anda, 1992).

Another aspect of concern for many Aboriginal people in the Pilbara was the relationship of the programme with Local Government. For many rural regions in Australia the history of Shire Councils was nothing less than antagonistic to the Aboriginal aspirations of development. A tactic of the wage funds disbursement by the Pilbara Health Unit of HDWA was to hand over the wages for Yandeyarra, Newman and Marble Bar to East Pilbara Shire for administration and provision of "other goods & services" (OGS). Similarly, to Ashburton Council for Onslow/Bindi. Town of Port Hedland wouldn't accept it due to the expectation of having to provide OGS. An aim of Pilbara Health was to gain more support from Local Government in the areas of health and building inspection, rubbish collection, road maintenance services. The politics, however, related to land tenure, payment of rates, overlap of roles of government departments and were complex. The issues and attitudes varied amongst communities and regions (Anda, 1992). Generally, though the desire was for self-determination. The Ngarda-Ngarli-Yamdu ATSIC Regional Council (1993), for example, expressed the desire for Aboriginal control of funds, avoidance of Local Government altogether and technical support only from HDWA.

It was proposed for some time to commence second stage or advanced training modules which would enable graduate EHWs to achieve the "Certificate of Advanced Environmental Health Worker". The modules included 1) Advanced Water Supply (core), 2) Advanced Sewerage (core), 3) Appropriate Technology (elective), 4) Revegetation (elective), 5) First Aid (elective). This second stage training would provide career development opportunities in and out of the community and move communities towards more self-reliance. WAWA, for example, were keen to offer custodian positions to adequately trained EHWs for operation and maintenance of remote community water supply and sewerage infrastructure (Anda, 1992).
The AEHP Review (Lewin & Jamrozik, 1993) was largely supportive and constructive towards the EHWTP recommending, for example, some changes that emphasised its community development focus on the one hand, and others that would make it conform more closely with mainstream training procedures on the other. There was not a rush by the HDWA to implement recommendations for an expanded program.

"The major problem with the program is that it can only ever be as good as the community. It is very difficult to get EHWs to work in dysfunctional communities. Why do filthy work for CDEP, when others get paid sit down money for doing nothing? Would you?" (Wright, 1994). A feature of the EHWTP, having envisaged these problems, was the sense of community service it instilled in the trainees, the camaraderie generated through collective practical exercises in communities, communication channels created between EHWs through the newsletter and networking across regions between communities and finally the iconography used on t-shirts, stickers, stationery for ready recognition in all situations. These were all motivational strategies that worked in varying degrees with different people.

"Behavioural change is hard to achieve at the best of times, but in providing the basic educational skills to repair and maintain health hardware, we begin to address some of the community needs" (Wright, 1994). Behavioural change was necessary to allow safe and healthy practices with the available technology, but installing water and sewerage systems and then worrying about human behaviour and support systems later was a let down for the potential effectiveness of this program. Because the program was never fully integrated into community and regional planning, maintenance scheduling prior to installation of community infrastructure and wider government policy formulation it never reached its full potential. As the AEHP Review found it was vastly under-resourced.

Events which followed as a result of increased attention to environmental health by the State Government were centrally-driven, largely a political exercise, and did not assist in empowering the program amongst communities. These were preparation of a new competency-based curriculum, unsuccessful attempts at accreditation, the announcement of $3 million for environmental health (the Environmental Health Action Plan) and the Inter Government Working Group (IGWG). The abandonment of the Community Leaders Management Conference was a serious loss to the process of developing a sense of community ownership. Without winning over the support of community management in this way through addressing their needs in the design and delivery of the program it would always be difficult for the EHW to gain full support from management back at the community. The trend was towards taking the little power away from the elders and
communities to achieve a program that met the criteria of city-based planners and regulators but which was not compatible with community development principles.

Nevertheless, there were positive principles embedded in the EHWTP of importance to this thesis. Suitably skilled 'barefoot' technologists, in the role of regional course coordinators, mobilised members of the community to take on tasks that may have otherwise been left. This empowered the individuals and provided a level of satisfaction to the wider community. The practice, usually involving a technological artefact or technique combined with a relationship of mutual trust, could be referred to as 'community-building technology'. The Community-building Technology concept is explained in detail at the end of Chapter Three.

The Essential Service Maintenance Worker Training Program (ESMWTP) was conceived by the State Government as a response to increasing costs of providing maintenance services to water supply, sewerage and power supply infrastructure in the 48 ACDP remote communities. SECWA and WAWA found it more difficult each year to provide the same level of service on a fixed budget. AAPA was keen to develop more community-based employment opportunities. Given the problems that previous training programs directed at remote Aboriginal communities had experienced, such as the EHWTP, the ESMWTP would not be commenced until accreditation had been received (Certificate in Remote Community Essential Services Work), a community-based career path for participating communities had been confirmed and wages for trainees had been secured (Stewart & Rowse, 1994).

DEET and AAD commenced development of the training program. WAWA and SECWA assisted in the drafting of a duty statement, and it became clear that this was a new occupation that was not accommodated by any existing training programs. A reference group was established which included two Industry Education and Training Councils and unions followed by a smaller working party to develop the curriculum and undertake consultation. A competency-based curriculum was designed which included a core module of basic technical trades training and the four modules on power, water/wastewater, buildings and motor vehicles/plant (Stewart & Rowse, 1994). A pilot program was conducted in 1995 and no further information was available.

It was difficult to see how the ESMWTP would be flexible enough to accommodate the immense differences in each of the communities. The program had been developed in a top-down hierarchical fashion, and it did not appear likely that a sense of ownership and participation would be gained from remote communities. As the State Government, through the AHD/HDWA, attempted to exert more control over the EHWTP it began to become more rigid in its structure and delivery. This was in contrast to the range of
programs that were being run by the Office of On-site Programs at Pundulmurra College, for example, during the late 1980s and early 1990s. These were community-based, flexible and responded to the immediate needs of residents using their local resources and skills with additional support from DEET (Anda & McGrath, 1990). There was a great shortage of such community-building approaches.

2.5.7 The Dominant Paradigm of Technology-Practice

The tragedy of November, 1989 when 8 Aboriginal people perished near Punmu brought great attention to essential services in remote Aboriginal communities. Ashe (1984) had forbade these tragic results if the expanding outstation movement in Western Australia was not treated seriously with appropriate financial and infrastructure support. Meanwhile, Aboriginal people were dying in remote Aboriginal communities due to appalling environmental health conditions. Post neonatal mortality rates were much higher in remote areas of WA than elsewhere in Australia as a direct result of the unsatisfactory arrangements for service delivery in housing, water, sewerage, power, solid waste management and internal roads (Daube, 1994). There was one inquiry after the next each of which questioned the dominant paradigm of government service delivery.

In January, 1990 the State Government announced an Inquiry into Support Structures for Remote Aboriginal Communities with a terms of reference to investigate emergency situations in relation to roads, water supplies, communications and the like. The report was completed by September, 1990. Recommendations called for the provision of radio communications, appropriate vehicles, improved roads, roadside water supplies and improved housing quality so as to avoid safety risks. The AAPA (1991) response was generally in agreement. An implementation strategy was proposed for each recommendation, although in many cases these were contingent on additional funds from ATSIC. HF radios and training were supplied as a project undertaken by RADG (Kutay, 1991).

At about the same time the Equal Opportunities Commission of WA released a study commissioned to "identify discrimination in the provision and maintenance of essential services and facilities to Aboriginal communities" (Davis, 1990). Some of the findings were as follows:

- A situation which essentially amounted to discrimination by Local Government authorities in neglecting to provide adequate municipal services.
- The Western Australian Government would not undertake any capital infrastructure works on Aboriginal communities until funding had been approved from the Federal
Government. Western Australia was the only State which did not contribute funds for such work.

- Lack of coordination between Commonwealth, State and Local authorities.
- While funds were often provided by the Aboriginal Development Commission (now ATSIC) for housing, inadequate funds existed for the services associated with them and subsequent maintenance or upgrading.

In response to the appalling rates of Aboriginal incarceration and deaths in custody nationally the Royal Commission into Aboriginal Deaths in Custody was commissioned by the Australian Government (Johnston, 1991). As the path to incarceration was shown to have direct links back to living conditions a number of recommendations (73, 74 and 76) concerning appropriate design and technology should have by now become well known to service provision agencies. Moreover, Recommendation 324 drew attention to the Tangentyere Council as a model and this is, indeed, given as a case study in section 2.6. Recommendation 325 argued for funds to be provided to Aboriginal housing associations to meet the costs of administration and repairs. Recommendation 326 referred to tendered public works to provide for local determination of award, community employment and training and use of local contractors. Recommendation 327 referred to specific training programs for Aboriginal people to build and maintain their own essential community infrastructure. Overall, one of the fundamental aims of the Commissioner's recommendations was to devolve more control of service delivery into Aboriginal hands in accordance with 'self-determination'. This would be achieved by block funding to Aboriginal organisations who could override conventional accountability requirements and transfer funds between programs as they saw fit to meet their needs. Alternatively, there would be a single program, for example, through ATSIC and once Regional Councils had been allocated funds they would have complete autonomy over their disbursement. However, like all other government departments ATSIC was program-centred and control-oriented and its dedication to public service professionalism prevented it from endorsing these proposals. In ATSIC's response to the Royal Commission one section was remarkable: "Management requires control. Control is contrary to self-determination" (Rowse, 1992a).

Outbreak of serious hookworm infection throughout the Kalumburu community in 1992 precipitated an examination of the powers of the State Health Act to enforce local government authorities' compliance with requirements for environmental health services to discrete Aboriginal settlements within their boundaries. In September, 1993, after the Western Australian Municipal Association (WAMA) had approached the Minister for Local Government, the Working Party on Local Health Authority Services to Aboriginal Communities commenced the following studies:
• Responsibilities of Local Health Authorities and Legal Entitlements of Aboriginal Communities to Services (Barker, 1994);

• Assessment of Local Health Authority Service Delivery Needs in Aboriginal Communities (Holman & Jolley, 1994)

• Revenue and Resources Implications in the Provision of Local Health Authority Services to Aboriginal Communities (KPMG, 1994)

Barker (1994) found that "local government... has for various reasons in the past failed to take an active role in the provision of environmental health services to Aboriginal communities" and, in fact, each community has a legal entitlement to the effective delivery of such services under the State Health Act. The report recommended the adoption of an 11-point Local Government Environmental Health Strategy. The focus of this Strategy was the establishment of a monitoring and reporting process with a regional approach linked to local government authorities. From this legal determination Holman & Jolley (1994) provided more of an action plan:

Ideally, environmental health services to Aboriginal communities should be delivered through networks consisting of a specialised EHO, working from the shire office, and a number of AEHWs located in each of the main communities or groups of communities, working under the direction of the EHO, whether they are employed by the local authority or by the communities themselves.

The report calculated, based on the typical duties of an EHO and the communities involved, the number of EHOs necessary to be 14. It was estimated that 8 or 9 Aboriginal Environmental Health Networks were necessary. "Each network would consist of one or two EHOs working from the local government office and up to 10 AEHWs located in the Aboriginal communities". To this date these positions have not been funded, although changes in the disabilities allowances under the WA Local Government Grants Commission would allow for the receipt of increased funds for shires required to participate in the expanded AEHP. This would not provide all necessary funds, however, and new sources were identified (KPMG, 1994) as being the Task Force on Aboriginal Social Justice and HIPP.

The overwhelming and extraordinary emphasis of these reports was on increasing inspection services, even the secondary consideration of providing more EHWs was to provide backup to these increased inspection services. While the need for maintenance is acknowledged this is generally understood to be at a simple, domestic level. Detailed maintenance work, refurbishment or replacement is not explained and is considered beyond the scope of the EHW or in conflict with the State Health Act. The technology-practice has been defined, set in legislation and was not to be questioned. The assumption was that with increased inspection services correct and sustained operation of technology artefacts and systems will follow smoothly.
The Task Force on Aboriginal Social Justice commenced in September, 1993 with the following terms of reference: *To review the activities of the Government of Western Australia in relation to the social conditions and the development of Aboriginal people and to recommend a strategy for implementation of the Government's program.*

The highest single priority that emerged in the 296 recommendations (Daube, 1994) was the improvement of environmental health conditions. The strategies proposed were drawn largely from the AEHP Review (Lewin and Jamrozik, 1993), the work in progress for the Working Party on Local Health Authority Services to Aboriginal Communities (Holman & Jolley, 1994) and insights by medically-experienced, Task Force Aboriginal member Mrs Sadie Canning. Recommendations addressed key problems that had dogged the WA Government for many years: outstations, negotiations with ATSIC, provision of essential services and fringedwellers. A major outcome of the Daube Report was the restructuring of the AAPA into the Aboriginal Affairs Department (AAD) that would have as its key objective the effective coordination of the various agencies delivering services to remote communities. With much fanfare the State Government announced the release of $5 million for the Aboriginal Environmental Health Action Plan as identified in the Daube Report.

The formation of the Chief Executive Officer Working Party on Essential Services to Aboriginal Communities in October, 1994 was an outcome of the Task force on Aboriginal Social Justice. The terms of reference were as follows:

- *To develop within six months a document for Government outlining the respective responsibilities of State agencies and the provision and maintenance of essential services to Aboriginal communities; and*
- *To develop a plan for the establishment of an Aboriginal Housing and Infrastructure Unit.*

In June, 1995 the Report of the Working Party (Hames, 1995) was presented to the Cabinet of Western Australia. Aspects of the recommendations paralleled those of the Working Party on Local Health Authority Services to Aboriginal Communities. The policy of not funding services to outstations was to be continued. A Housing and Infrastructure Unit would be established within Homeswest to coordinate service delivery in collaboration with the AAD. It would also coordinate the proposed Remote Areas Essential Services Program which would seek to have a minimum level of service installed in each community over a ten year period. Funds for this program would be sought through the ATSIC HIPP $17 million for WA and the recently announced environmental health programs of the Health Department. The development of this work and ongoing maintenance would be negotiated with the Commonwealth Government through a Memorandum of Understanding. A strong argument for this initial large investment of funds to get communities up to standard was that the costs incurred by the State Government from atrocious living environments (corrective services, medical services and other social welfare programs) would be reduced in the long term (Hames,

Hence in 1995, in the light of the formation of the National Native Title Tribunal, the WA Government's loss in its High Court challenge and a series of inquiries that demanded action on the basis of social justice and longer term cost effectiveness, major manoeuvring occurred on the part of the State Government departments and in the Government's relationship with the Commonwealth. However, would the outcome of all this be massively increased delivery of essential services to Aboriginal communities or a paradigm shift in the nature of technology-practice? As Fletcher (1992) noted of earlier bureaucratic adjustments, "programs designed for Aboriginal communities are sometimes used to develop administrative support structures, rather than to deliver an essential service." Regardless of the many departmental officers involved in these political processes demonstrating integrity and tenacious determination to make improvements in the system, considerable constraints to action remained in terms of lack of funds, little devolution of power to regional organisations and prescriptions for technology choice based on standardisation.

Regardless of the concerted efforts by Aboriginal organisations to influence State and Commonwealth Government policy, the key words that are becoming increasingly predominant in policy statements, and indeed, characterise the ideology driving the policy formulation, are the buzzwords: "mainstreaming", "normalisation", "user pays" and so on. This was not what Aboriginal people sought when they chose to remain in remote areas, gain maximum autonomy in their communities or embark on the outstation movement. Indeed, as Commissioner Johnston (1991) explained:

> It would be unfortunate if ideological concerns and narrowly focussed notions of efficiency and effectiveness were to obtrude in discussion about the means to be employed in the delivery of services. It seems to me that there is a need for flexibility as well as for considerations of practicality and efficiency to be taken into account, and, generally speaking, governments and Aboriginal people do acknowledge this in practice. The simple undeniable fact of the matter is that the condition of Aboriginal people is different to that of non-Aboriginal people; firstly, because of the accumulated disadvantage which this report indicates; secondly, because a very substantial number of Aboriginal people live in remote areas; thirdly, because they have a different cultural background; fourthly, they are just coming out of a period of having no rights and no say in their affairs; and fifthly, they have continuously been responding to agendas determined by others. To insist upon mainstreaming in service provision in these circumstances is both more costly in the long term and is thoroughly undesirable in my view.

The dominant paradigm of service delivery can thus be seen to be one of extensive bureaucratic administration, centralisation, control and intense scrutiny in the allocation of funds. This overshadows a range of line agency operations - water, sewerage, power, housing, roads, health, training, environmental health inspection. This paradigm disburses an amount of funds against a background of enormous need that is as effective as keeping a patient just alive on drip feed. It would appear that this is the best that can be
achieved from current government structures with continued political pressure from external Aboriginal community organisations, individuals, and concerned departmental officers who understand that current service delivery systems and the technologies deployed are often insufficient and inappropriate. Clearly a genuine "community development" approach is needed that will empower Aboriginal communities to become more self-reliant and Aboriginal organisations more effective in service delivery to meet the needs of their people. The question of how people can be sufficiently empowered to be able to participate in program delivery and subsequently control it, has been a perennial one of international significance and will be investigated in detail in Chapter Three. While many have provided answers one of the most concise has been: "They first have to become autonomous" (Handler, 1990).

One would hope that the results of the current period of intergovernmental negotiations would be more streamlined, effective service delivery mechanisms. However, it was difficult to understand why there needed to be three separate agencies responsible for coordinating service delivery: the ATSIC administrative wing, the Aboriginal Affairs Department and the Housing and Infrastructure Unit of Homewest.

Instead, these government agencies, in whatever form they adopt, would perform a more effective community development service if they were to respond to the needs of self-governing communities and regions. This would be accomplished through a process of negotiation, but also at an agreed minimum level that ensured the backlog of demand for housing and other services was met before 'steady state' conditions were reached thereafter to be followed by a negotiated 'business as usual' approach. ATSIC recently undertook a national consultative study to determine Aboriginal aspirations for a negotiated post-Mabo social justice package (O'Donoghue, 1995) in which the following was reported:

*What has been lacking is negotiation of forms of self-government which are particularly responsive to matters which Aboriginal & Torres Strait Islanders consider to be important. Models of self-government need to be developed which are tailored to the unique social and cultural features and the geographical location of the Aboriginal people concerned. Increasingly, indigenous people are seeking more extensive forms of self-government to improve service delivery and accountability at the Regional level.*

The Central Land Council suggested in the consultation process that in Australia Aboriginal self government could be:

* based on a particular area of recognised Aboriginal land;
* based on particular Aboriginal community which may consist of or include homeland centres;
* based on a particular geographic region;
* based around regional or local Aboriginal service delivery organisations; or
* clan or language group based.

All the evidence to date suggests that while there are people in the WA State Government agencies of enormous goodwill prepared to develop policies that accommodate the aspirations of regions toward community-control of service delivery, the powerbrokers
either do not understand the benefits that such a process will yield or are not prepared to change the underfunded, control-oriented approach. The Aboriginal resource agencies can have a much greater role in service delivery and technology choice than is currently granted. Some of the regional, community-controlled Aboriginal organisations already delivering services are described in the following section. These could be key organisations to take up the mantle of a more self-governing process and will be shown to be the main element of the Regional Technology concept.

2.6 ABORIGINAL RESOURCE AGENCIES IN WA

The legalistic approach to securing civil rights and more recently land rights has been well established for a number of years and sees its expression through the many Aboriginal legal services around the country. The medical model has been successfully developed through to its limits perhaps in the establishment of the community-controlled and based Aboriginal medical services. Aboriginal housing associations have also existed since the 1970's when funds began to flow to that area of need, and these organisations readily took up the subsequent asset management of community housing while the large proportion, rental housing, still remained within the control of State Governments.

Commissioner Johnston (1991) had recommended that Aboriginal organisations should be the preferred service providers (recommendation #192), they should receive triennial funding (#190), training in management and accounting (#196), funds should be disbursed to them through a single agency with simplified acquittal procedures (#191, 193) and government should not dictate the type of internal structures (#199).

The legal and medical services represented two types of resource agencies. The following discussion relates to the other two general types of resource agencies:

1) Dedicated to the provision of essential services to remote communities over a particular region or geographic area, mostly over traditional country, including outstations and larger settlements. The Pitjantjatjara Council is given as a case study of this type later in this chapter. In WA such resource agencies included Western Desert Puntukurmpurna Aboriginal Corporation, Marra Worra Worra and Waringarri Resource Centre although their service delivery scope and capacity are not as large as those of their Northern Territory counterparts.

2) Based in larger population centres and concerned with the provision of services to town residents, town campers and fringedwellers who don't have access or find it difficult to access mainstream services. The Tangentyere Council is given as a case study of this type later in this chapter. In WA such resource agencies included Bloodwood Tree Association, Eastern Goldfields Aboriginal
Advancement Corporation and Murchison Region Aboriginal Corporation. Again the latter in WA offer mainly administrative support and not the extent of physical services offered by the Tangentyere Council.

Generally, the resource agencies around Australia existed to provide the following services (House of Representatives Standing Committee on Aboriginal Affairs, 1990):

- provide essential services to Aboriginal people living in communities which are not being provided for by their local council;
- act as bridges and liaison points between Aboriginal people and non-Aboriginal people and agencies;
- provide access to culturally relevant professional advice in areas such as the law, engineering, architecture, management and accounting;
- coordinate and provide training to Aboriginal people in the skills required to become self-managing in a bi-cultural environment; and
- give effect to land management and wishes of a traditional nature on behalf of the owners.

The resource agencies had often arisen as direct expressions of local Aboriginal people's desire to take control of service delivery to their people and simultaneously provide employment opportunities. They were a self-motivated expression of action and determination to achieve improvements in life quality for their people. In any other setting around the world of impoverished, oppressed or marginalised peoples it has been well understood for many years that this is the starting point for any successful community development program (Lantzke, 1988).

It was well known that some of these resource agencies were ridden with factionalism, unprofessional in their conduct, not set up to administer large programs or had inexperienced staff. However, in these cases, this is exactly where the development effort could start - in strengthening the less-effective organisations to become more effective through financial support and professional development. It would then be possible to start genuine community-controlled development, devolved to a regional level and implemented from there to the individual communities. However, this is not to ignore the fact that some discrete remote communities chose to manage not only their own affairs, but also provided considerable support to their people moving out onto outstations (Anda, 1992).

Funding and distance were limiting factors on the breadth and depth of activities carried out by the resource agencies (House of Representatives Standing Committee on Aboriginal Affairs, 1990; Allbrook and Kickett, 1994). While ATSIC was historically their main source of funds there was no reason why the State Government could not fund
some of their programs. The Western Australian Municipal Association and numerous WA shires had supported Aboriginal self-determination. The Country Shire Councils Association, however, was vehemently opposed (Allbrook and Kickett, 1994). Reasons for the failure to fully utilise the resource agencies as appropriate instruments of community development were explained by the House of Representatives Standing Committee on Aboriginal Affairs (1990):

The most obvious clients are the voting members of the communities for whom the organisation was established. But there is a second group which includes Commonwealth and State Government agencies, shire councils, local businesses, mining companies and others who appear to view the agencies as instruments of non-Aboriginal administration which should be responsive to their needs for mediation with the community. However, many of these same groups appear to be resentful of the presence of resource agencies. Resource agencies are sometimes described by them as barriers to access to Aboriginal people.

Some of the more well-known Western Australian resource agencies are tabulated in Appendix Two along with their location, scope of activities and communities serviced. They varied in size and scope of activities, but on the whole provided a range of services over a range of functional areas that evolved to meet local needs.

The Western Desert Puntukurnuparna Aboriginal Corporation (WDPAC), for example, in its articles of associations had the following objects:

1. To relieve poverty, sickness, destitution, helplessness, distress, suffering, homelessness and misfortune among Aboriginals of the Western Desert of Western Australia;

2. In recognition of the severe problems encountered by Aboriginal people in the Western Desert and the unfortunate circumstances in which they find themselves the Association shall advance its central objects by the following means:
   a. To assist Martu [as Aboriginal people of the Western Desert refer to themselves] in gaining secure title to land within the Western Desert region.
   b. To assist Martu to overcome the problems of homelessness and the disadvantage of poor housing.
   c. To assist Martu to gain access to health, education, essential services, law and social services.
   d. To assist Martu by providing employment opportunities and work training.
   e. To arrest social disintegration within Western Desert Aboriginal society by conducting activities and programs to promote cohesiveness.
   f. To assist people of the Western Desert to build trust and friendship amongst themselves and other people.
   g. To assist Martu in the preservation, protection and enhancement of Culture.

Wong (1995), a management and finance consultant to WDPAC for a number of years, prepared a corporate structure for WDPAC that could be "recognised and acceptable by mainstream society and at the same time incorporating the Martu style of traditional decision making process". The aim of the structure was to promote communication and collective decision-making while at the same time being simple, practical, realistic and workable. "Key Martu or staff are always tempted to make decisions, that do not belong to them in order to keep things moving - progress. Some even take the line that: The best
approach to get things done is not to consult." Accordingly a corporate structure was proposed to overcome this.

The Waringarri Aboriginal Corporation (Resource Centre) was originally known as Balingarri and serviced communities in the Warmun, Kununurra and Wyndham areas of the East Kimberley region. In 1984, with the increasing development of outstations, Balingarri divided so that it could concentrate on the Warmun area, Joorook Ngarni on the northern area and Waringarri on the Kununurra area. The Waringarri goals were defined as follows:

1. To provide the social development of its members in all ways;
2. To provide, or assist to provide, accounting, book keeping, administration and community development services for its members;
3. To provide facilities for social and recreational activities for the Aboriginal people of Kununurra and young people in particular;
4. To encourage and develop social and recreational activities in their various forms amongst its members;
5. To help to bring about the self-support of its members by the development of economic projects and industries;
6. To support education, job training, health services, work and housing for its members;
7. To help and encourage its members to manage their affairs upon their own lands;
8. To help and encourage its members to keep and renew their traditional culture;
9. To help and build trust and friendship between its members and other people;
10. To participate with other Aboriginal Associations in progress for their mutual benefit.
11. To receive and spend grants of money from the Government of the Commonwealth or of the State or from other sources.

This snapshot of two resource agencies is provided to demonstrate their activities and level of organisation. They were the preferred place of employment for many Aboriginal people where the work environment gave them support, training, group process (rather than individual competitiveness) and respect for their cultural obligations (Arthur, 1994). Many of these Aboriginal resource agencies had the potential to expand their roles into a larger service delivery capacity. If State and Federal governments recognised this and began to direct most of their efforts in this way, there would be tremendous scope for improvement to community development activities and empowerment of communities so that they could commence a fuller process of self-determination.

The Kimberley Aboriginal resource agency, Marra Worra Worra (1995), based in Fitzroy Crossing, submitted its views on provision of essential services to the State Government and ATSIC. This submission presented an incisive critique of the studies in the preceding section and showed no confidence in the abilities of the State line agencies and the ATSIC process to deliver services to the region. It proposed three models by which it could strike a regional agreement with the State and Commonwealth to deliver services to communities in its region:
1. Establishment of a new corporate entity with representation drawn from the Kimberley regional Aboriginal organisations and ATSIC regional organisations;

2. Adaptation of the role, functions and membership of NBC (Northern Building Consultants) Aboriginal Corporation - the architectural and project management service owned by the three Kimberley resource agencies;

3. The Coalition of Aboriginal Organisations, recently constituted as a forum for Kimberley Aboriginal organisations to discuss common issues and objectives, could take carriage of the project.

Hunter (1993) believed the overt, imposed controls of missions and stations have been replaced with covert controls which rely on economic dependence. He quoted Kolig (1987):

_In this time of Aboriginal 'self-determination', advisers no longer issue orders to be obeyed by the Aboriginal clientele. Power has to be wielded more subtly and surreptitiously, by careful engineering and exploiting existing social trends, rifts, power struggles and dynamics within a community, so as to bring about the desired results, rather than by blunt superimposition of will._

There are three main enduring issues of early politics and policies according to Hunter (1993): centralisation, social organisation and economy. These are not only the foci of government agencies in Aboriginal affairs, but also Aboriginal organisations which were established and operated by non-indigenous processes as explained by Rowse (1992) and articulated below by the Race Discrimination Commissioner (1994):

_The Councils and Commissions established in Aboriginal and Torres Strait Islander Affairs are constructs which provide for an interface between cultures to the extent that no representative models have made it through from a bottom-up direction. That is, the structure of the councils are copied from western models and no truly indigenous models have taken over... Progress towards the empowerment of Aboriginal and Torres Strait Islander people may be impeded because, politically and legally, most of the avenues which are already in place have been established through non-indigenous processes and are not familiar to (or have been found useless by) many Aboriginal and Torres Strait Islander people._

A challenge for regional resource agencies as they assume more power and responsibilities will be to remain representative and accessible to their people. The citizen-state relationship, in this case the Aboriginal person and the large Aboriginal affairs bureaucracies have at times tended to become impersonal, faceless and uncompromising institutions, just as the range of government bureaucracies have for many mainstream Australians. It is the communitarian ethic that needs to be retained in the resource agencies whereby a people-centred approach to development could be achieved through an effective, 'dialogical' relationship (Handler, 1990) between community-based Aboriginals and resource centre staff based in regional centres. State and Commonwealth agencies could in turn support resource agencies via a dialogical relationship by providing funds, technical support, coordination and facilitation where necessary. This is part of the Regional Technology concept presented in the next Chapter. However, before such a concept is detailed the following section examines
cases where development technologists and NGOs have collaborated with Aboriginal communities in people-centred approaches to development. This information provides a basis and sets precedents for the Community-building Technology concept.

2.7 CASE STUDIES OF DEVELOPMENT TECHNOLOGISTS

Officially commissioned advice to government recognised the need for Appropriate Technology:

- The Blanchard Inquiry (1987) recommended that: "increased assistance be provided to organisations concerned with the development of appropriate technology for remote Aboriginal communities, and the extension of this technology into the communities."

- The Royal Commission into Aboriginal Deaths in Custody (Johnston, 1991) Recommendation #76 stated: "That the work of the Centre for Appropriate Technology in Alice Springs in the design of items specifically for infrastructural and technological innovations appropriate to remote communities, and that of similar research units, be appropriately encouraged and supported."

- The Australian Science & Technology Council (1993) "considers that further action should be taken to identify, research and develop and market appropriate technologies for remote communities in tropical Australia, and proposes a feasibility study for a Remote Area Appropriate Technology Corporation (based on existing centres) that would undertake these tasks."

If technologists are to take up this challenge it is of paramount importance that they come to terms with the cross-cultural protocols required of them - the "ethical-personal dimension" as Willoughby (1990) put it. In this section community development approaches outside of the mainstream will be examined. Particular emphasis will be given to instances in Australia where technology-practice in these projects has been placed under the rubric of Appropriate Technology. These case studies, scattered around the country, provide some insights into the community-oriented, people-centred approaches to development. They are in stark contrast to government programs that seek to establish Aboriginal enterprises for profit and property ownership. The achievements of Aboriginal people in various enterprises have been numerous and great where they have managed to secure a foothold since colonisation. In the form of government policy the covert goals or unintended outcomes may still be assimilation. The case studies below provide examples of the constructive community-building successes that could be transferred to Aboriginal communities elsewhere.
In this section 'development technologists' refers to those engineers, scientists, architects, technicians, tradespeople, bureaucrats and facilitators attempting to take a 'community development' approach to the delivery of technical services.

2.7.1 The Centre for Appropriate Technology

The most notable effort towards establishment of an Appropriate Technology mode of technology-practice in remote Aboriginal communities has been the contribution of the Centre for Appropriate Technology under the direction of Dr Bruce Walker. Indeed, the studies by Walker can be traced back before the Centre. The Centre is largely independent from the Community College from which it arose and from the Territory Government. Its clientele was completely Aboriginal and it had an Aboriginal management committee. It was engaged in technology adaptation and dissemination, training and design through consultation, therefore distinguishing itself from the control-orientation in service delivery of government line agencies.

The Technical Advisory Group for Aboriginal Lands (TAGAL) was formed in 1978 after a number of meetings throughout the 1970's between the Department of Aboriginal Affairs (DAA) and the CSIRO. A 1980 TAGAL workshop made the following recommendations with regard to Appropriate Technology:

- water - establish an outstation water specialist position;
- energy - establish an outstation fuel and energy specialist;
- information - provide access to technical consultants and establish an information/science journalist to collect and exchange technical information.

As a result of these and other TAGAL recommendations the Community College of Central Australia commenced work on 'appropriate technologies' in 1980 and a land management cell was established at the Central Land Council in 1983. The Appropriate Technology Section of the College completed a study on treatment options for excessive nitrates in drinking water, developed a handpump for supply to the Pintubi community at Kintore and its outstations, a hand-operated washing machine, a hot water chipheater, the VIP latrine, the Appropriate Technology Ablutions Facility and established the Appropriate Technology Enterprise Workshop for the manufacture of these.

Walker (1982) described some factors affecting quality and quantity of water supply to remote communities. Water quality standards are largely determined by those specified by the World Health Organisation. With increasing population densities in Western cities and increasing pollution to water sources these standards have become more stringent. Improvements in technology for water quality measurement and water treatment have also led to increase in standards. Walker (1982) pointed out the implications of a needs-based
assessment in determining the necessary water supply system. Bradshaw (1974) had defined the various types of needs:

- The normative need is what the expert sets as the desired standard with his value base. Normative needs change in time, both as a result of development in knowledge and the changing values of society.
- The 'felt' need is equated with want and is often the only determinant used in community development practice. It is, by itself, an inadequate measure of 'real' need.
- The expressed need or demand is 'felt' need applied to create a desired outcome to the extent possible with available skills and resources.
- The comparative need is found by studying the characteristics of those in receipt of a service. If people with similar characteristics are not in receipt of a similar service, then they are in need.

Increasing levels of service often place increasing demands on the community such as a new resident operator that demands a higher level of service again, additional funds for recurrent maintenance, etc. Thus, Aboriginal people may choose to forego the benefit to avoid the additional pressures on their lifestyle. "Needs are being redefined as their relationship within the total settlement framework becomes obvious" (Walker, 1982).

Walker (1982) argued that for an outstation the benefits of additional and more complicated reticulated power, water and sewerage systems were questionable. With increasing supply came a requirement for increasing disposal which made operation of the settlement more complicated. With increasing contingency in the design by outside engineers the more complicated the system became for operation and maintenance, and ruled out possibilities for community involvement at any stage. Without community involvement the systems were likely to fail as the people had not accepted responsibility for maintenance. This was difficult to avoid because the city-based planners had not been trained to include the people in design or construction.

Walker (1982) used the example of community involvement in selection and installation of handpumps on outstations for water supply. The outcomes were self-motivation to carry out repairs and further installations and massively reduced costs until people decided where they would like to establish a permanent community. The case of nitrates was used for an example of water quality. While the level of nitrates were often higher than WHO standards in Central Australia, the risks were not high and the benefits accrued by having the treatment technologies would not necessarily outweigh the strain on the community.

By 1984 the Centre for Appropriate Technology, as Walker's group became known, had identified the needs for an Aboriginal Technical Worker Training Program and was also
manufacturing solar stills, mobility aids for disabled people and portable fireplaces (Walker, 1984). By 1990 the Centre included offices, a display area, a training and manufacturing workshop and a residential complex. A number of the products, particularly the Ablutions Facility, were still being manufactured in large numbers for small outstations and larger settlements in the 1990's. Reflections in a 1985 workshop (Walker & Foran, 1986) included the following:

In the last five years the amount of available information and technical hardware has increased as funding support has been maintained. Unfortunately, the value systems necessary to support the hardware have not spread with the same speed. As a consequence there has been a flood of information into Aboriginal life and not much meaningful feedback to enable assessment of the impact of the information.

Three different approaches for technology transfer in remote Aboriginal communities were described by Miles, Walker & Last (1986). The first approach (the bureaucrat) was concerned with developing more efficient bureaucratic channels for the diffusion of technologies. They referred to Agarwal (1983) to explain the Community Development model of government and this theory is explained in Chapter Three. The second approach (the technologist) was concerned with a technology that could be accepted and operated by current values and resources. For successful technology transfer there needed to be compatible links between each of the players, but this became increasingly difficult with the growing number of organisations involved in the process. Only where the initiative came from the Aboriginal people were technologies transferred successfully. The third approach (the facilitator) was concerned with facilitating consensus within the community rather than democratic decision-making on the appropriateness of a technology. Only when all concerned understood the issue at stake did they collectively choose to adopt the choice or not.

Walker (1986) argued for a holistic, integrated development-planning approach. Synthesis at each level was required before, during and after planning and implementation as part of a problem solving approach. He described three possible Aboriginal development futures:

- Aboriginal people continue on the existing path but engage in wealth generation within the broader economy that allows them to support their lifestyle and culture. The values of the modernisation process supplant the traditional values.
- Aboriginal people disengage from the broader economy along with its standards, technologies and values and rely on their traditional values to achieve their own self-sufficiency.
- Aboriginal people attempt to modify both these futures by living in remote communities with no wealth generation activities but with continued political pressure on government to maintain the conduit of funds from treasury to support the lifestyle.
By 1985 over 70 VIP toilets had been installed in Central Australia (Walker, 1986a). Separating greywater and sewage would enable the functions of showering and defecating to be handled separately and within the means and abilities of the community. Many Aboriginal people felt that a toilet should consist of a white pan with water that flushed away the excrement and such a view needed to be traversed with supply of information. The VIP latrine was selected from a range of overseas options. An extension team installed the toilets in the field with help from the community and a video was available for communities to undertake installation independently. Some negative feedback included: too hot in summer, children may fall down the hole, fear of snakes in the dark interior and no door to prevent entry of animals. It was initially provided without a seat for squatting as was done in the bush but a seat was seen as an integral part of a toilet system and a concrete moulding painted white was included thereafter. Although this was different to the white ceramic it was accepted and demonstrated that dissatisfaction with technologies can often be cosmetic. Such concerns could be resolved through dialogue and involvement in design adjustments.

Walker (1988) elaborated on some of the factors affecting a problem-solving approach:

- The overdesign of technological artefacts and systems is one aspect of differing value systems between Western and Aboriginal culture and when imposed on Aboriginal settlements results in a lesser quality of life and potential for self-management;
- Benefits can be derived from technologies immediately even if they are inappropriate. However, the longer term impacts are more difficult to determine and hardware is thus often introduced to settlements without considering the relationship of time and value to other aspects of development in the settlement;
- National and regional policies and standards do not recognise the different skills and resources in different communities and reduce the ability of people in communities to generate individual responses to problems;
- In the same way that lack of skills may be evident, the lack of support services to a proposed technology will also present problems;
- The extremes of temperature, high usage rates and other environmental hazards are often not considered by city-based planners;
- As part of community participation in development programs it is imperative that people are provided with the information to become aware of the technological options available to them.

A Feasibility Study on the Aboriginal Technical Worker Training Program was completed (Seemann, 1988). It was found that the curriculum should:

- be based on existing skills, resources and functions performed in the community;
- promote cross-function skilling;
- promote an awareness of the options and impacts of technologies and training;
The curriculum would include transportation, communication, water management, shelters, spaces and landuse, waste control, enterprise.

*Generally, the synthesis of two concepts were required to produce the Aboriginal Technical Worker Program:*

1. *The concept of technacy as a generic cousin to literacy and numeracy. A concept that when delivered within an appropriate framework produced people who were able to demonstrate their capacity to creatively resolve problems through an improved relationship with the material forms and spaces that make up the built, natural and lifestyle context of the problem.*

2. *The concept of enhancing the range of existing functions and quality of life in remote settlements.*

(Seemann, 1990)

By 1990, as a result of a consultancy to the Human Rights and Equal Opportunities Commission (HREOC), Walker began to relate supply of essential services in Aboriginal settlements to human rights issues. The various international human rights instruments to which Australia was a signatory were identified in their capacity to highlight forms of inequality and discrimination in water supply and sanitation services. The issue was again brought back to standards in examining implications for technology choice. It was found that while water quality standards were an inferred right under the Racial Discrimination Convention the cultural rights of a community prevailed and this may allow a community greater powers in technology choice (Walker, 1990).

Numerous communities nominated themselves for the case studies. During 1990 and 1991 Dr Bruce Walker, with the assistance of the Remote Area Developments Group, conducted visits to ten selected communities around mainland Australia and the Torres Strait Islands. The ten case studies highlighted the following issues for service provision to remote communities:

- The demarcation border between centralised and domestic infrastructure is sometimes ambiguous leaving responsibilities undefined and resulting in inadequate or incomplete services (e.g. failure to connect mains water supply to individual houses, no reticulated water extended to more important but infrequently used cultural sites);
- The importance of water may lie beyond the walls of a house and beyond recreation (e.g. saline rockholes for ceremonial purposes; availability of dispersed, as opposed to centralised, supply where home is considered to be vast tracts of land; marine rights where the surrounding ocean is considered home);
- The possibilities for improved lifestyles resulting from proposed technologies can result in unfulfilled expectations (e.g. environmental degradation instead of increased amenity, high quality engineering standards instead of satisfactory capacity and quality);
• Individual rainwater tanks are often part of the community's water strategy for drinking and cooking, yet they are rarely taken into account in the technologist's demand calculations or maintenance schedules (e.g. the centralised supply system is massively over-designed, no chemical or microbiological testing of rainwater tanks occurs but water used on gardens receives high technology, costly, maintenance-intensive treatment, sterilisation and testing);

An overwhelming feeling conveyed by the report was the inability or unwillingness of technologists and bureaucrats to effectively consult with the communities where they had been designated to develop services. Effective consultation is deemed to be that which enables self-determination by the community subsequent to the provision of the desired services. Thus, this important national study concluded with only seven recommendations but which were powerful statements directed principally at the non-Aboriginal organisations engaged in technology-practice in remote Aboriginal communities.

In 1993 the ATWORKER Program (Certificate in Applied Design and Technology) had commenced at the Centre for Appropriate Technology with two streams of trainees as part of the pilot stage. Talbot and West (1994) explained how aspects of the program worked through group problem-solving projects using as a case study "the breakdown of flush toilets in Tangentyere Town Camps". A technical solution was indeed found but the design process was the important learning outcome along with gaining practical skills such as measuring and plumbing. The vision for the Program was to have ATWorkers as part of a permanent settlement life. The stage was set for Aboriginal people to embrace the notion of an ATWorker and take control of future developments.

In 1993 CAT established an office in Cairns with a view to working with the rapidly emerging outstation movement of the Cape York Peninsula. A feasibility study for the Cape York Peninsula Outstation Strategy was conducted (Moran, 1994) and included the feasibility of establishing outstation resource centres. The various categories of essential services were evaluated. The financial support for outstations was extremely limited. "It is likely that the long term sustainability of outstations will be dependent upon the ability of outstation groups to undertake maintenance themselves within their existing resources and to supplement their income through enterprise development".

A theme that was clarified through research with the HREOC was the domination of control-oriented programs in Aboriginal development versus the need for more people-centred, community, process or pluralist-oriented programs. Walker (1994) integrated development planning descriptions by Brinkerhoff & Ingle (1989) and Lea & Wolfe (1993) to contrast the control and process orientations of development administration.
In 1994 the CAT established the National Technology Resource Centre. The Remote Area Developments Group was represented on the Advisory Committee. The rationale for the NTRC included the following:

- Technology evaluation for Aboriginal and Torres Strait Islander use is a complex difficult task that is not well understood by people normally competent in technology transfer;
- While a number of reports have indicated concern over the durability of infrastructure investments, it appears that the appropriateness of the model of service delivery has not been seriously examined;
- While Aboriginal and Torres Strait Islander peoples have generally organised themselves into service provision agencies and resource centres (particularly in support of outstation developments), few have had the resources to back up commissioned research and translate its outcomes into practical measures.

The NTRC would tackle these issues by means of a toll-free number for technical advice, a quarterly journal, technical fact sheets and training workshops.

