

Remote Area Building and Sustainable Development

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Figure 1: Gundjehmi Aboriginal Corporation office, Jabiru, NT, by Build Up Design
(photo Simon Scally)

ABSTRACT

This note discusses approaches to sustainable design in remote, rural and regional areas.

Compared with urban settings, remote locations involve substantial environmental and financial penalties in establishing, maintaining and operating buildings, infrastructure and connected services.

On the other hand, working out bush can be very liberating. Unencumbered by neighbouring development and obligatory connections to services, there are opportunities to develop autonomous site specific solutions with positive environmental and social benefits.

The essential requirement is that the project's clients and end-users are engaged in design and delivery, as they are in the best position to decide what they require and what they are able to sustain in the long term.

Introduction

The advantages of building in remote locations is that it is often easier to achieve a positive sustainable outcome than in an urban or less remote location. The main factors that influence these outcomes are the same as elsewhere – client influence and cost.

In contrast to some developers who seek quick development and sale for profit, clients in remote areas, particularly Aboriginal people, farmers and pastoralists, often have a long-term commitment to the place and its preservation. They have often been born in the place and have a duty to look after it before passing the responsibility on to their children.

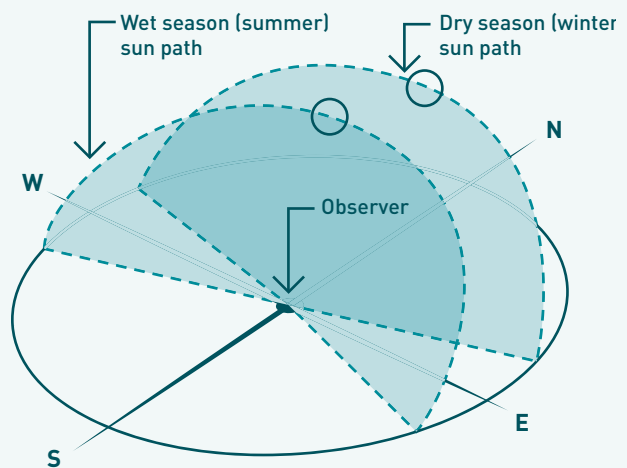
The heavy responsibility of this custody of the land leads to a “cradle to grave” approach to development, which requires a thorough investigation of development implications. This approach looks at the life-cycle implications of construction decisions, the clients’ ability to manage and fund the building’s operation, maintenance, waste disposal and power consumption. Ultimately it must take into account the building’s disposal or conversion at the end of its life.

Compared with urban settings, remote locations involve substantial environmental and financial penalties in establishing, maintaining and operating buildings, infrastructure and connected services. The small population base with few or no specialist skills can mean that standard trades like plumbers and electricians need to be transported to site. Materials that cannot be sourced locally require transportation to the site. Maintenance of assets outside the owner’s skills or which are dependant upon specialists incur an ongoing penalty which is compounded by the costs associated with transporting materials and labour long distances by road or sea. While it is usual to quantify these costs in financial terms, the environmental cost, with a transportation system dependant upon fossil fuel, is also high.

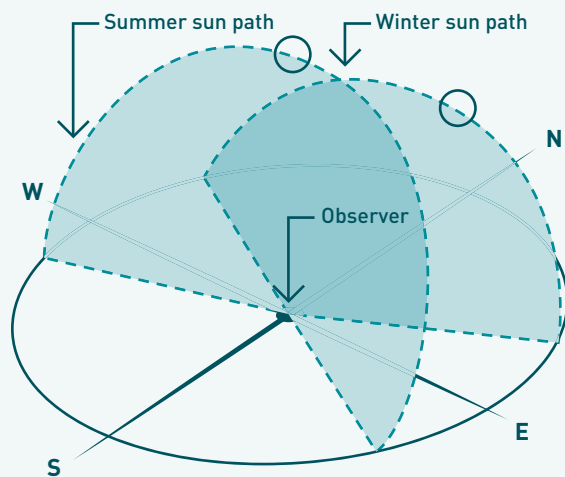
By focusing on a long-term approach to development, the client is able to consider the life-cycle cost of a building or development rather than just the initial procurement costs. As a result of this broader understanding, the pendulum between how “green” the client would like to be and how “green” they think they can afford to be swings in favour of sustainability. For the designer, the challenge is to find a long-term solution for their client, with the rigorous pursuit of best fit for a range of issues.

Design Process

Designers often find themselves working far from their usual environment. In Darwin, new arrivals are often shocked by the extremes of climate and the influence it has on the design of buildings. In northern areas of Australia, the sun travels directly overhead twice a year, and resides to the south for much of the wet season (southern summer).



Sun paths for northern Australia



Sun paths for southern Australia

Figure 2: Sun diagrams for northern and southern Australia

Local climate, winds, sun angles and microclimatic influences can be quite unique in a remote location and need to be carefully assessed to determine the best approach to building in that specific location. Traditional Aboriginal buildings and the buildings of early European settlement can provide clues on passive design principals for the region. These people built in a time before mechanical environmental control, and used only locally available

materials to produce comfortable buildings. The resulting buildings displayed a clear understanding of local climatic conditions and generally provided comfortable living conditions with minimal or low technological intervention.

Sleeping platforms in Arnhem Land are a sophisticated response to their environment. They are up off the ground so they catch more breeze and keep the sleeper away from snakes. This also provides a sheltered place to cook and a smouldering fire overnight helps ward off mosquitos. The roof shape follows the natural curve of the stringybark material, with low sheltering eaves to protect occupants from the sun and rain. A diagonal strut acts as a ladder while providing strength against strong winds.



Figure 3: Wet season sleeping platform, Burarra, Cape Stewart, central Arnhem Land, NT, 1937

(Photograph by D. F. Thomson. Courtesy of the Thomson family and Museum Victoria; TPH1742)

Site Assessment

Site assessment in remote areas must be undertaken with due diligence and should involve the participation of specialist consultants if required. The site may have areas of high conservation value, provide an opportunity to restore biodiversity or contain significant cultural sites. Integral to the process should be an assessment of the environmental impacts of the

proposed development. In remote areas, development will often be a substantial intervention on an untouched site. During the construction process, machinery and materials will need to be brought to site and the environmental impact will continue during the building's life. Site access routes must be carefully positioned and waste disposal areas suitably located to minimise the impact on the natural environment.

Participatory Planning

Planning should involve the participation of the owners and users of the building, as well as those people who will be affected by the development and may contribute to its success.

Cultural, lifestyle and building management issues need to be discussed with clients so that the designer may address them in an appropriate way. There are many examples of buildings that have failed due to a lack of consultation, poor design for site and locality, or a lack of site supervision that resulted in poor construction. This is of particular relevance to projects for Aboriginal clients, for whom buildings sometimes "land" on the ground after little or no consultation.

There can be unrealistic (urban based) expectations on the part of the design professional about the quality and frequency of maintenance, which impacts on the life of the building; remote locations may not have the skills base to maintain and manage complicated building systems.

Sustainable design solutions often require a high level of end user involvement after construction is complete, to maintain, operate and service buildings and systems. A greater level of involvement by the user during the design process allows them to understand what will be required of them to manage and maintain the asset, and is important for the long term sustainability of the project. The clients and end users are the ones who pay for and maintain the infrastructure. They are in the best position to decide what they require and what they are able to sustain in the long term.

Involvement in the decision-making process not only results in a