In summary, it can be seen that the underlying philosophy of CAT was the view that self-determination and indeed cultural survival of Aboriginal people were dependent on the freedom to make informed choices on technology artefacts and systems for their lifestyle and environment. The main concern of CAT's work was with promoting an atmosphere within which Aboriginal people could determine the relevance of existing engineering and health standards. By searching for avenues along which the flexibility in standards can be negotiated a problem-solving approach could be enabled. This would place the control and pace of development in the hands of the community rather than with distant planners who used a top-down, control-oriented or prescriptive approach. Some 20 years had elapsed since CAT's formative stages and the organisation continued to grow, sometimes sporadically due to the fickle nature of funding. In this time the above ideas had evolved and been impregnated in the minds of community Aboriginals and city-based bureaucrats, hundreds of appropriate technology artefacts had been supplied to many communities and a systematised approach to community development had almost become clear.

The intransigence of State Government departments and their preoccupation with regulatory controls was a factor which limited the widespread adoption of the CAT approach. Negative perceptions of the CAT hardware, as listed in Chapter One towards Appropriate technology in general, were held by some Aboriginal people and organisations (Duff, 1996). Just as the transition from a policy of assimilation to self-determination was difficult so would the technical response to Appropriate Technology. Much of CAT's existence was dependent on funds from ATSIC but the latter's national
programs - NAHS, CHIP, HIPP - still represented centralised, control-oriented responses to community needs.

2.7.2 Ecotech in the Maralinga Lands

Ecotech was a private design consultancy firm comprised largely of Dr Peter Davies (deceased) and Mr Brian Kirke of Adelaide. While the duration of their work with Aboriginal communities was only over several years their contribution was noteworthy, practical and demonstrated a constructive approach to technology development and dissemination.

Ecotech had initially been contracted by the South Australia Health Commission to undertake a study of water and sanitation issues in remote communities of the Maralinga Lands. Microbiological testing of water supplies available to the Oak Valley community had revealed that contamination occurred during the use of 1,250-litre water tanks mounted on trailers by family groups (Davies, 1990).

Ecotech endeavoured to understand the cultural motivations behind the lifestyle patterns of the Oak Valley community. Indeed, Kirke (1990) had managed to learn the indigenous language of the area to a basic level. He described the traditional means of obtaining water and the contemporary strategies (Kirke, 1990a). The numerous sources of contamination were identified - dogs licking the taps, broken taps leading to extraction of water through tank lid with any container handy, and animals entering and dying inside once the lid had been left off. Design modifications were proposed for the existing trailer tanks to reduce risk of contamination, keep the water cooler, extend the working life and minimise wastage of water. These were discussed with the community and subsequently two prototypes were provided which remained uncontaminated at the time of their writing (Kirke, 1990b). Seven more units were ordered.

A portable washing facility was designed to improve the health status of the community while at the same time allowing them to continue the mobile aspects of their lifestyle in moving from camp to camp (Kirke, 1990c). Two major barriers were understood to prevent regular washing: 1) lack of appropriate facilities and 2) lack of necessary knowledge, attitudes and habits. The existing facility had a number of problems including the following. Even though it was a wheel mounted unit its large size discouraged movement as rapidly as camp changes. There was not a water supply nearby. A diesel generator set was necessary to pump water to the unit. If a tap was left on, as children tended to do, the pressure pump would empty the 5 kl tank. The large amount of water used caused ponding and thus environmental health risks. Gas water
heating required refilling of bottles. Thus the first barrier was neatly overcome by the more appropriate design. However, the second barrier would require education and time.

The design criteria proposed were 'intermediate' technology, easy portability, self-contained water supply, pressure by a small header tank above shower, hand pumping from the attached 1.2 kl tank to the header tank, a CAT chipheater, lower quantities of water used result in reduced ponding and open design with some privacy but allowing UV sterilisation and drying from the sun.

In this case study a very small group of non-Aboriginal development technologists worked between a State Government agency and a remote Aboriginal community to develop appropriate, acceptable and cost effective technologies that satisfied the lifestyle patterns of the end-users. The designs were developed in consultation with the community all the way through the process, and although the equipment had to be constructed elsewhere its entry to the community was not disruptive. What had not been discussed was a repair and maintenance strategy, and this could be a drawback in the future.

2.7.3 Permaculture in Remote Aboriginal Communities

There had not been a social movement in Australia as popular as the Permaculture movement, as launched by Bill Mollison and David Holmgren in 1979, that devoted itself so enthusiastically to some of the main tenets of Appropriate Technology. Namely, self-reliance and a critique of the existing paradigm - in fact, not only a critique but a vociferous assault and an almost flagrant disregard of regulatory controls. The strong emphasis on site-specific design sought to establish inter-relationships between plants, animals, energy efficiency, water conservation, local resources and recycling.

The main ethics of Permaculture were "earth care, people care, surplus share" although Warwick Rowell (1995) has recently added the idea of "limits aware" to bring attention to the finite natural resources. There were ten or so principles (Mollison & Slay, 1991) and these embraced Appropriate Technology, recycling, no chemicals, and effective integration of all elements through good design.

Mollison was introducing the permaculture approach to remote Aboriginal communities in the 1970's. Visits to settlements such as Ernabella and Papunya with Charlie McMahon and Mike Last enabled Mollison (1979) to advocate and trial a range of permaculture designs based on the above principles. Since 1978 Mollison and other permaculture design course graduates have taught permaculture and home gardening to Aboriginal people across Australia. A teaching curriculum specifically for Aboriginal people was
developed. Along with *Introduction to Permaculture* (Mollison & Slay, 1991) this heavily influenced the design of course materials for the Aboriginal Horticultural Skills Certificate (TAFE, 1995). Emphasis was on health and nutrition, horticulture, plant nurseries and housing. As a result of these efforts more than 20 Aboriginal settlements had individual and community gardens, town tree plantings, market gardens, nurseries and numerous citrus trees in backyards for the children (Wade, 1991).

The Baroota Alcohol Rehabilitation Farm ran on permaculture principles and the Enfield Urban Farm Project in Adelaide was organised by a permaculture graduate for urban Aboriginal people. At the Cummeragunja settlement, near Echuca in NSW, a 1988 permaculture design course paved the way for a dramatic change of direction for its people. They voted to discontinue their acceptance of government aid which had failed to come to grips with the problems of poverty, ill health and unsatisfactory living conditions. Instead they planned to work together as a community to establish home gardens, orchards, small animal systems, bees and windbreaks to protect the area from hot, dusty winds. Long term income earning activities such as valuable timbers, nut trees and firewood trees were to be added later, along with short term income-producing activities such as food crops and a bush food nursery. The range of permaculture activities commenced in the early 1980s were reviewed by Mollison and Blewett (1986) and who also criticised mainstream, control-oriented programs.

In Western Australia, Pia Wadjuri had received support towards design development of permaculture gardens by Geraldton-based, permaculture facilitator Julie Firth, and this was implemented steadily over the last seven years by City Farm trainees from East Perth and their coordinator Roseanne Geddes. Establishment of a permaculture design commenced at a Walmajarri outstation in the Sandy Desert (Hardwick, 1994). The Aboriginal Affairs Department deployed a consultant in three Kimberley communities to develop permaculture food production, and this led to the infrastructure for a permaculture system being developed at Oombulgurri northwest of Wyndham. Permaculture activities were introduced to Roebourne in 1995. RADG prepared a preliminary permaculture design with Warta Kutju Aboriginal Corporation for Morapoi Station near Leonora.

McDonald (1993) explained some limitations of the permaculture approach in Aboriginal communities. Such criticism mirrored that arising in the 'two-thirds' world where permaculture techniques were successfully transferred but the ideology was unacceptable - the local, traditional culture was still robust. Cherikoff (1994) criticised permaculture as "a collection of invasive weeds and feral animals" and advocated his solution to food sustainability and economic independence as being "enrichland polyculture". This was a concept along the lines of permaculture where Australian bush foods were grown in a
polyculture arrangement, and the emphasis was on surplus production for commercial gain. The product would be sold to city restaurants and value-adding processors. The labour-intensive harvesting required from polyculture tree crops would apparently not be a problem for Aboriginal people in remote communities.

While the main focus of the Permaculture critique was agriculture the Permaculture movement advocated change in other areas of technology-practice - housing, energy, water supply, sewerage, city form, transportation and social behaviour - to build a holistic approach for self-reliant, sustainable living. Its adherents were largely anti-government and anti-welfare viewing both as causes of dependency and malaise. The permaculture approach saw self-sufficiency in food production as the basis of autonomy and empowerment. Aspects of design methodology such as zone and sector analysis have informed development of the Community Technology concept presented in Chapter Three.

2.7.4 Pitjantjatjara Council and Housing for Health

The Pitjantjatjara Council while Aboriginal-controlled, on Aboriginal land and largely Aboriginal-staffed is a Western construct, not traditional. This has arisen as a result of the choice to administer collectively a large number of communities of different tribes over a large area of land, the land tenure arrangements and funding requirements. However, traditional culture and elders are respected and have some influence and control over the decision-making process.

In 1976 the Ngaanyatjarra, Pitjantjatjara and Yankunytjatjara saw the need to effectively organise together to protect their land and culture. They formed the Pitjantjatjara Council which services their communities and outstations in Western Australia, South Australia and the Northern Territory. The Council was instrumental in securing freehold title in 1981 to traditional country in the northwest of South Australia. Pitjantjatjara Council Resource Centre in Alice Springs offers administrative, legal, anthropological, land management, infrastructure project management and accounting services to all associated organisations and communities.

The number of communities and area of land under administration by the Pitjantjatjara Council is a striking example of the control that Aboriginal people have achieved and the lengths they are going towards sustainable development with more community control over their technology choices. Map 2.1 shows the massive area of about 350,000 square kilometres under control and would come as a surprise to many Australians:
Map 2.1: Communities served by the Pitjantjatjara Council  
(Woenne-Green, 1995)

The land management efforts of the Pitjantjatjara Council were successful and are well known (Coombs, 1989; Last, 1983, 1986, 1988). These efforts demonstrate successful technology innovation, adaptation and dissemination, but are beyond the scope of this thesis.

In 1981 the Council assisted in the establishment of the Ngaanyatjarra Council to directly service the Western Australian communities. Land tenure in the form of 99 year leases was granted to most of this area by the WA Government in 1988. Ngaanyatjarra Council provided a range of health, transport, financial, women, aged, housing and road maintenance services to its communities in WA (Woenne-Green, 1995). The latter were transferred from the Shire of Wiluna once the Shire of Ngaanyatjarra was established (McLean, 1994).

Anangu Pitjantjatjara (AP) was the body corporate which held title to the freehold land in South Australia and in 1989 their officers moved from the Pitjantjatjara Council Resource Centre to Umuwa which was centrally located amongst the AP communities. Here, all major services for the AP lands were situated including AP Services, Training Centre and Nganampa Health Council. AP Services were engaged in road maintenance, water supply (Davies, 1986), power supply (Davies, 1986a), housing construction and maintenance.
In 1983 NHC took responsibility for all health services on the AP lands with accounting and hospital functions in Alice Springs (at the Resource Centre), main administration at Umuwa and 8 community clinics controlled by local health clinics. A review of the environmental and public health conditions on AP lands was initiated in late 1986 and completed by the end of 1987. It was known as the UPK Review - Uwankara Palyanyku Kanyintjaku - and subsequently became a framework for comprehensive action. In proposing the Review the NHC recognised it could not successfully operate in a vacuum, and that it would require the assistance of government to overcome the problems which a review would document (NHC, 1987). The cooperative structure had a positive community-base. The bulk of the fieldwork was carried out by a small, core, R&D team. UPK - a strategy for wellbeing - described the now well-known "9 healthy living practices":

1. Washing people;
2. Washing clothes and bedding;
3. Waste removal;
4. Nutrition;
5. Reduce crowding;
6. Separation of dogs and children;
7. Dust control;
8. Temperature control;
9. Reduce trauma.

Evidence from overseas and Aboriginal communities indicated improvements in environmental health through provision of health hardware (shelter, water supply, sanitation) would further improve child health by breaking the transmission route of infected secretions from eyes, ears, nose and coughing. Washing clothes and bedding, washing children and effective waste disposal would all assist in reducing diarrhoeal disease, respiratory infection, eye disease, skin infection and hepatitis. The effect of crowding had the tendency to increase the risk of secretion swapping, lessen access and effectiveness of washing facilities and nullify the effect of washing. The lack of food storage, preparation and cooking facilities generally led to poor food choices. The large number of dogs in Aboriginal settlements increased the transmission of disease by carrying organisms and acting as vectors where washing facilities were inadequate. Dust contributed to the symptoms of eye, respiratory and skin infections, and needed to be suppressed. Temperature extremes limited the ability of children to resist and recover from disease. Reducing hazards from poorly designed or maintained housing, building materials and car bodies would reduce trauma (Nganampa Health Council, 1987).

To effectively report back to Anangu and promote the messages the report was published in a graphical manner, a video was produced in Pitjantjatjara language, a music cassette was produced as well as T-shirts and a range of other paraphernalia. With these materials NHC sought community participation in a reflective approach to understand current problems with technology-practice in a historical context.

Furthermore, the Review outcomes were translated into an AP Design Guide (Pholeros, 1991) "to enable community councils and staff to better manage, plan, design, construct,
supervise, maintain essential health hardware resources”. The principles and design ideas for housing, living areas and services were clearly described and graphically presented enabling discussion and learning in communities. The document proved useful in other parts of Australia too and design ideas were implemented in the EHWTP.

It was often argued that Aboriginal people should pay for maintenance even when ill health and poverty was well documented. It was not possible for maintenance to be funded from rent. Prioritised against health outcomes the following division of maintenance and expenditure was recommended:

1. Essential maintenance. This would include immediate hazards to safety and health, reduce future maintenance by systematic replacement policy and enable washing and waste removal. It is proposed that this component of maintenance be funded directly by government agencies.
2. Secondary maintenance. This would include reducing the risk of trauma, control of temperature and dust, and providing some separation of children and dogs. Funding for this maintenance would be provided by communities either through rent payments, Community Development and Employment Program funds or other community resources.

Plumbers and electricians in particular were needed for health hardware maintenance in remote communities. Training of Aboriginal people in the community for these positions was not foreseeable, and long term funding was necessary for these positions. Nevertheless Aboriginal people needed to be able to identify the problems in their houses. Accordingly another innovation from the UPK Review was a 'house failure noticeboard' installed at the council office. Householders would mark the relevant box and then the maintenance worker could quickly respond with the appropriate remedy (Torzillo & Kerr, 1991).

Since completion of the UPK Review substantial works were undertaken on AP lands stemming from the recommendations (Pholeros, Rainow & Torzillo, 1993). Three major areas for future work were identified:

- design, supervision and implementation strategies for housing and health hardware infrastructure;
- the development of means by which community management could contribute to health hardware sustainability in communities;
- the critical role of maintenance in achieving sustainable health hardware. The report identified that in most communities, breakdowns in basic water and waste systems occurred frequently in all housing stock. In many houses major breakdowns were identified even prior to the first occupancy. Once breakdowns occurred the houses actually became health hazards rather than potential health providers. There was a complete lack of any formalised maintenance system within these communities.

Pholeros, Rainow & Torzillo (1993), described three major steps in improving Aboriginal child health: 1) Reduction in mortality rates through improved nutrition and access to hospital/medical services; 2) Reduction in hospitalisation through effective primary health care services based in communities; 3) Reduction in attack rates of infectious diseases through major improvements in environmental health.
The third factor may well be enough for some communities to provide them with the quality of life they are seeking. This became the main priority for the WA government in 1994/95 after the release of the Daube Report. However, the scenario may be further developed to include the subsequent steps necessary to gain empowerment and self-reliance. Empowerment would be enhanced through having the freedom and support necessary to make informed technology choices. Self-determination, self-reliance and a vision for the future would follow as a way of life and would be gained through, for example, regional agreements leading to self-government combined with the establishment of a community-controlled administrative apparatus. This scenario would probably lead to the adoption of environmental technologies such as renewable energy, energy efficient housing, growing and promoting nutritious fresh food, water conservation and wastewater reuse via a community-based problem-solving approach.

The above reveals two factors necessary to achieve community-controlled development or self-determination - firstly, the ability or motivation to rise to the challenge of becoming empowered and secondly, a flexibility in standards (or any regulations relevant to a community's development but enforceable externally to the community) to allow an Appropriate Technology or problem-solving approach.

In undertaking the Pipalyatjara Study, Pholeros, Rainow & Torzillo (1993) pointed out three factors (p11) which resulted in that community selection:

• the small population to better ensure achievable goals;
• community interest already existed;
• one person had a long cultural familiarity with the community.

Interestingly, these were the foundations of an AT approach that were found elsewhere to be critical for success.

Subsequently, ATSIC funded Pholeros, Torzillo and Rainow to disseminate the findings of the UPK and Pipalyatjara studies via a series of seminars around the country. With its tendency to engage large technical consultancy firms to manage its programs ATSIC recruited the Australian Water and Wastewater Association (AWWA) to organise and promote the seminars. Perhaps this approach would ensure that the findings were disseminated amongst planners, architects and engineers with more certainty.

However, all of the achievements of the NHC in the search for an Appropriate Technology mode of practice can be thrown into shadow if one examines the historical and cultural setting. The arrival of missions in the early part of the century followed by schools, stores and a money economy largely destroyed a lifestyle revolving around ceremonial activity, celebration of the land and spiritual instruction. Hunting and gathering activities supplied food, but did not occupy the majority of time as people are
often led to believe. There was still plenty of time for leisure and relaxation. All of these activities varied depending on the season. Wallace (1990) explained the collapse of traditional ceremonial life and traditional self-determination and their replacement by Western systems of self-management and self-determination:

The traditional lifestyle, including religious ceremony and hence religious teaching, is in the process of being destroyed. The older people cannot understand this new decision-making process and retire, taking no part in it. And so a widening gulf has been created between those whose authority was once passed onto the next generation in logical succession, and the younger ones who are trying to understand these new processes. Two elements accelerating the destruction of traditional values are schools and housing. Both these innovations are regarded by Europeans as essential to the changes that Aboriginal people must accept if they are to live in harmony with their European neighbours and achieve so-called self-determination.

When the Pitjantjatjara Land Rights Act became law on 19 March 1981, so began the Aborigines' journey on the road to the new form of self-determination. Each major settlement now has its elected council, with the central point being the Pitjantjatjara Land Council headquarters in Alice Springs. In addition, the health of the people is in the care of their Nyanampa Health Service, with resident doctors in the larger communities and a light aircraft stationed at Pukatja (formerly Ernabella). The doctors and nurses are all European and the introduction of Aboriginal aides has met with limited success.

European people find great difficulties in administration and in finding the right administrative staff in situations less complex than those described. White staff with proven knowledge and the ability to pass their expertise on to the Aboriginal people are difficult to find. There are many worthy people employed by Aboriginal communities in advisory positions, but in too many instances the adviser initiates, organises and acts, rather than advises. The councils have the right to appoint various people as community advisers, clerks, accountants and to other positions where Aboriginal people need help and advice. In no society would it be expected that expert decisions could be reached by inexperienced people who have not been given sufficient time to learn. In the meantime, Aboriginal people must make many doubtful decisions. They are aware that their knowledge of European ways is limited, so they know they must seek help from whites to advise and communicate for them.

Mander (1991) argued fiercely that it was the formation of non-traditional councils and corporations in North America under coercion by the US Government that led to loss of land, disempowerment, corruption and exploitation of natural resources by multinational companies.

Coombs (1994), however, believed that it was the 'bottom-up' federalism and the pattern of regional and local organisations that set the Pitjantjatjara and Tangentyere Councils as good models:

Aboriginal society traditionally was composed of small groups whose relationships with one another were frequently suspicious and hostile... A commonality of purpose, coupled with the expedience of having to provide specialist services to Aboriginal communities and a strong desire for cultural expression outside white Australian hegemony, will increasingly find a voice in these incorporated and informally federated organisations. These organisations, because of their 'bottom-up' federal structure, do not compromise the identity or culture of individual groups, but give common purpose and considerable effectiveness to Aboriginal aspirations and political action.

The question was now that Western systems of economy, management and communication had replaced the traditional ones, how could the young adults participate in the maintenance of these Western administrative and technological systems while at the
same time having enough contact with the last of the elders to continue some of the last remnants of traditional knowledge?

It seems that contemporaries of the NHC are more open to these perspectives on the problem of culture. It could not be expected that all white workers in Aboriginal communities, and particularly not technologists, could ever attain the level of acceptance, to the point of receiving a kinship position, that the small number had achieved. However, if there is to be a meaningful technology transfer under the control of Aboriginal people, at their pace and without further destruction of culture, the method by which selection of non-Aboriginal personnel occurs must receive much closer scrutiny. The selection process could, for example, be at least as rigorous as the Overseas Service Bureau in its recruitment of Australian Volunteers Abroad.

This case study has demonstrated the importance of a multidisciplinary approach - not just an intersectoral approach - with a health professional, technologist and community facilitator working together closely, cooperatively and intimately. NHC have attempted to create new models of technology design and maintenance to turn around decades of inappropriate technology-practice that have led to a poor health status. Their next phase is no doubt the transfer of this understanding to capable young adults who will be able to manage the technological systems and act as an interface between the community and outsiders in such a way that some level of traditional cultural practice can remain intact.

The 'health hardware' movement in indigenous affairs was one gaining considerable momentum. It was possible though that while this became prominent on the agenda of the major agencies in Australia to meet the perceived "needs" of Aboriginal people, it may only be another misguided policy like earlier periods in national policy towards indigenous Australians. While land rights have always been firmly positioned at the top of a community's list of priorities, health and housing were moving slowly but steadily to the top also. Once again it is technology hardware. A piece of the technology jigsaw that bureaucrats and technologists are most at ease with.

2.7.5 The Pitjantjatjara Council - Community Infrastructure

The Projects Section of the Pitjantjatjara Council was based in Alice Springs and handled longer term infrastructure and maintenance issues. Water supply comprised some 90% of these activities. The earlier experience of the Section with a drilling program, windmills, diesel pump, electrified submersibles and water quality was documented by Davies (1986) and showed a tendency towards substantial research, innovation and trialing of new products. Later, the Section tentatively began to equip bores with solar pumping
equipment (Davies, 1988). Power supply and maintenance was a comparatively minor activity and again the earlier experience had been described (Davies, 1986a). The Operations Centre at Umuwa was concerned with day to day operations and maintenance activities such as roads and rubbish collection. Sewerage management was also located at Umuwa because it required regular attention (Duff, 1996).

The AP experience of the Projects Section with "solar packs" or "home packs" had generally been positive. These were solar-powered, shipping containers for storage and refrigeration purposes originally developed by the former Solar Energy Research Institute of WA (now Murdoch University Energy Research Institute - MUERI) in a joint project with the former DAA and SECWA for Ngurawaana community in the Pilbara of WA (James, 1986). Operational experience after 17 units had been manufactured and installed by Advanced Energy Systems (AES), the commercial outcome of MUERI, in the field showed the drawbacks to be the lead-acid batteries which required regular topping up and interference with the load management controller which was subsequently improved (James & Williams, 1988). The experience of the Projects Section was that the units were usually underpowered and the tendency was for people to overload them with numerous appliances.

The solar packs had been around on the AP Lands since about 1985. In 1990 there were 2 AES units, 2 BP units and 4 Pecan units. Later another 2 AES and 2 BP units were installed. However, there was no field crew with AES and field support was even worse by BP so thereafter all units were bought from Pecan who were able to provide installation and back up service. AES tended to be too R&D oriented. However, the AES components were excellent and the Pecan units have been fitted with AES inverters and other AES components. There are now 45 home packs operating satisfactorily on the AP lands, only 8 of which are not Pecan. These are generally maintained by the Projects Section on their trip around the AP Lands once or twice a year (Duff, 1996).

All batteries were gel-type, no longer lead-acid, and the units are given more battery storage than normally supplied. The experience had been that Anangu will sometimes top up car batteries with anything they can get their hands on including Coca-cola. Anangu will remove batteries to use in cars but the gel-type are too big to put under the bonnet and if put on the front seat there is not a long enough lead to connect to the terminals on the engine (Duff, 1996). Gel-type require no topping up or maintenance and were only about 22% more expensive.

Very few houses on the AP lands had enough power with some drawing as much as 20 kWh/day if, for example, appliances were left running continuously. However others only drew 3.5 kWh/day and were able to rely solely on the home packs (an energy-
efficient home in suburban Australia would use 7 kWh/day while an average use would be around 12 kWh/day). However, in most situations there were diesel generator sets and the home packs were fitted with plugs to connect in diesel charge when flat. While diesel systems were common throughout the lands the Projects Section discouraged their use (Duff, 1996). Sometimes they only lasted 3 weeks or 3 months before failing and often the community failed to plan ahead resulting in fuel running out leaving the diesel sets idle for up to 3 months. There was reliable, renewable energy at 55 sites including wind turbines but diesel was still common.

The Projects Section and CAT had parted company in views toward technology-practice several years ago (Duff, 1996). Duff interpreted the views of CAT as only applying the technology that can be sustained by the community. He disagreed with this approach in that the "mob" often wanted a particular artefact or service that was beyond their ability to maintain, e.g. electrical power and appliances in general and specifically electric washing machines large enough to take several blankets at once. CAT advocated hand-operated washing machines but largely the "mob" wouldn't accept these. Instead the Projects Section had chosen to encourage the installation of renewable energy systems (over diesel-electric systems) wherever possible and durable, appropriately-sized appliances. The logic being that these would achieve a particular lifestyle function and while not rendering the community totally self-sufficient the systems could be maintained and managed by the region as a whole.

Another example, of how a regional approach by the Projects Section was able to satisfactorily achieve an outcome that could not be achieved by individual communities was in the area of water pumping. By sticking to one particular brand of submersible electric pump that was reasonably reliable for use in all communities serviced by the Projects Section they were able over a number years to understand all the nuances of the technology and the supplier in Adelaide. Shortcomings were known, such as product deficiencies and inordinate delays in the delivery of parts, and these were overcome by always keeping in stock a good range of parts and replacement units. Such an approach could probably not be achieved by an individual community.

This showed that a compromise can be achieved between the desire for a particular lifestyle supported by a certain technology and the lack of self-sufficiency created at the community level by this technology choice. That is, a regional organisation servicing a number of communities with common interests (land, culture, lifestyle) can implement various strategies to achieve lifestyle outcomes that individual communities could not technically support.
2.7.6 Town Camps and the Tangentyerre Council

The Royal Commission into Aboriginal Deaths in Custody had recommended (#324) that service providers look to the Tangentyerre Council in Alice Springs as a model for delivering services to town camps (Johnston, 1991). The history of the development of the town camps around Alice Springs and of the Tangentyerre Council are given by Heppel (1979), Heppel & Wigley (1981) and Tangentyerre Council (1994) and the social dynamics behind the health status of the town campers in Beck (1985). The administrative structure of the Tangentyerre Council shown in Figure 2.1 demonstrates the wide range of activities undertaken in its support of town camps. The Landcare and Housing Departments, for example, had become so successful that their services were sought by remote communities outside Alice Springs. The Housing Department had for years provided architectural and town planning consulting services, having arisen from the early activists that helped create the Tangentyerre Council, who were themselves architects. A housing design publication was produced along similar lines to the AP Design Guide (Morell & Ross, 1993). The Department was no longer dependent on government funds and was self-supporting from consultancy projects. The Landcare Department established a thriving nursery alongside the Pitjantjatjara Council nursery on the outskirts of Alice Springs and had provided a revegetation and house yard planting service for over ten years. The successful strategies deployed were further disseminated to town camps and remote communities through the production of a highly professional video (Tangentyerre Council, 1992). The Landcare Department was later expanded in its role to include Environmental Health.

Figure 2.1: The Administrative Structure of the Tangentyerre Council
The Council was an umbrella organisation that supported 18 housing associations, over 170 houses and about 1,200 people in the town camps. The housing associations are not controlled but supported by the Council. Town camps were established on the outskirts around Alice Springs with each language group having a separate camp. The sites were selected with approval from the Council Executive and then a design, landscaping and housing implementation process was commenced to suit the people's needs (Shaw, 1993). Many camps had secure leases to their land, but unfortunately the issue of land tenure and rates was still an unresolved problem after many years with the Alice Springs Shire Council refusing to provide certain municipal services and still demanding rates to be paid. A huge backlog of unpaid rates existed and the issue was being dealt with through the courts.

There were over 500 people working for the Council with some 360 of those in the CDEP. A group of elders known as Four Corners from the various camps would meet in the event of anti-social problems, usually arising from alcohol, and it would be they who determined whether the offenders would be dealt with under whitefella law or Aboriginal customary law (Shaw, 1993).

The Tangentyere Council understood a key element of Appropriate Technology which will be explained in the following Chapter Three. The importance of 'fit' between housing, settlement, technology and culture was embraced throughout the planning, design and maintenance projects and perhaps served as an example of the Community Technology concept. With lack of support from the Alice Springs Shire Council since the first fringedwellers of the last century and outright aggression to their presence from government and citizen groups, the Tangentyere Council was established in the 1970's to fend for itself. It has continued to grow, strengthen and become a highly effective organisation successfully applying community development principles in the delivery of services to town campers. Aboriginal organisations in WA providing similar services such as Bloodwood Tree Association in South Hedland, Eastern Goldfields Aboriginal Advancement Council in Kalgoorlie and Ngunnuwh Council in Halls Creek could receive greater support from State Government and local government authorities to evolve into similarly powerful and effective organisations with an autonomy that results in dignity and community-based action.

2.8 SUMMARY

In this chapter the background to contemporary Aboriginal communities in remote areas, their health status and the emergence of the environmental health model were described. Both ATSIC and AAD had community development programs which sometimes
contributed to empowerment and reduced dependency. Similarly, the Aboriginal programs of Homeswest and HDWA were attempting to maximise service delivery and empower Aboriginal people. This effort was an outcome of 'Aboriginalisation' of these divisions, particularly in senior positions, but not always. Aboriginal people within government agencies are, of course, ultimately constrained by mainstream public service requirements. However, although there were many well-meaning people in government agencies, the dominant technology-practice in essential service provision was one of extensive bureaucratic administration, centralisation, control and intense scrutiny in the allocation of funds. Technology was often selected and installed with city-based values and standards with little information available on possible alternatives. An early appraisal of the current tendency towards corporatising and tendering out of service provision indicates that such processes may only hamper Aboriginal development. Preferential tendering, for example, has been shown to be not entirely effective. For a more effective community development approach greater attention could be focussed on the Aboriginal regional resource agencies. For many years they have been providing a range of services to the communities in their region.

Case studies of successful approaches by development technologists were provided and some resource agencies in central Australia were described. CAT had developed successful artefacts, training programs and information services. It had managed to influence the government, private and Aboriginal sectors with its approaches although there was still ambivalence from some people and large, national programs by ATSIC which also funded CAT reflected entirely the opposite approach. CAT and Ecotech both demonstrated the effectiveness of small, non-government, non-Aboriginal organisations in being able to work in "community-building" ways. Individual permaculture activists/educators provided stimulus for a holistic appraisal of all technology serving discrete communities and their interactions. While the central Australian regional organisations had adopted Western systems of administration service delivery had become more finely attuned to the regional characteristics of environment and culture. Research and development to continually improve service delivery was integral to the operations. Although health problems still occurred and a mode of fully sustainable development had not been achieved it seemed the organisations were embraced by most of the people and communities. A greater level of autonomy was present and greater opportunities for Aboriginal employment were provided. The benefits of a regional approach to technological activities was apparent.

The following chapter examines international experience and reviews the Appropriate Technology literature. The review is used to develop proposals for empowering communities, improving technology transfer, achieving sustainability through 'fit', and allowing greater Aboriginal control in the management of technology-practice.
CHAPTER THREE

Technology Choice in Remote Aboriginal Communities

3.1 TECHNOLOGY CHOICE

Aboriginal people seek mainstream, Western, industrial technologies for the development of their communities. Nevertheless, they are engaged in a continuous process of reflection on the context of their lives in the shadow of the dominant mainstream society. For permanent settlements in remote, arid areas Aboriginal people today look forward to a reliable water supply system, safe sewerage, a modest supply of electricity and a robust means of transportation. Standards and preferences of city-based technologists often dictate the actual technology used but Aboriginal people in remote areas may benefit from a greater freedom of choice as to what technologies are deployed in their communities. However, the bureaucratic system that dispenses funding may be so control-oriented that it is not possible to consider alternatives. This was essentially the conclusion of Chapter Two's analysis of service delivery by government programs in remote Aboriginal communities.

Technology is often assumed to be about hardware, devices, but it is also concerned with the systems that support it and the culture that gives rise to it or adapts its lifestyle around it (Pacey, 1983). Technology is thus not neutral and can change culture. Non-Aboriginal people in mainstream Australia rarely place the context of their lives against the historical factors that have led to the imposition of the transportation, communication, food production and shelter systems into which their daily activities are integrated. These technological systems are changing too; often towards more centralisation and automation. The need to transfer these same systems from mainstream society to remote Aboriginal communities is questionable. These issues will be studied in the following pages.

In this chapter aspects of the international Appropriate Technology movement are examined for their relevance to remote Aboriginal communities. The experience of Appropriate Technology along with community development theory gives rise to the concept of Community-building Technology. The tendencies of industrialism in Western society will be contrasted with "sustainable technologies" and a new concept of
Community Technology (c.f. Boyle, 1979; Hess, 1978) will be constructed. The relevance of 'sustainable development' to the Aboriginal setting will be described and this will contribute to the development of the Regional Technology concept.

3.1.1 The Appropriate Technology Movement - "Small is Beautiful"

In this section the origins and concept of Appropriate Technology will be explained in order to assess its relevance to the Australian Aboriginal setting.

The Ghandhian community development movement in India was one of the inspirations for the Appropriate Technology movement. The movement started and made its initial expression in the West through Fritz Schumacher's seminal work *Small is Beautiful*. Schumacher, an economist, had been working in Burma and India for the British Government to formulate large-scale economic development programs when the more 'grass-roots' work of Ghandhi came to influence his thinking. The idea common to both of their approaches to economy and technology was that human values must determine our choice of technology and not *vice versa*. Schumacher's "intermediate technology" was more productive than traditional technology but still cheaper and simpler than the expensive capital-intensive technology of the West. As Willoughby (1990) pointed out in reflection this early concept was a specific application of what he came to term the "general principles" approach of Appropriate technology. Although the Appropriate Technology movement has waned somewhat since the 70s and 80s it is gaining renewed validity in developing countries, and a South-South technology transfer paradigm is emerging (Reddy, 1993) against the dominant North-South paradigm of the last 50 years.

Common across the movement was a critique of the existing socio-political paradigm within which the technology-practice operates. In addition to Ghandhi the movement was also founded on the profound writings of Mumford (1934), Marcuse (1964) and Ellul (1964) before Schumacher completed his socio-economic analysis. The critique of technological society was continued by Illich (1973), Winner (1977) and Sale (1980). Schumacher inspired the more practical how-to-do-it handbooks like the AT Sourcebook (South Pacific AT Foundation, 1977) and the Lik Lik Buk (Darrow & Pam, 1978) for developing countries and the magazines such as Soft Technology (Alternative Technology Association, Melbourne) for do-it-yourself enthusiasts of the north.

The Intermediate Technology Development Group (ITDG) was launched by Schumacher with a group of some 20 people in London as part of the Overseas Development Institute in 1965 (McRobie, 1991). In 1966 voluntary technical panels were set up and by 1970 there was access to technical advice in agriculture, water, health and building. Data was
assembled on efficient techniques for rural and small town environments. In the early 1970s *IT Publications* was established and the magazine *Appropriate Technology* commenced issues. Dissemination of the information to developing countries began through these, the media, aid organisations and country organisations. ITDG set out to change the UK Government's development policy as well as establish sister organisations in developing countries. In developing countries the task soon became 'Find out what the people are trying to do and help them do it better'. ITDG went on to set up demonstration projects, collaborate with field projects and take on consultancies in developing countries. Most recently country offices were set up to focus on projects and the UK office on policy and publications (McRobie, 1991).

There was much to be learned from the evolutionary process of the ITDG and such an approach was attempted in my fieldwork described in Chapter 4. Indeed, the growth of the Tangentyerre Council and the Centre for Appropriate Technology in Alice Springs mirrored some aspects of the process just explained but with a regional focus instead of an international one.

Comprehensive reviews of the various strands of thought and action in the movement have been conducted by writers such as Willoughby (1990) and Smillie (1991). Willoughby took a global perspective and was particularly determined to clearly define Appropriate Technology and formulate a framework for it to be embraced in policy development in the developed world. Smillie restricted his review to its role in the developing countries. Only the salient features relevant to technology-practice in Aboriginal Australia will be discussed here.

Pacey (1983) defined the concept of 'technology-practice' as comprising technical, organisational and cultural aspects. This holistic approach to technology has continued to be developed by numerous other commentators in the field of the philosophy of technology including more recently Drenson (1995). Willoughby (1990) used the work of Pacey (1983) and Galtung (1979) to derive his schema of technology-practice to "act as a map for locating technology-related concepts". This three-dimensional view later became the first major element of his "integrated framework" for Appropriate Technology. Their notions of technology-practice are adapted into the diagrammatic representation of Figure 3.1, and from this new schema theoretical models are constructed for the Aboriginal setting at the end of this chapter. Common to their views was that technology does not merely consist of artefacts, hardware or devices alone. Technology has sociopolitical (organisational) and ethical-personal (cultural) dimensions as well.

Pacey (1983) saw medicine as an alternative paradigm for viewing technology-practice because, as opposed to engineering technology, it was embedded within all aspects of
human life. It had at least produced "primary health care", "community medicine" and the "barefoot doctor" whereas, he noted, no such endeavours had been made at such a scale in engineering technology. This medical paradigm is also true for service provision to remote Aboriginal communities. The community-based Aboriginal medical and legal services have made a significant contribution to community development, whereas the Aboriginal regional resource agencies, at least in Western Australia, are still nascent and limited in their scope of work. For instance, housing and infrastructure delivery is still firmly controlled by government and the non-Aboriginal private sector as described in Chapter Two. The Environmental Health Worker Training Program sometimes had a community-building effect as explained in Chapter Two as a result of a 'barefoot technologist' approach in communities.

**Figure 3.1: Technology-practice** (Pacey, 1983)

In seeking to define Appropriate Technology a "general-principles" approach was preferred by Willoughby (1990) to avoid the problem of finding agreement on meaning and application across the diverse range of literature. The "specific-characteristics" approach could be used when the exact circumstances of the technology application were known such as in a discrete Aboriginal community or region. After a rigorous evaluation
of the literature Willoughby went on to construct his own definition which was given in the first chapter.

The concept of 'technacy', documented subsequent to Willoughby (1990), was used by Seemann (1990) at the Centre for Appropriate Technology (CAT), Alice Springs as a tool to develop approaches to technical education in Aboriginal communities. The concepts of literacy and numeracy are well established. Literacy is a one-dimensional expression of qualities while numeracy is a two-dimensional expression of quantities. Technacy refers to the ability to interpret the three-dimensional expression of material forms and spaces in our natural and built environment (Seemann, 1990). Seemann explained that education in Aboriginal communities may have provided one and two-dimensional information on science and technology products but "to interpret the human or settlement context of these messages is a generic skill not embraced by literacy or numeracy." CAT thus established the Aboriginal Technical Worker training programme (Certificate in Applied Design and Technology) as a means of addressing this critical issue (Talbot & West, 1994). The aim of the course is to support Aboriginal people in remote communities to become "technate" with the new "spaces and shells" created in their communities from introduced technologies.

As providers of the training program to indigenous Australians CAT was able to gain further insights into the critical role of technical education for the understanding and design of infrastructure for their settlements by the same indigenous Australians. As explained above conventional forms of Western education did not provide a holistic understanding of the human environment without the technacy concept. Western education has increasingly led to "disintegrated" learning since the advent of the industrial revolution (Seemann & Talbot, 1995). As an example of this Seemann and Talbot (1995) referred to Venn's logical framework for integration of sets. They saw this method of representation as an example of how Western industrial society typically views aspects of the world as independent sets rather than essential parts of the whole. The possibilities for integration as a whole are limited. For example, in Figure 3.1 only by the overlap of the three circles at the centre can a holistic mode of technology-practice be represented. Only through holistic learning responsive to community needs followed by endogenous problem-solving can indigenous people develop sustainable technological systems for their settlements. This raises the question: what are the possibilities for these technological systems and the lifestyles they support? and: can this lead to criteria for a suitable mode of technology-practice?

The above work of Seemann and CAT was embodied in his research towards his Doctor of Philosophy thesis (Seemann, 1997). Again indigenous technological empowerment through appropriate educational methodology, technacy, for the sustainable development
of their remote communities was the main thrust. Government policies and programs to address this need were called for, local independent technology services were needed to proved support to communities, and a regional approach was suggested. The study provided an excellent understanding of the technology functions and settlement development patterns to date. The study led one to ask whether it would be possible to develop a framework through which the technology support could occur in partnership with the new educational methodology. What would be the criteria for the participation of non-indigenous technologists and for the mode of technology-practice they would work within?

Continuing the review of Willoughby (1990) begins to yield some of the criteria. Willoughby (1990) synthesised the various strands of thought in the Appropriate Technology movement into an "integrated framework" comprised of four major elements: Firstly, there was the three-dimensional view of Appropriate Technology which is represented by Figure 3.1. Secondly, "technological fit" referred to a compatibility between "means" and "niche". Thirdly, there must be "endogenous technological development" which included endogenous innovation, self-reliance, community development and technological mix. The fourth major element he called "practical holism": "By this is meant a mode of praxis based upon a holistic approach to society, the environment, technology and other factors." The attributes of practical holism were: radical critique, human compatibility, environmental compatibility and integrated problem solving. His detailed and scholarly description of his “integrated framework” are condensed into a table which is provided in Appendix 3.

Willoughby's review of Appropriate Technology was indeed extensive and was done with the aim of formulating a universally applicable theoretical approach rather than blueprints for various settings. Indeed, as Willoughby clearly explained: "the general-principles approach is vacuous unless translated into tractable and specific terms at the level of particular localities and regions." To develop a "specific-characteristics approach" for remote Aboriginal communities application of his integrated framework to this situation, as described in Chapter Two, combined with further review of specific strands within the movement is necessary.

For example, Community Technology as discussed by Boyle (1978) sought to answer the question: "The range of activities undertaken in a modern industrial economy is enormous. In which of these would it be reasonable for a small, self-governing community to become self-reliant? And conversely, which of these activities would it be more sensible for small communities to leave to larger, more centralised organisations?" These are questions that Torres Strait Islanders asked while on the path to autonomy and indeed are now being asked by Aboriginal communities of the mainland in their quest for
'regional agreements'. Public administration, foreign trade, immigration, customs and defense are perhaps areas that may be left to the national government. Community Technology aims for self-reliance in areas such as manufacturing, energy and food production. These are not unreasonable aims for Aboriginal communities particularly across a region as a whole, although the current focus on achieving greater autonomy would continue before and during the development of these areas.

The early concept of Community Technology had a practical expression in the Adams-Morgan neighbourhood in the United States (Hess, 1979), the Institute for Self-Reliance in Washington DC and the Centre for Alternative Technology in Wales. Community Technology had an emphasis on technologies tailored to the needs of a community and local control of the technologies was possible. Such communities are small enough to allow face-to-face participation in decision-making and the political institutions are in the hands of the people.

Village Technology was another example of a major strand within the movement. It was a direct, practical expression of the Schumacher philosophy and was promoted by a number of non-government organisations working in developing countries such as Volunteers in Asia, Volunteers in Technical Aid, the South Pacific Appropriate Technology Foundation and out of Australia APACE (Irons & Bryce, 1994) and AREA who work predominantly in the Pacific Islands and PNG. There were also successful government organisations such as AT International which was a division of the US Agency for International Development and university-based groups such as the Brace Research Institute at McGill University in Canada. These organisations offered a vast array of designs for small-scale technical solutions in developing countries but which could also be used by people in the West seeking to establish decentralised, autonomous communities.

The emphasis in Village Technology was labour-saving devices for small-scale, local manufacturing – essentially another form of "intermediate technology". The philosophy and many devices arising from the approach may be relevant to some Aboriginal communities. However, many remote communities are not oriented towards manufacturing activities choosing instead to be mainly consumers of goods and services. The focus of activity in remote Aboriginal communities is the maintenance of community in its cultural sense. Community Technology, although oriented towards the north, has a philosophy which relates strongly to the activities of remote Aboriginal communities.

Permaculture (Mollison, 1988), described in Chapter Two, embraced some aspects of Village and Community Technology. It used a holistic design process, with strategies such as zone and sector analysis, to place elements (technological artefacts, plants and
animals) in the landscape in an integrated manner, as an ensemble. The principles and ethics of permaculture embodied the "practical holism" of Willoughby's (1990) integrated framework. Such principles can readily contribute to a model for technology-practice in remote Aboriginal communities.

A number of scholars have more recently called for "Appropriate Technology" to be adopted in mainstream industrial society such as Azelvandre (1994) drawing largely from Schumacher and ITDG for his principles and Thayer (1994) whose orientation was towards the deteriorating natural environment under industrialism. With a focus on urban, Western society their ideas cannot all be transferred to the Aboriginal setting. However, as an alternative approach to technology-practice in mainstream society they offer a means of empowering local communities for local employment and sustainable development. Their philosophical approach is relevant and Thayer's work is examined further in section 3.5 while Azelvandre's work is effectively covered by the review in this section.

Francis and Mansell (1988), for their work in developing countries, considered a variety of sources of "appropriate technologies":

1) Traditional technology modified by design, improved resource use or better materials;
2) Introduction of a successful technology from an earlier stage of development of a different economy;
3) New technology to meet a specific need;
4) Modern technology reduced in scale and/or complexity;
5) Transfer of technology between developing countries.

Again these principles generally reflect those of "intermediate technology".

With careful contrasting these sources can be relevant to the Aboriginal setting. For example, the recent understanding of the outdoor living environment in community housing design (Pholeros, 1993) relates to the first source. The introduction of the hand-operated washing machine and hand pumps are perhaps examples of technologies from earlier stages in Western development introduced to remote Aboriginal communities as in the second source. Solar water pumping is a case of (3): a new technology to meet a specific need. But perhaps more so is the solar-powered, reverse osmosis desalination unit currently under development by the Remote Area Developments Group (Harrison, 1996). The fourth "scale-down" source is how Ihde (1993) summed up the Appropriate Technology movement but the movement represents much more than this. In contrast Francis & Mansell (1988) found that this was the least common source in developing countries and indeed it is the same for remote Aboriginal communities. The introduction by CAT of the VIP toilet from Botswana to Aboriginal communities is perhaps an
example of the fifth source. This source brings us back to the point made at the beginning of this section about the resurgence of the Appropriate Technology movement due to a strengthening of South-South dialogue (Reddy, 1993).

### 3.1.2 Application to Remote Aboriginal Communities

The examples above have been provided to show how the Appropriate Technology movement is not homogenous and cannot be transferred directly to remote Aboriginal communities.

The focus of "intermediate technology" was to develop increased efficiency of labour and increased productivity for the elimination of poverty. This would not be the main focus of a mode of technology-practice for remote Aboriginal communities. However, the regional approach to economic development of “intermediate technology” is useful.

Community Technology (Boyle, 1979; Hess, 1978) offers useful insights in as far as there is some attention to the integration of technology systems where the technological elements of settlements are working together, interacting to support the community functions and life.

The process of development of the Intermediate Technology Development Group has almost been mirrored by to some extent by the Centre for Appropriate Technology, central Australian indigenous resource agencies, Ecotech and the Remote Area Developments Group as described in Chapter 2. Medicine has embedded itself in the life of Aboriginal communities more firmly than engineering technology and has thus appreciated the three-dimensional character of technology.

Willoughby's "integrated framework" can be applied to remote Aboriginal communities with a view to developing a "specific characteristics" approach for technology-practice.

### 3.2 INSIGHTS FROM DEVELOPING COUNTRIES

#### 3.2.1 Relevant Studies

Various studies have sought to identify programs overseas, both in developing countries in general and specifically in other Fourth World communities, that may be relevant to the Aboriginal setting in Australia. Lantzke (1988) explored "emerging patterns" behind the non-government organisations 'grassroots' development projects in Third World countries to see what lessons may be learnt from these. Anda (1993) toured programs
concerned with environmental health and environmental technologies for community
development in several Latin American countries. Hunter (1993) characterised the
various periods and theories in international development, and offered a schema for
contemplation and debate amongst those in positions of power in Australian Aboriginal
service delivery programs. Daube (1994) distilled useful information from numerous
development programs and services for indigenous people in Canada, United States and
New Zealand while seeking to recommend a program for the WA State Government. The
Race Discrimination Commissioner (1994) explained paradigms at the two poles of the
development continuum, lessons from the International Drinking Water Supply and
Sanitation Decade, water supply conditions in indigenous settlements of Canada and
struggles over Native American water rights in the United States. Anda (1993) also
toured Native American communities in the southwest United States with the Indian
Health Service.

This section will describe overseas trends in development theory and practice to see what
bearing this has on Aboriginal development in Australia. The emphasis of development
efforts since the Bretton Woods Conference after World War II (WWII) was on the
financing of massive infrastructure in developing countries (Goulet, 1992). In many
countries this turned out to have devastating effects.

Well before Bretton Woods a "concern for poverty" already existed and various non-
government organisations already had different viewpoints. Escobar (1995) explained
"the concern with poverty" in the colonial era "was conditioned by the belief that even if
the 'natives' could be somewhat enlightened by the presence of the coloniser, not much
could be done about their poverty because their economic development was pointless".
He described how the rise of international discourse on development began after WWII.
However, Berger (1995) of a decidedly stronger viewpoint, believed that "liberal
developmentalism had already begun to emerge in Anglo-American discourses on Latin
America, Africa and Asia by the 1930's...[and] explicitly racist ideas about the inherent
inability of Asians, Africans and Latin Americans to 'progress' survived into the post-
1945 era. At the centre of Escobar's book is the argument that the international discourse
on development, which emerged in the first decade after 1945 has less to do with
development and more to do with the exercise of power over the Third World". Escobar
argued that development is the last and failed attempt to complete the Enlightenment in
Asia, Africa and Latin America.

It was a logical continuation of colonialism: "an extension of the project of wealth creation
in modern western patriarchy's economic vision, which was based on the exploitation or
exclusion of women, on the exploitation and degradation of nature, and on the
exploitation and erosion of other cultures". This section will also examine the alternatives to mainstream development approaches that arose in developing or third world countries such as indigenous movements for decolonisation.

A vast amount of literature has been generated, especially since WWII, on approaches to development in the Third World. "One of the most unhelpful comments which can be made in observing Aboriginal and Torres Strait Islander communities is to liken them to the Third World problems" (Race Discrimination Commissioner, 1994) and as Lantzke (1988) observed "...there will be minimal value for outstation Aboriginal people in the comparison being made to Third World rural poor. Its value is for the non-Aboriginal who needs to develop a fuller understanding of the issues involved." Some useful insights can be gained from 'grassroots' development approaches.

3.2.2 Grassroots Development Insights

Apprehensively, Lantzke (1988) reviewed literature on Third World grassroots development strategies and searched for elements in common with the Australian situation. Parameters for extension work based on these, particularly in relation to water and wastewater innovations, may be helpful. The role of participation - "the taking of collective initiatives by the rural poor in an organised framework, following self-deliberation, and self-managing the tasks initiated" (International Labour Office, undated) - while not a panacea (Cohen & Uphoff, 1980), is now understood to be of paramount importance in the Third World for community development.

Lantzke (1988) was influenced by his work with rural poor in Bangladesh, and Bunch (1982). Lantzke outlined four categories of "program don'ts":

- paternalism,
- the rich relative approach,
- the blueprint approach and
- extension to village progressives.

Paternalism, "giving away to" and "doing for", must be avoided at all costs for a number of reasons including: villagers can become convinced they are incapable of making progress themselves - they are robbed of their self-respect; recipients become blinded to the need to solve their own problems; it hinders dissemination of meaningful innovations as that task, like most, remains the responsibility of the project; and it is often more expensive than other methods.

The "rich relative" approach involves merely giving cash instead of time to a worthwhile project and ignores the possibility that a range of other skills may be necessary to enable
sustainable change. Lantzke (1988) contrasted the blueprint approach against the process approach. ‘Experts’ test hypotheses through pilot projects, and a generic model is developed which can then be implemented elsewhere by predetermined step by step procedures. This is useful for planning, design and construction of infrastructure but avoids community participation and the development of sustainable local organisations. The two town planning demonstration projects commenced by the WA Government in 1996 in response to recommendations by Hames (1995) could be viewed with some scepticism.

A village leader, progressive or elite may be willing to try a new innovation offered by an extension agent and may indeed be able to afford the risk of failure. Its transfer is assumed to occur vertically to other poorer farmers and from there, horizontally, to other poor farmers convinced of its benefits. However, changes are risky for the poor and innovations designed by outside experts are often designed for optimum conditions. The position of the elite’s are often strengthened. For example, the ‘green revolution’, although it increased productivity under certain conditions, required substantially larger inputs which could not be afforded by the poor without first entering into debt. The assumed benefits did not often "trickle" across to women.

So what is the role of the outsider, asked Lantzke? He organised his responses under three categories: factors that influence the way we work with the poor; ways to approach the poor and the influences that development organisations have on projects.

Under the first: Development should occur with a human face and not just increased productivity or technology transfer for higher, abstract goals without local meaning. Developing positive relationships with the poor are important. Participation by the poor in local decision-making needs to occur from the beginning for a number of reasons but not without skill development. The whole thrust of being involved with the poor ought to be to facilitate them not just to solve one problem, but to go on to handle their total situation.

Under the second: The poor have existing skills that ought to be recognised and built upon. Start with issues that are important to the poor. Generate enthusiasm by achieving an early recognisable success through starting slowly and small, with technology limited in scope to enable small-scale experimentation. Group formation is important for accepting new innovations, greater participation and offering an improved learning environment. Local organisations are important for tackling broader issues (regional or national) - although potentially threatening to Governments and local elites such organisations are an essential aspect of both national identity and survival of the poor. Art forms such as popular theatre reaches a wide audience, is oral and therefore more
accessible, dramatically represents local problems and can stimulate local group action. Technologies need to be appropriate to the poor and their participation in basic research, adaptive research or trial runs will enable understanding of their concerns, ability and risks.

Under the third: Development at the grassroots level is a learning process for all involved, especially the development organisation. Flexibility is best achieved from decentralised and participatory development organisations. Development organisations need 'teamness' with an important role for facilitators (change agents) as well as technical and managerial specialists. The willingness to undertake evaluation is a key to success and organisations can use it to stay in good fit with their beneficiaries and their programs.

Given the characteristics of the outstation movement, as described in Chapter Two, his general conclusion was that the "grassroots development insights [were] not directly relevant to the initiation of action amongst the Aboriginal outstation people". However, as development is a process and the people were still clarifying their position, the insights may be constructive, particularly with regard to the process by which the people adapt "white" innovations into their lifestyle aspirations. This adaptation will change the value base of the people, and they will need to determine to what extent they want to accept change. Lantzke (1988) expressed this graphically in Figure 3.2:

**Figure 3.2: Technological Influences on the Aboriginal Value Base**

![Diagram showing the interaction of White Society, Western Technology, Aboriginal People, and Traditional Technology, with arrows showing the influence and change in value base.]

Given the above Lantzke went on to make some recommendations regarding the process of innovation communication, particularly with respect to water supply and wastewater disposal:
1. An integrated approach is necessary for innovation extension that complements other issues being dealt with by outstation groups;
2. Collaboration with other outstation groups ought to be considered to integrate effort and place the innovation extension in the context of Aboriginality;
3. Regional technical support units ought to be established to respond holistically to Aboriginal initiated action for water supply and wastewater disposal technologies;

4. A program that enables people to visit other sites where Aboriginal people have successfully adapted innovations will satisfy the objective of allowing Aboriginal people to be their own example in the search for identity in a period of change;

5. Funding should occur through regional organisations to locally prioritised projects instead of through departmental bodies to specific projects prioritised from a centralised process;

6. Care needs to be taken in establishing exactly what the needs of a community are bearing in mind the impacts that a particular technology choice will bring;

7. An approach by outsiders towards innovation extension needs to encourage the distinctiveness of Aboriginal people by drawing upon, for example, the existing skills base and fitting with cultural aspects as much as possible such as, for example, the attitude to time;

8. While the successful operation of some technologies will be dependent on the introduction of others, such as water supply followed by wastewater disposal, they ought to not be imposed if they are not felt to be important, rather their need may be addressed later through involvement in the planning process from the very beginning;

9. The technologies of the previous living situation will influence the choices people make for their new settlement and the facilitator needs to be aware of this background;

10. As some technologies, such as toilets and laundries, will be operated and maintained largely by women they need to be involved in the planning process;

11. The proposed use of the new settlement needs to be understood as this too will have implications for technology choice;

12. Awareness is only one part of the decision-making process and if information dissemination materials such as videos are used they need to be followed up by discussion;

13. Structures need to be created that support the above two-way process - the Community Development Employment Program (CDEP) by ATSIC and Training for Aboriginal People (TAP) by DEET were seen as positive.

The work of Bunch (1982) and Lantzke (1988) pointed to the benefits of the partnership between technologist and local community. Such an approach, utilising the elements listed above, brings more control back to the community-level and allows for a rate of development, within the financial means, at the pace of the community. Together the work in impoverished, disempowered or fractured communities can be towards a 'community-building' effect, while at the same achieving a level of development that can be self-managed and sustained with the support of regional organisations.
Hunter (1993) proposed a model that sought to explain the fundamental asymmetry of power between Aboriginal Australia and the dominant non-Aboriginal society. He described the four main phases through which 'development' has passed: Resource Aid, Technical Aid, Grassroots and Dedepvelopment.

The theoretical basis of Resource Aid arose from the post WWII reconstruction programs where the successes suggested similar responses elsewhere and allowed the major powers to exercise covert control. Thus emerged the Bretton Woods institutions. In the developing countries it was recognised that expertise was needed and the focus changed to Technical Aid. Individuals were selected as the beneficiaries of education and technology. All too often they were the elite's and village progressives. The seductive appeal of life in the West was attractive to many, however, "[t]he era of technological aid has been a manifest failure" (Hunter, 1993).

Major departures from these two modes began in the 1970's with 'trickle-down' approaches being replaced by 'grassroots' approaches. Factors contributing to this change were institutional (e.g. the 1978 Alma Ata WHO conference promoting 'primary health care'), ideological (e.g. Paulo Friere agitating for organised education and action within the oppressed) and popular (e.g. the Liberation Theology movement breaking away from the control and convention of the Church of the rich). Hunter (1993) felt that 'grassroots' approaches were at the cutting edge of development activity and would remain until their limitations, e.g. constraints by the same institutions that promoted them, were fully apparent to a newer, alternative mode.

According to Illich (1977) even the 'grassroots' approach, reflecting the actions of one group on another, could entrench the asymmetries of power. Reflection of those in power is necessary. "Deinstitutionalisation" is needed to halt further impoverishment. This is the "dedepvelopment" mode or "development as paradox". This represents relinquishing power in favour of mutual growth - competition on an equal footing leading to collective action. "Advocates of this approach to development are unlikely to be well received by the representatives of the privileged societies" (Hunter, 1993). This could be seen in the 1995 WA Court Government's action against the Mabo High Court decision, its attacks on Aboriginal people negotiating directly with mining companies, and its opposition to Aboriginal resource agencies (e.g. Marra Worra Worra, 1995) negotiating for self-management of essential services with direct funding from Canberra. The State Government argued that these developments further erode State rights in favour of the Federal Government.
Hunter (1993), Osborne & Mitchell (1991) and Simpson (1991) advocated what were effectively "dedevelopment" or "learning process" approaches and all appreciated what Chambers (1983) described as the "reversal in thinking" necessary by non-Aboriginal development experts. The technologist attempting to work in the cross-cultural setting and in a 'community-building' context would be well served by taking heed of these commentators.

3.2.3 Experiences in Overseas Development

The post-WWII development effort imposed on Third World countries was based on the belief that these countries needed to pass through the same phases that the West had - even though this has been accompanied by serious social and environmental effects (Francis & Mansell, 1988). The capital intensive development often carried out by Government in Aboriginal communities is reminiscent of the international aid projects of the 1960's which focussed on "technical aid" or "resource aid" (Hunter, 1993). During the 1970's it came to be realised, with the ineffectiveness of these programs to mobilise the poor in the Third World and improve their standard of living, that people-centred, basic-needs approaches to development were necessary. Community Aid Abroad is an Australian NGO dedicated to this philosophy in its programs for developing countries and has recently brought this approach to Aboriginal Australia.

In these projects it has been found that participation by the local community in all stages is essential to gain support, improve self-esteem and move towards self-sufficiency and prosperity. This requires participation in decision making, implementation, receipt of the project benefits and evaluation of the outcome (Cohen & Uphoff, 1980). Participation in the initial needs assessment for research projects as well as subsequent program evaluation (e.g. Rapid Rural Appraisal - RRA) allowed local people to "share, enhance and analyse their knowledge of life and conditions, to plan and to act" (Chambers, 1992). However, although community participation is empowering it is not a panacea (Whyte, 1984). It may well be, for example, that the supply of housing or ablutions facilities as rapid, in-out, turnkey projects by subcontractors to communities where conditions are appalling and people are very sick is appropriate. In this situation participation at the level of the regional organisation in planning and supervision may be sufficient. Nevertheless, the necessity of participation continues to be demonstrated in contemporary development theory, for example, in the emerging field of Participatory Rural Appraisal (PRA) (Lamb, 1993; Chambers, 1994; Chambers & Gujit, 1995). In Australia PRA may well be a useful tool for both outsiders (technologists, planners, project officers, area managers) and Aboriginal organisations (resource agencies, medical services) working in remote Aboriginal communities (Wilson, 1996).
The opposite to people-centred approaches to development, which is where genuine community participation does occur, is control-orientation - typically the hallmark of governments and bi-lateral aid, and defined in the first chapter of this thesis. Therkildsen (1988) questioned the long term sustainability of control-oriented approaches versus the adaptive planning/implementation approach. Brinkerhoff and Ingle (1989) described the integration of a blueprint or pre-planned approach with a process or problem-solving approach to achieve one that is both structured and flexible. Walker (1994) integrated the development planning descriptions by Brinkerhoff & Ingle (1989) and Lea & Wolfe (1993) into a table that contrasted the control and process orientations of development administration. The table provided an overview of the characteristics of each approach and Walker used many of these principles to argue his case in the report on water supplies and sanitation in remote Aboriginal communities for the Human Rights and Equal Opportunities Commission (Race Discrimination Commissioner, 1994). It serves as a convenient starting point in Chapter Five of this thesis to evaluate the fieldwork of Chapter Four alongside the review of this chapter.

A key aspect of some successful community development projects in Peru was that they first involved strengthening of the local base organisations (Anda, 1993). However, there was an element of competition amongst the NGOs who supported them - presumably because of the increasingly limited funds and resources. The problem for many Aboriginal community and regional organisations is that they too lack the necessary skills, resources and stable personnel to effectively deliver substantial services. The approach in Peru needs to be taken in Australia: focussing government funds and development services on strengthening regional organisations rather than single, centralised agencies trying to deal with hundreds of discrete communities simultaneously. Discrete Aboriginal communities also unwittingly compete for funds through the current ATSIC Regional Council process. A more coherent, ordered approach could be arranged by regional resource agencies receiving block funding to service their communities on the basis of locally-determined need.

What seemed to characterise the situation in El Salvador was a greater sense of cooperation amongst the NGOs and while the war had ceased there was a sense of impending doom due to the social and ecological crisis (Anda, 1993). However, this was being approached headlong with broad-ranging, dynamic programs towards sustainable development (Knott, 1993). It was quite clear that the government was interested in developing larger-scale infrastructure for national economic development but which would benefit the large landowners and not the poor. The latter was the focus of the NGOs and it was the Salvadorean Centre for Appropriate Technology (CESTA) in
particular that demonstrated an approach relevant to Aboriginal regional resource agencies in Australia. This approach could be summarised as:

a) all CESTA workers gaining a detailed knowledge of the social, economic and ecological problems facing the rural poor;
b) providing education to the rural poor for them to see the alternative options available for sustainable development;
c) securing capital and developing production facilities to manufacture eco-technologies for the urban and rural poor;
d) introducing appropriate technologies to rural communities only after these had been trialed, demonstrated and accepted in the education programs.

Like El Salvador, war brought massive ravages to the economy and environment of Nicaragua. But the switch to a conservative government imposing extreme policies of economic austerity wrought terrible difficulties upon the poor, particularly in rural areas. Again the approach of many of the NGOs was an environmental one but with a stronger economic emphasis due to the deteriorating economy (Anda, 1993). This emphasis also came about due to the presence of numerous NGOs supported by international aid for a number of years. The realisation that the economy would not improve in the near future motivated strategies towards sustainability. The revegetation projects motivated the strengthening of community-based organisations and the improvement of networks and communication channels (Devereaux, 1993). The local nurseries and actual tree-planting had a strong community-building effect generating pride and a sense of ownership and future vision amongst the local people. Such projects occur in Australia (Last, 1988; McGlew, 1992; Kalotas, 1993; Penberthy, 1996) but often suffer from lack of long term support. This is perhaps where economic linkages need to be made as in Nicaragua. This can be done by focussing on regional organisations with block funding, legislating for their access to grants in the same way as local government and setting up regional agreements with mining, pastoral and other regional economic activities - not just forcing Aboriginal people to take up enterprises through ideologically-based policies.

Perhaps the most succinct account of what can be learnt from development efforts overseas for remote Aboriginal communities is that by Chambers (1987). From a range of experiences over a number of years he was able to distill five key points that outsiders need to undertake for successful development projects: a learning process approach; people's priorities first; secure rights and gains; sustainability through self-help; and calibre, commitment and continuity of staff. An extensive review of this work cannot be presented here, but it is in the detail where it can be seen that these lessons are reflected in the previous reviews in this section and can be applied to many situations in the Australian setting.
In summary, the experiences of development assistance overseas has shown the following to be most effective: participation at the local or regional level; strengthening local or regional, community-based organisations; development workers to be thoroughly informed of local issues, longer term support may be necessary for sustainability. It has also shown that small, non-government organisations offering development assistance can often achieve a lot more than centralised government departments. While the achievements of NGOs, such as CAA and OSB (1996), in Australian Aboriginal communities may be small they are effective and perhaps greater funding should be directed to them.

3.2.4 Technology Transfer

With bi-lateral international development the focus was often on dams, bridges, railways, major roads, and the notion of "technology transfer" was used as if technology was neutral (Goulet, 1977; Smillie, 1991) rather than identifying all possible impacts as discussed earlier.

Agarwal (1983) discussed several ways in which new technologies can be disseminated amongst rural communities and concluded that innovation should be inherently linked with diffusion. A 'straight transfer' or 'top down' approach takes a need for an innovation and its associated attributes, and is concerned with transferring this product to the end users. The preoccupation in this approach is with the means by which the recipients can be persuaded to accept the innovation, rather than with problems such as unsuitability of the innovation or environment and a relationship that is unequal and hierarchical. Secondly, a prototype can be developed and the end users involved in the final stages of its adaptation to the local environment. Furthermore, the innovation can come from observing the current practices of the users and then given sophistication by the technologist.

The two preceding approaches were classified together as 'innovation adaptation' and would generally be concerned with the adequacy of the extension system (e.g. local R & D or technical training organisation), the bureaucratic rigidities and the class basis of the society in diffusing the technology. However, there were situations of economic (e.g. class) and social (e.g. gender) hierarchies where the 'straight transfer' or 'innovation adaptation' approaches would not be successful. Structural transformation (e.g. redistribution of wealth, change of attitudes) may be necessary to facilitate user-involvement and/or acceptance of a product in a diffusion process. Agarwal's analysis of the latter innovation adaptation approach found that fundamental material and ideological changes were necessary in these communities for user adoption of the product, and these provided constraints on ongoing trials.
In the case of Aboriginal communities structural transformation could represent the empowerment of Aboriginal regional resource agencies to control the development process. Acceptance and wider diffusion could follow from regionally-controlled, community-based trials with commercially-available technologies. Experimentation could also occur in this environment with newer innovations and adaptations of existing technologies. Failure under such circumstances may not represent such a great inconvenience as mutual support and locally managed back-ups could be arranged. Moreover, the experience of such mistakes and failures will be retained within the region and communities rather than by a city-based engineer or utility. This experience is accumulated by the regional agency which becomes more effective and professional with time.

Initially, it may be necessary for a new regional agency to employ a professional from elsewhere or a non-Aboriginal, but nevertheless one who must be familiar with the culture and characteristics of the region's communities. Such a person would be an important motivator in the early stages. Chauhan (1983) evaluated eight different development projects around the world and concluded that success was achieved where there was a dedicated motivator. This was usually a salaried professional that worked with the community without taking credit and their importance was not immediately obvious to the outsider.

The marginalisation of women from control of technology as well as its development is well documented (Shiva, 1988; Smillie, 1990; Warren, 1995). Their source of strength, innovation and perseverance was often under-estimated. Indeed, to ignore women in Third World development projects and Aboriginal communities risks dramatic failure as evidenced when the first Remote Area Hygiene Facility was to be installed at Halls Creek and will be explained in Chapter Four. Smillie (1991) addressed the issues of women and technology after reviewing the international movement. "Socio-cultural constraints can be an important factor in the success or failure of new approaches for women". While cultural constraints can be pronounced in strongly religious or traditional societies, in Aboriginal Australia the role of women has been promoted and can be more so. Regional and community councils are often predominantly male, but the influence of women is, of course, strong outside these forums. For male outsiders in Aboriginal communities it may be necessary to make acceptable, alternative arrangements for the participation of women.

The 1980's were the International Drinking Water Supply and Sanitation Decade. "The principal lesson is that progress and continuing success depend most on responding to consumer demand... Equipment choice, installation, financing, maintenance strategies
and cost recovery are important considerations that must be dealt with afresh in each locality. It is important to test several options and approaches in the communities where they will be used. It is also vital to offer consumers a range of choices and allow them to choose the one they prefer and are willing to pay for. (Cairncross, 1992). To adopt such an approach for remote Aboriginal communities it may be necessary to challenge established patterns by service agencies, negotiate change to regulatory requirements and standards (as indicated in Chapter Two), provide more information to regional areas and conduct locally-controlled trials. This may require more devolution of power and practice to Aboriginal regional resource agencies.

Thus for the technologist involved in technology transfer in Aboriginal communities considerable patience, energy and reflection is required from the individual or team. The process by which such people have been selected to date has often been questionable. Recruitment processes by the Overseas Services Bureau, for example, for Australian technologists to work in developing countries is rigorous and personal. Government recruitment of consultants is often based merely on monetary considerations. The former needs to be seriously considered for funding as a legitimate part of the overall development process. Such recruitment procedures could be handled through regional Aboriginal organisations. The use of trials, with a mix of technologies, with regional control and local participation is an effective innovation process. The participation of women as development technologists may be essential, especially in environmental health.

3.3 INSIGHTS FROM OTHER FOURTH WORLD SETTINGS

As Daube (1994) noted in his report towards a new program in State Aboriginal affairs:

At the outset of its deliberations the Task Force recognised that indigenous peoples in other countries faced socio-economic disadvantage comparable to that experienced by Australian Aboriginals. It seemed appropriate therefore that a knowledge of the problems confronting other indigenous peoples and an evaluation of the effectiveness of initiatives implemented by various governments to address those problems offered the potential to yield useful ideas for consideration in Western Australia.

Smith (1987) observed emerging trends in indigenous activism to discuss four questions which he believed one must ask of any development effort among indigenous peoples:

1. Is the indigenous community in control of the conceptualisation, planning and implementation of their development?
2. Does the indigenous community exercise control over its territory and over all the resources found within the limits of that territory?
3. Does the program for development promote self-sufficiency and economic independence of the community?
4. Does the development process strengthen the social and cultural bonds of the community and affirm the sense of historical identity and cultural dignity of the community members?

3.3.1 United States

Community-controlled health services are widespread across tribal lands, and they have made massive improvements to the state of health of Native Americans. However, these services are paralleled by an extensive, government-controlled, white bureaucracy and technical service agency.

As with the Water Authority of WA and the Health Department of WA the Indian Health Service (IHS) - Sanitation Facilities Construction Branch (SFCB) provides conventional water and sewerage systems with the aims of reliability, low maintenance, simplicity and improving health (Anda, 1993). The SFCB has used "appropriate technologies" to some extent. Solar power and small water supply systems are supplied to individual, isolated Navajo households, and reuse of lagoon effluent is practised in several locations for growing of crops for livestock feed. A key factor of the SFCB approach is regulatory flexibility and willingness of the engineers to sometimes consider a range of solutions to a particular problem rather than being tied to a single technology. For example, on-site effluent disposal could result in evapotranspiration, dry well or mound systems depending on the site conditions and did not have to be conventional leach drains or deep sewerage to lagoons. This was probably the result of Federal rather than State regulatory control on the reservations.

However, this tinkering at the edges does not effectively change the paradigm under which the whole operation works. While there have been well documented improvements in health statistics over the decades, the IHS is centralised and control-oriented using technologies essentially unchanged for 100 years and derived from densely populated urban centres in temperate climates. The southwest was characterised by either sparse population over large areas or small communities, yet conventional water and sanitation technologies were adapted by white engineers by means of extensive and expensive pipework systems. The health improvements rely on conforming to a Western model that has not been conceived of by the local community and does not necessarily empower the communities towards self-reliance. Moreover, the practices do not contribute to sustainable development, in fact, they promote unsustainable lifestyles.

However, Daube (1994) saw the IHS as a successful model of Indian participation with Government:

In keeping with the concept of tribal sovereignty, the Indian Self-Determination and Education and Assistance Act of 1975... builds upon IHS policy by giving the tribes the
option of staffing and managing IHS programs in their communities, and provides for funding for improvement of tribal capability to contract under the Act. As a result increasing numbers of American Indian and Alaska Native Governments are exercising operational control of hospitals, outpatient facilities, and other health care programs.

Excellent recording and documentation of statistics, needs analysis is carried out by the IHS at a level unprecedented in Australia. However, this required a white bureaucracy organised almost into an army with austere hierarchies. In fact, the Public Health Service is federally constituted as a sector of the armed forces giving it access to the resources of the military such as the large transport aircraft and requiring senior personnel at regional and central offices to wear military uniforms. Some people may find this quite attractive for its order, efficiency and performance, but the whole emphasis becomes one of sameness of service as soon as possible to conform to Western lifestyles rather than equality of outcomes with sensitivity to cultural needs.

The Taskforce on Aboriginal Social Justice (Daube, 1994) devoted considerable attention to other Fourth World situations and believed "that a number of innovative overseas ideas are both applicable to the Western Australian situation and amenable to local adaptation". The Taskforce noted that the situation of disadvantage of indigenous people elsewhere was often comparable to that of Australian Aboriginal people, even though there had been positive developments in political and organisational competence.

Ever since the passage of the 1975 Indian Self-Determination Act, the tribes have had the option of taking back from Federal authorities the administration of education and other social programs. Consequently, Indian governments now control about 40% of the BIA's [Bureau of Indian Affairs] $1.9 billion budget. However, in the absence of development, this autonomy has merely given many Indians the responsibility to administer their own poverty. Indians still have the shortest lifespans, highest infant mortality rate, highest high school dropout rate and most extensive health problems of any US ethnic group.

American Indians have not fared well under policies of Federal control and over the last 20 years there has been a significant move towards self-determination for tribes which now exercise significant sovereignty in areas such as taxation, law enforcement, social service, resource management and reservation economic systems.

One of the major findings [of the Harvard Project in American Indian Economic Development] is that sovereignty itself is a major factor in increasing economic performance and where the role of the Bureau of Indian Affairs is reduced economic development prospers. This is contrary to the Government's view that if tribes want sovereignty they must first establish self-sustaining economies. In essence, what this means is that a reduction in government programs which perpetuate welfare dependency results in improvements to development.

So while Daube eschews the role of government, he in fact finally recommends it for service provision in Aboriginal communities in Western Australia. However, he recommends the role for State Government and not Federal. What was perhaps lacking in his review was what processes occurred after reduction in government programs. It is likely that community empowerment occurred as a result of regaining more control over their affairs.
As Mander (1991) discussed in detail with regard to Native American people across North America, Daube (1994) also noted the failure of imposed, alien (non-Indian) forms of government, that are not in tune with traditional structures to work effectively or enable economic development. These are the modern industrial society's 'corporation' and the BIA-imposed tribal councils. The Ak-Chin Indian reservation south of Phoenix was quoted as an example of where self-government had led to self-sufficiency. While Daube (1994) saw the benefits of sovereignty and reduced government control in the United States, he still did not recommend programs that foster the empowerment of regional organisations or move regions and communities towards economic and regulatory sovereignty. The preferred model for the WA Government remained as service delivery by centralised line agencies. Anything else was left as an issue for the Commonwealth - especially when it came to funding.

3.3.2 Canada

Canadian indigenous groups - Indians, Inuit and Metis - lobbied powerfully and in a united way throughout the 1980's for aboriginal self-government. Though this was not fully achieved they now exercise a number of powers, have responsibility over a range of policies and programs and receive block funding in some cases which enables them to decide on the priorities for spending (Wolfe, 1991).

In the case of Canada the Taskforce (Daube, 1994) noted:

*Much of the improvement in Indian health conditions can be attributed to better treatment and control of infectious diseases, which at one time took a serious toll on Indian populations. The increased urbanisation of Indian populations, however, has resulted in a greater incidence of cardio-vascular diseases, cancers and mental health problems.*

*Many of the illnesses in Indian communities are related to poor water quality and, in addition to the annual capital allocation for water and sewerage projects on Indian reserves, the Government is providing $275 million over six years to accelerate the establishment or improvement of safe water and sewerage services. Additionally, Indians are being trained in water treatment practices. Most of the funds and projects are being managed by the Indian bands whose reserves have been identified as priority areas.*

*Today, essentially all Indian bands administer their own housing programs (with management and technical assistance from Government agencies). Indians have been exploring ways to improve the use of existing Federal resources and to enable individuals and the private sector to participate more fully in the financing and construction of housing.*

Elspeth Young (1995) conducted a detailed, comparative study of the development phenomena occurring with indigenous people in the remote areas of Canada and Australia. She commenced her study by using the case of the remote area dwellers in Botswana to illustrate the complexities of development, and serve as a basis to demonstrate the socio-economic disadvantage suffered by indigenous people in Australia and Canada. In the case of Botswana as a result of a preoccupation with national
development focussed on urban and rural centres, programs for the indigenous people in remote areas were assimilative in nature. In Canada indigenous people were organised and achieving levels of autonomy comparable to in Australia. The reasons for failure of most development policies and programs in Canada and Australia were similar. The reasons included:

a) cross-cultural barriers which resulted in assimilative rather than self-determination approaches continuing to this very day;

b) bureaucratic inflexibility preventing adjustment of program parameters even when it was clear they were not achieving their goals;

c) socio-economic disadvantage coupled with lack of control over resources compounded the development problems;

d) the legacies of past colonialism are deep-seated and non-aboriginal people doggedly believe the choices of industrialised, capitalistic societies are the best (Young, 1995).

What seemed to characterise government documentation of the Fourth World experience is the focus on the administrative systems and business development and less so on details of community-control, the community-based trialing of technologies to determine their appropriateness or the cultural dimension of technology in development. Even rarer is the focus on water and sanitation and little evidence of a strong role of non-government organisations. Government dominates all aspects of service delivery in the Fourth World setting, and also regulates it with the same standards used in the national mainstream setting. This is largely due to the fact that Fourth World communities rarely have an economic base after colonisation and loss of land, they are often in remote areas which are inhospitable and unattractive to non-indigenous people, and they are dependent on government support. The support of non-government organisations is usually negligible.

Thus in other Fourth World settings the dominant paradigm is still control-orientation and assimilation although groups are making efforts to achieve higher levels of autonomy. Where more autonomy was gained in the management of development efforts in the Third World empowerment followed. It is harder to find similar examples in the Fourth World, due to massive government dominance of development programs, but the preceding review has shown that they do exist. The next section will consider the underlying cultural basis of Western, industrial society's drive for assimilation.

**3.4 QUESTIONING THE DOMINANT TECHNOLOGICAL SOCIETY**

There have always been vigorous critiques of industrialism, particularly this century as industrialisation spread across the globe (Benjamin [1892-1940], 1968; Mumford, 1934;
Ellul, 1964). Some of the contemporary commentators, intellectuals, artists and activists have been collectively referred to as the Neo-Luddites (Glendinning, 1990; Mander, 1991; Sale, 1995). The Luddites uprising in England in 1812 was a revolt by cottage-based textile industry workers against the new technology of factory-housed machinery which left them without work. The lack of concern for the traditional workers in the way that the new technology was introduced was disastrous and is perhaps analogous to the way technology has been introduced to contemporary indigenous Australian communities.

Mander (1991) believed the "technological juggernaut" of Western industrial society, with massive investment directed at nanotechnology, genetic engineering and robotics, had gone as far as to plan obsolescence for the human body and the minds of most. He offered 10 principles by which people could resist technological domination, a list of reminders that he kept pinned above his desk, and which perhaps each Aboriginal community council and Aboriginal resource agency may find useful in their offices to recall when meeting with city-based engineers and bureaucrats:

1. Since most of what we are told about new technology comes from its proponents, be deeply sceptical of all claims.
2. Assume all technology "guilty until proven innocent".
3. Eschew the idea that technology is neutral or value free. Every technology has inherent and identifiable social, political and environmental consequences.
4. The fact that technology has a natural flash and appeal is meaningless. Negative attributes are slow to emerge.
5. Never judge a technology by the way it benefits you personally. Seek a holistic view of its impacts. The operative question is not whether it benefits you, but who benefits most? And to what end?
6. Keep in mind that an individual technology is only one piece of a larger web of technologies, "megatechnology". The operative question here is how the individual technology fits the larger one.
7. Make distinctions between technologies that primarily serve the individual or the small community (e.g. solar energy) and those that operate on a scale outside of community control (e.g. nuclear energy). The latter kind is the major problem of the day.
8. When it is argued that the benefits of the technological lifeway are worthwhile despite harmful outcomes, recall that Lewis Mumford referred to these alleged benefits as "bribery". Cite the figures about crime, suicide, alienation, drug abuse, as well as environmental and cultural degradation.
9. Do not accept the homily that "once the genie is out of the bottle you cannot put it back," or that rejecting a technology is impossible. Such attitudes induce passivity and confirm victimisation.
10. In thinking about technology within the present climate of technological worship, emphasise the negative. This brings balance. Negativity is positive.

It was the corporation, according to Mander, that makes this destruction of community, nature and indigenous societies possible - that non-human entity, on paper only, that no single human being takes responsibility for. The main thrust of his book was the extent of destruction of the Indian (Native American) nations in the past, the theft of their lands that continues today and the impact that technology is having on their culture. He
described how Indians were coerced into accepting the corporation as their system of administration, replacing traditional forms of government by the elders, thereby enabling land to be privatised and sold off for mining, dams, roads, railways, forestry and agriculture. Latterly, he spoke of all the individuals, community organisations, think-tanks and Indian Nations that were resisting this onslaught against the natural environment and indigenous people - and indeed having the odd victory here and there.

It was the values of the Indians that he looked towards as offering some guidance for an alternative vision of the future. He summarised what dozens of people, organisations and Indian nations had been saying on what it may mean to "go back":

- We surely need to abandon all values that place emphasis on commodity accumulation as something desirable in life;
- Growth economics, the profit motive, and the market economy, all counterproductive to a sustainable future, must be regarded as short experiments that have failed miserably, and must be abandoned as such; there is no more room for them on Earth.
- A long list of technologies and technical systems must be re-examined from a holistic, systemic perspective. Those technologies found incompatible with sustainability and diversity on the planet must be abandoned.
- Finally, we need to rethink our relationship with nature and with native peoples. This includes relearning history, and grappling with the forces that caused this history to occur. And we need to directly support the struggles of native people to recover and maintain their land base and sovereignty, wherever this battle occurs.

The first industrial revolution set the stage for the second, the start of the computer age, which was somewhere in the post-WWII period. While some referred to it as the cleaner, information-based "post-industrial" era, Sale (1995) argued that its essential features were still industrial:

- The new technologies, as in the first industrial revolution, have been imposed on society without consideration of long-term effects or by putting them to the vote. "Indeed, it is the imperative to control, whether by the state or other institutions, that may be the most decisive characteristic of computerisation..."
- The values of the past - the small community, the small town, the neighborhood - are no longer relevant and are destroyed to be replaced by individuality, mobility, consumption, growth and change.
- Needs are now manufactured, and advertising by television and computer-aided multi-media methods (the 'image' technologies) is the principal means by which this is achieved.
- The state has facilitated the development of the technological society. Multinationals, having rendered it impotent, now milk it for the money to pay for the new public works - paving the world with the information superhighway.
- The impact of automation on employment had been dramatic, but with computerisation has been created a lasting and structural problem.
- The computer has enabled a more rapid destruction of nature in both degree and kind creating a "technosphere so imminent in our lives, artificial, powerful, and global, and fundamentally at odds with the biosphere."
While the preceding commentators provided a strong case against the pervasive use and reliance on technology alone, many others disagreed and argued that technological advancement made possible the eradication of diseases, the removal of drudgery and repetition from work and the delivery of a range of goods and services which made life more comfortable - for those that could pay.

Jones (1982) appreciated the benefits of technology but saw beyond life as a wage-slave devoted to earning these benefits to a time when people lived a life of enforced leisure. He described the historical transition from an agrarian society, through one based economically on manufacturing, through the current era of services, to the future which will be based on education and leisure as the predominant activities. Jones admired the work of Mumford who pointed to "polytechnics" where technology was "based upon more organic, earth-centred, multifarious principles" (Willoughby, 1990). Jones also admired the values of the Appropriate Technology movement as advanced by Schumacher. However, given the already high levels of centralisation in advanced industrial countries, a category which Australia may just fit into, the successful transition to a post-service economy may only integrate some of the Appropriate Technology attributes. There was a need for government to avoid the trend occurring with corporatisation where Parliament is no longer the place for debate for technology choice. In fact, there is no longer much debate at all on whether or not to implement new innovations on a widespread scale. This need was to a small extent satisfied with the establishment of the Australian Science & Technology Council (ASTEC) in the early 1990's. Furthermore, there is a great need to ensure that the people of Australia are adequately informed of the technological changes that are occurring.

Jones (1982) put forward a well thought out political program of reform to adapt to the demands of the future. The program included the provision of government to legislate in the area of technology choice, supply of information on likely impacts from technology proponents to the labour movement, establishment of a parliamentary office of technology assessment and "the need to adopt appropriate technology to meet particular needs, rather than accepting the view that technology must either be adopted in toto in its most advanced form or, in effect, be totally rejected". Jones viewed the continuation of centralisation in mainstream society as almost inevitable, but in some areas he indirectly championed the notion of autonomous, self-determining, culturally-based communities as a constructive feature of the post-service society. This view of the post-service era fits neatly with Aboriginal priorities towards a lifestyle that has strong connections with the land rather than a compulsion to work for more consumer goods. Clearly, Aboriginal people need to have access to up-to-date information, control of resources and control of
a selection process that will enable them to put in place the sustainable technologies to enhance this lifestyle and reduce recurrent maintenance costs.

Thayer (1994) believed in sustainable technologies and sustainable landscapes as a way towards resolving the dilemma of what he called "environmental guilt". He defined a sustainable landscape as a place where human communities, resource uses and the carrying capacities of surrounding ecosystems can all be perpetually maintained. A sustainable technology was a technology which when employed productively by humans, results in no loss of ecosystem carrying capacity, resource availability or cultural integrity. Sustainable landscapes would:

1. Use primarily renewable, "horizontal" energy at rates which can be regenerated without ecological destabilisation.
2. Maximise the recycling of resources, nutrients and byproducts and produce minimum "waste" or conversion of materials to unusable locations or forms.
3. Maintain local structure and function, and not reduce the diversity or stability of the surrounding ecosystems.
4. Preserve and serve local human communities rather than change or destroy them.
5. Incorporate technologies that support these goals. In the sustainable landscape, technology is subservient, not primary and dominating.

While usefully explaining a "new" mode of technology-practice, mainly at the artefact level, Thayer (1994) had no clear means of action or social organisation by which to move towards sustainability. The connection between Aboriginal people in remote communities and their surrounding landscape is of paramount social and cultural significance. If they continue to have no control over the technologies deployed in their communities the concept of "landscape guilt", as Thayer refers to, may emerge to have the same numbing effects it has had in Western technological society. Already in remote Aboriginal communities we can see the packaging of modern Western society strewn across the landscape with no effective means of waste management; diesel generator sets causing massive recurrent fuel costs with no vision in place for phasing them out, and sewage effluent continually spilling out into community spaces to create massive environmental health hazards rather than being directed towards the creation of greener environments. The landscape connection and Thayer's notion of 'sustainable technologies' can contribute to the model of Community Technology to be proposed.

Murray Bookchin (e.g. 1983) consistently argued against the environmentalist "fads" that some of the above ideas may tend towards. So-called environmental technologies or sustainable technologies may merely become part of a company's program in market expansion and diversification to reap a greater share of the profits and preserving the debilitating producer-consumer relationship. He called for a deeper understanding of
ecology combined with a view towards social reorganisation - social ecology. The city as it originated in Athens was a highly self-conscious ethical entity and he believed it could be relived. (Nevertheless, one needs to consider the glorification of the Athenian polis with care. The Left often applauded its democratic tradition while the Right envied its exclusively male domain and its oppression of women and slaves.) The mundane, expanding and ecologically destructive urban belts were nothing of the kind, and needed to be decentralised to bring them back to a human scale where self-government by participatory democracy and popular assemblies could occur. It was neighbourhood cooperatives, vocational collectives - libertarian municipalism - that could commence the process of decentralisation. According to Bookchin (1989) the change would need to be slow to accommodate time for education and learning human-to-human cooperation without hierarchy.

According to Bookchin (1980) "ecotechnology" transcends mere technical meaning by considering an ensemble of technologies, rather than individual technologies, "functionally integrated with human communities as part of a shared biosphere of people and non-human lifeforms". "Ecocommunity" was considered by Bookchin (1980) to be a decentralised one that allowed direct popular administration, recycling of wastes, maximum use of local resources, and large enough to foster cultural diversity and psychological uniqueness while set in an ensemble of libertarian institutions.

Mitsch & Jorgensen (1989) attempted to provide a technical basis to Bookchin's ideas of ecotechnologies, already over two decades old. They made a point of differentiating their new branch of engineering from previous methodologies such as environmental engineering and the newer strands such as biotechnology which sought to manipulate at the genetic level. The important point to note at this stage of the discussion is that the development and application of technologies need to be based on the natural biogeochemical cycles and not just one part of them. There is no doubt that more of this work is needed, as long as it is grounded in a people-centred appreciation as well as an ecological one, to make a relevant contribution towards achievable, acceptable technologies in remote Aboriginal communities. Their source could be from environmental technologies (Salvato, 1958), appropriate technologies (Schumacher, 1973), ecotechnologies (Bookchin, 1980) or sustainable technologies (Thayer, 1994) where the criteria for the community are satisfied.

Trainer (1992) outlined a practical community-based and initiated transition to a "radical conserver society" as did a number of others (Mollison, 1978; Kennedy, 1991; Smit & Nasr, 1992; Anda et al., 1994). The transition would start with local communities taking action into their own hands through a series of steps which they clearly described. Clear, practical action around these so-called sustainable technologies or ecotechnologies
grounded in people-centred approaches that traverse cross-cultural barriers is what is necessary for achievable, sustainable development in remote Aboriginal communities. These approaches support the Community Technology model.

In summary, the point of this section has been to demonstrate how the dominant mode of technology-practice in Australia today, like all Western, industrial societies, and in fact any technological societies, have values and a trajectory that arise from the first industrial revolution. These values and directions tended, through colonisation and industrialisation, to destroy traditional cultures and economic bases, and more recently as part of the second information revolution, through 'image' technologies particularly but also through subtle forms of government control which objectified them, effectively turning them into commodities, for the benefit of First World consumers or continued a process of assimilation-by-stealth in "mainstreaming" their needs for service delivery.

Given the directions Aboriginal people are struggling to take themselves, as indicated at the end of Chapter Two, it may be possible to look at some alternative tendencies within technological society as outlined above for ways in which to adapt Western technological approaches to the needs of remote Aboriginal communities. The strong anti-technology standpoints of some commentators in the preceding discussion contribute to this study in as far as technology is necessary and beneficial but the issue is where the control of technology lies and how it is applied. As stated in Chapter One Aboriginal people have selectively adapted technologies into their culture for hundreds of years prior to permanent occupation by Europeans. The successful selection, adaptation and management of technology in the now sedentary Aboriginal communities are what is required. Thus the adaptation of some "sustainable technologies" from mainstream society that are more sensitive to the landscape may fit with the tendency of Aboriginal people towards Westernisation, and give more time to conduct their own cultural activities. The means by which these technologies and systems can come under Aboriginal control, and are managed to suit Aboriginal aspirations towards "sustainable development", are examined in the following section.

3.5 SUSTAINABLE DEVELOPMENT

In recent years "sustainable development" has been located on the agenda of mainstream social and economic activity around the globe. Indeed, a seemingly global commitment to this agenda item has occurred with the pronouncement by Brundtland (1987) that it is necessary to have "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The focus of
the debate, as can be expected, has been on the resource consumption and wastes of the industrialised world.

Zethoven (1991) observed the debate and defined three positions present: shallow, intermediate and deep sustainable development. The first assumed that natural and human-made assets could be substituted while the other two couldn't. The Business Council of Australia and the Australian Government, for example, fitted the 'shallow' position with their continued support for indiscriminate economic growth even with the loss of "unimportant species". The "ecologically sustainable development" package brokered by the Australian Government between industry and the mainstream conservation organisations on this shallow basis resulted in Greenpeace walking out of these negotiations (Beder, 1994). The Brundtland Report espoused an 'intermediate' position which would accommodate growth in developing countries to achieve a sustainable livelihood security while growth in the industrialised world is curbed. Many environmentalists fit the 'deep' position of sustainable development, and this is the position applicable to Fourth World communities. Within a framework of 'deep' sustainable development local communities, such as remote Aboriginal communities, are able to undertake limited and finite growth to remedy the disadvantage they suffer within an industrialised nation.

In contrast to the great attention of sustainable development theory and practice to the Third World, very little attention has been paid to Fourth World situations. Indigenous people have largely been ignored with regard to discussions on sustainable development in industrialised countries such as Australia (Stocker, 1993). The debate has been closely linked to the resource sector in Australia, yet Aboriginal people are seeking a way forward to "ecologically" sustainable development in remote areas. Stocker & Pollard (1994) looked at what principles were common to a number of successful community-based approaches to "ecologically" sustainable development in regional areas including an alternative technology centre and a remote Aboriginal community. They included:

- skilled community workers who were able to balance a number of projects simultaneously;
- the history of the community, patterns of development and formation of structures all being integral;
- skilful communication with all tiers of government but a range of incompetencies on the latter's part;
- networking with other related interest groups;
- the high profile of the groups within their region;
- group processes that evolved over time with the interest of members, relating to their personal lives, dealing with conflicts as they arose and adjusting to suit the needs of individual projects - in other words flexibility;
• the groups understood the funding sources and were able to mobilise physical and human resources, but comprehensive information to suit their needs was often not available; while training for skills development was highly valued an effort had to be made to secure the necessary information;
• a strong sense of place derived from the natural and social environment.

Young & Ross (1993) commenced a study that set out to document such achievements and the contribution that Aboriginal culture can make to the mainstream agenda for sustainable development. Young (1995) went on to argue that Aboriginal people need "support systems aimed at total development" and she reviewed the international development literature to adapt a model for sustainable development which corresponded with the three dominant aspects of Aboriginal society: the people (the social system), their means to survival (the economic system) and their environment (the biological and resource system). This is shown in Figure 3.3. Seemann (1995) would again see this as a “disintegrated” view of the world as opposed to a holistic one and a Western cultural framework would make it difficult to actualise the “Aboriginal concept of development” at the core.

![Diagram](image)

**Figure 3.3: A Sustainable Development Model for Remote Aboriginal Communities (Young, 1995)**

Although the economic growth paradigm in mainstream society may continue to detrimentally affect policies towards Aboriginal communities for some time Young (1995) outlined the parameters that would form the basis of the above model. These generally included consultation at the grass-roots level, enough flexibility in the program to allow
change midway through projects, and the need for Aboriginal people to sometimes take an adversarial approach towards government agencies. More specifically, efforts towards sustainable development would involve:

- acknowledgment of the need for Aboriginal control over development, both at national and regional levels and also at community levels;
- recognition of the social and economic diversity of Aboriginal communities, and of how this affects their responses to development opportunities;
- negotiation (a step beyond consultation) to ensure both that the development is following an appropriate path, and that those concerned get their fair share of the benefits flowing from it;
- deliberate fostering of Aboriginal skills to enhance their chances of more equal participation in development affecting them;
- creation of an Aboriginal resource base, over which they exert control in ways which allow them to determine how these resources might be used for development;
- provision of adequate and appropriate forms of financial backing so that Aboriginal groups and individuals can offer the capital needed to carry out their plans.

To implement Young's strategies may require the financial and logistical support of non-government organisations such as the Overseas Service Bureau (1996), Community Aid Abroad, APACE, AREA, professional associations and perhaps research groups that are able to assist in trials of devices, maintenance programs and management systems. As some commentators have suggested perhaps the only path to ecologically sustainable development in the Fourth World is to transform the Western systems of natural resource use, social order and knowledge production to those of their colonised indigenous people. Christie (1993) argued that Western science and Aboriginal science are both socially constructed and each have their own dimension of truth: while Western science affirms truth through combined empirical and theoretical evidence, Aboriginal science has combined the experience of generations with a belief system to give it a firm ecological grounding. Technologists willing to take a "learning process" or "dedevelopment" approach, as described in section 3.2.2, towards the Aboriginal belief system would contribute towards "community-building" development.

In the "Water Report" (Race Discrimination Commissioner, 1994) Walker argued that certain technological approaches taken in urban mainstream Australia towards "sustainability" such as reticulated sewerage, water conservation and renewable energy may not necessarily be appropriate in remote Aboriginal communities at a certain stage of their development.

*It is therefore inappropriate for Aboriginal people to choose technologies without considering the level of dependence reflected in those solutions and the impact on their community of choosing particular options. It could also be argued that it is unethical to encourage levels of service and associated technologies for communities when the recurrent resources are not identified.*

*There are also other issues regarding sustainable development which require consideration. Under community control, sustainable development may be localised, selective and have differential growth patterns, whereas with a regional focus (such as ATSIC Regional Plans) it tends to be generalised with an economic impetus. Service provision needs to be sustained at both levels.*
The challenge is how the two levels of development may be integrated to provide a regional development framework which tolerates localised activity. In the same way that sustainable development is not possible without careful technology choice from the mainstream of technologies or through the development of appropriate local technologies, it is also impeded by inappropriate regional development foci.

With respect to regional organisations and community participation substantial experience has been gained in developing countries. Brinkerhoff & Goldsmith (1992) arrived at some strategic options that would help to ensure the sustainability of institutions involved in development work:

- secure commitment to the project from the elites and beneficiaries in the recipient country;
- strategic planning should identify realistic objectives;
- formulate or revise strategies at appropriate times - early or at a point of crisis;
- build alliances, support networks with project stakeholders;
- differentiate perceived versus actual payoffs;
- offer ongoing training to build up skilled personnel and create a high performance organisational culture;
- maintain prolonged collaboration for institution building.

This collaborative approach is not the adversarial one proposed by Young (1995). However, there is no doubt given the diversity of Aboriginal communities, that no single approach will be relevant to all communities.

Using the preceding review it is now necessary to develop the models of Community-building, Community and Regional Technology. These have emerged from an understanding of the conditions experienced in remote Aboriginal communities and the current approaches to development as described in Chapter Two. The problems and alternatives to the dominant industrial paradigm were outlined and aspects of sustainable development theory were discussed from which a discourse on technology-practice for Aboriginal development can be advanced. The discourse is grounded in the general principles of Appropriate Technology discussed earlier in this Chapter. Specific criteria for sustainable technology in remote Aboriginal communities is not the focus of the models due to the great variability in level of development and aspirations between different communities. However, the models will need to offer more than the "general principles" approach to Appropriate Technology.
3.6 DEVELOPMENT OF CONCEPTS: METHODOLOGY

In this section a mode of technology-practice with a basis in self-determination will be distilled from the preceding discussions. This mode of technology-practice has begun to emerge as concepts in this chapter and will be articulated clearly in this section.

For qualitative research in the social sciences ‘grounded theory’ (Strauss & Corbin, 1990; Glaser, 1992; Strauss & Corbin, 1994) is one methodology used to generate new theory to describe certain phenomena. Using this methodology ‘data’ is firstly analysed to determine consistent patterns, to detect ‘categories’. The ‘categories’ must be firmly grounded in the ‘data’ and there must be ‘conceptual linkages’ between each of them. The ‘theory’ is that represented by the final integration of the most reliable categories. As explained by Strauss & Corbin (1994): “Grounded theory methodology explicitly involves “generating theory and doing social research as two parts of the same process”... Because grounded theory is a general methodology, a way of thinking about and conceptualizing data, it was easily adapted by its originators and their students to studies of diverse phenomena. To name only a few, these included professional socialization, policy arenas, remarriage after divorce, interaction between builders and a would-be homeowner...”

The ‘grounded theory’ methodology was found to be most appropriate for development of the following theoretical concepts. However, in the context of the overall project the methodology was not entirely satisfactory. The point of this study was not solely to generate new theory. Rather, it was initially to develop suitable technologies for specific conditions. Later the rationale emerged for conceptualisation of improved service delivery and improved technology-practice in collaboration with regional indigenous agencies. Consequently, it became necessary to develop the following concepts in the writing up of this study.

The fieldwork itself however was a ‘community-based action research’ (Stringer, 1996) or ‘participative action research’ (Reason, 1994) project having been conducted in collaboration with regional indigenous agencies and communities with the aim of meeting their practical needs in the short term. In the medium term a ‘two-way’ process of learning occurred where both parties sought to develop improved training and manufacturing operations. The higher order goals of achieving an improved mode of technology-practice for remote Aboriginal communities were only feasible in the longer term and were not seen to be objectives during the early fieldwork.

Nevertheless, interest in the broader aspects surrounding the technical nature of the project by this author are also reflected in the elements of action research as described by
Sarantakos (1998): *The elements that characterise action research are the personal involvement of the researcher, the emancipatory nature of the research, the active involvement of the researched, and its opposition to certain policies and practices... The researcher here takes the side of the respondents, helps them understand their real situation, explains to them the reasons for this and shows them ways of change and 'liberation'. The researcher together with the respondents work towards change.*

To further highlight the orientation of action research the following example by Reason (1994) is provided: *The process of participation and dialogue often starts with an intervention that has a formal objective of adult literacy or development of health care. Thus in a tribal village in India funds were originally provided for an adult education project. Despite many difficulties, not least of which was dealing with the “culture of silence” of the village, the educators were able to develop these classes as “a forum for open discussion on the socio-economic position of the village and a place for beginning action to change it”. The outcome was not only improved economic conditions, but also an enhanced sense of community self-determination and a social structure in which future development decisions might be made.*

The reason why this study cannot be articulated under a single social science research methodology is because, firstly, it was initially commenced as an engineering science research project to evaluate the technical performance of specific technologies under specific conditions. This approach would still accord with Willoughby’s (1990) definition of “appropriate technology” as provided in Appendix 3: *Artefacts which have been tailored to function as relatively efficient means and to fit the psychosocial and biophysical context prevailing in a particular location and period (i.e. technology which is compatible with its context).* However, as has already been discussed in Chapter One, Appropriate Technology is a holistic mode of technology-practice and thus the “specific characteristics” approach will not suffice for the articulation of broader theory. To paraphrase from Chapter One: Willoughby (1990) defined Appropriate Technology as "artefacts which have been tailored to function as relatively efficient means and to fit the psychosocial and biophysical context prevailing in a particular location and period" and is a "general principles" approach. Willoughby (1990) embodied this approach in his “integrated framework” as described in Chapter 3 and the formulation of the following theoretical concepts is grounded in his “integrated framework” as well as the data provided in Chapters Two and Three.

Secondly, although the fieldwork became an exercise in ‘action research’ where both parties sought to improve themselves collaboratively various factors prevented any rigorous collaboration in the subsequent evaluation and formulation of concepts. Although the concepts to follow have been presented at several forums with indigenous
participation since the fieldwork (Anda et al., 1995; Anda, 1996; Anda et al., 1998) this does not represent sufficient collaboration to be classified as ‘action research’ in totality.

3.6.1 Non-Aboriginal Technologists and Self-Reflection

The value of Aboriginal culture has been reviewed from an intellectual point of view and the people have achieved a degree of civil and human rights, but the value of Aboriginal culture can also allow reflection on the inadequacies of our own contemporary culture. How can Aboriginal people help us so that we can help ourselves? How can we behave not as experts but as facilitators willing to learn to change ourselves? This is the concern of Illich (1973), Hunter (1993), Osborne & Mitchell (1991) and Simpson (1991) described in section 3.2.2.

There are a number of roles in which technologists relate to Aboriginal communities. Many of these were discussed in Chapter Two but are summarised in Table 3.1. Delivery of technology-related advice or services can occur through the sectors listed in Table 3.1:

<table>
<thead>
<tr>
<th>Sector</th>
<th>Technologist type</th>
<th>Specific vocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Health (water supply &amp; sewerage maintenance, pest control, solid waste management, hygiene)</td>
<td>Regulatory bureaucrat</td>
<td>Shire Environmental Health Officer plumbers, pest controllers</td>
</tr>
<tr>
<td></td>
<td>Trade contractors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintenance &amp; repairs</td>
<td>CDEP workers, Environmental Health Workers</td>
</tr>
<tr>
<td>Community Infrastructure (water supply, sewerage, internal roads, access roads, airstrip, community buildings, ablutions facilities)</td>
<td>Engineering design</td>
<td>WAWA engineer, Main Roads Department engineer, Shire engineer, consultant engineer consultant engineer, Australian Construction Services engineer, foremen, tradespeople, CDEP workers</td>
</tr>
<tr>
<td></td>
<td>Civil works construction</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Training</td>
<td>TAFE instructor, Education Department teacher, Community College instructor, CDEP supervisor</td>
</tr>
<tr>
<td>Housing</td>
<td>Design</td>
<td>Consultant architect, State Housing architect, resource agency architect carpenters, bricklayers, plumbers, electricians, concreters, metalworkers, tilers and other building crafts</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td></td>
</tr>
</tbody>
</table>

There are also the coordinators, planners, administrators and researchers who assist in the processes of service delivery. They are all in a position to contemplate their role and impact while working in the cross cultural setting of Aboriginal communities. Dr Bruce Walker and Dr Helen Ross are two examples of 'experts' working 'across' disciplines in the cross-cultural setting. They are both psychologists who are technically-competent - Ross particularly with housing design, Walker particularly with water supply. It is necessary for technologists to work across disciplines, to reflect and be open to learning themselves as well as assisting others to learn their skills. Such an approach will empower both parties, build stronger communities and organisations and support a longer term development approach.
The following sections propose models for integrating technologists into spheres of Aboriginal control as well as providing a basis by which to examine the fieldwork. Three modes of technology-practice will be defined below which are inter-related to operate as a holistic mode of technology-practice, but which can operate separately under specific conditions. They are Community-building Technology, Community Technology and Regional Technology.

3.6.2 Community-building Technology

The notion of 'community-building' has been referred to in particular social research areas most notably in 'action research' (Stringer, 1996). In these contexts and the context of the present study community-building refers to the strengthening and empowerment of local communities of people. Thus 'community-building technology' refers to technology-practice that empowers local communities. With this term 'community-building technology' as coined by Newman (1992) a concept has become evident from a review of the literature, builds upon the previous experience of the Appropriate Technology movement and can come under Aboriginal community control. It is a concept that can be applied in practice where people are not too sick, frail or aged for full participation in physical work towards the development of their own community infrastructure - although there would be many aspects that require different levels of participation by differently-abled people. It was the basis for the extension work by this author in the Aboriginal community setting.

Community-building Technology embraces, in particular, the "practical holism" of Willoughby's (1990) integrated framework, the "dedevelopment" approach espoused by Hunter (1993), the reflective orientation called for by Osborne & Mitchell (1991) and the emphasis on two-way learning by Simpson (1991).

Community-building Technology requires special characteristics of the outsider; the technologist. The recruitment processes used by some NGO's working outside of their own country demonstrate a commitment to finding these characteristics, and can be adopted by regional organisations to support the Community-building Technology concept. Aboriginal communities provide many fine examples of such selfless workers, yet there have been many examples of inappropriately-placed people who were not able to cope with the emotional stress and harsh conditions who entrenched themselves in the community behaving in dictatorial ways and/or mismanaging finances.
In the mode of technology-practice referred to as Community-building Technology the technologist is principally a facilitator. This person endeavours to learn the history, politics and protocols of life in the community. Their role is as an agent of technology transfer. While their primary task may be, for example, to coordinate the construction of water tanks or facilitate commercial-scale seed-gathering they will also, in liaison with the Community Council, participate in face-to-face meetings to mobilise community members, empower them to participate in the project and ensure that the opportunity for people to learn is provided during the project. The outcome of the latter will be to increase the level of technacy in the community. In these dealings they will be sensitive to issues of gender, culture and local community politics as well as the impact of their own presence. For example, if it becomes necessary to collaborate with a particular "elite" the consequences of this need to be considered and compensated for. A key outcome of Community-building Technology is a stronger, more united community. As a result the technologist will develop a "radical critique" (Willoughby, 1990) of the situation of indigenous Australians with respect to mainstream Australia if that consciousness was not already present.
The features and relations of Community-building Technology is illustrated in Figure 3.4.

The Community-building Technology mode of technology-practice may, in fact, commence with the technologist assisting the community in a problem-solving exercise, a planning workshop or a design meeting. In the process of Community-building Technology the dynamic interaction between the technologist, the community members and the technology itself will achieve the "fit" between the means and the niche, i.e. contribute to the creation of an ensemble as required for Community Technology. Community-building Technology may be the preferred mode of technology-practice for the implementation of trials under the Regional Technology model and this will then determine whether the fit can be achieved. Such projects will endeavour to achieve the human and ecological-compatibility necessary for sustainability.

There are a range of projects possible under the rubric of Community-building Technology. Many CDEP projects, some community-based training programs, the housing work of Paul Haar (1992), the community landscaping work of Jim Sinatra and RMIT students (Hunter, 1991; Sinatra, 1991) and the permaculture work of City Farm with city teenagers at Pia Wadjari (Anda, 1996) were examples. These are discussed in some detail in Chapter Two. Community-based training programs which provide a completed technological artefact are perhaps the key area where Community-building Technology can come into effect. However, as a program it need not be promoted as 'training' but rather 'service delivery with community participation' or terms and policies that avoid paternalism. Nevertheless existing policy frameworks may require the use of certain descriptions to locate the program within particular funding categories. A community may identify particular infrastructure, technology or service needs and at the same time be aware of the lack of certain skills, uncertain of the design process or unfamiliar with the planning methodology. For this situation a training program in the context of Community-building Technology may be appropriate. The on-site programs of Pundulmurra College appeared to have successful outcomes, were greatly appreciated by communities, and demonstrated the characteristics of Community-building Technology (Anda & McGrath, 1990).

In summary, Community-building Technology occurs where community infrastructure is designed, selected, trialled, adapted, built, managed or maintained by the community in collaboration with the 'outsider' and in the process knowledge is built upon, a stronger sense of community is achieved and empowerment occurs. Moreover, the participation of non-Aboriginal technologists and also students provides a dynamic, cross-cultural, learning experience for both sides. This experience and its promotion furthers the cause of reconciliation. In the following Chapter Four the fieldwork involving the Remote Area Hygiene Facility serves as an example to validate the Community-building Technology
concept which forms a basis of this thesis. In the following section an integrated ensemble of sustainable technologies - Community Technology – can be the outcome of the application of a series of Community-building Technology projects.

3.6.3 Community Technology

In brief, "ecotechnologies" are those technologies designed to mimic natural ecosystems or function efficiently in association with ecosystems non-destructively or without depleting them to levels beyond recovery. "Sustainable technologies" are those which can be deployed without fear of depleting or degrading natural resources. "Environmental technologies" are the environmentally-friendly approaches to water supply, sanitary provision, food production, shelter and energy systems. Appropriate Technology is that defined in broad terms by Willoughby (1990) in Chapter One and in Appendix 3.

The Community Technology concept and the graphical interpretation of Figure 3.5 are derived primarily from the three dimensional view of technology-practice by Pacey (1983) and Willoughby (1990), the notion of technological fit by Willoughby (1990), the integrated design approach by Mollison (1988), the notions of sustainable technology and sustainable landscape (Thayer, 1994), and a model proposed for sustainable development in remote Aboriginal communities (Young, 1995). The practice of Community Technology has the aspirations of discrete remote Aboriginal communities and precedents in the North as its source of inspiration (Hess, 1978; Boyle, 1979; Bookchin, 1980) and situations will arise where certain artefact selections can be made from the South (e.g. Darrow & Pam, 1978; Frances & Mansell, 1988). In either case these need to be the outcome of a process of analysis and problem-solving. The practice of Community Technology will itself be a source of innovation as well as adaptation.

Community Technology is a term that can be readily deployed in regional areas as 'community' itself is the parlance of Aboriginal development (Smith, 1989; House of Representatives Standing Committee on Aboriginal Affairs, 1990) as described in Chapter One. Community Technology refers to the hardware, artefacts, devices and their management and maintenance systems in discrete, remote Aboriginal communities. Regional Technology provides management support at a regional level, the negotiation of block funding to support communities, coordinates the trialing of new artefacts and systems in communities, provides training and organisational development to discrete communities and in general encompasses the systems and cultural motivation to support Community Technology. Community Technology consists of a number of discrete elements (whether referred to as ecotechnologies, sustainable technologies, environmental
technologies or appropriate technologies) that when designed to work together in an integrated fashion function as an efficient, ecologically-sound, culturally-compatible 'ensemble'. Furthermore, the aim is for each element within the ensemble to perform multiple functions and for each function to be performed by a number of elements (Mollison, 1988). The features of Community Technology and its dimensions are shown in Figure 3.5.

Figure 3.5: The Features of Community Technology

Some Aboriginal organisations, such as the Kimberley Land Council, have a modus operandi represented by the interaction of socio-economic dimensions and cultural dimensions, i.e. the organisation functions under Aboriginal control, and decision-making occurs in the 'Aboriginal domain' (Rowse, 1992). This is position (a) in Figure 3.5. Some Aboriginal resource agencies, such as the Tangentyere Council and Pitjantjatjara Council, operate according to the interaction of the socio-economic and technical dimensions as described in Chapter Two and indicated by position (c). While providing excellent services to their Aboriginal client base the political system of organisation is along Western lines and the organisations are staffed with a large number of non-Aboriginal people which prevent a completely Aboriginal way of doing things from occurring (Wallace, 1990; Rowse, 1992). Development technologists at the Centre
for Appropriate Technology and Ecotech were successful in being able to develop and provide technologies that satisfied the contemporary cultural dimension of Aboriginal people living in remote areas and are located at position (b). However, even though providing services according to the wishes of their Aboriginal clients they operated in concert with but separately to Aboriginal-controlled organisations.

Community Technology recognises the distinctive characteristics of remote Aboriginal communities, i.e. their small population sizes, their dispersal across regions of similar physical characteristics, aspects of traditional culture that still thrive, their strong sense of community, the kinship bonds, a lesser possessiveness towards consumer and infrastructure goods, and a range of other factors that differentiate them from mainstream Australian settlements as described in Chapter Two. While recognising that these characteristics may often be similar across each region and perhaps vary from region to region, Community Technology recognises that each community within a region will be different, and also seeks a certain level of independence.

**Figure 3.6:** An ensemble of interacting sustainable technologies is the basis to Community Technology (adapted from Harrison, 1996)

Community Technology is the mode of technology-practice through which technical support from the Regional Technology concept is integrated with on-site training, trials, installation, management and maintenance as will be discussed in the next section.
The range of technologies promoted by Community Technology include the essentials of food, shelter, energy, water and the categories can be extended to transport, waste reuse and ecological restoration. There is a definite link to community population sizes; optimal sizes are based on anthropological factors and the characteristics of the technologies themselves. The way these technologies interact with each other and the relations they have with the supporting organisations, Aboriginal culture and the natural environment are crucial to how they act as a reinforcing, sustainable ensemble. The nature of this ensemble, as adapted from Harrison (1996) is represented graphically in Figure 3.6.

Consider, for example, energy management. In the ideal case the holistic and sustainable approach of Community Technology would support the use of a mix of renewable energy sources with diesel back-up, housing would be of climate-sensible design, they would be fitted out with energy-efficient appliances, and the process of implementing these systems would involve community planning and awareness-raising to ensure that residents were willing and able to live a low-energy lifestyle that would limit the size of the power supply system to one within economic reach. Moreover, planning and design of the power supply systems and settlement layout for energy efficiency would be made in cognizance of the requirements for energy-efficient placement of landscape features such as trees for shade and shelter, earthworks for water harvesting, solar street lighting, as well as vehicular and pedestrian road and pathways. Community participation and control of the process is essential to take account of cultural needs and how these impact on the design process at a site specific level. For example, while climate sensible design would be one factor affecting the design of housing there would be equal consideration given to both the indoor and outdoor living environments – the house yard being the preferred living area for most people in remote communities for most of the time. Thus the selection and placement of vegetation in the yard becomes a factor in climate sensible design as does the yards relationship to adjacent yards and houses for both climatic and cultural reasons. A similar case could be presented for water and waste management with a view to ensure an approach is taken that integrates all of these. Under normal circumstances each of these are dealt with in ad hoc, incremental way for existing settlements and even for ‘greenfield’ developments there is an uncoordinated sectoral approach by service delivery agencies and subcontractors, and professional project and program managers responsible for overall coordination rarely have the depth of experience to appreciate the significance and requirements for achieving this level of integration.

It would now be possible to formulate the specific criteria for sustainable technologies in remote Aboriginal communities. For technology-practice to be sustainable in the mode referred to as Community Technology any criteria needs to be applied by Aboriginal
people, in the Aboriginal domain (Rowse, 1992), with their control and participation, i.e. in the framework of Regional Technology to be discussed below. For non-Aboriginal technologists involved in this process it requires serious reflection on the values they bring with them and care in the extent that they participate.

In summary, Community Technology is a mode of technology-practice where there is a holistic approach to planning, placement of elements, housing and infrastructure selection and design so that these all operate together in the community as a technically-efficient, ecologically-sound, culturally-compatible ensemble. The community is supported in this development through the Regional Technology concept to be described below.

3.6.4 Regional Technology

It has been argued that while traditional Aboriginal people were modifiers of the continent's ecology over thousands of years their culture was largely sustainable, of a low impact on the environment. It has been shown in Chapter Two and the preceding sections that the "community development" approach taken by government in Aboriginal communities is unsustainable. Indeed, the mainstream, Western, industrial mode of technology-practice, described in section 3.4, being imposed on remote Aboriginal communities hampers their ability to become autonomous and sustainable. A mode of technology-practice is necessary that aims to fit with the development aspirations of remote communities, provides improvements to health and contributes to the sustainability of that community. This is an approach that supports sustainable culture within a region consisting of communities and can be termed Regional Technology.

The 'region' is generally defined by a group of communities that are affiliated by cultural commonalities. They are usually within a geographic area which is often characterised by a single, broad set of climatic and terrestrial features although sometimes a region may cover coastal to inland areas.

For example, the last decade saw a surge in the outstation movement on the Dampierland Peninsula in the West Kimberley. The region here can be clearly defined geographically as the peninsula itself, and the indigenous people who have always lived upon it are predominantly the Bardi and Nyul Nyul. Some outstations are based on very strong and independent families including politically-powerful individuals. Many others, however, are supported administratively by the well-established Mamabalanjin Resource Agency (see Appendix Two) based in Broome at the southwest corner of the peninsula. This organisation could conceivably be expanded to provide other support functions. Far North Queensland has also seen a surge in outstation numbers in recent years. They have
been supported in their initiatives and land tenure through the Cape York Land Council and administratively through the Aboriginal Coordinating Council. Once again this region is clearly defined as the Cape York Peninsula.

The regional organisation serving the affiliated communities is usually located in a regional centre of the same geographic area to make use of other resources, organisations, transport and communication links.

For example, the regional resource agencies Tangentyere Council, Ngaanyatjara Council and Pitjantjatjara Council are based in Alice Springs and their activities were explained in section 2.7 of the previous chapter. Tangentyere services the town camps and communities in and around Alice Springs. Ngaanyatjara services the remote communities of western Northern Territory into Western Australia. Pitjantjatjara services the remote communities of northern South Australia into the southern part of the Northern Territory. These three organisations are noted for their well-established and successful service delivery capacities. Tangentyere has benefited greatly from its local presence but the other two are also based in Alice Springs because this is the regional centre for all the communities mentioned and is an important resource and social centre. The Pitjantjatjara Council has realised the importance also of a local presence and established an operations base and settlement called Umawa in the middle of the Anangu Pitjantjatjara lands from where all heavy infrastructure development and maintenance services are provided, i.e. roadworks, construction, building maintenance, plant and machinery maintenance.

As has already been explained in Chapter Two there are no regional resource agencies of such status in Western Australia although a number could develop to this point. For example, Marra Worra Worra, Waringarri, Winun Ngari in the Kimberely are three highly developed administrative support agencies that could easily be expanded to housing and infrastructure service delivery and training provider status. There are aspirations by Aboriginal organisations in the Pilbara to achieve similar status and many of these resource agencies are listed with a brief description in Appendix Two.

Regional Technology embraces, in particular, the three-dimensional view of technology and endogenous technological development by Willoughby (1990), the grass roots development insights by Lantzke (1988), it responds to the questions asked by Smith (1989) and heeds the inherent aspirations of Aboriginal organisations for greater duty in service delivery and autonomy.

If ATSIC could successfully achieve greater devolution of decision-making and control of funds, it is possible that communities through a process of control and empowerment can build up their own systems of infrastructure that maintain the lifestyle they are looking
for. To achieve this it will be necessary to negotiate power entrenched in the apparatus of State and Local Governments, say through 'regional agreements' (Marra Worra Worra, 1995), as well as to continue further devolution of power at a Federal level where most funding for Aboriginal affairs, particularly infrastructure, is derived.

The control of technology-practice needs to swing over to Aboriginal people as it has in the medical and legal services. In legal and medical jargon it can be seen that their 'technology-practice' is firmly embedded in a set of human relations whereas engineering technology is not. Where is the 'community engineering' or the 'community maintenance'? The 'community clinic' is there and so is the 'community office'. The technology artefacts of a remote community need to have their associated reference point for community access. The Regional Technology model will also integrate with medical services, legal services, land administration, cultural services and economic development. The establishment of 'Aboriginal technical services' will be the outcome of Regional Technology and is the natural progression from medical and legal services.

The elements of Regional Technology and their interrelationships are shown in Figure 3.4. At the moment the regional resource agencies in Western Australia, without wanting to detract from the important and successful work they already do, are marginalised to a relatively minor position. The State Government through city-based forums such as the State Advisory Committee (SAC) and Intergovernment Working Group (IGWG) determine what programs will be formulated and funded for remote Aboriginal communities. An alternative is for block funding, suitably accompanied by a due process of funds accountability, to go straight to the regions where programs are conceived, designed and implemented but where necessary with the cooperation of State and Local Government agencies. In the regions planning and management will be carried out by the ATSIC Regional Councils and the regional resource agencies liaising with Local Government and with regional offices of State Government where necessary. As part of this cooperative approach towards community development the State agencies would still provide technical support and training where sought. However, as adjustments are made to the ATSIC apparatus by its non-Aboriginal political masters, such as with a change of Government, regional organisations will, no doubt, reassess their relationships with the elected wing and/or the administrative wing. It should be made clear that the roles of ATSIC Regional Councils and the regional resource agencies would be quite different as they are now. The principal role of the ATSIC Regional Councils now is to decide which of the projects presented to them each year will be funded. In recent years each ATSIC region has developed a five-year plan, such as that by Anda et. al. (1993), so in theory funding is not granted in an ad-hoc manner but with a needs-based, democratic process and medium-term view. The resource agencies can then provide administrative support to the communities and the projects implemented and, moreso in the case of the central
Australian organisations, actually implement the projects where they have the physical capacity to do so. Figure 3.4 indicates the range of organisations likely to be a part of Regional Technology although these relations will not be static.

**Figure 3.4:** The Relations of Regional Technology (encompass the complete field of relationships indicated)

The advantages of the Regional Technology concept must be identified not only against the model for essential service delivery that has occurred over the last two decades with State Government utilities, but also against the new government-controlled model that is emerging, that is, corporatisation, privatisation and tendering of contracts to private companies. The government approach has tended towards "mainstreaming" over time with questions of rateability of land, metering of services and "user pays" overshadowing those of technology choice. With the corporate model becoming established there is no reason why contracts cannot be awarded by the government regulatory office to Aboriginal enterprises particularly in regional areas by adding 'social justice' clause to the tendering process. However, under the current economic rationalist agenda, particularly at a state level, this is unlikely. In Western Australia apart from a few small building construction and maintenance companies there are none that could offer an equivalent service to the government utilities or even components thereof. To establish these would require a long term community development approach oriented towards enterprise and
organisational development - unlikely in a climate of economic rationalism oriented towards market forces.

It is more likely that an Aboriginal capacity to deliver services, resembling Regional Technology, could be built out of a block funding approach from the existing funding mechanisms at a national level, i.e. through ATSIC and the Local Government Grants Commission, whereby regional Aboriginal organisations, growing into organisations like those of Central Australia, are treated as local government authorities. These may also choose to contract services to the existing Local Government. This would also require a shift away from national ATSIC programs such as CHIP and HIPP where Central Office in Canberra appoints large engineering firms (Australian Construction Services (now Works Australia) and Ove Arup & Partners respectively) as national program managers of massive infrastructure development projects. The program managers then appoint project managers who design and manage settlement infrastructure upgrades. The project managers in turn appoint subcontractors to carry out the on-site construction works. Instead these funds would be directed through the regional organisations, but there is no reason why the engineering firms and associations could not act in a community development, technical advisory capacity if they were willing and able to do so. The Institution of Engineers, Australia, for example, had in an informal manner promoted such an approach though its voluntary wing RedR at the 1994 Conference on Technology Transfer (Anda & Ho, 1994) and the Australian Water and Wastewater Association (AWWA) had coordinated for ATSIC a series of national seminars on health hardware (Lawrence, 1995).

Consequently, if WA regional resource agencies were able to develop the physical capacity of the central Australian organisations and the technical capacity of an engineering consulting firm they could in theory be awarded the contract through ATSIC to become the project managers of settlement upgrades and in time even the regional program manager. The regional organisation would then be in a position to award construction contracts directly to Aboriginal enterprises unless the work could be done through the CDEP. The whole focus of such an operation would then be to ensure the Aboriginal enterprises and CDEP did become the modus operandi through various capacity-building, institution-strengthening, and training programs. This would be achieved through the relationships with the various agencies and the independent technical support as represented in Figure 3.4.

An additional argument for Regional Technology is the high turnover of non-Aboriginal people working in remote areas away from their place of origin. Regionally-based Aboriginal technical services will provide the opportunity to have a stable workforce to serve remote Aboriginal communities. While individuals may still come and go a
framework and a core group will always be present. Moreover, if a rigorous recruitment process is adopted at a regional level, such as that used by the Australian NGOs Community Aid Abroad and Overseas Service Bureau, a more dedicated team of activists will be built up as opposed to mere "job seekers" and career bureaucrats. The Overseas Service Bureau (1996), for example, has a rigorous process that screens applicants for their potential to be sensitive in the cross-cultural setting. The process does aim to ascertain that the applicant genuinely possesses the technical skills required for the position. But it also aims to determine whether the applicant has the flexibility and contemplative ability to be able to adapt his/her knowledge, behaviour and project implementation in-situ as the conditions change and one's willingness to reflect reveals these needs.

Given the foregoing political and economic constraints it would no doubt initially be difficult to implement the Regional Technology model in a widespread manner. A cooperative approach may need to be enlisted involving many stakeholders. Nevertheless the advantages of Regional Technology over the government-controlled approaches could be expected to be as follows:

- more control over technology-practice, in all three dimensions, would enable a cultural outcome, a modus vivendi, most satisfactory for Aboriginal people with the financial resources available rather than the mainstream way of life that urban Australians have been moulded into by government and market forces;
- the experiences gained in the particular mode of technology-practice adopted stay with the region and its inhabitants so that skills development can occur in the community;
- within the framework of Regional Technology more opportunities would emerge for training and employment of Aboriginal people than under the current approaches to service delivery following the increase in local work content and skills development;
- technologies are selected, developed, trialled and managed to suit the region's particular characteristics and the needs of its communities not transferred directly from city suburbs without recognition of the values that they bring with them;
- the current process of trying to get country shires to change their historical pattern whereby they failed to meet their responsibilities to remote Aboriginal communities would be expedited, i.e. many of these responsibilities could be assumed by the regional resource agencies;
- Regional Technology would allow remote communities to develop a sustainable ensemble of technologies to cater for the way of life that they are looking for with a closer scrutiny on requirements for recurrent maintenance costs and life-cycle/replacement costs than currently given by the mainstream approach; this will be termed Community Technology and explained below;
- Regional Technology would place greater emphasis on community development in the true sense of the definition, not just its material expression, and where necessary a
"community-building" effort would be the focus of technology-practice and this will be termed Community-building Technology as explained below.

In summary, the Regional Technology concept is a mode of technology-practice under Aboriginal control within a geographical region of communities. It is primarily concerned with the coordination, selection, trials, delivery and management of technology over a region that includes a number of discrete communities with some common cultural characteristics. The main agent is a regional Aboriginal organisation such as a resource agency that is representative of the communities it serves. The central Australian resource agencies discussed above essentially emulate the Regional Technology concept and a number of regional resource agencies in Western Australia could be expanded to fulfill the same role and thereby improve the quality of service delivery to remote Aboriginal communities. The regional groupings in Western Australia would include the east, west and central Kimberleys; Pilbara; Midwest, Central Lands and Goldfields and these roughly correspond with the current ATSIC regions.

3.6.5 An Holistic Framework for Technology-practice

The preceding discussion of the three concepts (Community-building Technology, Community Technology and Regional Technology) implies a dynamic relationship between them and a schematic overview of this is suggested in Figure 3.8. Thus an integrated framework comprising three concepts has been developed for remote Aboriginal communities with more of a "specific characteristics" approach and strongly allied to the integrated framework offered by Willoughby (1990). This study generates Regional Technology as its main new theory and its validation will be undertaken in Chapter Five by means of the 'grounded theory' method.

Regional Technology embodies Community Technology and Community-building Technology as a holistic mode of technology-practice. Both of the latter can be conducted independently in discrete communities in certain situations. However, as part of the Regional Technology mode of technology-practice sustainability is ensured through ongoing financial, management and maintenance support. Together a holistic framework is provided that provides community-building, development and empowerment where necessary. The action-orientation diminishes when conditions of health and material wellbeing satisfactory to the community are achieved so that cultural activities can be focussed on. This is the plateau, a condition of stability, to aim for with the holistic approach to technology-practice.
It is hard to see a 'statewide technology' or a 'national technology' being supportive of self-determination, nor could either necessarily satisfy all the factors mentioned above. State Governments and borders are based on the colonial history of Australia and as a political entity today provide mainstream services and planning support to regional areas. Although mechanisms for ensuring public health and safety must always be paramount, notions of State and Nation become burdened with standards and other such factors which favour conformity and remote-control instead of appropriateness. Moreover, state government policy, as described in Chapter 2, is ultimately driven by electoral politics which results in a view of 'need' from the perspective of the urban-based majority not regionally-based minorities of other culture and socio-economic conditions. Nevertheless, statewide or national Aboriginal coalitions, such as those developing
educational resources and health promotion materials, may continue to be necessary in some form. State Governments can assist in the transition to Regional Technology by the provision of technical and planning support, as can Federal Government with block funding.

In summary, Community-building Technology is a simultaneous process of service delivery and empowerment. In essence, it applies technology in a community in a culturally-appropriate manner. Community-building Technology can be one process which contributes to the formation of an ensemble of sustainable technologies - Community Technology. These actions are supported by the Regional Technology concept. The technologist and community receive coordination, planning and funding application support from regional organisations. This is the holistic, integrated framework that is analysed in Chapter Five against the fieldwork of Chapter Four and the literature review of this chapter.

3.7 EVALUATION PROCEDURES

As per the 'grounded theory' methodology described at the beginning of section 3.6 the review of practice and literature in Chapters Two and Three constitutes the 'data'. The three concepts of Community-building Technology, Community Technology and Regional Technology have been generated from this review of the literature and from the author's own experience during the fieldwork itself. Embodied within this formulation of concepts in the preceding section has been the assumption of 'categories' and their 'conceptual linkages'. It is now necessary to clearly describe the fieldwork in the following Chapter Four as this will also constitute 'data'. An evaluation of the fieldwork is conducted in Chapter Five which is also supported by the 'data' of Chapters Two and Three. Firstly, however, an approach to the evaluation needs to be rigorously defined.

This section develops an approach for the evaluation of the fieldwork. Firstly, the 'categories' alluded to above are clearly articulated in Table 3.2 as criteria for the concepts and are derived from the preceding review of current practice, Appropriate Technology, Community Development and Sustainable Development.

In his "integrated framework" Willoughby (1990) presented criteria for "technology assessment" in the Appropriate Technology mode of technology-practice. These were, in point form: technical efficiency; economic status; socio-economic bias; cultural compatibility; environmental impact; resource requirements; ownership potential; scientific input; aesthetics; durability; social value; capital cost; political bias; origins; employment impact; technical sophistication; development pattern; scale. These are
general enough to form the basis of an assessment procedure for this study. The interpretation of the criteria may vary but some form of bias is presumably overcome through the participation of end-users in an evaluation process as stressed by Willoughby (1990).

This chapter has also briefly described the work of Bunch (1982), Francis & Mansell (1988) and Lantzke (1988) whose insights and criteria are relevant enough to integrate into an evaluation process. Willoughby (1990) had also reviewed a range of authors of the Appropriate Technology movement to arrive at his list above. Francis & Mansell (1988), for example, proposed the criteria tabulated in Appendix 3.

Stewart (1990) presented a checklist for development projects which accords with the criteria of the above table and Willoughby's (1990) assessment. Willoughby's criteria above is of a general nature. Other authors reviewed were generally concerned with the rural poor in developing countries. However, Lantzke (1988) and Walker (1994) provided insights and criteria specifically for the remote Aboriginal community setting. Those of Lantzke regarding innovation communication are discussed in section 3.2.2, and the features of control-oriented and community-centred modes of development are contrasted by Walker in a table in Appendix 3. A consideration of the foregoing assessment criteria in relation to the proposed concepts has resulted in the preparation of the criteria in Table 3.2.

The preparation of Table 3.2 constitutes the most appropriate criteria for evaluation of the fieldwork in order to see if the concepts can be validated. The criteria generated from the 'data' are 'coded' using the three-dimensional view of technology-practice. Thus, Table 3.2 constitutes a matrix and each cell contains criteria that have been selected and 'coded' from two directions of analysis: firstly in terms of its dimension of technology-practice as described in section 3.1.1 and secondly in terms of the characteristics of the concept as described in the preceding section as well as the other elements of Willoughby's (1990).

The technical-empirical 'coding' reflects the technical requirements of each concept and also provide the criteria by which the first question of this thesis can be answered, i.e. was the Remote Area Hygiene Facility technically appropriate? The socio-political 'coding' reflects the organisational requirements of each concept; the criteria defining the systems necessary to support the mode of technology-practice. The ethical-personal 'coding' reflects the cultural and behavioural aspects to be expected under each concept; the criteria that describe in particular the uniquely indigenous attributes of the mode of technology-practice.
Accordingly, the criteria of Table 3.2 are appropriate for a clear, structured and rigorous approach to the evaluation.
### Table 3.2: Criteria for Community-building Technology, Community Technology and Regional Technology

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<tr>
<th>Community-building Technology</th>
<th>Community Technology</th>
<th>Regional Technology</th>
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| **Technical-empirical:**     | Low to medium level of 'technacy'  
(High levels of competency in complex skills are not necessary because major outcomes sought are in the socio-political and ethical-personal dimensions. The project need only require some basic skills to ensure completion on site of the task and for subsequent maintenance and operation.)  
Technical efficiency of artefacts  
(The artefact or process itself upon completion or installation must be able to deliver the service required of it in an efficient manner)  
Capital and program costs  
(The project costs need to be within the means of the community or regional organisation and ideally not exceed those that would be incurred by using an outside contractor) | Low to medium level of 'technacy'  
(High levels not essential if Regional Technology provides a supportive role)  
Technical efficiency of artefacts  
(as for CBT)  
Interaction of elements and functions  
(Each element should perform a number of functions and each function should be provided by a number of elements)  
Sustainability  
(Technology adapted should not degrade the surrounding environment or deplete resources)  
Capital and operational costs  
(These should be within the means of the community and regional organisation and recurrent costs should be economically sustainable) | High levels of 'technacy'  
(Necessary to provide technical support to communities)  
'Technate' employees from region  
(Local Aboriginals will already have region-specific cultural and environmental knowledge)  
Organisational costs  
(Adequate funds for salaries, travel and overheads need to be sustained for the long-term if effective support is to be provided) |
| **Socio-political:**          | Access to high levels of 'technacy'  
(Mechanisms to exist whereby remote community has access to the technical support of personnel in regional centre)  
Managed and maintained by community  
(This should be done for essential services within the community to the largest extent possible)  
Community ownership  
(All infrastructure and management systems dedicated to the community should be owned by the community to allow ongoing self-determining development and maintenance) | Supports multiple communities  
(The regional organisation comes into existence as a result of providing a service to more than one community and is given the mandate to serve by the communities)  
Block funding and financial support  
(At least triennial funding should be secured with maximum discretionary powers and long term funding guaranteed)  
Management/mainten/training support  
(All three support services offered to communities)  
Coordinates trials and evaluations  
(In consultation with communities new technologies are selected and adopted)  
Equivalent status to Local Government  
(For funding and technology approvals) |
| **Ethical-personal:**        | Supports lifestyle and culture  
(as for CBT)  
Aboriginal community control  
(Technology, management and planning process is owned and controlled by the community)  
Community management culture embodies Aboriginal ways  
(Western systems of administration should be adapted to suit Aboriginal culture if these are necessary for technology systems)  
Health improvement  
(Either quantifiable or state of mind satisfactory to community for physical, emotional and spiritual wellbeing) | Supports lifestyle and culture  
(as for CBT)  
Aboriginal regional control  
(The organisation to have control over its operations and receive the cooperation of other stakeholders in the region)  
Organisational culture embodies Aboriginal ways  
(as for CBT) |
CHAPTER FOUR

Prototype Development and Fieldwork

This chapter describes the fieldwork conducted by the author in Aboriginal communities in remote areas of Western Australia. The fieldwork directly relevant to this thesis is the construction of ablutions facilities in Kalgoorlie, the construction of ablutions facilities in Halls Creek, the establishment of the Remote Area Technology Centre in South Hedland and a statewide feasibility study into regionally-based, technical information services. The thesis is also informed by the author's investigative visits to Alice Springs, Doonadgee in Queensland and several Torres Strait Islands, formal employment with Pundulmurra College to train Aboriginal Environmental Health Workers in Pilbara and Kimberley communities and preparation of the Ngarda-Ngarli-Yarnu Regional Plan as a consultant. These activities and others involving the author's participation are listed chronologically in Appendix One. The chapter commences by outlining the approach of the Remote Area Developments Group (RADG) and summarising the research projects related to the Remote Area Hygiene Facility.

While reference is occasionally made to the concepts proposed in Chapter Three it is not until Chapter Five that the fieldwork is evaluated against the criteria proposed for these concepts of Community-building Technology, Community Technology and Regional Technology.

4.1 THE APPROACH TO TECHNOLOGY DEVELOPMENT BY RADG

The Remote Area Developments Group was established within the Institute for Environmental Science at Murdoch University in 1986 to investigate the water and sanitation problems of small communities in remote areas. Research relevant to these areas had been neglected in the past although the prevalence of ill-health, environmental deterioration and lack of appropriate technology suggested there were significant needs (O'Connor, 1988).

In 1987 RADG undertook an investigation of water supply and sanitation in 18 remote Aboriginal communities throughout Western Australia funded by the Department of
Aboriginal Affairs (DAA) (now ATSIC). RADG used this opportunity for community visits to pursue the following objectives:

1. To provide a general orientation to the remote Aboriginal communities.
2. To develop contacts and learn from others involved with appropriate technology (including training programs) for these communities.
3. To investigate the existing water supply and sanitation systems at the communities (Mathew & Lantzke, 1988a).

As well as commenting on the water supply, toilets, washing facilities and wastewater disposal specific to each community reflections were made on these as well as general community and training issues. These led to a number of suggestions for approaches to supply of water and sanitation in each of these communities (Mathew & Lantzke, 1988b) and later, with several years of experience, the various options chosen by communities were explained (Mathew & Ho, 1992). Attention was not devoted to purely technical matters, however: "Although the primary focus of this paper has been towards the provision of basic facilities of water supplies, toilets and disposal of waste waters our approach has been to try and understand this within the total needs of the communities. The members of those communities need to work out their priorities and their lifestyle. Care must be taken by technologists that they don't overide the communities and install facilities that are not wanted. Patience and an understanding of the total context of the community are needed" (Mathew & Lantzke, 1988b).

Earlier RADG had carried out a desk study of the outstation movement in Western Australia based largely on available reports (e.g. Public Works Department, 1982), and this provided RADG with some preliminary information with which to commence its fieldwork - "a form of technology that provides clean water and adequately purifies their wastes will be of great assistance. The characteristics of this technology would preferably be:

1. Small, simple and cheap but effective, especially under sporadic heavy loading.
2. Relevant to the particular environmental conditions.
3. Suitable to be managed and maintained by women.
4. Integrated into whatever house or shelter design is preferred"
(Fernihough, 1987).

The community visits provided general insights for specific research projects (Mathew, 1988). Those recommended were as follows:

- Desalination of drinking water by reverse osmosis and electrodialysis to reduce the dissolved solids concentration from 5000 ppm to 1000 ppm;
- Solar hot water system using black polyethylene pipe to provide hot water for showering;
Hand-flushed, water seal, low water demand toilet using an 'S' trap which reduces blockage and at the same time provides the appearance of a flush toilet;

- Disposal of wastewater by evapotranspiration trench filled with gravel and with trees planted on the sides;

- Appropriate technology information data base to store information relevant to remote areas and make it available to the users.

The early investigations of RADG were made in large, isolated settlements and small, remote outstations. The majority of fieldwork by this author, construction of ablutions facilities, was subsequently conducted in town camps.

It was early in 1988 when this author joined RADG to commence research and development for the second project: the solar water heater. This chapter describes the fieldwork carried out by this author over a seven year period from 1988 to 1995. A number of technologies were developed, tried, adapted and evaluated. The final stage of the field work was consultation with Aboriginal people in regional areas to understand the needs for technical information.

By 1989 it had become apparent that it would be most useful to establish a centre in Western Australia similar to the Centre for Appropriate Technology in Alice Springs. This would both satisfy needs at a local level for some Aboriginal communities and perhaps more effectively influence service delivery to communities elsewhere.

The model applied by RADG, and the author, to the development of technology for remote Aboriginal communities was, in summary, as follows:

- invitation to visit communities;
- identification of needs;
- university-based research and development of hardware prototypes;
- establish university and remote demonstration sites;
- install demonstration prototype in self-nominated community and with community involvement;
- gain feedback to carry out modifications;
- install additional units with community involvement;
- reflection and evaluation;
- establishment of Appropriate Technology training and manufacturing centres;
- facilitating the development of community-controlled technical information services.

This approach sought to correspond with issues raised in Chapters Two and Three. No action was undertaken in the field nor an Aboriginal community entered until a request was received (Chambers, 1992). There was a dual approach to all community visits -
presentation as an 'expert' was avoided as much as possible and the opportunities were used as learning experiences (Korten, 1980; Chambers, 1983; Osborne & Mitchell, 1991), however, a tangible, positive contribution was usually attempted while in the community such as a repair and maintenance task. The latter point mirrored the approach taken in the Environmental Health Worker Training Program (Wright, 1994) and Uawkara Palyanyku Kanyintjaku (Pholeros et al., 1993) and these two cases were discussed in Chapter Two. The installation of demonstration or trial units was to give the community a clear opportunity to assess the technology and suggest modifications (Agarwal, 1983). Community participation was also sought during installation (Cohen & Uphoff, 1980; Porter et al., 1990), indeed, it was essential as was discovered in the Halls Creek project. It was proposed to establish the regional centres only after communities had accepted the technologies, decided what others were needed and become familiar with some of them. The proposal for technical information services only came after considerable community and regionally-based discussions, substantial networking and a clarification of information needs (Anda, 1995).

4.2 SUMMARY OF EARLY RADG RESEARCH

A review of some of the research and development activities associated with the Remote Area Hygiene Facility (RAHF) are included to illustrate the approach of RADG and illuminate the atmosphere in which they all occurred. A summary is provided here with more detail in the appendices and the reader should refer to the published papers referenced if further information is required. The research on a pour-flush toilet, evapotranspiration wastewater disposal system and plastic solar water heater are described leading to the field work with the RAHF. They were all occurring simultaneously during the period 1986-92. The development of an Appropriate Technology database by Ross Lantzke in RADG is explained because it reflected work towards satisfying a need expressed by people in regional areas as identified in the early visits to 18 communities. This need was also raised at the 1994 Conference (Anda & Ho, 1994) and a process was commenced in 1995 to develop a technology information service in WA and is described in section 4.6. Similarly, the National Technology Resource Centre was established in Alice Springs in 1994 in response to this need.

4.2.1 The Search for an Appropriate, Alternative Toilet

The failure of conventional water-based sewerage systems in Aboriginal communities and the subsequent health hazards are well documented (e.g. Nganampa Health Council 1987, Mathew & Lantzke 1988, Health Dept of WA 1992). This is largely due to the numerous inadequacies of the modern flushing toilet, inappropriate disposal technology,
lack of training for maintenance, and the manner in which technology transfer occurred. Existing options for toilets in remote communities were evaluated by RADG (Mathew, McGrath & Newman, 1988).

Ashby (1984) trialled three prototype designs of the 'aqua privy' toilet in a number of Aboriginal communities. In many of these communities it had been found that the conventional flush system would be inappropriate as it required experience in its use, maintenance backup, and a reliable water supply. The 'aqua-privy' design was adapted from those used in a slightly different configuration overseas, and other types of toilets were reviewed but rejected for various reasons. Over four years 100 of these toilets were installed in Aboriginal communities of the East Kimberley region even though it was understood that they did not comply with the Septic Tank Regulations or the Health Act. The 'aqua privy' toilet extended to numerous communities, however, its use did not become widespread (Anda, 1992). This was perhaps because of its non-compliance, lack of acceptance or the installation of conventional flush toilets in preference by funding agencies. Many of the aqua privies suffered from severe corrosion around the base at their junction with the concrete floor (Anda, 1992).

Principles were developed by RADG that could be applied to remote Aboriginal communities for sewerage systems (Mathew, McGrath & Newman, 1988):
- separate greywater (sullage) and sewage (blackwater) for treatment and disposal;
- keep the toilet outside and separate from the house;
- make the installation simple so that participation in construction, handling and maintenance become possible for the community;
- adopt familiar technology and local materials where possible;
- deep sewer systems are generally more expensive to install and maintain;
- where soil absorption capacity is low it is best to avoid the disposal of effluent by the use of a conventional leach drain;
- communal ablutions facilities are to be discouraged.

RADG thus felt that the following criteria should be applied to the development of a toilet for remote Aboriginal communities (Mathew, McGrath & Newman, 1988):
- it should be a 'toilet with water' and white;
- it should be 10 metres from the home;
- hand washing water should be available nearby;
- low water use will be an advantage;
- a design that reduces blockage is preferred.

After reviewing various designs it was decided that the pour-flush toilet may satisfy the above criteria (Mathew, 1989). Pour-flush toilets had a water seal of about 20 mm and
were available in many different designs. The water seal prevented odours from emanating from the pit which in turn avoided attraction of flies.

It was decided to adapt the direct discharge, pour-flush toilet to Australian conditions. This pour-flush design was similar to that constructed in Fiji by the Ministry of Health. Its main features were the storage pit, covering slab, bowl holder seat, the bowl with a water seal trap and provision for water (Mathew, 1989). The bowl was made from white, high density polyethylene in two parts that joined together by a flare and taper: the upper bowl and the U-bend where water remained after each flush to provide a seal. If a blockage occurred in the U-bend it could be readily pushed through with a piece of rubber hose whereby the material would drop down into the pit.

Design details of timber and fibreglass moulds for the concrete bowl holder seat and its support slab over the pit were obtained from Fiji (Mathew, 1989). These were adapted by the author to produce sheetmetal moulds which would offer greater durability and longevity in remote areas and could be lubricated with readily available motor oil for easy extraction of the set concrete products. The entire assembly was the first constructed in Australia as part of the prototype Remote Area Hygiene Facility (RAHF) built as a research and development facility at Murdoch University (Anda et al., 1989). The moulds later became an essential component of the jigs and fixtures in community-based construction of the Remote Area Hygiene Facility.

There was little doubt that the common dry pit toilet was the best option for remote communities, if the only criteria were low cost, ease of construction, low maintenance and low water use. The VIP toilet (Walker, 1984) or its derivatives offered privacy, while limiting odours and flies. They were, however, dark and Aboriginal people sometimes feared the presence of spiders and snakes. The pour flush toilet, because it incorporated a water seal, allowed the toilet to be bright and airy, while still eliminating odours and flies. Both designs rarely became blocked. While not strictly a dry pit, flushing only required two litres of water, so the life of the pit was not unduly affected. While the pour flush system had been used successfully overseas, and was welcomed grudgingly in town camps, it became clear that some residents in permanent communities preferred the convenience and amenity of a push-button cistern and RADG commenced research toward this end (Harrison, 1992). It was found in some central Australian communities that if maintenance support was provided flushing toilets functioned satisfactorily (Pholeros et al, 1993).
4.2.2 Wastewater Disposal by Evapotranspiration

In many areas of Western Australia, the soil was extremely impermeable with high clay and silt contents causing applied water to pond on the surface. In such situations conventional septic tank with soil absorption systems frequently failed when effluent moving into the disposal field was not absorbed by the soil quickly enough to prevent its rise to the surface. The only alternative currently used in such situations was a reticulated sewage collection system which was very costly, inevitably consumed vast amounts of water in remote Aboriginal communities and frequently failed due to lack of maintenance. Principles for the disposal of wastewater in remote Aboriginal communities advocated by RADG were listed above in section 4.2.1.

Evapotranspiration (ET) systems had potential for use in those areas where soil absorption fields failed. The systems cost considerably less and required potentially less maintenance than reticulated systems (McGrath et al., 1991). RADG investigated the effectiveness of ET systems in disposing of wastewater and the application of these systems to remote Aboriginal communities by installing the first system at the Pepper Tree Camp RAHF project in Kalgoorlie during December, 1990. This was undertaken with community participation in planning and construction.

An ET system was a variation of the normal subsurface disposal method. Disposal of effluent from the field occurred primarily by soil evaporation and plant transpiration rather than soil percolation - as occurred in conventional leach drains. The disposal field essentially comprised a layer of gravel for distribution of effluent below a layer of coarse sand through which capillary action to the surface occured and in which plants grew.

ET systems were installed in Aboriginal communities with community participation at Kawarra (McGrath, Ho & Mathew, 1990), Kalgoorlie (Anda, 1991), Halls Creek (Anda, 1992) and Parngurr School in the Western Desert (Walsh, 1990). In each case no problems were reported and in some, e.g. Halls Creek, vegetation planted on the fields was flourishing. Most importantly, no cases of ponding were reported - one of the main reasons for developing this technology. It would be desirable, however, to conduct monitoring of performance over a longer period on the installations so comparative results against conventional systems will be available.

4.2.3 Plastic Solar Water Heater:

Conventional solar water heaters were plagued with the following problems in remote communities:
- freezing caused fracture of copper tubes in the panels;
• servicing of cracked tubes or other failed components was not readily available within communities;
• panel glazing was smashed by rocks causing marked reduction in performance;
• absence of electricity to boost supply on overcast days;
• Aboriginal people found difficulty relating to that technology in a meaningful way.
• the quality of water in remote areas led to a rapid build-up of deposits in the copper tubes, resisting flow or causing complete blockage (Walker, 1984).

Moreover, the volume of hot water generated was sometimes insufficient for a given usage pattern. Contractors had sometimes installed the equipment incorrectly. For example, glycol not being filled in the heat exchange units, wrong pipe connections and no connection to water supply.

Research and development of a solar water heater that sought to represent an "appropriate technology" in remote Aboriginal communities commenced in January, 1988 and was subsequently documented as an Honours thesis (Anda, 1988). Two prototypes were tested - one which used black low density polyethylene (LDPE) reticulation tubing in the collector and the other which used high density polyethylene (HDPE) swimming pool heating batts. Each of these materials were cheap and readily available. The collectors were 4 m² in area and unglazed. Several other prototypes were later developed from different plastics (Anda & Ho, 1991; Gray et al., 1991). One was a low pressure, semi-glanzed, thermosyphon system. The absorber of this prototype was made from an extruded ethylene-propylene-diene-monomer (EPDM) section (manufactured for swimming pool heating), mechanically jointed to cPVC header manifolds with acetal nozzles and neoprene grommets. Glazing was in the form of clip-on acrylic panels (again not liable to be smashed), and collector insulation in polystyrene foam. The storage tank was an innovation of this author resulting from contemplation of the popular wine cask and the TNT liquid materials, pallet transport system. In each of these systems a plastic bladder was supported on all sides by rigid sheetmetal walls of 4-litre and 1000-litre volumes respectively. The solar water heater tank was designed with a roughly 200-litre volume. All of the materials used in the construction of this system were relatively inexpensive and readily available. The system was supplied in kit form to be constructed on site by community members. The aim was to enable communities to maintain the system, and repair it if it broke down.

The solar water heaters were installed for field trials on RAHFs at Newman, Pundulmurra College, Kalgoorlie and Halls Creek. In several units the storage tank's polyethylene bladder had to be replaced due to leaks developing. They were apparently affected by exceedingly high temperatures but were also probably unable to operate at temperatures continuously at 60 degrees Celsius or above. Negotiations with the bladder

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manufacturer Entapack, a company in Melbourne, resulted in having new bladders made from what was apparently a nylon/polyethylene laminate. However, this also developed leaks after a year or so. Unfortunately, the manufacturer was unable to give specific details on the plastic materials nor were they prepared to use a plastic that had higher temperature capabilities.

Upon installation of the solar water heaters at Halls Creek their development had only progressed marginally since the units were installed at Kalgoorlie. For this prototype assembly operations were trialed at the Remote Area Technology Centre and shown to be feasible for a small number of units using prefabricated components from Perth. After 12 months the unit at Halls Creek developed leaks from the collector manifold grommets. The neoprene had perished under the continually high temperatures and exposure to ultraviolet radiation. Although, Halls Creek provided more useful field experience for these prototypes further development should have occurred before any more were deployed in actual communities. Clearly, further experimentation was necessary with different plastics materials and if a suitable material could not be found redesign would have been the next stage. Because of this and the fact that a complete manufacturing capacity for the solar water heaters had not been developed, the 'Solco' plastic solar water heater was used on some of the RAHF. This appeared to perform satisfactorily for at least 12 months although it may not have had a large enough capacity for more than a small family using the RAHF, and plumbers had reported cracking at tank connections over time.

Subsequently, the collapsible, kit-form storage tank was coupled up with a pair of 'Wulfing und Hauck' polypropylene panels (imported from Germany) and a unit installed at Kawara community at Purnululu (Bungle Bungles) in the East Kimberley. The bladder also had to be replaced on this unit. Apart from one of the German panels having to be replaced after being pierced they performed satisfactorily.

At that point in time another company in Perth had begun manufacturing a solar water heater with a plastic lined tank but with copper tube panels. Although the panels would be susceptible to corrosion and blockage in the highly mineralised waters an innovative connecting mechanism combined with other simple design features meant that they were low cost and easily replaced. Collaboration between the company and RADG commenced to jointly develop plastic panels. The company also trialled a set of the German panels and sought to gain a manufacturing license. However, the company was bought out and closed down by a larger entity with competing interests.

Research commenced on a 'Class A' solar water heater for remote areas operating at higher (mains) pressure (Gray et al., 1992). Class A is a mode of operation specified in
Australian Standard 2984 (Standards Australia, 1984) in which the water delivery temperature at the hot outlet remains above 57°C under a specified flow. Apart from high temperature, the materials must also be able to withstand mechanical stress (due to high water pressure), ultraviolet radiation and oxidation. Suitable plastics and forming processes were being assessed with the aim of building and testing a high temperature/pressure prototype in the future. It was hoped to produce a solar water heater that could retail at a cost attractive to the wider community. Additional funding was required to continue research and development of this technology.

4.2.4 Appropriate Technology Data Base

The fifth project recommended for research and development after the 1987 investigations for the Department of Aboriginal Affairs (DAA) was the creation of a computer data base of technologies that may be appropriate to remote Aboriginal communities. A graphical, user-friendly software package was developed which included the following categories: water supply, shelter, communications, energy, waste disposal, land use, society, general. The user could then obtain information on: literature, research, available products and consultants. Several hundred items of information were entered on the system (Lantzke, 1989) and the package was given to DAA for a trial period to gain feedback. Unfortunately, there was no further initiative on the part of DAA as it became preoccupied with the changeover to ATSIC and further development of the data base ceased.

It was apparent later that a computer database of technology information could still be of interest to remote communities via Community Councils, Aboriginal resource centres, ATSIC regional offices, etc. With the increasing presence of computers in the offices of remote communities a database could be established in several ways:

- mailout of regularly updated computer discs;
- a central repository of information accessed by modem (internet web site);
- access to an interactive advisory service via electronic mail;
- access to a visual, interactive advisory service via video link-up.

The Centre for Appropriate Technology in Alice Springs established the National Technology Resource Centre in 1994 as a technology information service mainly to central Australian Aboriginal communities but also across Australia by means of a quarterly magazine.
4.2.5 The Prototype Remote Area Hygiene Facility

While RADG was initially dedicated to the research and development of a number of discrete technologies it became apparent that if several of these were merged into one - the Remote Area Hygiene Facility (RAHF) - a more holistic vehicle existed for their promotion and transfer to Aboriginal communities. The aim of developing the RAHF was to provide a new, low-cost option for remote communities that were seeking ablutions facilities with participation in their construction and ongoing design development.

The RAHF was an ablutions block adapted from the Appropriate Technology Ablutions Facility (ATAF) design by the Centre for Appropriate Technology (CAT) in Alice Springs. A fundamental difference was that the toilet became part of the facility whereas CAT has always provided the Ventilated Improved Pit (VIP) toilet separate to the ATAF. CAT separated toilet and shower to treat them as separate functions with different disposal methods. Both units included a shower and laundry. The designs enabled both to be located away from the house or the main sleeping area of a camp to avoid hazardous living conditions in the event of flooding.

Wastewater effluent from the ATAF was disposed of in a shallow, rock-filled trench of 12-metres length. This avoided the need for a backhoe which is often unavailable in a remote outstation. However, this trench may flood under heavy loading and would not be accepted in WA if the State Health Act was enforced by the local shire. The evapotranspiration (ET) trench was used on the RAHF and sized to comply with WA requirements.

It was also a Health Department requirement that the toilet pit be connected to the ET trench. The pour-flush toilet did not have a sealed pit and being low water use would be unlikely to fill to the level where discharge occurred. Thus the earlier mentioned criteria of separating blackwater and greywater is largely retained.

A chipheater, a product of CAT, was used for water heating. It relied on a pressure relief valve. This was not acceptable by the Water Authority of WA (WAWA) as build-up of deposits on the valve may not allow the rapid release of steam and a 6-metre copper pipe shephard's crook was required. The additional structure to support this would add significantly to the cost and was not justified for the Aboriginal setting (Walker, 1988) where a judicious use of firewood allows heating of water only to its required temperature rather than boiling it with a fierce fire (as a European may tend to) and then having to mix it with cold water. The incorporation of the solar water heater on a raised roof structure
allowed the 6-metre pressure release pipe to be adequately supported and meet WAWA requirements.

The first RAHF prototype, illustrated in Figure 4.1, was built at Murdoch University for the following reasons:

- to become familiar with construction requirements and potential problems;
- to conduct experimentation on the solar water heater;
- to demonstrate the technologies to visitors.

![Figure 4.1: The early RAHF prototype](image)

It included the hand-operated washing machine and chipheater by CAT for demonstration purposes. The RADG technologies incorporated were the pour-flush toilet and the plastic solar water heater, each described above. The evapotranspiration system was not installed as simulated experiments were occurring elsewhere on the campus.

Structurally, the building was the same as the ATAF, using 50 x 50 mm steel square hollow section (SHS). The steel frames themselves were 2 metre x 2 metre modules allowing several variations of the layout and orientation. A SHS, waist height, bench jig was made for the workshop situation for ease of fabrication of the frames in the field with electric arc welding where electrical power was available. Fixing together the steel frames, attachment of cladding and roofing was by means of tek gun and screws (Anda, 1991a). Conceivably, this was possible with hand tools only, i.e. a brace to drill holes, bolts and heavy duty pop rivets. However, in most situations electrical power or a
portable generator was available. The skills associated with working with steel are commonplace in many communities as a result of past experience in the pastoral industry and being largely self-reliant with motor cars.

The 100 mm concrete slab was poured into prefabricated, C-purlin formwork set in place with the correct gradients for drainage. Cyclone rating was considered for areas around Port Hedland, for example, and brackets were welded onto the C-purlins through which tek screws could pass into the base of the steel wall frames. The concrete slab was designed with an open spoon drain to avoid pipe blockages, as in the ATAF, and for the shower water and any laundry spillage to run into the centre and into the ET trench via a box culvert. This drain box was made from concrete with a sheetmetal mould while pouring the slab (Anda, 1991a). The drain box had a hinged and padlocked sheetmetal cover to prevent entry of sand and objects. It was filled up with chicken mesh to intercept objects that may flow in.

The addition of the solar water heater on a redesigned roof was also a variation on the ATAF. CAT had chosen to avoid them and develop the chipheater in response to the problems experienced in remote communities (Walker, 1984). The solar water heater was connected as a preheater to the chipheater via an L-ported, three-way, selector valve (Anda, 1991a). Thus, with some preheating, one could either take water direct from the chipheater in the cold season or when numerous showers exhausted hot water from the solar unit. In the summer hot water could come direct from the solar unit. The roof structure for the solar water heater allowed the shephard's crook (vent pipe) for the chipheater to be connected here via a bracket. This satisfied the WAWA requirements and overcame the problem described by Walker (1988). The layout was such that the facility could be installed in any direction on a north-south or east-west axis. The two roof sections are then installed so that the solar collectors will be facing north.

Taps were ceramic disc, anti-vandal. The tap in the toilet for filling the flush bucket was spring loaded. A large stainless steel laundry trough was used so that as well as handwashing clothes women could also use them for washing babies. The trough was surrounded on both sides by grid mesh shelving fixed sturdily to the steel frame. In this manner large wet blankets could be thrown on there to drain after washing and children could also sit there.

A feature not always catered for in Aboriginal housing or ablution programs was a washing line. In the situations where they had been seen in remote communities, e.g. the flimsy Hills hoist, they had suffered from vehicle impact or children swinging around on them (Anda et al., 1990). The innovative aspect of this item was the post construction from old bore casings concreted into the ground. Four 5-metre x 6 mm woven steel
cables were attached to a 50 x 50 mm SHS crossbar (Anda, 1991a). The washing line could then be quite reliably used as a children's swing and a vehicle engine hoist.

The RAHF was initially costed at approximately $15,000 to install in a remote community while local involvement in construction could reduce this.

This display unit was inaugurated by the Honorable Ernie Bridge, Minister for Agriculture, Water Resources and the Northwest as part of the RADG Workshop on Water Supply, Water Use and Waste Disposal for Remote Communities (Ho, 1989). The workshop was attended by representatives of communities and government service providers.

![Image](image.jpg)

**Figure 4.2: Construction of the display RAHF at Newman**

In early 1990 a second RAHF was installed at Newman Campus - Hedland College (Figure 4.2). The intention was to demonstrate the facility to nearby Western Desert communities, primarily Jigalong, and their surrounding outstations. The principal of the College, Mr Bob Hart, was supportive of the efforts of RADG. Mr Hart had become familiar with the work of CAT. He had been involved in the installation of VIP toilets at Ngurawaana and ATAFs plus VIP toilets at Goodabinya near Marble Bar. A VIP toilet was also installed alongside the RAHF for demonstration purposes.

A seminar was scheduled on the site (Ho, 1991) which would have been attended by local community representatives and regional government service providers. This would have provided an opportunity to gain a clear insight on the acceptance of the technology by people in this region. The seminar was cancelled about a week beforehand as the College was unable to provide the support it had initially agreed to.
4.3 FIELD PROJECT #1: Kalgoorlie RAHFs

This section documents fieldwork conducted over several years (1989-93) with the above technologies. Once the opportunity arose to embark on this fieldwork the underlying motivation was community participation in adaptation of the design and in installation. Conducted in the tumultuous context of town camp life it became apparent that the provision of ablutions facilities with participation, as discussed in Chapter Three, could have a positive community-building effect in addition to providing the basic services of ablutions. The fieldwork revealed the appalling lack of facilities, the malfunction of what did exist, and government service provision, as described in Chapter Two, was often seen to be ineffective. The need for integrated Community Technology was clear. In the background to this fieldwork was occasional interaction with a variety of Aboriginal organisations that were entirely familiar with the problems, the opportunities and the constraints to action. Some of these were regional organisations dedicated to specific services such as healthcare, while others offered a limited range of services, but with financial and training support could offer a lot more. This could become the basis to Regional Technology.

4.3.1 Kalgoorlie Fringedweller Camps

In late 1990 Mr Preston Thomas, a prominent Aboriginal from the Goldfields region in WA, and a representative from the Aboriginal Affairs Planning Authority (AAPA) visited Murdoch University to inspect the RAHF display unit. Preston was the Coordinator of Ninga Mia Village and was also involved in negotiations on providing services for the Aboriginal transient, homeless or "fringedweller" people around Kalgoorlie. Preston recommended that AAPA fund RADG to provide the RAHFs. AAPA subsequently provided RADG with $58,000 to supply four of the RAHFs to the Pepper Tree Camp "fringedweller" camp on the outskirts of that town. An additional two RAHFs were built about 12 months later with the support of RADG researcher Evan Gray at another camp closer to Kalgoorlie townsite called Nanny Goat Hill.

The decision to proceed with the RAHF projects in fringedweller camps as offered by AAPA had both advantages and disadvantages. The advantages were:

- Funding was available immediately to start a demonstration project;
- The town camps were on major communicaton and transport links and could therefore be serviced with greater ease and reliability than outstations;
- Experience could be gained from this before attempting a project in a remote outstation;
- Feedback could be gained from the fringedwellers which could lead to design improvements;

1 5 6
• Need in these communities was extreme but committed funds from agencies were limited so at least a service was being provided.

The disadvantages were:
• RADG had not been involved in initial consultation with the community - this had been done by AAPA - so a full understanding of the needs and aspirations of the town campers was not at hand upon commencement;
• The fringedweller camps consisted of many alcoholic people so community involvement was limited and difficult;
• Town camps were comprised of people who were typically dejected and/or highly transient whereas outstations had usually arisen from people with initiative.
• Being within close proximity of the town centres local government acceptance of the project was tenuous and regulatory body approval of the devices would be difficult or not possible.

The fringedwellers at Kalgoorlie represented a homeless group of some 70 permanent people plus a larger number of transient people from outlying desert communities who moved from town to town to keep in touch with relatives. While RADG had anticipated that its work would serve outstations (or homeland centres), Preston Thomas and AAPA had decided that the design was appropriate for their situation due to its low-cost, robust construction and the community-based nature of installation advocated by RADG. Under a statewide policy the AAPA was aiming to improve living standards in all town camps through provision of basic ablutions and shelter (AAPA, 1992).

Ninga Mia Village was several kilometres to the east of Kalgoorlie township and is located on a map in Appendix 4. Pepper Tree Camp was closer to Kalgoorlie lying between Ninga Mia Village and the town. The Camp was next to Half Way Camp which was several decades old and unused except for the supervisor's hut which was more modern and occupied by one elderly man. Pepper Tree Camp later became known as Silver City Camp after Preston and the team of workers constructed basic zincalume shelters there for the campers. Nanny Goat Hill Camp was closer again being just on the other side of the town's ring road. Ninga Mia Village takes its name from Jimmy Brennan, otherwise known by his Aboriginal name 'Ninga' (Thomas, 1991). Jimmy Brennan fought in World War II alongside many other Australian comrades where conditions were equal for all. However, upon returning to Australia after the war he found difficulty in being recognised as a full Australian citizen. Also the conditions in which his fellow Aboriginal people lived was appalling. Jimmy Brennan set to work trying to improve life and rights for Aboriginal people. Today, Ninga Mia Village still operates after his initiatives. The Village provided accommodation and care for Aboriginal people whose population varied between 100 and 300, although conditions
were extremely overcrowded at the latter figure. Many of these people were aged and a food hall provided meals for them. Accommodation was basic with communal ablutions facilities and people often chose to camp outside where they practiced wood carving and socialised around fires.

Town camps had been present in the Goldfields since early settlement in the last century and they came and went for varying durations. In the 1990’s those such as Pepper Tree Camp and Nanny Goat Hill were fairly permanent, although their conditions and status under Local Government certainly were not indicative of permanence. There were a number of other camps around the perimeter of the Kalgoorlie townsite, and they each attracted a particular group of people originating from different outlying communities such as Coonana, Cosmo Newberry, Laverton, mainly former missions, which are located on a map in Appendix 4. There was continuous movement between the Kalgoorlie town camps (which could number up to several hundred people in total), town residences and the outlying communities. At the time of the fieldwork approximately 70 of the fringedwellers were relatively permanent. The Goldfields region is the traditional country of the Wongai people and is represented under ATSIC as the Wongatha Regional Council which can be located on the map in Appendix 2.

4.3.2 Construction of RAHF’s at Pepper Tree Camp (Ninga Mia Village)

Walker (1994) has said that rather than concentrate on inputs, targets and standards to achieve improved health and living "concentrate on the process of achieving adequate outcomes. Time needs to be spent working out the components of this process, the protocols for this process and the mechanisms for providing Aboriginal people with the control of the process".

It was assumed that Preston Thomas and AAPA had laid the foundations at Pepper Tree Camp for community support. This previous phase of the project was never known to the author but perhaps the most critical. Preston had been able to mobilise a team of men who, for the large part, were enthusiastic and dedicated beyond the end of the project and into subsequent work. Three town-resident Aboriginals, two town-resident Torres Strait Islanders and three fringedwellers, from amongst the end users, worked on construction. (Torres Strait Islanders had settled in many parts of Australia. One factor contributing to this was their recruitment for the construction of railways around Australia. They were renowned for their immense work capacity and great speed in teams while building the enormously long railways around the continent.) They were paid wages by AAPA as Ninga Mia Village maintenance workers. These people were previously alcoholics and semi-skilled and in the end could quite competently and independently finish the Remote Area Hygiene Facility.
Preston built a workshop (Figure 4.3) with the men at Ninga Mia Village using second hand materials they had collected at abandoned minesites. The jigs used for construction of the RAHF's were sent there from Murdoch University.

A training course was arranged for the team in welding techniques at Kalgoorlie College. This improved their existing knowledge and skills to a point where most of them were able to use electric, MIG and oxy-acetylene welding equipment to a high standard.

The fact that the first RADG fieldwork had commenced in a town camp and not in an outstation presented difficulty in implementing these so-called "appropriate technology" devices as basis for "research and development" to test the hypothesis that outcome is more important than submitting to the requirements of standards. The local government by-laws and State Health Act had typically been enforced a little more rigorously in towns compared with remote settlements within the same shire boundaries. The Shire of
Kalgoorlie-Boulder health and building surveyors were, in the event, not overly concerned about what was happening at Pepper Tree Camp.

The pour-flush toilet only required 2-3 litres per flush and with such a reduced effluent output did not need as large a disposal field as a full-flush, S-bend toilet. Nevertheless, these design details had to be negotiated with the Shire of Kalgoorlie - Boulder's Environmental Health Officer. To satisfy the State Health Act, an evapotranspiration trench size as required for conventional leach drains was used - although design criteria was later available (Standards Australia, 1994). The resulting size was considerable as evident in the video produced during the project (Anda, 1991). Building permits were also obtained from the Shire.

Mains water was also negotiated and installed with meters to each of the three sites by the Water Authority of WA. Individual water pipelines were installed from the meters to each RAHF by the work team using 25 mm HDPE. Standpipes with gravel sumps were also installed near or on the RAHFs for hosing down, cleaning and garden watering. These were built as in the Uwankara Palyanyku Kanyintjaku (UPK) report (Nganampa Health Council et al., 1987).

Three of the RAHFs were built at Pepper Tree Camp as a community-based, construction training and employment project, coordinated by this author, during December 1990 to June 1991. This construction phase was successful, in terms of completing the units, and largely attributable to the Community Coordinator, Preston Thomas, himself a Wongai Aboriginal, having immense leadership abilities and camaraderie. While the workers involved in the construction were locals, and they demonstrated positive camaraderie, they were not completely derived from the town camp itself where the RAHFs were being built. One, two or three camp members did regularly work on the project, and this was perhaps enough to instill a sense of ownership of the project amongst camp members in general. The author camped in the nearby Ninga Mia Village for a number of months over the construction phase.

Once the first unit was installed and operating the campers immediately began using it and while the additional units were being built, operation could be assessed and assistance was provided for minor maintenance. Two further units were built several hundred metres away and Preston Thomas later negotiated the supply of materials from Consolidated Gold Mines for the team to build basic shelters alongside the ablutions blocks. It became apparent that lighting was necessary and as a power supply was not readily available research commenced into a suitable solar light. A prototype was later developed that integrated suitable components, as an appropriate complete unit was not available commercially.
4.3.3 Preparation of Manual and Video

During this first construction phase in the field a manual was prepared that would provide clear information for future installations (Anda, 1991a). The manual consisted of 54 pages divided into three chapters. The main, first chapter provided clear, hand drawn sketches with dimensions for cutting, installation, etc. which appeared less daunting than the technical drawings provided in the third chapter for presentation to regulatory authorities for approvals. Accompanying the sketches through the chapter were a numbered sequence of captioned photographs which gave step-by-step instructions for the construction process. The second chapter provided materials lists and costings while the third provided technical drawings and plumbing schematics for more detailed construction aspects, for other subcontractors, as well as for approvals. As drafts were prepared at Kalgoorlie these were used with ease by Preston and the team. A final version was prepared with the assistance of architect Tom Hibbs.

In addition to the pictorial construction manual a video was produced (Anda, 1991) during the activities at Pepper Tree Camp showing the method of construction and community involvement. A forty-minute version was produced which showed all construction stages as well as providing an introduction, an explanation to the function of the various technologies and demonstration of the methods used. This video was made available to subsequent groups that sought to build the RAHF and was accompanied by the construction manual.

Later, the video was re-edited to produce a condensed, eight-minute version which was more for promotional purposes. A brochure was also produced describing the RAHF and is provided in Appendix 5. Together, these were mailed to a number of Aboriginal organisations for promotion and to ascertain the level of interest in a subsequent survey by RADG.

4.3.4 Construction of RAHFs at Nanny Goat Hill

Twelve months later, while this author was employed at Pundulmurra College as Pilbara Region Coordinator of the Environmental Health Worker Training Program, Evan Gray of RADG installed two more RAHFs at the Nanny Goat Hill camp which was only several hundred metres from the edge of the Kalgoorlie township. These included modified pour flush toilets as a result of negotiations that occurred with the AAPA and the HDWA before this second stage could commence.
AAPA had developed "benefit criteria" (Baker, 1992) when advising the HDWA on what they desired from the "appropriate technology" project at Nanny Goat Hill and were essentially still supportive of the RADG approach. AAPA felt that its criteria should be kept in mind when considering costs which in turn would depend on the following factors:

- initial capital requirements;
- replacement costs and timing of these;
- repair and maintenance costs;
- relocation costs;
- future expansion;
- providing alternatives to failed technology;
- modification to structures.

Subsequently, the HDWA provided a list of specifications for modified RAHF's to be installed at Nanny Goat Hill (Psaila-Savona, 1992), although the toilets in the RAHF's were misunderstood to be VIP toilets which are those manufactured by the Centre for Appropriate Technology (Walker, 1984).

4.3.5 Return Visits to Kalgoorlie

Between 1992 and 1995 a number of visits were made to the Goldfields region for various projects and visits to the RAHF's were made.

The RAHF at Pepper Tree Camp had been in continuous, communal use by itinerant campers. Only in the latter visits after a number of years had the unit fallen into disrepair and with no further campers at this site. The additional two RAHF's built near Pepper Tree Camp, subsequently known as Silver City due to the accompanying custom orb shelters, received only occasional use by different groups of itinerant town campers. This was rumoured to have been due to dislike of the shelters. However, it was more likely that the site was chosen by AAPA and Preston because it was on Ninga Mia land which allowed certain regulatory approvals to be gained and not because it was the preferred site by itinerant town campers. By this time there were a number of other town camp sites around Kalgoorlie.

The units at Nanny Goat Hill were still in regular use several years after installation. This site had also been equipped with better quality housing and connected to the town electricity supply. The two RAHF's were still used communally and suffered from lack of regular cleaning although still functioned as required.

It appeared the RAHF had at least provided a low cost solution to the need for ablutions facilities in these camps. It was evident that that there many other issues of concern including land tenure conflicts, inappropriate locations, other services, site development options, caretaking and management.
4.4 FIELD PROJECT #2: Halls Creek RAHF's

4.4.1 Halls Creek Town Camps - Mardiwah Loop

In January, 1991 a single RAHF was installed in Mardiwah Loop town camp at Halls Creek for trial purposes with additional funds from AAPA.

The development of Mardiwah Loop commenced with the excision of 20 hectares, negotiated by AAPA, from the adjacent cattle station, Moola Bulla. The station was a "feeding depot" for Aborigines from 1910 until 1955 but was now a white-owned enterprise (Kimberley Language Resource Centre, 1991). Halls Creek and Mardiwah Loop lay on the traditional land of the Kija people, north of the adjacent traditional land of the Jaru people. Gooniyandi country lay to the west of Halls Creek. The various families at Mardiwah Loop were mainly of these three peoples. The Kukatja people from Balgo and surrounding, smaller communities to the south regularly came to Halls Creek for supplies, meetings and social gatherings but resided at other groups of houses in the town and another camp. These communities of the East Kimberley region can be located on the map provided in Appendix 4.

Europeans or "gardiyahs" first came to the area in 1875 as pastoralists seeking grazing land and began to establish stations. "The pastoralists recruited Aboriginals often by coercion to work under horrific conditions" (Kimberley Language Resource Centre, 1991a). Aboriginal people were killed by the pastoralists, some for stealing cattle, some for no reason other than to occupy and use the land unhindered. Those that worked on the stations, without cash payment and for rations only, could at least be with their families on traditional land and carry out various ceremonies in the wet season. However, during the seventies many people began to migrate to the towns for various reasons. For example, ill-treatment by managers, abuse of the women, stations in the region owned by Vestys Ltd were sold off (Kimberley Language Resource Centre, 1991a) and introduction of award wages led to many redundancies.

This pattern was repeated all over Australia during the 1970's and many rural towns found themselves surrounded by "fringedweller" camps, where Aboriginal people had to endure appalling living conditions as explained in Chapter Two. This has continued even after the introduction of citizenship rights, social security benefits and apparently equal opportunity for employment. The allocation of funds and delivery of services has, in numerous cases, not been able to meet the needs of these people either in quantity or appropriateness. The fact that many of these people had formerly been station employees
meant that they had acquired a wide range of trade skills. A map of town camps around Halls Creek is provided in Appendix 4.

The history, contemporary social dynamics and settlement patterns in relation to the interaction of Aboriginal and non-Aboriginal people of Halls Creek have been described by Ross (1987), Rumley (1989) and Memmot (1992).

Mardiwah Loop was divided into 20, roughly 1 hectare lots about one kilometre north of Halls Creek along the Moola Bulla Station road as shown on the map in Appendix 4. Different family groups who settled here were dissatisfied with the lifestyle in town and preferred an open, rural setting with more privacy and space and access to town amenities. Many had come from the Homeswest rental estate, Yardgee, on the edge of town, whose houses over the years had rapidly deteriorated. Alcohol and break-ins had become a big problem. The young community at Mardiwah Loop was not unified at the time of this author's fieldwork, and some families were more influential and powerful than others. The individual titles to each block were reminiscent of an urban subdivision.

A graded road was provided as well as a water ring mains from which single pipelines were progressively run to individual camps where standpipes were located - without protective bollards, soakwell or concrete surround leading to the inevitable problems. Cars sometimes ran over the standpipes, lack of drainage underneath the taps led to stagnant ponds of immense health risk and hosing down next to the taps resulted in thick mud and a pointless cleaning exercise. Numerous connections from the ring mains to individual premises had not been completed after many months. Digging the trenches for the pipeline was immensely difficult in the rocky, clay earth. At one time three, abandoned, broken down backhoes were observed at Mardiwah Loop. Some residents used old plastic piping to connect to the meters and run a rudimentary supply to their shelter - often many leaks were evident.

People defecated in the surrounding bush or built their own rudimentary pit toilets. Some people constructed showers with lean-to walls or showered in town when visiting relatives. Shelters arose in a variety of forms from simple corrugated iron lean-to's to old Main Roads Department caravans. In most cases, people took great care of their residences, even developing gardens around them in these harsh conditions. They often appeared to be relaxed in their home environment.

RADG provided a concrete mould, for base and pedestal, and assisted in the construction of improved pit toilets over the duration of its involvement at Mardiwah Loop in an attempt to meet the shortfall of ablutions facilities. During a tour by senior Health Department staff wandering through the rudimentary dwellings, stagnant ponds, wrecked
car bodies, piles of rubbish, aged and infirmed people the comment was made that the pit toilets should be fitted with ventilation pipes (Penman, 1993). Such an attitude concerned with standards, set against the scene described, invoked thoughts on the relevance of technology such as those expressed in Chapter Three and articulated by Walker (1994): "Among those unique issues which affect technology choice are a lack of specialisation, high mobility, environmentally harsh conditions (particularly the impact on materials), different range of skills, the lack of spare parts and equipment to modify the built environment and a lack of money in many areas of the community particularly for recurrent activities". However, this is not to suggest that funds should not be found and used to rectify these appalling living conditions. Rather, steps need to be taken quickly in these situations that make use of available resources and motivations of the people. To have a singular focus on standards inevitably resulted in lengthy delays until funding arrived - if ever - for the conventional solution.

4.4.2 Construction of Trial RAHF at Mardiiwah Loop

Figure 4.4: Building the first RAHF at Mardiiwah Loop.
In this second project after Kalgoorlie the AAPA was not accompanied by a central, prominent Aboriginal person from the community when it approached RADG. Community support to the proposal was uncertain. Nevertheless, meetings were held with the regional Aboriginal resource agency in Halls Creek, Ngoonjuwah Council, and further understanding of the community dynamics was gained. Consultation also occurred with the Mardiwah Loop Management Committee to determine who would be working on the construction project and where the first RAHF would be sited. It was initially decided that it would be built in the camp of the chairman. However, the first public meeting on site was attended by a number of vocal women and they demanded that it be located in Jack Ryder's camp. Their reasoning was that this site was more central to a number of larger camps which had many women and children who would make greatest use of the laundry and shower.

The first unit would be prefabricated at the Remote Area Technology Centre, Pundulmurra College and trucked from there. Ngoonjuwah Council wanted all subsequent units to be built in their workshop as part of a TAFE training program. This was later changed to the larger workshop owned by TAFE itself. Negotiations proceeded between AAPA, DEET, TAFE and Ngoonjuwah Council to establish the training program and secure wages for the trainee workers.

![Image](image.png)

Figure 4.5: First RAHF completed at Mardiwah Loop for trial purposes

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Once the agreement was made to install additional RAHFs these negotiations had failed, and most of the prefabrication was undertaken by the Remote Area Technology Centre (RATC) at Pundulmurra College. Nevertheless, the on-site installation work was considerable. Maintaining a stable workforce turned out to be a challenge in the face of DEET training wage uncertainties, decisions as to which family groups would receive the limited number of ablation blocks in the first round and dissatisfaction by some with the equipment being offered. The first RAHF was installed nonetheless in January, 1991 with the support of an Aboriginal builder from Hedland (originally trained at Pundulmurra College) and the enthusiastic participation of residents Harold Cox, Raymond Yeeda as well as a number of others intermittently (see Figures 4.4 and 4.5).

4.4.3 Construction of Additional RAHFs at Mardiwha Loop

After the RAHF had been in use for several months, and the residents had decided on what design changes were necessary, RADG was awarded a contract from AAPA for another ten units. Arrangements for their construction begun shortly after January, 1991, including the various negotiations with other agencies and the community at Halls Creek.

The design satisfied most residents except the toilet and shower were to be located at opposite ends for privacy during simultaneous use. However, the RATC had already delivered some prefabricated units to site and these required separation of the toilet and shower on site by the work team. Wages were late in being organised for these people. When the time came to commence installation of the ten RAHFs wages were not forthcoming as had tentatively been offered by DEET reducing motivation in the community to offer their labour under RADG supervision. Construction of the ten RAHFs on site commenced in May, 1991.

The management of this project as a training venture by TAFE collapsed shortly after commencement. Nevertheless, the community decided it would like to be involved in the provision of another ten of the ablation blocks, even though some people were not happy with some features, e.g. the pour-flush toilet. While it was not the objective of RADG to take on the role of a conventional builder RADG agreed to install conventional flushing toilets in three of the units. The intention of RADG was to facilitate the community-based trials of alternative (not currently regulated) technologies where these would satisfy the particular community.

A factor which contributed to the not entirely smooth management of the project was this author's departure from the scene in the month following the commencement of construction to take up a position at Pundulmurra College as Pilbara Coordinator of the Environmental Health Worker Training Program. Fortunately, this author was replaced.
by the patient and competent David Ross who was a licensed plumber. David supervised the project at Halls Creek from July, 1991 - June, 1992.

During this time the older style, prefabricated RAHFs already trucked to site from the Remote Area Technology Centre at Pundulmurra were modified and installed. The wall panel design, which had worked well at Kalgoorlie, was not found to be so convenient by the RATC due to transportation requirements as well as the design modifications required by Mardiwh Loop residents. Instead a cubicle design was adopted - one for each of the shower and toilet which were located at opposite ends of the concrete slab. The laundry took the space in the middle. C-purlins could easily span the length of the block upon which roofing sheets and the solar water could be installed. These newer units were installed with flushing toilets. The installation of ET wastewater disposal systems (see Figures 4.6 to 4.8) was subcontracted to a local plumber with a backhoe. Liaison with regulatory authorities, i.e. the Halls Creek Shire and Health Department of WA, commenced to gain correct approvals for wastewater systems.

Figure 4.6: The improved design of RAHF with separated toilet and shower showing drainage works underway.
Figure 4.7: Wastewater disposal in the modified RAHF at Mardihawah Loop was by ET trench shown above under construction.

Figure 4.8: RAHF at Mardihawah Loop showing vegetation growth on ET trench. Note Ipkendanz-style shelters to right.
4.4.4 First Return to Mardihah Loop

This author returned 18 months later, in December 1992, in an attempt to complete the project and rectify a number of problems. A wide range of outstanding work was undertaken with two residents, Jimmy Deegan and Harold Cox, over two weeks. A range of maintenance tasks were also completed on the RAHFs. The latter indicated the high rate of use of the ablutions blocks.

Numerous sets of the concrete toilet seats and slabs were made with Jimmy and Harold using the sheetmetal moulds as some camps were completely without toilets. The plumber excavated 3 holes for 2 deep 44-gallon drums with his backhoe.

Two of the RAHFs had a range of problems. It was understood that these units' construction was undertaken/supervised by a local builder in collaboration with TAFE. It was not recommended to use these people again.

Installation of septic tanks and evapotranspiration trenches for the flushing toilets on three RAHFs had been sub-contracted to a local, Halls Creek plumber. These were not complete at the time of this visit and were suspended due to a number of bureaucratic problems. Consultation with the appointed plumbing contractor, the Shire Environmental Health Officer, and the Perth HDWA Waste Management officer responsible for approvals, led to commencement of installation of the three septic tank and ET systems. Upon departure one unit had been completed and excavation of the other two were well underway.

On the other five units various repairs and connections to plumbing were required. While the repairs were no longer part of the RADG brief, it was expedient to attend to these given that the units had not been completed before use commenced and Murdoch University was considered responsible for problems arising. Another local plumber was given a work list of what to complete.

The modified RAHF design with two separate cubicles for shower and toilet, sight screens and C-purlin roof structure was an excellent improvement for ease of manufacture, ease of installation, simplicity in design and reduction in materials. While the volume for transportation was greater it was possible to put many components inside the cubicles for trucking.

The RADG solar water heater installed on the first unit was still functioning satisfactorily with only weepage occurring at the cold water entry connection to the lower manifold of
the panel. Four other RADG SWHs had been installed but remained unconnected. Four Solco SWHs had been installed and one of these was not connected. On one Solco unit a major leak existed from the header tank and this was repaired. It was claimed that in a very short time the connection points on the Solco units fatigued and cracked.

The ET trench on the first unit was covered with self-established vegetation growth indicating absorption of effluent throughout the trench.

Two trenches had to be reconstructed around the soakwell due to incorrect construction. Both soakwells were completely filled with sludge as well as cans, rocks and sand. All other trenches appeared to be offering satisfactory drainage but needed to be planted with trees. A maintenance programme was recommended to include six-monthly pumpout of soakwells and septic tanks due to the large number of residents using each unit.

The 2 chipheaters connected did not appear to have been used much probably indicating that sufficient hot water was available from the solar water heater or the water was usually warm enough after its lengthy travel in above ground pipes.

4.4.5 Second Return Visit to Mardiwah Loop

The author visited Halls Creek again during February 1993 on request from a Department of Community Services officer to ensure the local plumbers finished the three sewerage (septic tank & ET) systems and carried out repairs and connections. There were several other minor details to attend to including fencing off and seeding the ET drains, putting up a washing line and laying some gravel. The work was generally impeded by torrential rain and in fact it would have been more effective to have left the visit for another month. During the week some 500mm of rain fell in a town which had an annual average of 520mm. Halls Creek became completely inaccessible from either side, the plumber was unable to return from Perth and the author had to fly out on the mail plane when the airstrip was dry enough.

It was an excellent time for seeding ET surfaces with the wet season. Seeds had begun to sprout after only a few days.

4.4.6 Third Return Visit to Mardiwah Loop

After returning to Halls Creek in April, 1993 to collect the motor car after the February floods and inspect the plumbing repairs the following observations were made:
• Block # 85 (Jack Ryder) This was the original unit installed in January 1991. The U-bend of the toilet pan was missing thus creating odours and promoting flies and mosquities. The solar water heater was leaking to the extent that the pooling water constituted a health risk and was disconnected. It could be repaired by replacement of six joiners on the panel. The tank bladder may also have required replacement. The chipheater was connected here but could not be used without the solar water heater functioning because of its series connection as a preheater. A new washing machine was provided. All six of the washing machines delivered from Pundulmurr College were supplied without flexible connections. It was thus not possible to discharge effluent down the drain.

• Block # 86 (Ben Duncan - 'Pilot’) This unit had one of the three flushing toilets and was operating satisfactorily. The chipheater was installed and required connection. A new washing machine was supplied.

• Block #88 (Elizabeth Skeen) The newly connected solar water heater required a leak in the header tank to be fixed and was subsequently operating satisfactorily. The shower rose was replaced. The chipheater required connection. Handles were required to laundry and shower hot water taps.

• Block #93 (Herbert Hester) The solar water heater was connected and operated satisfactorily. This unit was the most successful with all aspects functioning - including a connected chipheater. Herbert felt that a flushing toilet would be much better. A new washing machine was delivered.

• Block #97 (Mr Carey) The above person was deceased and all former members of this camp had moved away although some residents were still present and using the block. The new residents at Block 101 had taken the laundry trough to use under their tapstand. The shower rose was replaced. The solar water heater was connected and commissioned. A new washing machine was supplied. The toilet pan U-bend was missing and should be replaced. The chipheater required connection.

• Block #100 (Jack Jugari) The chipheater required connection.

• Block #102 (Lilly Button) This was the second of three flushing toilets and all seemed satisfactory at this block. The chipheater required connection.

• Block #103 (Tony Johnson) A chipheater was supplied and needed connection. The Solco solar water heater had been connected. The protective paper coating had set
hard on the glazing and could be only partly scrubbed off. The laundry and shower hot water tap handles needed to be fitted.

- Block #104 (Jerry Woodhouse) Connection of chipheater was necessary. All else was satisfactory. This was the third of three flushing toilets.

WAWA had warned RADG against connecting chipheaters until a manufacturing license and hydraulic testing had been complete. This was a procedure that was never able to be completed by RADG or the Remote Area Technology Centre due to lack of staff.

Seeds which had germinated on the ET trenches at the last visit had now died and new seeds had not germinated although kapok and grasses were advancing on all trenches. Vegetation continued to increase on the ET trench at the original block with legume/pioneer shrubs now beginning to appear. This indicated perhaps that a progression of an ecosystem, having commenced with grasses, is occurring and trees may eventuate.

The pour-flush toilet, even though not openly supported by anyone, functioned well in 4 out of 6 blocks. In the two blocks where the U-bend was missing one camp had alcoholics and the other was used intensively by up to five family groups which would increase the risk of damage. The other blocks were mainly used by only one family but up to four in one. The U-bends may not have been adequately secured to the pan when installed.

All spring-loaded taps in the toilets, which were top-of-the-range $120.00 each, had worn out and some had been replaced with others requiring replacement. The highly mineralised water caused this wear on the springs and valves and resulted in deposits on all hot water plumbing.

All solar water heaters were providing hot water satisfactorily except for the damaged unit at Jack Ryders camp.

It was believed that failures in equipment would continue to occur if a maintenance programme was not instituted by the community.

4.4.7 Fourth Return Visit to Mardiwhah Loop

A fourth visit was made to Mardiwhah Loop in December, 1996 by Dr Kuruvilla Mathew. All of the improved RAHF units were still operating satisfactorily. The chipheaters were still not connected. This meant that plumbers working on the site were still bound by the
Water Corporation ruling that they were not approved and could not be connected in WA. Commercially-available wood burning heaters had been installed. This indicated that the Solco solar water heaters were probably not providing enough hot water all year round as expected. Wood heating was still an acceptable option for the residents.

The older units were not inspected.

4.5 FIELD PROJECT #3: Regional Appropriate Technology Centres

To summarise from earlier in this chapter, the steps taken in this project were as follows:

- identification of the needs of remote Aboriginal communities;
- research, development and demonstration of "appropriate" water and sanitation technologies;
- field trials in remote communities with community participation;
- feedback, modifications and market evaluation;
- establishment of Appropriate Technology training and manufacturing centres in regional towns.

The community-based construction of RAHFs in the town camps has been reviewed to understand the dynamics and potential of the Community-building Technology model and this will be discussed in the evaluation of the following chapter. The Community Technology model became apparent through the RAHF projects, but more directly through visits to isolated, discrete communities while working on the HREOC Water Study, the EHWTP, the Ngarda-Ngarli-Yarndu Regional Plan and the Regional Workshops Feasibility Study.

By 1989 it had become evident to RADG, after researching a number of technologies, that it would be most useful to establish a centre in Western Australia similar to the Centre for Appropriate Technology in Alice Springs. This would both satisfy needs at a local level for some Aboriginal communities and perhaps more effectively influence service delivery to communities elsewhere. Such a centre could contribute to a system and culture of Regional Technology. The rationale for this was as follows:

- the centre could offer training while engaged in manufacture of essential, sturdy, low-cost products;
- a single centre could be used as resource by a number of communities and town camps in a region;
- it could be operated as an independent Aboriginal enterprise such as a number of Aboriginal building companies, e.g. Hedland Building and Maintenance (Colin Beck), Yawony Building Co. in Perth and the Roebourne company;
alternatively, it could be operated as a collectivised enterprise by a number of Aboriginal organisations such as Mayaroong Constructions in Kununurra which was a division of Waringarri Resource Agency serving the East Kimberley region;

- the centre could serve as a vehicle for technical information, design services, construction supervision in communities, liaison with service providers, government agencies and utilities;

- it could be linked to an existing technical trades education centre such as Pundulmurra College, Kalgoorlie College or a regional TAFE centre whereby training support would be readily available.

### 4.5.1 Kalgoorlie - Ninga Mia Constructions

As the construction of three ablutions facilities at Pepper Tree Camp drew to a close, discussions with Preston Thomas and the workers moved on to the idea of the team staying together and forming an Aboriginal building and manufacturing company. It was felt that with the experience gained the group could perhaps continue to at least manufacture ablutions facilities for other town camps and regional communities, but possibly also develop a wider range of products and undertake a variety of building and maintenance contracts with communities. The team had already used the rudimentary workshop they had built at Ninga Mia Village to fabricate steel furniture for the town campers including bed frames, chairs and tables after the RAHF's had been finished. Conventional commercially available furniture was not durable enough. It was agreed that it would be useful for Preston and the group to go on a Work Information Tour to Alice Springs to see the Centre for Appropriate Technology and Aboriginal organisations such as the Tangentyerre Council that had established successful service delivery for town camps and remote communities. The formation of Ninga Mia Constructions Aboriginal Corporation was proposed. Brochures and product documentation were produced (RADG, 1991) and were used for promotion and lobbying. Negotiations between Ninga Mia Village and the AAPA commenced for assistance in the establishment of the enterprise. Although a number of the workers were involved in construction of further RAHF's for other town camps at Kalgoorlie the enterprise did not materialise. The failure of the Ninga Mia Constructions Aboriginal Corporation to even get off the ground was in part a result of the factionalism between groups in Kalgoorlie. Each of the town-based resource agencies wanted to develop into larger organisations but their differences appeared to be irreconcilable. The Aboriginal Affairs Planning Authority when consulted with this idea by RADG were reluctant to support the proposal due to this very factionalism and did not want to risk their credibility with each group and the ability to continue working with them in the future.
4.5.2 South Hedland - The Remote Area Technology Centre

The strong relationship between RADG and Pundulmurra College in South Hedland led to the establishment of the Remote Area Technology Centre (RATC) in February, 1991 and was the first attempt to replicate something like the Centre for Appropriate Technology in Western Australia. It was made possible through a funding arrangement between TAFE Aboriginal Access and Pundulmurra College. The aims and objectives of the RATC were as follows:

- Research, design, test and manufacture technologies appropriate to Aboriginal lifestyles thereby enhancing self reliance, self determination and enterprise of Aboriginal people;
- To maximise the involvement of Aboriginal people in the design, selection, production and maintenance of appropriate technologies;
- To provide technical advice, information and options to further the technological and economic development of Aboriginal people;
- To provide training in not only practical skills but also management techniques to facilitate the establishment of a core management group able to plan, chart and oversee the future operation of the RATC (McConkey, 1991).

A number of excellent local Aboriginal people commenced work at the RATC and were engaged in the manufacture of the RAHF for Halls Creek and other sites, the plastic solar water heaters, pit toilet housings, chipheaters, hand-operated washing machines, canvas swags, canvas groundsheets and several other items as required. A number of prototype devices were also prepared. Considerable income was derived from the sale of these products. Many young Aboriginal people were able to obtain work experience over the years of its operation. Ashley Graham, for example, became Foreman of the operations and his production of the wide range of manufactured goods was of superb quality.

Once the RATC was operational the Appropriate Technology Display Park (AT Park) was established. This was made possible largely through the financial support of the Renewable Energy Advisory Council (REAC) and private company sponsorship and included the RAHF, various pit toilets, a windmill and bore, wind turbines, solar panels and trackers, a Mono submersible pump, a small shelter designed by Mike Ipkendanz, Innotech plastic sewerage system components and a number of other items (McConkey, 1991). Having the Pundulmurra Plant Nursery immediately next to the AT Park, made the visits to the College by community people, government representatives and many other Aboriginal people most worthwhile. The AT Park became a useful resource for modules of the Environmental Health Worker Training Program conducted at the College.
It served as a stimulating tour during the Conference on Environmental Health in Developing Communities in October, 1991. Many Aboriginals from outlying communities visited the AT Park when visiting Hedland.

The Remote Area Technology Centre would need a dedicated manager for its operations to be continued over the long term. However, the manager Greg McConkey decided to transfer to Geraldton and establish the Environmental Health Worker Training Program in the Midwest Region. He was replaced by David Ross who later had to also manage the EHWTP thus giving each position only 50%. Due to minimal moral and financial support within the College to either program, David Ross was eventually attracted to take up a position with the Western Desert Puntukurnuparna Aboriginal Corporation. The Centre manager position was delegated to one of the automotive trades workshop staff but still at only 50%. Operations wound down. The AT Park was largely disassembled. Ashley Graham decided to return to his home town of Carnarvon.

The collapse of the Remote Area Technology Centre was allowed to happen due to other crises occurring within the College. The Centre never really became a separate identity, such as Mayaroong Constructions had, which would have encouraged a more assertive business stance. If a more concerted effort had been made to shift the Centre to the control of a regional Aboriginal organisation, its stability and continuation would have been enhanced. It certainly would have been more eligible for financial support from ATSIC and even the State Government. Under the control of an Aboriginal organisation there would have been a greater incentive to purchase its products. For example, Jigalong had been a steady consumer of the swags, but its non-Aboriginal storekeeper found a supplier of imported, cheaper, albeit lower quality swags. Such decisions may have attracted greater scrutiny if affecting poorer financial performance for the Aboriginal organisations owning the Centre.

In Halls Creek, the abandonment by TAFE earlier in the project's establishment resulted in the loss of training support and a functioning workshop. The support of Ngoonjuwah Council in the early stages allowed the use of its workshop but this had less tools and equipment. Later in the project the mobilisation of Aboriginal organisations and community support became less of a concern than finishing the construction of the ablutions blocks, and the slow pace of this caused some disillusionment for David Ross whose perserverence over 12 months was nevertheless commendable. After this time all funds and resources had been exhausted and the objective of this author was to complete all outstanding work and attempt to understand what had happened in the latter stages.
4.6 FIELD PROJECT #4: Development of Regional Technical Information Services

The direct involvement of RADG as a builder for the RAHF projects was discontinued due to the reasons described in the previous section. The 1994 National Conference on Technology Transfer in Remote Communities (Anda & Ho, 1994) precipitated the conduct of a Feasibility Study into Regional Workshops on Appropriate Technology by this author (RADG, 1995) and this follows the earlier attempts by RADG (Lantzke, 1989) to develop information services for remote Aboriginal communities and their regional organisations as described in section 4.2.

4.6.1 Feasibility Study into Regional Workshops

A resolution arising from the conference was to conduct a Feasibility Study into Regional Workshops to present the information to a broader base of people in a relevant format. ATSIC funded RADG to do this work and meetings were held in regional centres across the state with Aboriginal people. Through the Feasibility Study the opportunity was seen to commence a means of technology-practice discourse that is firmly Aboriginal community-controlled through the process of regional workshops and associated strategies. The basis of the Feasibility Study was a series of meetings in the regional centres that serve most of Western Australia's remote Aboriginal communities. RADG met with representatives from Aboriginal organisations in the following ATSIC zones:

- Wongatha (Goldfields-Esperance region) - Kalgoorlie;
- Yamadji (Midwest region) - Geraldton;
- Wunan (East Kimberley region) - Kununurra;
- Ngardi Ngarlali Yarndu/Western Desert (Pilbara region) - South Hedland;
- Malarabah/Kullarri (West Kimberley region) - Derby.

4.6.2 Strategies Developed from Regional Meetings

After having met with representatives of communities and regional organisations it became evident that implementation of one of the following strategies or a combination of these may serve to begin a technology information service in Western Australia that met the felt needs (Anda, 1995):

1. Further discussions and networking between Aboriginal Resource Agencies, ATSIC Regional Offices and ATSIC Regional Councillors to negotiate a suitable approach in each region for a technology information service. This could be facilitated by a Technology Information Officer who could at the same time run workshops with Project Officers. Such facilitation will provide the opportunity
for the ideas presented in the study to be adapted and taken control of by Aboriginal people in accordance with their needs.

(2) Conduct an exhibition of relevant technologies and a workshop simultaneously. The most commonly expressed idea was an exhibition of working displays. The exhibition could be a mobile active display such as the Energymobile from Melbourne demonstrating renewable energy technologies. Product suppliers could sponsor the event while offering displays. The workshop could include presentations from experienced practitioners in the Appropriate Technology movement such as the RADG, the Environmental Technology Centre at Murdoch University, CAT, the Alternative Technology Association (ATA), APACE and the Development Technologies Unit of Melbourne University. While State Government service agencies could make presentations, the event would be Aboriginal-controlled. Another means of satisfying the need to see technology in operation would be through reintroduction of the DEET Work Information Tour Scheme.

(3) Identify, select and set up community-controlled, operational models of technology artefacts or systems. Examples suggested in the meetings included wastewater reuse schemes, solar energy systems and housing maintenance programs. The point being that the experience gained, whether they be successes or failures, would reflect the region's specific characteristics and benefit the region's communities rather than a remote, city-based agency.

(4) Set up an independent technical advisory service or one controlled by each or several Aboriginal Resource Agencies. While some people were aware of the National Technology Resource Centre in Alice Springs use was not generally being made of the service. A local service may be able to make more use of the Alice Springs service after establishing inter-regional networking by information officers, newsletters or email.

The following stages were proposed to implement the above strategies:

- Stage 1: Regionally-Based Networking
- Stage 2: Technology Information Officer - Facilitation
- Stage 3: Pilot Regional Workshops
- Stage 4: Touring Display of Alternative Technologies
- Stage 5: Re-introduce Work Information Tour Scheme
- Stage 6: Regional Technology Demonstration Models
- Stage 7: Technical Advisory Service

The rationale for conducting the above Feasibility Study was the concern of Aboriginal people at the 1994 conference to have the information brought to people in regional areas. The aspirations of Aboriginal people in regional areas was for more information and
control over technology choice and practice. This was clearly a basis for the proposed Regional Technology concept to be realised in Western Australia. There was great interest in a range of technologies that seemed to offer financial saving, energy saving and labour saving over the longer term. These technologies seemed to fit the criteria of "sustainable technologies" and "appropriate technologies" as described in Chapter Three but without the labels. The negative perceptions of "appropriate technology" introduced in Chapter One were effectively dispelled in the Feasibility Study. The way in which the representatives at the regional meetings seemed to picture this range of technology as being mutually supportive of a more sustainable, satisfactory community life alluded to the ensemble of technologies as proposed under the Community Technology model. Regional Workshops could serve as a forum, a fillip by which to initiate the process towards Regional Technology. Following the workshops could be the development of regional technical advisory networks whose support could lead to the establishment of regional Aboriginal enterprises or utilities.
We believe that the failure of a great many development projects to achieve even the most fundamental objectives is due on the part of development practitioners to appreciate the significance of history. Projects are frequently designed as if time began with the project implementation schedule. Past lessons are seldom examined and still fewer professionals bother to inquire into the historical circumstances of the people their interventions seek to assist.

Doug Porter et al. (1991)

This chapter analyses the fieldwork conducted by this author in relation to the Remote Area Hygiene Facility (RAHF) and the associated technologies developed by RADG, i.e. the solar water heater, the evapotranspiration wastewater disposal system and the pour-flush toilet. The efforts to establish autonomous, regional training and manufacturing centres and technical information services are also evaluated. Numerous social development commentators (Cohen & Uphoff, 1980; Reason, 1994; Stringer, 1996) and development technologists (Francis & Mansell, 1988; Willoughby, 1990) held that the participation of the end-users in assessment or evaluation was beneficial to the overall development process as discussed in sections 3.2.3 and 3.6 of Chapter Three. However, the “action research” (Reason, 1994; Stringer, 1996) approach to the fieldwork could not be sustained through to evaluation as has already been explained at the beginning of section 3.6 and documented in Chapter Four. Nevertheless, this evaluation is structured to determine what bearing the project planning, implementation and outcomes had on the concepts Community-building Technology, Community Technology and Regional Technology, i.e. it seeks to answer the second question of this thesis presented in the Introduction. The structure and format of the evaluation provides academic rigour by obeying the general principles of the ‘grounded theory’ methodology (Strauss and Corbin, 1990) as described in Section 3.6. Moreover, the evaluation is structured in terms of the three-dimensional view of technology-practice. The first question of this thesis regarding the technical efficiency of the RAHF and its components is answered in the context of the technical-empirical dimension of Community-building Technology.

The process of the evaluation is to match the relevant aspects of the fieldwork to the criteria of Table 3.2 as in a matrix. The table is reproduced below as Table 5.1 and indicates, by the use of an asterisk (*), which criteria were able to be evaluated.
### Table 5.1: Criteria Evaluated

<table>
<thead>
<tr>
<th>Community-building Technology</th>
<th>Community Technology</th>
<th>Regional Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical-empirical:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low to medium level of 'technacy'</td>
<td>Low to medium level of 'technacy'</td>
<td>High levels of 'technacy'</td>
</tr>
<tr>
<td>Technical efficiency of artefacts</td>
<td>Technical efficiency of artefacts</td>
<td>'Technate' employees from region</td>
</tr>
<tr>
<td>Capital and program costs</td>
<td>Sustainability</td>
<td>Organisational costs</td>
</tr>
<tr>
<td></td>
<td>Capital and operational costs</td>
<td></td>
</tr>
<tr>
<td><strong>Socio-political:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning/problem-solving process</td>
<td>Access to high levels of 'technacy'</td>
<td>Supports multiple communities</td>
</tr>
<tr>
<td>Community involved in planning, design, implementation and evaluation</td>
<td>Managed and maintained by community</td>
<td>Block funding and financial support</td>
</tr>
<tr>
<td>Implementation of trials</td>
<td>Community ownership</td>
<td>Management, maintenance and training support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coordinates trials and evaluations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equivalent status to Local Govt</td>
</tr>
<tr>
<td><strong>Ethical-personal:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supports lifestyle and culture</td>
<td>Supports lifestyle and culture</td>
<td>Supports lifestyle and culture</td>
</tr>
<tr>
<td>Gender aware</td>
<td>Aboriginal community control</td>
<td>Aboriginal regional control</td>
</tr>
<tr>
<td>Individual and community empowerment</td>
<td>Community management embodies</td>
<td>Organisational culture embodies</td>
</tr>
<tr>
<td>Reconciliation</td>
<td>Aboriginal ways</td>
<td>Aboriginal ways</td>
</tr>
<tr>
<td></td>
<td>Health improvement</td>
<td></td>
</tr>
</tbody>
</table>

Most of the criteria of Community Technology could not be evaluated because a project could not be established that resembled its most basic features. The RAHF had been constructed in the town camps as an isolated technology and could not be integrated with existing technologies (apart from simply being connected to water supply pipelines) or settlement patterns (apart from simply being sited to suit the location needs of the residents). A complete settlement would need to be established or upgraded at the initiative of the community members against which the specified principles and management systems could be evaluated. Similarly, for Regional Technology it was only through the Feasibility Study and the Remote Area Technology Centre that some criteria could be indirectly assessed, and not directly through an actual project whereby a regional organisation supports the Community Technology functions of a number of communities. Table 5.1 enables one to see that the first question to be answered in this thesis concerning the technical efficiency of the Remote Area Hygiene Facility becomes only a part of an Appropriate Technology mode of technology-practice. Nonetheless, an evaluation was carried out to provide indication of the applicability of the Community-building Technology, Community Technology and Regional Technology concepts when considered with other evidence from the literature and other work referred to in this chapter.
An analysis of each asterixed criterion in Table 5.1 follows. The analysis takes the format of firstly defining what could have been achieved for the criteria under the particular mode of technology-practice concept; secondly what actually took place as a comparison against this; and thirdly how the concept criteria can be achieved in the future.

5.1 COMMUNITY-BUILDING TECHNOLOGY

To reiterate from section 3.6.2 in Chapter Three: Community-building Technology occurs where community infrastructure is designed, selected, trialled, adapted, built, managed or maintained by the community in collaboration with a technologist and/or facilitator and in the process knowledge is built upon, a stronger sense of community is achieved and empowerment occurs. Moreover, the participation of non-Aboriginal technologists and also students, 'outsiders', provides a dynamic, cross-cultural, learning experience for both sides. This experience and its promotion furthers the cause of reconciliation. The following evaluation of the criteria required for this concept to be successfully enacted is based directly on the field experience with the Remote Area Hygiene Facilities which was documented in Chapter Four, evidence from the literature described in Chapters Two and Three, and the operations of the various Appropriate Technology centres established or attempted in each region to support the manufacturing operations.

5.1.1 Technical-empirical dimension

Level of Technacy

To meet this criterion of Community-building Technology the community members participating directly in the project need only have a small amount of technical skills, say equivalent to those accrued in a position such as trades assistant or early high school, and a low level of technacy, say that enabling one to understand the interactions of a facility with power, water and waste management. High levels of competency in complex skills are not necessary because major outcomes sought are in the socio-political and ethical-personal dimensions. The project need only require some basic skills to ensure completion on site of the task and for subsequent maintenance and operation.

In Kalgoorlie the community-based facilitator, Preston Thomas, had a medium level of technacy by having a strong and creative problem-solving ability (Seemann, 1990), possessing a range of trade skills, being able to maintain machinery and vehicles, coordinate the construction of the RAHF's as well as manage a range of services to the Aboriginal communities of Ninga Mia Village and the town camps. While construction of the first RAHF was under way Preston and the team were involved in setting up the
fabrication process for subsequent units, resolving a number of design problems and preparing the construction manual while engaged in the project. This occurred with the technical support of the author reflecting both the “action research” method (Reason, 1994; Stringer, 1996) and the “dynamic interaction” required for “technological fit” (Willoughby, 1990) as described in section 3.1.1. The construction team had a lower level of technacy, but once a course in basic welding skills had been provided this level was adequate for the construction of the RAHF s. In Halls Creek the key participants in construction of the RAHF s possessed a low to medium level of technacy having worked on stations and regularly maintaining vehicles which therefore provided some problem solving ability and this was demonstrated in their creative and functional self-built shelters from waste materials. It had been proposed to start a TAFE centre to support the project but this did not materialise as explained in sections 4.4.2 and 4.4.3.

Nevertheless, the skills available were adequate and in both sites the low to medium level of technacy established in section 3.6.2 as being a criterion for Community-building Technology was shown to be appropriate.

_Technical Efficiency of Artefacts (first question of thesis)_

As defined by Willoughby (1990) “appropriate technologies” are “artefacts which have been tailored to function as relatively efficient means and to fit the psychosocial and biophysical context prevailing in a particular location and period (i.e. technology which is compatible with its context)”. However, the technical efficiency of an artefact refers merely to its ability “to function as relatively efficient means” and this is all that is necessary for this particular criterion of Community-building Technology. The artefact or process itself upon completion or installation must be able to deliver the service required of it in an efficient manner

Scientific performance testing of two components of the Remote Area Hygiene Facility, the plastic solar water heater and the evapotranspiration trench, was conducted in earlier work by this author (Anda, 1988) and by McGrath, Ho & Mathew (1991) respectively and these were discussed in sections 4.2.3 and 4.2.2 respectively.

Assessment of overall technical performance of the first community-based RAHF at Kalgoorlie was possible after commissioning while building the second and third units, later telephone communication with the Community Coordinator, and then during a visit three and a half years later.

While a fully monitored, community-based performance trial was not conducted on the solar water heater other than that conducted earlier on previous prototypes (Anda, 1988) it
was possible to make on-site assessments such as that it was providing hot water satisfactorily. However, it was evident that the plastics materials used were not able to withstand extended operation at the high temperatures or under continuous operation in ultraviolet radiation. Upon installation of the solar water heaters at Halls Creek their development had progressed only marginally from those at Kalgoorlie. For this prototype assembly operations were trialled at the Remote Area Technology Centre and shown to be feasible for a small number of units. Although more useful field experience was gained, further development should have occurred before any more were deployed in actual communities. Clearly further experimentation was necessary with different plastics materials, and if a suitable material could not be found redesign would have been the next stage.

The pour-flush toilet performed as required at Kalgoorlie. Flushing was effective and as a result of careful and correct use by most residents the cubicle was generally in hygienic condition. User adaptation for cleaning became a problem and is described below. The pour-flush toilets performed even better at Halls Creek where they were installed in Mardiwhah Loop town camp due to the diligent operation and maintenance by the residents.

The evapotranspiration trenches were sized in accordance with prescribed design calculations (McGrath et al., 1991) and requirements under the Health Act. Consequently, given their superior performance to conventional leach drains, which effectively resulted in oversizing, there were no recorded cases of overflowing at either site over several years. This was even the case with the first RAHF being used by a number of individuals and families as was the case with the RAHFs installed at Nanny Goat Hill with flushing toilets.

Taps were "top-of-the-range", ceramic disc, anti-vandal, but even these suffered from worn springs, broken handles and worn discs from intense use and highly mineralised water. Spare parts for these taps were expensive and not available in Halls Creek. With Environmental Health Workers present and able to conduct the required maintenance, common outdoor brass taps may have been more appropriate. Even though more maintenance would be required by these taps the washers, O-rings and complete replacements were available in the local hardware store for use by the EHWs and residents.

The early structural design of the RAHF in 2 metre x 2 metre panels with associated construction jigs worked effectively at Kalgoorlie in the community-based setting with self-built workshop and this was documented in the manual and video. However, the Halls Creek trial RAHF identified the need for a number of design modifications
including sight screens for privacy and wind protection for the doors. This led to the panel approach being abandoned by the Remote Area Technology Centre in favour of cubicles. This improved the efficiency of transport from Hedland to Halls Creek as other components could be packed inside the cubicles. Moreover, smaller size steel was used, and there was no doubling up as in the case of the panels where vertical joints occurred. The cubicles were placed at either end of the 4-metre-long concrete slab, and roof purlins simply spanned between them and upon which the custom orb roof sheeting was installed as well as a simplified structure for the 'Solco' solar water heaters.

AAPA interpreted the experience with the RAHF project at Halls Creek to be unsatisfactory and they decided to look elsewhere for the provision of another five ablutions facilities. Those selected were of standard design installed in a more conventional manner with little community involvement. As discussed in section 2.5.1 of Chapter 2 and section 3.2.2 of Chapter 3, while this approach may more often deliver the required artefacts on the ground within the required timeframe, the higher order outcomes of community and sustainable development are not achieved. The design consultants, however, were an Aboriginal corporation well known in the Kimberley - Northern Building Consultants (NBC). The designs reflected a range of improvements and modern building techniques. However, NBC appeared to have adapted some of the design details from the RAHF. Community preference for the separation of toilet and shower was, however, overlooked. The wastewater disposal technology was not known. Without an innovation or technical research agenda, and with connection to sewer not possible at this site without enormous expense, the convention of septic tanks and leach drain would have been undertaken.

A shortcoming of the RAHF project was not to have collaborated with an architect or builder already successfully engaged by Aboriginal communities. In fact, during initial discussions with RADG, the AAPA had an experienced architect meet the author and review the proposal. If the architect had collaborated on the project some of the problems with design details of the building construction may have been avoided.

In summary, the technical efficiency of the prototype solar water heater was not entirely satisfactory both in terms of the first question of this thesis and the criteria for Community-building Technology. Further research and development should have occurred before multiple field trials. However, both the evapotranspiration trench and pour-flush toilet performed satisfactorily as far as technical efficiency was concerned. Indeed, the former became common practice in place of conventional leach drains in remote Aboriginal housing. ET systems known by the author to have been subsequently installed were at Punmu, Parngurr, Purnulu, Irrungadjji (Nullagine) and were proposed for a number of other sites. The structural design of the RAHF initially suited
the more successful case of Community-building Technology at Kalgoorlie. However, at Halls Creek the approach reflected more of the Regional Technology concept with prefabrication conducted by the Remote Area Technology Centre. However, the distance of separation was perhaps too far between the Centre at South Hedland (Pilbara ‘region’ or Ngarda-Ngarli-Yamdu ATSIC Region) and the site at Halls Creek (East Kimberley ‘region’ or Wiman ATSIC Region). Design modifications were thus an outcome of this change to this broader regional approach.

In future, for this criterion of Community-building Technology to be achieved the desired level of technical efficiency of the artefacts themselves needs to be achieved within the timeframe of the project and the regional organisation supporting the delivery of the artefacts ideally needs to be within what is actually considered to be the ‘region’.

**Capital and Program Costs**

Ideally, capital and program costs should be low for the Community-building Technology model as they were in this project. This is particularly necessary because of the longer time span required in a process involving community participation and strengthening of local organisations – a process yeamed for in so many indigenous communities. This fact is reflected in the statistics for both housing and infrastructure need (Gordon, 1994) and inadequate maintenance capacities (Pholeros et al., 1993). The project costs need to be within the means of the community or regional organisation and ideally not exceed those that would be incurred by using an outside contractor.

To understand the economic value of the project it was useful to compare the RAHF against other ablutions facilities. At the time in 1990 Australian Construction Services offered an ablutions facility for Aboriginal communities comprising a toilet and shower for men, a toilet and shower for women, a common laundry area in the middle and conventional solar water heating. The toilets were the aqua-privy type. The entire facility was supplied and installed for around $40,000. Ablutions facilities by building company Murray River North cost in the order of $30,000 fully installed. The Centre for Appropriate Technology supplied the ATAF comprising shower, laundry, concrete base and chipheater for approximately $2,500. The VIP toilet was supplied for about $1,300. Installing both these facilities in a remote community resulted in a total cost of approximately $9,000. The Remote Area Hygiene Facility with evapotranspiration trench was supplied and installed for approximately $15,000. Providing the RAHF alone in kit-form complete with structure, toilet, shower, chipheater, hand-operated washing machine and solar water heater was valued at around $10,000. Materials alone cost $8,500.
Considerable economic benefit may have been gained at Halls Creek if the RAHF s had been constructed locally without prefabrication at the Remote Area Technology Centre. To this end the "intermediate technology" approach (Schumacher, 1973) would have been appropriate. However, if this approach had been taken it is certain that the Remote Area Technology Centre would not have been so successful for the time that it existed. Indeed, having been awarded the contract to prefabricate the RAHF s was crucial to its establishment and this again underlines the importance of the regional approach outlined in section 3.6.2.

5.1.2 Socio-political Dimension

Learning/problem-solving process

At both sites the cultural and technical learning experiences for the author, RADG and the community participants were a two-way process as described in section 3.2.2. It is an essential requirement that this process is embodied in Community-building Technology. The community participants themselves should identify needs, problems and solutions. The learning component should enable this by implementing a project after this identification and provide design as well as technical skills.

A considerable difficulty for the technology transfer process was that the AAPA made a contract which put the technologist in the position of "building contractors" not "community development technologists" as described in section 2.7. The technologist was not a "partner in development" all the way through. This disabled the community-based action research approach (Stringer, 1996) before outcomes and evaluation were realised. One might assume that a request from a community member for the technology represents an expressed need back in the community. However, in Kalgoorlie extension of technology occurred through the progressive leader open to the use of such innovations (Lantzke, 1988), rather than the town campers being involved throughout the process. The author was only able to interact with the community members after the coordinator had made the arrangements and once the project was under way. It became apparent that although the campers participated intermittently in the construction, they had probably not been involved in early planning with AAPA. Admittedly, this would have been difficult due to their transience and alcoholism affecting many of them.

The author's early departure from the Halls Creek project created discontinuity in a process where patience and perseverance was necessary to gain community support and confidence for community-building. Between the author's departure and the arrival of his replacement (David Ross) a local builder unknown to RADG was used to coordinate site
works, but this led to a number of mistakes in the construction which had to be rectified later, particularly in the construction of the evapotranspiration trench. Close attention had not been given to the design drawings of the construction manual. Aggregate had not been placed around the plastic drum soakwell nor had large enough holes been drilled. This required excavation and reassembly. It became clear though that the drum was probably not an ideal substitute for a proprietary concrete soakwell even though it had a number of advantages. It also became clear that there were a number of design details that needed to be improved upon in the construction manual. Moreover, given RADG's city-base insufficient funds had been budgeted for the recurrent travel necessary. Again this experience revealed that a more satisfactory position in the future would be to collaborate with a reputable builder or architect in the region from the beginning.

In future, for the problem-solving process to come in to play, as is required for Community-building Technology to be achieved, it is still necessary to have technical skills and practical experience within the group process. These skills and experience would most typically reside in the person of technologist or facilitator to the level of a tradesperson, engineer, architect or builder depending on the type of project. This is compatible with a low to medium level of technacy of the overall group process and while it is not essential that this resides with the technologist/facilitator the latter does need to have the personal skills to manage the problem-solving process.

*Community involvement in planning, design, implementation and evaluation*

Community involvement in all phases of the project is an essential requirement of Community-building Technology. This enables the “dynamic interaction” (Willoughby, 1990) to take place between all participants and stakeholders which in turn leads to “technological fit” (the second major element of Willoughby’s (1990) integrated framework”) as discussed in section 3.1.1 and listed in Appendix 3. Community-building Technology enables “technological fit” because the “dynamic interaction” between, at least, the technologist/facilitator and community members is an ongoing process of negotiation that resolves the financial, logistical and technical problems as they emerge. Thus community involvement and the problem-solving process of the preceding discussion are inseparably linked.

At Kalgoorlie, there were parallels with the "technologist", the "facilitator" and the "bureaucrat" models discussed by Miles, Walker and Last (1986). These roles were seen to be roughly as follows:

- Aboriginal Coordinator, Ninga Mia Village - facilitator;
- Statewide Fringedwellers Program Officer, AAPA - bureaucrat;
• Remote Area Developments Group extension worker - technologist.

With these three characters coming together in the early planning stages a number of potential problems were resolved, but a number of factors, such as the aspirations of the residents and specific hygiene behaviours, remained unknown through the project.

This was a pilot project which the bureaucrat (AAPA) trialled as part of a new statewide program. It seemed that the conventional "top-down" (direct welfare provision) and so-called "bottom-up" (via a community organisation) models were abandoned in favour of allowing a "facilitator" (in this case a progressive leader or elite – section 3.2.2) from the community to direct most of the activity. The facilitator was not from the camp of people to be served but from a nearby village. While being from the same Wongatha language group he was not as traditional as the camp members. He spoke confidently with them, although sometimes in an austere manner. He appeared to be accepted by many as their representative, although sometimes begrudgingly. It was never known whether he had decided to select the RAHF through consensus decision-making with the camp members. Given this it is more likely that the bureaucrat's pilot project followed the lines of the conventional "bottom up" model whereby a community organisation, namely the Coordinator and his administrative structure at Ninga Mia Village, were used as an intermediary for smoother lines of communication. Under this scenario it is unlikely that the camp members were involved in the selection of the technology even though Preston had discussed the provision of the services and agreed on the arrangements to be implemented on the site with the community.

All planning for the project was essentially done by the bureaucrat and the facilitator. As a result when the technologist was commissioned to provide the ablutions facilities, he had no direct knowledge of either the camp members views of the RAHF design, their current feelings of camp location or facilities or their aspirations. These were conveyed by the bureaucrat and facilitator. Through observation and discussion further understanding of the conditions had to be gained during the actual implementation of the project on site. Unfortunately, no plans were made for evaluation upon completion, and evaluation undertaken in this section was based on observation, reflection and further site visits for other purposes with export of this information into the ‘grounded theory’ method to be undertaken in the chapter. The project was seen by the facilitator and bureaucrat as an engineering exercise - the provision of sanitation facilities with no hygiene behaviour education nor arrangements for maintenance.

The provision of ablution facilities for the camps was the only physical services planned although later some corrugated iron shelters were provided. The suitability of the shelter
design and location was made evident by the absence of users after their completion. There were no other resources planned as part of a holistic development such as fencing, paving, amenity plantings, furniture and rubbish collection. There were some social services in place such as a breakfast program and health care. It was expected that maintenance and caretaking of the RAHF would be provided by the Coordinator and workers from Ninga Mia Village.

RADG, the technologist, had essentially been running a marketing campaign for the RAHF by having brochures, seminars and demonstration units. These are, no doubt, what initially attracted the bureaucrat and the facilitator and led them to make their choice. It was through this initial development and demonstration phase, where literature review and community visits occurred, that the technologist was able to gain some insights into community needs and design possibilities.

The design process of the technologist was primarily driven by scientific endeavour to produce alternatives that would perform more satisfactorily in the given environmental conditions. It was also believed that cultural factors would be more adequately satisfied through the use of criteria such as small-scale, on-site, simple construction, local materials and the use of existing skills and technologies where possible – the “intermediate technology” approach. The prototype designs were made after evaluation of documented evidence backed up by limited fieldwork but not long term personal experience in the setting for which they were intended. The design process corresponded with ‘user adaptation’ (Agarwal, 1983).

A limited amount of feedback on design weaknesses occurred throughout the process. For example, Preston Thomas and co-workers had pointed out the need for lighting in the camp which was without electrical power. RADG commenced investigation into available solar lights and found that none would be completely reliable for this application. Development of a unit was initiated in collaboration with Murdoch University Energy Research Institute (MUERI). The solar light was ready for trial 6 months later.

At Halls Creek the AAPA failed to secure the support of a key facilitator in the early planning as they had with Preston Thomas in Kalgoorlie. Rather there were several key people who took up representative positions from the Mardiwah Loop community, the Ngunjwah Council resource agency and TAFE. However, their participation dwindled after the initial casual arrangements were made. The reasons for this included the unreliable DEET training wage payments, the inability of the Mardiwah Loop community to sustain an effective management committee, the lack of support staff and resources available at the resource agency, and the withdrawal of TAFE as a formal project partner.
For the remainder of the project over the next two years there was not a prominent individual or group from the community associated with the project to act as a motivator and coordinator. This was then left to the author in the case of the first trial unit, and to David Ross for the installation of all other units.

It was clear from the beginning that there would not be sufficient units constructed for the whole of Mardiwah Loop. This was disheartening for the community and set up competition and factionalism. This also contributed to lack of effective representation from the local stakeholders. Having set these preconditions it became difficult for RADG to mobilise participants continuously for the remainder of the project.

Due to the inability to gain support for local manufacturing the RAHFs were prefabricated in the Remote Area Technology Centre at Pundulmura College and then trucked the 1,300 kilometres to site. However, the Centre failed to deliver the equipment to site in a coordinated fashion and this caused some delays. Moreover, the decision was made to press ahead with prefabrication of additional RAHFs before the feedback from the trial unit had been fully gathered. Consequently, the first several prefabricated units delivered to Halls Creek had to be modified by cutting and rewelding. This lack of coordination arose as a result of the Centre being too far from Halls Creek. It was proposed at one point to send community representatives to the Centre for training and participation in prefabrication but again the distance was too far and it was not possible to organise this. Thus, lack of coordination and community involvement in this aspect of the project highlighted the tension that can emerge between Community-building Technology and Regional Technology, i.e. the Centre was effectively out of the ‘region’ as far as the Regional Technology concept was concerned.

In future, for this criterion of Community-building Technology to be achieved, planning for post-implementation evaluation needs to be included; the project itself should not start until it is certain that full commitment has been gained from all necessary stakeholders to ensure adequate mobilisation of community members; and the regional resource agency supporting the project should be within reasonable distance of the project community – at least within the ‘region’.

**Implementation of trials**

The use of trials via Community-building Technology is a powerful means of ensuring an appropriate mode of technology-practice. Community-building Technology allows participation and assessment by communities with low technacy levels before considering full-scale implementation. Successful adaptation of a new or unfamiliar technical solution provides greater opportunity for empowerment. If the adaptation is unsuccessful but a
sense of ownership of the project is achieved then the experience gained is retained and will be carried forward as a learning experience.

The display unit at Murdoch University, the first production unit at Kalgoorlie, and the first trial unit at Halls Creek were useful in that they allowed the community to make additional preparations and to identify a number of inadequacies in the design. The most notable design change was the preference for the toilet and shower to be at opposite ends of the RAHF for privacy in the event of both of them being used simultaneously. The dissatisfaction of a number of people with the pour-flush toilet resulted in the last three RAHFs out of the nine having conventional flush toilets installed. Stronger winds in Halls Creek resulted in the doors being blown off and called for the use of stronger door hinges. The concern for privacy by these residents, who were more permanent than the Kalgoorlie campers and not alcoholic, resulted in sight screens being added in front of the doors. These also deflected the wind placing less strain on the doors when left open. The trials were not taken far enough though to ensure the reliability of the solar water heater indicating that the technical efficiency of the artefacts is strongly linked to the value of pre-implementation trials.

In future, for this criterion of Community-building Technology to be achieved the implementation of trials needs to be conducted not only to allow community participation in design but also to ensure the artefacts are technically-efficient for the application prior to implementation.

5.1.3 Ethical-personal Dimension

Supports lifestyle and culture

Community-building Technology is sensitive to the current lifestyle, culture and values of the community. Ideally, the technology proposed should not be in conflict with these values. The technology adopted integrates well with community life and its longer term impacts are anticipated.

Various historical factors had led to people living in town camps. The RAHF was an attempt at technological adaptation to lifestyle in these camps. Community-building Technology was an attempt to develop a model for participation and empowerment in this environment. The actual town campers at Kalgoorlie had not been entirely involved and the level of physical participation at Halls Creek had not been high. Nevertheless, while the RAHFs were not ideal technological solutions, they had served as a useful resource, where before there had been none in immediate proximity. There were no other choices,
however, and people’s personal lives were often traumatic - not an ideal situation for relaxed and reflective participation in design development and construction. The difficult and even traumatic lifestyles did not allow the author to clearly understand what the contemporary culture and values of the people were. A methodology to gain this understanding would probably be beyond most technologists, indeed, this is the domain of an anthropologist. Thus, an important role of the facilitator is to be able to understand the community cultural dynamics and communicate these to the technologist where the latter is unable to grasp this alone.

In future, for this criterion of Community-building Technology to be achieved it is essential that strong and effective communication exists between the technologist, facilitator and community members where the technologist does not possess the skills to fully interpret the values and lifestyle of the community.

*Gender aware*

Community-building Technology ensures the equal opportunity participation of men and women where culturally-appropriate. The technology takes account of gender roles and capacities and does not disempower women.

The women at Halls Creek who vetoed the original decision of RAHF location by the male camp leader highlighted the way gender issues can possibly be accommodated in a small-scale, community-based approach to service delivery. In nearly all cases cleaning and some minor maintenance was done by women to the extent that some units were kept in a condition that seemed immaculate in the most difficult social and environmental circumstances. This indicated that design development and construction planning of such facilities should ideally involve women from the start.

*Individual and community empowerment*

A Community-building Technology project seeks to create empowerment of both the individual and the complete community so that the community can be moved to further action to ensure its development, consolidation and improvement of health. Community-building occurs through a process of building confidence in individuals, increasing self-esteem, improving group activities and strengthening community organisations.

A problem that should have been addressed in the planning stage was provision of information or training for the camp residents in correct use, cleaning and maintenance of the RAHF. Nevertheless, the facilities generally appeared to be used and formed part of the camp life in a pattern representative of their mobility. User adaptation to the
equipment seemed to be complete, although the chipheaters were not used extensively. It was not known whether the solar water heater was able to always provide sufficient hot water, people didn't mind cold showers or there was uncertainty about the function of the chipheater.

Later, some ablution facilities were abandoned at Pepper Tree Camp in Kalgoorlie but it was not known whether this was due to dissatisfaction with the site or the usual mobility of town campers. Additional RAHFs were later requested and built at Nanny Goat Hill, another nearby site. The camp was abandoned at one point but, in accordance with their custom, this was due to a camp member's death. These facilities appeared to be well used two years later.

Pour-flush toilets were installed in the first three RAHFs at Kalgoorlie, and seemed to satisfy the residents using them. However, the person responsible for cleaning the ablution blocks knocked the U-bends out, because he found he could then clean them better with the hose.

All the ablution facilities were used communally and apart from cleaning and maintenance done for a short period after completion of the first unit, there was no organised maintenance program. This led to most of them falling into disrepair and unhygienic states. It was evident from the beginning that there would need to be camp workers and cleaners or paid Environmental Health Workers on a permanent basis, particularly in the case of highly transient camps or those used by alcoholics. However, it was not possible to empower community members to do so, nor did negotiations with the State Government lead to the provision of wages for such positions.

The empowerment - pride, confidence, independent initiative - of the individuals involved in the project was quite clear at Kalgoorlie. For Preston and the team the RAHF certainly fulfilled its role as Community-building Technology. As a result of this the team was enthusiastic to embark on the larger initiative to establish a construction company as described in section 4.5. RADG was keen, with the support of others, to act as a technical advisory group for such a venture as proposed by Miles (1985), Lantzke (1988) and more recently by the Race Discrimination Commissioner (1994). However, the necessary establishment funds for the venture could not be secured from DEET or AAPA. Each of the latter was concerned that factionalism may not be overcome, and had recommended for more collaborative arrangements with other Aboriginal organisations in Kalgoorlie before they would consider supporting the initiative. Unfortunately, Preston was only willing to undertake a limited amount of negotiations to this end and the proposal could not be brought to fruition.
Funds and time were not available for the author to embark on the third model of Agarwal (1983) - 'structural transformation' - with the fringedweller community. The campers had clearly adapted their lifestyle around the first ablution facility. With resources and time this could have been developed further to train an Environmental Health Worker for maintenance and domestic hygiene. This person could have been funded as a camp caretaker also. An ongoing development program could have focussed on wider camp improvements to include upgrade of the basic shelters, revegetation, permaculture, children's play equipment, furniture etc.

The Mardiwah Loop residents differed from those in Kalgoorlie town camps in that many of them were from pastoral properties where they had worked and maintained their own households. There was also much less alcoholism amongst these people. Consequently many of the people had built their own shelters and developed house yards to a high standard given the limited finances and materials available. Usage of the RAHF's and adapting lifestyle to its operating requirements was not a problem, and a number of the RAHF's were maintained to a high operating and hygienic standard. RADG encouraged the residents and supportive officials to seek finance for regular septic tank pumpout and to train selected residents in maintenance of equipment to avoid environmental health hazards. Two people joined the EHWTP although this was not sustained. The local EHFSO gave considerable moral support to those interested, but not enough practical support to ensure a satisfactory level of maintenance to health hardware around the Loop.

Mardiwah Loop residents had built their own pit toilets, improved pit toilets with technology provided by RADG, pour-flush toilets with RADG support, and flushing toilets with the support of RADG. Low-flush toilets were offered and conventional modern toilets were built by external contractors. A range of choices were thus made available for evaluation by the residents, but having had previous experience with conventional flush systems these were preferred. Coupled with water supply, water heating and showers the longer term outcomes on health would be important to observe. A survey conducted in the town about two years later had indeed shown improvement in health status.

The achievements in Mardiwah Loop were in many ways less than those of Kalgoorlie. Due to lack of firm organisation in the beginning, no local facilitator, little continuity throughout and minimal community support in the latter stages the sought after "community-building" effect could not be clearly demonstrated. Mardiwah Loop demonstrated technological dysfunction in so many ways, from broken down backhoes to stagnant ponds of water at standpipes. However, each family's living area evidenced a high degree of order, ability for self-build from found objects and domestic hygiene. What was deficient, apart from these people's employment prospects and economic
power, was adequate funding from government to finance the most basic improvements. Also lacking was an integrated effort on the part of regional government agencies and Aboriginal organisations to support the community technological systems of water, wastewater, solid waste, transport and energy. There were fragmented efforts such as the towns' Aboriginal Medical Service offering a daily bus service in and out of Mardiwah Loop for the frail and aged, the HDWA-funded EHFSO offering some environmental health support to the community, and the Shire protesting loudly against State Government inaction. Meanwhile, other organisations such as TAFE, Ngoonjuwah Council (the regional resource agency), and Community Health (HDWA) remained fairly passive in the background. A concerted effort by these organisations to act collectively, perhaps requiring a skilled facilitator to negotiate an agreed plan of action, could have, with additional funding under a DEET or ATSIC program, built a support system for services in Mardiwah Loop along the lines of Community Technology described in Chapter Three. The act of these organisations working together productively in this fashion would correspond with the Regional Technology concept.

Nevertheless, the experience at Mardiwah Loop did demonstrate the impact that a change agent such as RADG could have in this environment, if the project had been managed more effectively on site from the beginning.

In future, to ensure Community-building Technology is fulfilled through this aspect the initial planning needs to ensure that all of the community members concerned fully understand the process and design to be implemented to enable their participation, and that the key stakeholders in the community and region are allied to the project where necessary to provide effective support.

Reconciliation

A higher order outcome of Community-building Technology is to make a contribution to reconciliation between Aboriginal and non-Aboriginal people in the region as a result of it demonstrating positive and constructive interaction as well as civic duty. The involvement of non-Aboriginal personnel, particularly those from urban areas, promotes better understanding of Aboriginal society and an appreciation of the need for social justice in the wider community.

Although Preston was a "progressive elite" (Bunch, 1982; Lantzke, 1988) in Kalgoorlie he was a powerful change agent capable of coordinating activities that involved both Aboriginal and non-Aboriginal stakeholders. Being prominent in the community as a result of these activities his role was exemplary for the "reconciliation" movement and in white-Aboriginal relations for all practical purposes. He enthusiastically took up the
RAHF project and saw this as a beneficial contribution to his broader activities. However, in Halls Creek, there had not been a key individual nor had strengthening of a community organisation occurred thus the demonstration of a reconciliation activity had not been able to occur. Indeed, there were massive race relations problems in Halls Creek which resulted in severe riots in the town in 1995. This is not to say that such key individuals did not exist. In fact, the determination of many led to an Aboriginal woman becoming a town councillor.

In future, it will be necessary to seek the support of a key respected individual in the community or region for the project. This individual, or a group of people, needs to be someone who is regarded highly in the region by both Aboriginal and non-Aboriginal people and therefore it may not be essential for the person to be Aboriginal.

### 5.1.4 General conclusions

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<th>Technical-empirical:</th>
<th>Socio-political:</th>
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<td>Low to medium level of 'techncy' Technical efficiency of artefacts Capital and program costs</td>
<td>* Learning/problem-solving process * Community involved in planning, design, implementation and evaluation Implementation of trials</td>
<td>* Supports lifestyle and culture * Gender aware Individual and community empowerment Reconciliation</td>
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Table 5.2: Criteria Evaluated for Community-building Technology

Each of the criteria have been evaluated for Community-building Technology in at least one of the locations of Kalgoorlie and Halls Creek. In each case what could have been been achieved was clearly articulated. What actually happened in the fieldwork was described in comparison with this. Finally, what should happen in the future in each case where the criteria were not fully satisfied has been explained. However, there have been a number of cases where the criteria could not be completely satisfied for the concept. Nevertheless, in each case, combined with evidence from the literature, the fieldwork has provided sufficient experience to give insights as to what future actions would be necessary to fully constitute Community-building Technology.

For example, it was found that the technologies could be trialed in remote communities, still achieve the community-building effect with some failures, and these failures could be used for adaptation towards better technology. However, while this may apply to the level of technology such as building design it was not a satisfactory approach at a level where research into specific materials of construction was necessary and could not be undertaken by the local community. This is where research would need to be continued

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outside of the Community-building Technology concept, perhaps as part of Regional Technology, by the independent technical support group.

Other examples, include the need to ensure that there is sufficient technical expertise assigned to the project which depends on the project type, and the need to ensure that post-implementation evaluation is planned for the project from the beginning for Community-building Technology to be fulfilled in the future.

There has been sufficient ‘data’ gained from the fieldwork as presented in the preceding section 5.1 to validate the Community-building Technology concept as per the grounded theory methodology.

5.2 COMMUNITY TECHNOLOGY

To reiterate from section 3.6.3 Community Technology is a mode of technology-practice where there is a holistic approach to planning, placement of elements, housing and infrastructure selection and design so that these all operate together in the community as a technically-efficient, ecologically-sound, culturally-compatible ensemble. During the fieldwork it was not possible to establish a complete ensemble of interacting technologies in either of the town camp settings as required for the Community Technology concept. This would have required the design and placement of the RAHFs to occur as part of a broader and integrated settlement upgrade program at a scale not within the scope of a Ph.D. study and possibly at a scale and level of coordination unprecedented in Aboriginal development. However, the RAHF projects and the Feasibility Study (Anda, 1995) were able to provide useful insights on some of the criteria and the following evaluation draws upon these. Further research is necessary to refine and validate the concept of Community Technology in remote Aboriginal communities.

5.2.1 Technical-empirical dimension

Sustainability

Community Technology requires the economic, physical and ecological sustainability whereby its components do not degrade the surrounding environment or deplete the natural resources. The establishment of an integrated ensemble of technologies results in a technically-efficient, low-maintenance, low-energy, ecologically-healthy settlement that can be sustained with lower inputs than a conventionally engineered settlement.
The sustainability of a larger technology ensemble supporting community life could only be evaluated to the extent that the community directed the placement of the RAHFs within each family camp’s shelter system and living environment. In fact, the community appeared to be highly organised and self-disciplined when it came to the selection of family camps which would receive the limited number of RAHFs and then the family group itself determining where the RAHF would be located within the camp. Thus the selection of the site for each RAHF by the family group members was affected by factors that they were aware of such as proximity to different living areas and shelters within the camp, the location of the existing water supply pipeline, and the need to leave room for the evapotranspiration system. No doubt there were cultural factors too. However, beyond this sustainability can only be measured in terms of the discrete RAHF technologies in this study.

The economic sustainability of the RAHFs can be examined in terms of management and maintenance. Their capital costs were shown to be lower than other similar technologies (section 5.1.1) and even when supplied in a “community-building” context overall program costs were competitive. The RAHFs were designed with utmost durability in mind, although the solar water heater failed in this regard, leaving only proprietary items, such as the taps, to deteriorate in the harsh conditions. Management and maintenance of the RAHFs were left to individuals, so while some were kept in excellent condition over a number of years others, combined with incorrect installation, overuse and abuse deteriorated quickly.

The ecological sustainability of the RAHFs can be examined in terms of environmental impact. The greatest environmental liability in this technology would be disposal of wastewaters. Impermeable soils meant that groundwater contamination was unlikely and the evapotranspiration method allowed bush and habitat regeneration to occur.

There was a desperate need for training and employment opportunities in Halls Creek as in many other regional areas with high Aboriginal populations. All of the town enterprises were typically owned and operated by non-Aboriginals. Many non-Aboriginals in the town held more than one job, working day and night. Here, more so probably than in the Goldfields case, there was a need for an Aboriginal building enterprise to provide the many regional communities with their basic infrastructure requirements. This would have also provided much needed training. At the time, of the limited number of local enterprises in the building trades, the reputable contractors were always very busy with both town and remote community projects which demonstrated a market. However, to achieve sustainable development in this town for Aboriginal people in the longer term it would be necessary for "structural transformation" (Agarwal, 1983) that resulted in the local economy being redistributed more equitably in favour of Aboriginal people. In the
Aboriginal people. In the meantime, it would be necessary to secure block funding to a regional Aboriginal organisation that supported services in all the communities so as to achieve Regional Technology.

If the RAHFs had been provided as part of a wider town camp development approach, such as that described in the next section, the interacting technology-practice necessary for an ensemble (see section 3.6.3) may have become evident and its sustainability could have been evaluated.

In future, for this criterion of Community Technology to be fulfilled an ensemble of interacting technologies would need to be established to determine the level of human, economic and energy inputs necessary to sustain it.

**5.2.2 Socio-political Dimension**

### Managed and maintained by community

Community Technology requires that the essential services of the settlement (power, water, sewerage, solid waste, housing, transport, roads) are managed and maintained as an integrated ensemble by the community.

This can be clearly visualised for a discrete remote community where most of the infrastructure is handed over to the ownership of the community once commissioning has been completed. However, in the case of town camps where services may be delivered and owned by the mainstream agencies and utilities arriving at such a scenario will be more complex.

Clearly, there are considerable problems such as land tenure, rateability by local government, requirements under the Health Act, funding from State Government, willingness for the State and Local Governments to accept a proposed model and willingness by the regional Aboriginal organisations to collaborate. The experience of the Tangentyerre Council in Alice Springs showed that these were not insurmountable problems. It requires the dedication of an individual negotiator/facilitator or a cohesive community group over an extended period of time to resolve these conflicts and constraints. While Preston Thomas had the energy and dedication for this task he was not neutral enough for the town's Aboriginal politics. This is where either the State Government has a role through its AAD as an 'enabler' or an independent technical advisory group with an experienced facilitator.
Clearly Ninga Mia Village was not able to cater for all the needs of the town campers both in terms of available resources and cultural compatibility. In Alice Springs it was possible to establish a number of town camps all supported through a single resource agency. This would be necessary in Kalgoorlie and Halls Creek also.

A model begins to emerge from the above as to what may constitute a sustainable form of development in town camps such as those at Kalgoorlie and Halls Creek. The stages for development could thus be:

- Negotiate collaborative arrangement between existing town-based Aboriginal organisations to support town campers with their participation or for them to collectively establish a new resource agency which would, however, require more funds;
- Establish a technical advisory group to support the resource agency;
- Develop community plans with each of the town camps;
- Negotiate land tenure arrangements;
- Agree on infrastructure technology designs that are cost-effective, compatible with the land tenure (e.g. where land tenure was uncertain: kit form housing able to be locally manufactured and compatible with the transient, outdoor lifestyle; on-site wastewater disposal systems instead of connection to town sewer; community scale renewable energy system instead of connection to town mains);
- Establish manufacturing and training centre in conjunction with Kalgoorlie College and TAFE;
- Train Environmental Health Workers with the support of local shire and college;
- Appoint combined caretakers/EHWs to each camp;
- Commence camp development plans.

There should be sufficient flexibility in these arrangements and technologies, so that in the event of a camp no longer being used, such as after a death, the resources and personnel can be directed to the other camps. Otherwise security will be necessary at the camps such as fencing or patrols.

In future, to satisfy this criterion for the town camp setting the above development scenario offers an opportunity to trial the Community Technology concept. For discrete remote communities where it is the norm for community ownership of infrastructure and housing local management and maintenance is only becoming a reality in recent years. The management and maintenance of these settlements upgraded in accordance with the Community Technology concept would be a new development again.
Community ownership

Community Technology requires at least the sense of ownership which can be achieved through Community-building Technology. However, community ownership of the infrastructure itself may be necessary also to satisfy this criterion. Ideally, all infrastructure and management systems dedicated to the community should be owned by the community to allow ongoing self-determining development and maintenance.

The transient nature of the community at Kalgoorlie and the fact that a number of different families used the ablutions block resulted in no sense of ownership. However, the stable family camps at Halls Creek took great pride and care in their units. A lack of sense of ownership in town camps would be exacerbated due to insecure land tenure and proximity to township. The possible benefits of community ownership of complete outstation or town camp services as part of the Community Technology concept could not be demonstrated in the RAHF projects.

In future, it will be necessary to implement a complete settlement upgrade along the lines of Community Technology with community ownership and control to evaluate this criterion.

5.2.3 Ethical-personal Dimension

Health improvement

The improvement of environmental living conditions and community health are essential requirements of Community Technology. Health improvement, either quantifiable or as a state of mind satisfactory to community for physical, emotional and spiritual wellbeing, must be achieved.

The health outcomes can be discussed in relation to the RAHF projects and Community-building Technology concept, but the criterion has been assigned to Community Technology because it is under this concept that health outcomes would in theory be yielded. The Community-building Technology concept on the other hand is concerned with discrete technologies or services.

The author wrote to the Director of Aboriginal Health, HDWA to seek funds and assistance so as to conduct an evaluation of the RAHFs at Kalgoorlie for health outcomes. It was argued that a collaborative, multi-disciplinary approach was necessary. The Director wrote back to advise this would not be possible or necessary, and that the

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HDWA would be able to carry out its own evaluation though this was never done by them.

Health outcomes for the project would be difficult to determine, notwithstanding the highly transient nature of the camp’s population. Moreover, death and injury from vehicle accidents, domestic violence and alcoholism; poor nutrition; hypertension and other causes of morbidity, which were all prominent, masked any improvements in the area of infectious diseases for the small group benefiting from the ablutions facilities within the total population. An evaluation of health outcomes needed to have a plan prior to commencement that identified the beneficiaries and users of the RAHFs and followed their behavioural and medical conditions continually for some time afterwards. This could be a major and costly project, but was a shortcoming of the whole RAHF project in terms of gaining measurable outcomes and has been identified as a problem in other water and sanitation development projects around the world (Blum & Feachem, 1983; Yacoob & Whiteford, 1994). Health outcomes would have become clearer by providing water and sanitation facilities to all town camps, adopting a management and maintenance program and monitoring changes in behaviour and health over a long period of time.

As indicated above a survey conducted at Halls Creek in 1994 had found some improvement in the indicators of Aboriginal health although it was not possible to secure information on this.

In future, to achieve health improvements a complete settlement upgrade that creates an integrated ensemble of sustainable technologies would need to occur in collaboration with the regional Aboriginal Medical Service that monitor health changes over time.

5.2.4 General conclusions

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<td>Capital and operational costs</td>
<td></td>
<td>Health improvement</td>
</tr>
</tbody>
</table>

Not all of the criteria could be evaluated for Community Technology as an integrated ensemble of sustainable of technologies could not be established within the scope of this study. Indeed, there are no settlements in Western Australia that embody the characteristics of Community Technology, however, there may be non-Aboriginal
examples of such settlements in other states that may be able to contribute to further research. In each case what could have been achieved was clearly articulated. What actually happened in the fieldwork was described in comparison with this. Finally, what should happen in the future in each case where the criteria were not fully satisfied has been explained. There has not been sufficient ‘data’ gained from the fieldwork as presented in the preceding section 5.1 to validate the Community Technology concept. However, there have been several cases where the criteria showed some support for the concept in practice. The design and level of technology offered in the RAHF could be sustained in the community, the technology could be managed and maintained, a sense of ownership developed as a result of the community involvement at Halls Creek, and health improvement was also evident at Halls Creek. This preliminary research into the Community Technology concept and evidence from the literature warrants further research being undertaken on this topic.

5.3 REGIONAL TECHNOLOGY

To reiterate from section 3.6.4 the Regional Technology concept is a mode of technology-practice under Aboriginal control within a geographical region of communities. It is primarily concerned with the coordination, selection, trials, delivery and management of technology over a region that includes a number of discrete communities with some common cultural characteristics. The main agent is a regional Aboriginal organisation such as a resource agency that is representative of the communities it serves. The following evaluation is based on evidence from the literature, the field experiences with the Remote Area Hygiene Facility where a wide range of interactions took place with regional agencies, and insights gained from the operations of the Remote Area Technology Centre, Ninga Mia Constructions, a centre at Halls Creek, and the Feasibility Study (Anda, 1995).

5.3.1 Technical-empirical dimension

*Level of Technacy*

High levels of technacy are required in this dimension of technology-practice if the Regional Technology concept is to occur, i.e. if the regional indigenous resource agency is going to be able to successfully support an ongoing series of Community-building Technology projects which would contribute towards the development of a stable Community Technology mode of technology-practice within the communities in its region. To reiterate from section 3.1.1 technacy refers to the ability to interpret the three-
dimensional expression of material forms and spaces in our natural and built environment (Seemann, 1990). This ability is then applied in a community-based problem-solving manner to develop the sustainable shelter systems and infrastructure necessary for each community.

Kalgoorlie and South Hedland were both sizeable regional centres. The established Aboriginal technical services would have access to high levels of technacy by means of employment, voluntary support or consultancies of technically skilled personnel. Such personnel would be available via independent technical advisory groups, utilities, government departments and local consultants. Indeed, the central figures at both locations were continuously interacting with other agencies and individuals in the region for technical support and sponsorship.

In future, the ideal case would be where the regional agency is able to offer communities a high level of technacy support to ensure Community Technology can be implemented and sustained in each discrete community.

'Technate' employees from region

The Regional Technology concept requires ‘technate’ employees ideally from within the region to ensure cultural protocols can be met by the agency in its work with the region’s communities. Local Aboriginal people will already have region-specific cultural and environmental knowledge.

At both locations it was shown that some Aboriginal employees with a low to medium level of technacy could be gained from within the region. It was seen however that a higher level of technacy would need to be developed to ensure the success of the Regional Technology concept. Adequate training could be provided by use of local resources with the support of the Centre for Appropriate Technology initially.

In future, the recruitment of ‘technate’ staff would be required by the regional agency, i.e. those who had gained a sufficient level of technacy such as that accrued through the successful completion of the Certificate in Applied Design and Technology as offered by the Centre for Appropriate Technology in Alice Springs or equivalent. Later this training could be offered directly to regional and community Aboriginal people with a longer term view for their recruitment to the agency operations.
Organisational costs

Under this criterion adequate funds for salaries, travel and overheads need to be sustained to the regional indigenous agency for the long-term if effective support is to be provided to communities using the Regional Technology concept.

The Remote Area Technology Centre demonstrated that costs could initially be offset by receiving administrative support from a college or regional resource agency. The Centre also showed that as part of its ongoing operations goods could be manufactured for sale and consulting services offered so that income was derived from an enterprising approach. The Feasibility Study identified the range of services that needed to be provided by an Aboriginal technical service agency operating as per the Regional Technology concept. The major costs are the administrative support requirements typical of service delivery organisations. Access to direct block funding from the Federal Government or funds from the Local Government Grants Commission by having similar status to a Local Government Authority are two options (Johnston, 1991).

In future, organisational costs would need to be sustained through block funding just as any other local government or statutory authority. However, the opportunity would also emerge to raise funds through enterprise developments.

5.3.2 Socio-political Dimension

Supports multiple communities

The Regional Technology concept is based on the idea that the regional indigenous resource agency supports a number of communities within what is defined to be the ‘region’. The regional organisation comes into greatest effect when providing a service to more than one community and is given the mandate to serve by the communities.

This was not demonstrated at Kalgoorlie or Halls Creek, but at South Hedland a variety of projects were conducted at communities within the region. These included ablutions facilities at Punmu and Drover’s Rest town camp and came about as a direct result of regional commonalities, interactions and linkages with Hedland as the regional service centre. During the Feasibility Study (Anda, 1995) it was evident that a number of Western Australian resource agencies were successfully engaged in a number of community-based projects within their region such as Balingarri Resource Agency being involved in projects with outstations surrounding Warmun (Turkey Creek) in the East Kimberley. It was also evident that lack of unity or agreement on purpose amongst
different Aboriginal groups constituting separate small resource agencies lacking in substantial power within a region will cause conflict between them in seeking to represent discrete communities of the region.

In future, the strength and success of the Regional Technology concept will rely on the smallest possible number of regional resource agencies harmoniously providing services to many communities within the region so as to maximise resources available and ensure their effective deployment to the communities.

*Management, maintenance, training support*

Under this criterion for the Regional Technology concept it is essential that the regional resource agency supporting community development in the region is able to offer all three functions of management, maintenance, and training support where necessary. This support is necessary to the organisational structure of the agency as well as the communities. Institutional strengthening and capacity building for the resource agency will be perhaps the main task to ensure the viable introduction of the Regional Technology concept to Western Australia.

This was not demonstrated at Kalgoorlie, partially demonstrated at Halls Creek through nearly having established TAFE support for the RAHF project in Mardiwah Loop, and quite clearly supported at South Hedland. The Remote Area Technology Centre at South Hedland was able to at least provide training through employment at the Hedland workshops and through community participation during installation in communities. It was certainly identified as being necessary in the Feasibility Study.

The high mobility and turnover of technologists and other staff in Aboriginal affairs and community organisations is detrimental to the longer term goals of community development. There are key people in the field, both government and community, who have the skills, energy and dedication to achieve change and results in the longer term. The development of more of these people needs to be fostered and they need moral and material support over the longer term to sustain their efforts. This is particularly necessary for regional and community organisations where conditions are often harsh and remuneration not commensurate with these, particularly if these are compared with other regional activities such as mining. Therefore, the will may exist for the Regional Technology concept to be realised against adversaries, but for strengthening and sustainability it will need support from government, the private sector and NGOs.

In future, the organisational system of the agency can be supported financially, technically and morally by regional mining companies, government agencies
conventionally involved in the area, and specific NGO's such as RedR (the Institution of Engineers, Australia group "Registered Engineers for Disaster Relief"), Community Aid Abroad and the Overseas Service Bureau.

**Equivalent status to Local Government**

A large regional indigenous resource agency could be block funded in a similar fashion to a Local Government Authority (Allbrook & Kickett, 1994) as described in section 2.4.4 and as recommended in the Royal Commission in Aboriginal Deaths in Custody (Johnston, 1991). Regulatory approvals, for example from Local Government and the Health Department, would be negotiated through a Regional Technology framework rather than Community-building Technology. Evaluation of this aspect of the RAHF projects therefore occurs under this criterion for the case of Regional Technology.

Regulatory approval was obtained for the RAHF's construction from the City of Kalgoorlie-Boulder by completing building and septic tank permit applications and paying the necessary fees. The only requirement was that an outlet from the toilet pit be installed and piped to the ET trench. Beyond this there was little concern from the Shire Environmental Health Officer and Building Surveyor. The Water Authority of WA was also happy to comply with the request for water connections to the site after full fees had been paid. In general, the project experienced a constant tension between research and development of "appropriate technologies", regulations (e.g. the Health Act), and community participation in terms of achieving a balance between each of these constraints.

During 1995 the opportunity arose to visit the camps again. The units at Nanny Goat were functioning but were poorly maintained. The unit at Pepper Tree Camp had not been maintained and had fallen into disrepair. The Silver City Camp nearby had not been used for some time. The needs of the town campers had not been understood in this Camp's establishment, but development had gone ahead here because the land tenure was part of Ninga Mia Village. Nanny Goat Hill and other camps were the preferred sites, but these were Crown land or part mining tenements. Consequently, the RAHFs at Silver City had fallen into disrepair and parts had been stolen by non-Aboriginals.

A visit to the City of Kalgoorlie/Boulder offices had procured correspondence occurring over 1993 and 1994 pertaining to environmental health conditions at Ninga Mia Village and the town camps. During this time following the legal determination that the State Health Act binds the Crown on land held in Aboriginal trust and the election of the new State Government, environmental health had become a highly politicised issue. The
HDWA had undertaken surveys across the state itself and through the shires on Aboriginal communities. The City had completed surveys in the camps and had repeatedly written to Ninga Mia Village to rectify unsanitary conditions and maintenance problems in the Village and camps but, of course, the Village had neither the responsibility, staff nor funds to conduct the required plumbing, electrical and construction trades work. The Council also wrote repeatedly to the AAPA and the various Ministers but as the 1995 visit had shown, apparently to no avail. In the minutes of one particular meeting between AAPA and City representatives (City of Kalgoorlie/Boulder, 1994) the City argued that the State Government was responsible for conditions in the camps and asked AAPA to have a full-time caretaker installed. The AAPA offered to set up a committee to look into the issues!

At Halls Creek septic tank and building permits had been received from the Shire of Wyndham-East Kimberley before the Shire of Halls Creek had its own Environmental Health Officer (EHO). However, when an EHO was appointed by the latter he sought redesign and new approvals for the evapotranspiration systems which caused considerable delays. The WAWA regional plumbing inspector disallowed connection of the chipheaters that had not been installed on the last three or four units as they were not an approved water heating device in Western Australia. Endeavours were made by the Remote Area Technology Centre and RADG to carry out the necessary procedures to gain approvals, but these could not be arranged before the Centre was disbanded.

The Health Department of Western Australia (HDWA) proposed that a State committee be formed to evaluate the development and diffusion of "appropriate technologies". A number of problems were made apparent with the RADG plastic solar water heater and later a commercial plastic unit (Morris-White Pty Ltd) became available that more-or-less satisfied the design criteria originally set by RADG. Unfortunately, this company, along with Rheem, was bought out by Southcorp who later closed down Morris White to market the more conventional solar water heater by Rheem, which did not satisfy the RADG criteria.

From the experience at the Kimberley town a new toilet and sewerage system design became apparent that would probably be satisfactory to the community, environmental and regulatory conditions. This involved modified septic tanks and a new low-flush cistern while retaining the U-bend pan. While the project failed its community-building model, the up-side may be the negotiation with regulatory authorities (e.g. HDWA, WAWA) of designs and manufacturing procedures for the chipheater, evapotranspiration wastewater disposal system, low-flush toilet, solar water heater and structure that satisfy statutory requirements.
However, given the change of government in 1993 this may not occur in the near future. As mentioned in the Kalgoorlie evaluation Aboriginal environmental health became a focus of policy-makers. Legal determination of the scope of the Health Act was found to include Aboriginal reserves. The HDWA sought to implement strategies that would resource local government authorities to fulfil their requirements to Aboriginal communities under the Act, while at the same time searching for a non-compliant local government that it could use as a test case in court. In fact, the Shire of Halls Creek took legal action against the State Government in 1995 over conditions in Mardiwha Loop as did the Shire of Derby-West Kimberley over conditions in Mindi Rardi town camp at Fitzroy Crossing. The outcome was, in fact, that the State Health Act was not binding on Crown land and in this case the Aboriginal Lands Trust (Templeman, 1996).

The above typifies the processes of regulation, legislation and litigation which occur at a scale that often render the participation of Aboriginal people at a community level impracticable. In future, it is through realisation of the Regional Technology concept that Aboriginal organisations could be empowered and resourced to participate in them. From the evaluation of the fieldwork it is evident that Community-building Technology and Community Technology cannot provide the means by which communities can be engaged in such political processes.

5.3.3 Ethical-personal Dimension

This evaluation has been unable to validate the criteria pertaining to the ethical-personal dimension. However, during the Feasibility Study Aboriginal people identified a uniquely Aboriginal and autonomous technical service as being important in service delivery. If the Kalgoorlie or Halls Creek centres had commenced, the management style would have been largely determined by the founding and controlling Aboriginal activists. The aspirations for autonomy with Aboriginal processes of management such as those conducted by the Kimberley Land Council (Rowse, 1992) were thus made apparent in the Feasibility Study. However, because the centres were not established the exact nature and outcome of their management processes could not be compared against Regional Technology.
5.3.4 General conclusions

Table 5.4: Criteria Evaluated for Regional Technology

<table>
<thead>
<tr>
<th>Technical-empirical:</th>
<th>Socio-political:</th>
<th>Ethical-personal:</th>
</tr>
</thead>
<tbody>
<tr>
<td>High levels of 'technacy'</td>
<td>• Supports multiple communities</td>
<td>• Supports lifestyle and culture</td>
</tr>
<tr>
<td>'Technate' employees from region Organisational costs</td>
<td>• Block funding and financial support</td>
<td>Aboriginal regional control</td>
</tr>
<tr>
<td></td>
<td>• Management, maintenance and training support</td>
<td>Organisational culture embodies</td>
</tr>
<tr>
<td></td>
<td>• Coordinates trials and evaluations</td>
<td>Aboriginal ways</td>
</tr>
<tr>
<td></td>
<td>• Equivalent status to Local Govt</td>
<td></td>
</tr>
</tbody>
</table>

The above evaluation has been able to show key criterion have been indirectly satisfied for the Regional Technology concept even though the concept has not been directly correlated with a fully established regional resource agency providing a wide range of services to communities in place of Western Australian State Government agencies. Consequently, there has been sufficient ‘data’ evaluated in this section to validate the Regional Technology concept as per the grounded theory methodology.

Information gained through fieldwork conducted to establish the regional Appropriate Technology centres and the Feasibility Study strongly supported to the Regional Technology concept. During the RAHF projects there were requirements for interaction with a range of agencies, particularly with the Health Department of WA and Local Government Authorities. Such activities would normally, in theory, be conducted via regional Aboriginal technical services, i.e. the Regional Technology concept.

5.4 SYNTHESIS OF THE EVALUATION

Three concepts for technology-practice were developed in Chapter Three. Criteria for their evaluation were presented after a review of literature pertaining to technology assessment. The criteria were presented for each concept under the three dimensions of technology-practice and this allowed a closer inspection of the fieldwork. The fieldwork was described in Chapter Four and generally followed a community-based action research methodology (Reason, 1994; Stringer, 1996). At the beginning of this chapter the table of criteria was summarised and the criteria that could be evaluated from the fieldwork was identified. This essentially follows the ‘grounded theory’ methodology (Strauss & Corbin, 1990).

The RAHF projects at Kalgoorlie and Halls Creek provided a broad enough experience to be able to validate the Community-building Technology concept and evaluate the technical efficiency of the artefacts themselves. The plastic, solar water heater performed
satisfactorily, was able to be assembled in small numbers in a regional workshop, but required further development before it could provide long-term service and go into production. The evapotranspiration wastewater disposal system performed exceptionally well and its installation in numerous other communities commenced. The pour-flush toilet performed as required, but for wider acceptance a new type of cistern needed to be developed. The RAHF went through a series of improvements until the final version was able to satisfy most of the users at the locations installed. In Kalgoorlie the model of Community-building Technology had been demonstrated to be effective amongst the workers of Ninga Mia Village and some fringedwellers. Empowerment, skilling and enhanced sense of community for the work team led into ongoing activities including maintenance.

However, not enough projects were implemented at Kalgoorlie or Halls Creek that could function together as an integrated ensemble to demonstrate Community Technology. Sufficiently extensive fieldwork had not been conducted to enable validation of the Community Technology concept with the criteria of Table 3.2. It would be necessary to conduct fieldwork with a number of essential services (e.g. water supply, sewerage, power supply and food production) simultaneously to understand the interaction between the artefacts, the management systems, the natural environment and the cultural aspects of the community necessary for sustainability. Indeed, the community's views of what constituted "sustainability" would need to be integrated into the concept. If the town camp development model proposed in this study had been accepted by Government and community this may have allowed the design process, community development and introduction of technologies in such a manner as to enable the formation of an integrated ensemble of sustainable technologies. This would have involved the integration of shelter systems, landscape design, food production, energy management, waste management and transport for ecological, economic and cultural sustainability with community-based training, employment, management and maintenance.

The necessary organisational development for Regional Technology could not be achieved at Kalgoorlie or Halls Creek within the scope of the fieldwork. However, the combination of the RAHF projects, the regional Appropriate Technology centre at Pundulmurra College, and the Feasibility Study provided enough experience to evaluate some criteria of the Regional Technology concept in the technical and social dimensions. The advantages of the support possible from a regional resource agency had become evident at both RAHF project sites. The failure to gain their full support throughout had made the project a struggle in Kalgoorlie and left it floundering in Halls Creek. There was a failure in the early planning stages to secure funds for subsequent management, maintenance and building up the construction group into a sustainable Aboriginal technical service that could take on activities including the construction of further RAHFs
for other town camps. The Remote Area Technology Centre at Pundulmurra College demonstrated that a light engineering facility that recruited Aboriginal people could offer a quality service in remote and regional areas. A sufficiently large, regional Aboriginal organisation did not exist to take control of the facility and consequently its continuation as part of an educational institution could not be sustained. It was not possible to evaluate the criteria of the Regional Technology concept in the cultural dimension. This was because it was not possible to establish Aboriginal-controlled regional organisations for technology-practice within the scope of the fieldwork and this prevented evaluation of management and lifestyle outcomes. In future, it will be necessary to work alongside strengthening regional resource agencies to conduct research into these factors. Indeed, this may well become possible as a result of recent developments in Western Australia. The State Government has appointed three regional service providers to undertake the management and maintenance of essential service infrastructure in remote Aboriginal communities in place of the Water Corporation and Western Power. Two of these successful tenders involved the regional indigenous resources agencies Morra Worra Worra for the Kimberley region and Ngaanyatjarra Services for the Central Lands of Western Australia.

This evaluation has shown how difficult it is to gain clear insights into the cultural factors affecting technology-practice. Few criteria could be evaluated under the "ethical-personal" dimension. This is due in part to the fact that evaluation procedures were not included in the early planning of the fieldwork. Moreover, cross-cultural evaluation is difficult for the non-Aboriginal technologist untrained in this area. Further research and development fieldwork would need to include Aboriginal participation in evaluation planning and design of the evaluation methodology.

Nevertheless, some overall general findings have been made in this evaluation for the three concepts that comply with the principles of the ‘grounded theory’ methodology, i.e. sufficient data has been generated and conceptual linkages between the three concepts have been established. Community-building Technology is clearly a powerful process for application in communities. By itself, however, it does not provide a complete nor holistic mode of technology-practice necessary to support the myriad of activities in a discrete settlement. Although Community Technology has not been clearly validated it has been articulated to the extent that its linkages to Community-building Technology and Regional Technology are evident and it will be a critical component of a holistic mode of technology-practice. Regional Technology has been shown to provide an adequate framework within which an holistic and sustainable mode of technology-practice can occur with Community-building Technology and Community Technology as its core components. As per the ‘grounded theory’ method, the limited role of Community-building Technology, and the weakness of findings surrounding Community Technology
in this study, Regional Technology becomes the main ‘theory’ to emerge from this study as a guiding and integrated framework for holistic technology-practice in remote Aboriginal communities.

Future research will be necessary to further elaborate on these findings and to clarify the role and nature of Community Technology. It is hereby proposed that this be undertaken in collaboration with the three new Western Australian regional service providers. A number of possibilities exist as to how this collaboration and research could be undertaken but it would need to done with a two-way mutually beneficial learning process approach. For example, the development of a demonstration community (an outstation) could be established as described by Anda, Mathew & Ho (1998). Alternatively, a settlement upgrade could occur in an existing community such as that proposed for Goodabinya in the Pilbara region by Anda (1998). Another project with which the author is currently involved that will provide further insights is the design development of housing and landscape in collaboration with the community members of Jigalong and Irrungadjji on the edge of Western Desert and other researchers (Alpers et. al., 1998).

The first two proposals would require a large amount of funds and resources allocated to them through an agency such as ATSIC and this has been documented. The third project already has combined ATSIC and State Government funds committed to the upgrade of the total settlement but unfortunately at this stage there is not the vision or knowledge amongst the main government representatives to implement a concept such as Community Technology. The benefits that could be accrued by this community if such a concept was implemented include a reduced dependence on outside sources, reduced recurrent expenditure, health improvement, community empowerment, the development and trial of a range of innovative technologies that would be of benefit to mainstream communities and developing countries, local employment, the development of Jigalong as a major service provider to its surrounding outstations, and a major contribution to the reconciliation process.
CHAPTER SIX

Conclusions and Recommendations

6.1 REITERATION OF THESIS OBJECTIVES

This study has explained that indigenous peoples in Australia are asserting a right to self-determination in terms more far-reaching than those yet endorsed by Australian governments. Self-determination, in theory, should enable Aboriginal people living in isolated settlements to arrive at some point of equilibrium between a highly centralised, intensive infrastructure as in urban areas and their former traditional, nomadic existence. This point will occur in time and space where indigenous Australians are satisfied with the extent to which they can practice their culture. At the chosen equilibrium a level of amenity from modern technology will allow them to fulfil this practice as well as the modern lifestyle practices.

The first question of the study was to examine whether the Remote Area Hygiene Facility (RAHF) was technically appropriate. However, the remote, community-based fieldwork alongside Aboriginal people to install the RAHF using an action research methodology elevated the struggle for self-determination to become a major focus. Indeed, the statement of the problem itself moved beyond issues of lack of basic sanitary facilities, for which the RAHF had been designed. Consequently, three concepts were developed in order to interpret the outcome of the technology with regard to the non-technical issues. This presented an additional question to answer: do the concepts of Community-building Technology, Community Technology and Regional Technology provide a framework for an appropriate mode of technology-practice in remote Aboriginal communities? The general principles of ‘grounded theory’ methodology were adopted to answer this.
6.2 CONCERNING THE TECHNICAL APPROPRIATENESS

The plastic solar water heater had been shown by Anda (1988) and in subsequent prototypes to perform satisfactorily in the short term. However, failure occurred in the medium term due to plastics materials not being able to withstand extended operation in higher temperatures or with ultraviolet radiation. For the final prototype design assembly operations were trialed at the Remote Area Technology Centre and shown to be feasible for a small number of units. Further research and development was necessary to find alternative plastics and if this was not possible redesign would have been the next stage.

The evapotranspiration trench performed exceptionally well, and exceeded the requirements of the State Government as stipulated in the Health Act. The design began to be adapted by others to replace conventional leach drains in remote Aboriginal communities across the state where soils had low permeability.

The pour-flush toilet, although achieving all its technical design objectives, was found to be unacceptable by some camp residents at the second project site – the Mardiwah Loop town camp at Halls Creek. There was intense desire by some to have a conventional white ceramic pan cistern-flush toilet. Modifications were later applied to the second round of RAHF\'s built at Kalgoorlie to satisfy these demands. The preceding appearance described was provided but a complete S-bend was partially eliminated from between the pan and the septic tank to avoid blockages. Research continued to develop an appropriate cistern for flushing the U-bend toilet pan.

The modular panel design of the RAHF structure provided an effective construction solution at Kalgoorlie for the Aboriginal workers with low to medium levels of technacy. However, for the Remote Area Technology Centre with people of higher level technacy and the need to transport prefabricated components long distances with minimum on-site assembly, the design was modified in favour of a cubicle approach. Moreover, the Halls Creek experience showed that toilet and shower separation and sight screens were preferred to enhance privacy in the communal setting.
6.3 CONCERNING THE THREE CONCEPTS

In Kalgoorlie Community-building Technology was demonstrated to be effective amongst the workers of Ninga Mia Village and some fringedwellers. This concept essentially comprised the community's identification of project need; the combined experience of an outside facilitator and technologist, preferably in one person to reduce overheads and coordination difficulties; the mobilisation of community members; and the coordination of the project to conclusion if necessary. The outcomes, however, are not simply the provision of a specific service or artefact. Empowerment, skilling and enhanced sense of community lead into ongoing activities, management, maintenance and organisational development.

As for Community Technology – the integration of technologies in a settlement as an efficient, ecologically-sound, culturally-compatible 'ensemble' - more services were necessary at both the Kalgoorlie and Halls Creek town camps before this effect of an ensemble of mutually supportive technologies could occur. This thesis has thus been unable to confirm the validity of the Community Technology concept. However, a process for development of transient centres to support itinerant fringedwellers such as those at Kalgoorlie was developed. This and other settlement upgrade projects to test the Community Technology concept could be the subject of further research.

The advantages of the support possible from a regional resource agency had become evident at both RAHF project sites. The failure to gain their full support throughout had made the project a struggle in Kalgoorlie and left it floundering in Halls Creek. It was not possible to secure funds for subsequent management, maintenance and building up the construction group into a sustainable Aboriginal technical service that could take on the construction of further RAHFs for other town camps. The sustainability of these developments and the community they served would depend on the community members being part of a strong representative organisation. This organisation would be the regional resource agency or a division thereof and would need support from Government agencies, training providers and consultants to become established and manifest the Regional Technology concept. A fully-fledged, Aboriginal-controlled regional organisation delivering the services currently provided by State and Local Governments in Western Australia had not been allowed to emerge before and during this study. However, the will and determination exists in a number of Aboriginal organisations to take on this level of autonomy, and, indeed, this capacity has been demonstrated by a number of Central Australian organisations. The Regional Technology concept could be studied further through a range of projects in collaboration with
these latter organisations as well as through emerging developments in service delivery in Western Australia.

Community-building Technology is clearly a powerful process for application in communities. By itself, however, it does not provide a complete nor holistic mode of technology-practice necessary to support the myriad of activities in a discrete settlement. Although Community Technology has not been clearly validated it has been articulated to the extent that its conceptual linkages to Community-building Technology and Regional Technology are evident and it will be a critical component of a holistic mode of technology-practice. Regional Technology has been shown to provide an adequate framework within which an holistic and sustainable of technology-practice can occur with Community-building Technology and Community Technology as its core components. In accordance with the ‘grounded theory’ method Regional Technology becomes the main ‘theory’ to emerge from this study as a guiding and integrated framework for holistic technology-practice in remote Aboriginal communities.
6.4 FINAL CONCLUSIONS & RECOMMENDATIONS

(i) The plastic, solar water heater performed satisfactorily, was able to be assembled in small numbers in a regional workshop, but required further development before it could provide long-term service and go into production.

(ii) The evapotranspiration wastewater disposal system performed exceptionally well and exceeded Health Department requirements.

(iii) The pour-flush toilet performed as required, but for wider acceptance a new type of cistern needed to be developed.

(iv) The RAHF went through a series of improvements until the final version was able to satisfy most of the users at the locations installed.

(v) The Remote Area Technology Centre at Pundulmurra College demonstrated that a light engineering facility that recruited Aboriginal people could offer a quality service in remote and regional areas. A sufficiently large, regional Aboriginal organisation did not exist to take control of the facility and consequently its continuation as part of an educational institution could not be sustained.

(vi) Community-building Technology is demonstrated where community members are mobilised, trained and empowered to implement practical projects for the provision of their community's essential services. The Kalgoorlie RAHF project was able to demonstrate this concept. It can be integrated into CDEP, the Homeswest Management Support Program, other existing service delivery programs, and is an essential component of Regional Technology.

(vii) Community Technology is demonstrated where sustainable technologies are designed and deployed to act as an integrated ensemble in a discrete community. The concept could not be validated within the scope of research work for this thesis. Nevertheless it has been shown to be another essential component of Regional Technology. Discussions need to be undertaken with remote communities and regional organisations to determine whether trials can be undertaken. For example, the town camp development process or design and implementation of a settlement upgrade could be proposed.
(viii) Regional Technology is demonstrated where a regional Aboriginal organisation, an Aboriginal technical service, is established to provide technology trials, delivery, management and maintenance for a collection of communities. The experience in Central Australia, the work of the Remote Area Technology Centre, the aspirations of a number of regional Aboriginal organisations in Western Australia and the discussions held during the Feasibility Study are sufficient to conclude that the concept will provide an holistic mode of technology-practice with the initiative of Aboriginal organisations, and that they should be supported in these endeavours. Discussions need to be undertaken with regional organisations to determine whether collaboration with RADG can occur for further research.

(ix) Regional Technology is the main theory to be validated in this study in accordance with 'grounded theory' principles. Regional Technology provides an integrated framework for establishment of an holistic mode of technology-practice in remote Aboriginal communities with Community-building Technology and Community Technology conceptually linked as its core components.
6.5 RECOMMENDATIONS FOR FURTHER RESEARCH

(i) Further research and development is needed on specific technologies for the conditions of remote Aboriginal communities, e.g. the plastic solar water heater, desalination processes, revegetation techniques, removal of hardness from water, the water supply bacteriological test kit, modified septic tanks, energy efficient housing, and local food production. The Community-building Technology concept can be applied as an action research approach to community-based technology development.

(ii) Further research is necessary to investigate the Community Technology concept. This should be conducted in partnership with a regional Aboriginal organisation to implement the town camp development process or the deployment of a number of sustainable technologies in a small community.

(iv) In 1998 the WA State Government announced the successful tenders for the three new regional service providers for management and maintenance of power, water and sewerage infrastructure in the state’s remote Aboriginal communities. One was an indigenous regional organisation already providing services to the Central Lands, the second was another regional indigenous organisation in partnership with a non-Aboriginal private consulting firm, and the third was a non-Aboriginal contracting firm that had agreed to seek collaboration with regional indigenous organisations as per the tender requirements. Overall program manager for the statewide activities appointed by the WA Government was Ove Arup consulting engineers. The mode of technology-practice that emerges in this new arrangement will make a most worthy study and should be taken up as soon as possible.
AUTHOR'S POSTSCRIPT

It is necessary for governments and service providers to achieve multiple outcomes rather than just providing shelter or ablutions facilities. Regional Aboriginal organisations and RADG need to convince government agencies that more resources are necessary to achieve the longer term Appropriate Technology and community development goals. The provision of a larger amount of funding in the short term will be compensated by reduced funding for solving crises in the future.

At times the issue of the willingness of the mainstream community to accept continued funding to Aboriginal communities is raised. However, not only does the current level of funding of some $1 billion per annum need to be continued, but an additional $2 billion has been estimated as being necessary to meet the backlog of demand for housing and infrastructure and rectify the disadvantage in this area (Gordon, 1994). The challenge will be to convince the electorate, Parliament and the Budget Estimates Committee of this need and to remove misunderstandings about special privileges available to Aboriginal people. "There are many myths current in the general Australian society today that to some extent have replaced the stereotypes of the past. While many of these stereotypes still exist, the new myths relate to the 'privileges' available to Aboriginal people... In view of the general picture of Aboriginal disadvantage, those new myths are remarkably curious" (Johnston, 1991).

Administrative procedures need to be developed that achieve accountability with the minimum of effort. Performance indicators are desirable for both sides. "Aboriginal people have just as much interest as the funders in ensuring that funds are applied to best advantage and that needs are properly identified and are being met with some sense of priorities" (Johnston, 1991).

In the earlier periods of assimilation and integration government programs actively forced indigenous Australians to adopt white Australian codes of conduct and technology. Today indigenous people are confidently asserting their cultural attributes while demanding greater but selective access to the goods and services of modern technological mainstream society to improve their health and quality of life. This will inevitably shift indigenous cultural values towards modern Western values. It is ironic that governments today are resisting these demands of self-determination.

Regional Technology offers a process whereby funds for essential service delivery can be allocated and managed by Aboriginal people to achieve the desired project outcomes in
communities without the overheads associated with large, centralised bureaucracies. Community Technology becomes the outcome; the point along the continuum sought by each particular community; an ensemble of sustainable technologies. Community-building Technology is the localised, community-based approach to technology-practice that delivers a specific essential service in the community. In the process Community-building Technology provides skilling, empowerment and a better understanding of where people want to be on the continuum between centralised, control-oriented technology-practice and small-scale, people-centred approaches to development.
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APPENDIX ONE
<table>
<thead>
<tr>
<th>Year</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>Commence research and development of a plastic solar water heater; Conference on Science &amp; Technology for Remote Aboriginal Communities at Murdoch University;</td>
</tr>
<tr>
<td>1989</td>
<td>Construction of research RAHF at Murdoch University; Workshop on Water Supply, Water Use and Waste Disposal in Remote Communities at Murdoch University and RAHF inauguration;</td>
</tr>
<tr>
<td>1990</td>
<td>Evaluation of community development project at Nullagine; Commencement of Appropriate Technology Development Unit; Visits to Coonana and Punmu with Dr Bruce Walker for HREOC National Water Study; Conference on Technology for Community Development in Australia, South East Asia and the Pacific at Alice Springs; Construction of research RAHF at Newman; Installation of pit toilets at Puma Jina camp, Newman; Initiation of Pundulmurra Plant Nursery; Installation of 4 RAHF's at Kalgoorlie;</td>
</tr>
<tr>
<td>1991</td>
<td>Installation of 4 RAHF's at Kalgoorlie continues; Installation of first RAHF at Mardiwh Loop, Halls Creek; Initiation of Remote Area Technology Centre at Pundulmurra College; Visits to Doomadgee and Torres Straits with Dr Bruce Walker for HREOC National Water Study; Commencement of 10 RAHF's at Halls Creek; Course Coordinator, Environmental Health Worker Training Program, Pundulmurra College, South Hedland; Workshop on Appropriate Technology for Environmentally Sustainable Development at Murdoch University for ASEAN delegates; Ivomec/Covian dog injection trials in Pilbara communities; Water supply test kit trials in Pilbara communities; Construction of demonstration RAHF at Pundulmurra College; Public Health Association of Australia Conference on Aboriginal Health at Alice Springs; Conference on Environmental Health in Developing Communities at Pundulmurra College, South Hedland;</td>
</tr>
<tr>
<td>1992</td>
<td>Course Coordinator, Environmental Health Worker Training Program, Pundulmurra College, South Hedland; ATSIC Ngarda-Ngarli-Yarnu Regional Plan Consultancy; Improvements to Halls Creek RAHF's and construction of pit toilets;</td>
</tr>
<tr>
<td>1993</td>
<td>ATSIC Ngarda-Ngarli-Yarnu Regional Plan Consultancy continues; WHO Travel Fellowship to study water, sanitation &amp; environmental restoration programs in the Americas;</td>
</tr>
<tr>
<td>1994</td>
<td>Conference on Technology Transfer in Remote Communities at Murdoch University; Inauguration of the Environmental Technology Centre; Pundulmurra College EHWTP Business Plan Consultancy;</td>
</tr>
<tr>
<td>1995</td>
<td>RADG &amp; Advisory Committee Planning Workshop; ATSIC consultancy: Feasibility study to conduct regional workshops on Appropriate Technology; 4th International Symposium on the Role of Universities in Developing Areas, RMIT, Melbourne. Kimberley and Midwest Environmental Health Workers graduate at Murdoch University after RADG AT module at Environmental Technology Centre.</td>
</tr>
</tbody>
</table>
APPENDIX TWO
For communities in this area, please refer to Map 2 in this set of 2.
Kimberley Region - Aboriginal Communities

Last Update: August 1995
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## Aboriginal Resource Agencies in WA

<table>
<thead>
<tr>
<th>Region</th>
<th>Location</th>
<th>Services Offered</th>
<th>Communities Serviced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joorook Ngarni Aboriginal Corporation</td>
<td>East Kimberley</td>
<td>Administration, bookkeeping, grant applications</td>
<td>Town reserve, Kalumburu, Oombulgari</td>
</tr>
<tr>
<td>Waringarri Resource Centre (since 1984)</td>
<td>East Kimberley</td>
<td>Administration, bookkeeping, community devlmt, alcohol, media, nursery, arts, constrctn, language</td>
<td>Mirima, Darlu Darlu, Alligator Hole, etc.</td>
</tr>
<tr>
<td>Balangarri Aboriginal Corporation</td>
<td>East Kimberley</td>
<td>Administration, bookkeeping, grant applications</td>
<td>Warmun</td>
</tr>
<tr>
<td>Ngunjuwah Council</td>
<td>East Kimberley</td>
<td>Accounts, auditing, coordination of funding, basic essential service delivery, some road maintenance.</td>
<td>Mardiwhah Loop, Lundja, Nicholson town camp, etc,</td>
</tr>
<tr>
<td>Marra Worra Worra (since 1978)</td>
<td>West Kimberley</td>
<td>Administration, bookkeeping, income payments, land claims, planning, infrsrctre devpment, training, cultural initiatives, business operation, road maintenance</td>
<td>Jimbalakadunj, Bayulu, Wangkajungka, Ngalingkadji, Yiyili, etc.</td>
</tr>
<tr>
<td>Winun Ngari Resource Centre</td>
<td>West Kimberley</td>
<td>Administration, bookkeeping, grant applications, infrastructure development, planning, training</td>
<td>Mowunjam, Kupangari,</td>
</tr>
<tr>
<td>Mamabulanjin Resource Agency</td>
<td>Dampierland Peninsula</td>
<td>Administration, bookkeeping, grant applications</td>
<td>Beagle Bay, Djarindjin, many outstations</td>
</tr>
<tr>
<td>Port Hedland Regional Aboriginal Corporation</td>
<td>Pilbara</td>
<td>Administration, bookkeeping, grant applications</td>
<td>Tjalka Boorda, Anderson Street, town households,</td>
</tr>
</tbody>
</table>
### Bloodwood Tree Association

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilbara</td>
<td>Administration, bookkeeping, grant applications</td>
</tr>
<tr>
<td>South Hedland</td>
<td>Drovers Rest, itinerant fringdwellers,</td>
</tr>
</tbody>
</table>

### Pilbara Meta Maya Board Aboriginal Corporation (since 1996)

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilbara</td>
<td>Administration, bookkeeping, housing construction supervision, rental housing</td>
</tr>
<tr>
<td>Port Hedland</td>
<td>technical advice, training, database, maintenance and management</td>
</tr>
<tr>
<td></td>
<td>Town houses and remote communities throughout region.</td>
</tr>
</tbody>
</table>

### Western Desert Puntukurnuparna Aboriginal Corporation

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western</td>
<td>Administration, bookkeeping, grant applications, environmental health, land claims</td>
</tr>
<tr>
<td>Desert/</td>
<td>Jigalong, Punmu, Parngurr, outstations</td>
</tr>
<tr>
<td>East Pilbara</td>
<td></td>
</tr>
<tr>
<td>Port Hedland</td>
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### Ngarin Resource Centre

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Pilbara</td>
<td>Administration, bookkeeping, grant applications</td>
</tr>
<tr>
<td>Roebourne</td>
<td>Cheeditha, town households, Ngurrawaana</td>
</tr>
</tbody>
</table>

### Karijini Aboriginal Corporation

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Pilbara</td>
<td>Administration, bookkeeping, grant applications, ecotourism</td>
</tr>
<tr>
<td>Onslow</td>
<td>Wakathuni, Youngaleena</td>
</tr>
</tbody>
</table>

### Kuwinywardu Aboriginal Resource Unit

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gascoyne</td>
<td>Administration, bookkeeping, grant applications</td>
</tr>
<tr>
<td>Carnarvon</td>
<td>Communities Serviced</td>
</tr>
</tbody>
</table>

### Murchison Regional Aboriginal Corporation

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murchison</td>
<td>Land acquisition, health promotion, housing management</td>
</tr>
<tr>
<td>Geraldton</td>
<td>Communities Serviced</td>
</tr>
</tbody>
</table>

### Miniarra Resource Agency

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midwest/North</td>
<td>Administration, bookkeeping, grant applications</td>
</tr>
<tr>
<td>Goldfields</td>
<td>Communities Serviced</td>
</tr>
<tr>
<td>Meekatharra</td>
<td></td>
</tr>
</tbody>
</table>

### Marruwayura Aboriginal Corporation

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midwest/North</td>
<td>Administration, bookkeeping, grant applications</td>
</tr>
<tr>
<td>Goldfields</td>
<td>Communities Serviced</td>
</tr>
<tr>
<td>Wiluna</td>
<td></td>
</tr>
</tbody>
</table>

### Eastern Goldfields Aboriginal Resource Agency

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern</td>
<td>Administration, bookkeeping, grant applications, training, community stores, land</td>
</tr>
<tr>
<td>Goldfield</td>
<td>issues</td>
</tr>
<tr>
<td>Kalgoorlie</td>
<td>Town households, town camps, Cosmo Newberry</td>
</tr>
</tbody>
</table>
### Leonora Aboriginal Movement Body

<table>
<thead>
<tr>
<th>Eastern Goldfield</th>
<th>Leonora</th>
<th>Administration, bookkeeping, grant applications</th>
<th>Communities Serviced</th>
</tr>
</thead>
</table>

### Esperance Aboriginal Corporation

<table>
<thead>
<tr>
<th>Southeast</th>
<th>Esperance</th>
<th>Administration, bookkeeping, grant applications</th>
<th>Communities Serviced</th>
</tr>
</thead>
</table>

### Wheatbelt Aboriginal Corporation

<table>
<thead>
<tr>
<th>Wheatbelt</th>
<th>Northam</th>
<th>Administration, bookkeeping, grant applications</th>
<th>Communities Serviced</th>
</tr>
</thead>
</table>

### Southern Aboriginal Corporation (since 1983)

<table>
<thead>
<tr>
<th>Great Southern</th>
<th>Albany</th>
<th>Housing maintenance and management, training, farm management, health promotion.</th>
<th>ATSIC Kaatanyiny region within Albany, Brookton, Hyden, Ravensthorpe.</th>
</tr>
</thead>
</table>
APPENDIX THREE
Technology-related Nomenclature (Willoughby, 1990)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition / Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;technology&quot;</td>
<td>The ensemble of artefacts intended to function as a relatively efficient means.</td>
</tr>
<tr>
<td>&quot;technology-practice&quot;</td>
<td>The ensemble of operations, activities, situations or phenomena which involve technology to a significant extent.</td>
</tr>
<tr>
<td>&quot;technological&quot;</td>
<td>A term used to qualify operations, activities, situations or phenomena which involve technology to a significant extent (i.e. the adjectival form of &quot;technology-practice&quot;).</td>
</tr>
<tr>
<td>&quot;technical&quot;</td>
<td>The adjective or adverb used to qualify phenomena (either human or non-human) dedicated to efficient, rational, instrumental, specific, precise and goal-oriented operations.</td>
</tr>
<tr>
<td>&quot;technicity&quot;</td>
<td>The distinguishing factor or quality which makes a phenomenon technical (i.e. the noun equivalent of &quot;technical&quot;).</td>
</tr>
<tr>
<td>&quot;technique&quot;</td>
<td>Human skill which involves a significant technical element.</td>
</tr>
<tr>
<td>&quot;technological science&quot;</td>
<td>The scientific study of technical matters, or scientific practice which involves a significant amount of technology.</td>
</tr>
<tr>
<td>&quot;appropriate technology&quot;</td>
<td>Artefacts which have been tailored to function as relatively efficient means and to fit the psychosocial and biophysical context prevailing in a particular location and period (i.e. technology which is compatible with its context).</td>
</tr>
<tr>
<td>&quot;Appropriate Technology&quot;</td>
<td>A mode of technology practice aimed at ensuring that technology is compatible with its psychosocial and biophysical context. The term may also be used to denote the general concept, social movement or innovation strategy associated with this mode of technology-practice.</td>
</tr>
</tbody>
</table>
### Major Element

<table>
<thead>
<tr>
<th>Sub-notion</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three dimensional view</td>
<td>Technical-empirical</td>
</tr>
<tr>
<td>Socio-political</td>
<td></td>
</tr>
<tr>
<td>Ethical-personal</td>
<td></td>
</tr>
<tr>
<td>Technological fit</td>
<td>Compatibility and dynamic interaction between:</td>
</tr>
<tr>
<td></td>
<td>Technological means and</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Technological niche</td>
</tr>
<tr>
<td>Corollaries of AT</td>
<td>Non-neutrality of technology</td>
</tr>
<tr>
<td>Technology as a determining factor</td>
<td></td>
</tr>
<tr>
<td>Heterogeneity of technology</td>
<td></td>
</tr>
<tr>
<td>Technological context</td>
<td></td>
</tr>
<tr>
<td>Technology choice</td>
<td></td>
</tr>
<tr>
<td>Control of technology</td>
<td></td>
</tr>
<tr>
<td>Technology assessment</td>
<td></td>
</tr>
<tr>
<td>Local focus in technology-practice</td>
<td></td>
</tr>
<tr>
<td>Endogenous technological development</td>
<td>Endogenous innovation</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Economic self-reliance</td>
<td>Not necessarily self-sufficiency but not dependency</td>
</tr>
<tr>
<td>Community development</td>
<td>Balance between top and bottom</td>
</tr>
<tr>
<td>Technological mix</td>
<td>Promote range of skills for sustainability.</td>
</tr>
</tbody>
</table>

**Practical holism**

| Radical critique                       | Address root cause, question *status quo*, structural perspective, interrelatedness |
| Human compatibility                    | Both subjective and objective, psychosocial and biophysical          |
| Environmental compatibility            | Efficient use of natural resources; Re-use and recycle; Local resources; Minimise environmental impact; Renewable resources; Low-pollution, renewable-resource economy. |
| Integrated problem solving             | Systems approach to analysis, single element can serve numerous functions |

Technology Choice: A critique of the Appropriate Technology movement.
Kelvin W. Willoughby (1990)
## Characteristics of Modes of Development (from Walker, 1994)

<table>
<thead>
<tr>
<th></th>
<th>Control Oriented</th>
<th>Community Centred</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nature</strong></td>
<td>Authoritarian</td>
<td>Consultative</td>
</tr>
<tr>
<td></td>
<td>Centralised</td>
<td>Localised</td>
</tr>
<tr>
<td></td>
<td>Accountable to Government</td>
<td>Accountable to community</td>
</tr>
<tr>
<td></td>
<td>Project oriented</td>
<td>Process oriented</td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>Small</td>
</tr>
<tr>
<td><strong>Needs</strong></td>
<td>Rigid time frames</td>
<td>Flexible time frames</td>
</tr>
<tr>
<td></td>
<td>Fixed procedures</td>
<td>Flexible Procedures</td>
</tr>
<tr>
<td></td>
<td>Regular reporting</td>
<td>Flexible Reporting</td>
</tr>
<tr>
<td></td>
<td>Quantifiable Performance Indicators</td>
<td>Qualitative Performance Indicators</td>
</tr>
<tr>
<td></td>
<td>Big Budget</td>
<td>Low Budget</td>
</tr>
<tr>
<td></td>
<td>Bureaucratic Control</td>
<td>Community Control</td>
</tr>
<tr>
<td><strong>Goals</strong></td>
<td>Predetermined</td>
<td>Evolutionary</td>
</tr>
<tr>
<td></td>
<td>Economic Optimisation</td>
<td>Social Optimisation</td>
</tr>
<tr>
<td><strong>Modes of thought</strong></td>
<td>Analytical</td>
<td>Intuitive</td>
</tr>
<tr>
<td></td>
<td>Reductionist</td>
<td>Holistic</td>
</tr>
<tr>
<td></td>
<td>Conscious, deliberate</td>
<td>Experiential, Contextual</td>
</tr>
<tr>
<td></td>
<td>Compartmentalised</td>
<td>Integrated</td>
</tr>
<tr>
<td></td>
<td>Standardised</td>
<td>Diverse</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>Hierarchical</td>
<td>Overlapping Authority</td>
</tr>
<tr>
<td></td>
<td>Top Down</td>
<td>Bottom Up</td>
</tr>
<tr>
<td><strong>Activities</strong></td>
<td>Formal</td>
<td>Informal</td>
</tr>
<tr>
<td></td>
<td>Economic Analysis</td>
<td>Social and Cultural Analysis</td>
</tr>
<tr>
<td></td>
<td>Administrative</td>
<td>Political</td>
</tr>
<tr>
<td></td>
<td>Technological Focus</td>
<td>People Focus</td>
</tr>
<tr>
<td></td>
<td>Financial Accountability</td>
<td>Financial Management</td>
</tr>
<tr>
<td><strong>Personnel</strong></td>
<td>Formally Qualified</td>
<td>Limited Formal Schooling</td>
</tr>
<tr>
<td></td>
<td>Urban Based</td>
<td>Rural based</td>
</tr>
<tr>
<td></td>
<td>High Level of Technical Competence</td>
<td>Modest Technical Competence</td>
</tr>
<tr>
<td></td>
<td>Specialist</td>
<td>Generalist</td>
</tr>
<tr>
<td><strong>Ethos</strong></td>
<td>Apply Constraints</td>
<td>Foster Capabilities</td>
</tr>
<tr>
<td></td>
<td>Stability</td>
<td>Change</td>
</tr>
<tr>
<td></td>
<td>Standards of Living</td>
<td>Quality of Life</td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
<td>Higher Output</td>
<td>Better Society</td>
</tr>
<tr>
<td></td>
<td>Efficiency</td>
<td>Efficacy</td>
</tr>
<tr>
<td><strong>Training</strong></td>
<td>Structured/Accredited/Formal</td>
<td>Flexible Adaptive/Informal/Task Oriented</td>
</tr>
<tr>
<td><strong>Evaluation</strong></td>
<td>Did Outputs Match Inputs</td>
<td>Did People Achieve Outcomes</td>
</tr>
</tbody>
</table>
## Criteria for a Technology to be Appropriate (Francis & Mansell, 1988)

<table>
<thead>
<tr>
<th>Technical</th>
<th>Social</th>
<th>Economic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using local materials and power sources.</td>
<td>Involving the local people as possible in its development and introduction (ideally, responding to a locally felt need);</td>
<td>Being in line with the general requirement that for productive industry, investment per workplace should be limited to about five times the per capita income per annum, and for other uses should be as low in investment and running costs as possible;</td>
</tr>
<tr>
<td>Where possible, making use of and building on locally understood technologies.</td>
<td>Using existing or easily developable skills and avoiding difficult, costly or time-consuming retraining;</td>
<td>Minimising in particular the need for investment requiring hard currency;</td>
</tr>
<tr>
<td>Again where possible, using techniques already proven locally or elsewhere, to avoid failures for technical reasons;</td>
<td>Offering on a continuing basis, greater or expanding job prospects;</td>
<td>Yielding a product competitive in price with that resulting from the alternative choices of technology;</td>
</tr>
<tr>
<td>If the aim is a product, ensuring that it is produced in acceptable but not unnecessarily high quality, and in quantities adequate for the intended market, existing or potential; that it is reliable in operation, low in maintenance costs, and simple to repair; and that transport facilities for bringing it to consumers are adequate;</td>
<td>Creating jobs with intrinsic interest, as far as possible;</td>
<td>Ensuring that the use of the investment is compatible with local, regional and national development plans;</td>
</tr>
<tr>
<td>Where appropriate, ensuring that local requirements of climate and geography are met.</td>
<td>Minimising the need for the movement of labour;</td>
<td>Integrating the producers more into the national monetary system;</td>
</tr>
<tr>
<td></td>
<td>Encouraging regional and rural development;</td>
<td>Ensuring that the main economic goes to the people concerned as a whole, and not to a new class of middlemen, or to foreign investors.</td>
</tr>
</tbody>
</table>
APPENDIX FOUR
Town camps at Kalgoorlie near Ninga Mia Village
Town camps around Halls Creek
Layout of blocks at Mardiwah Loop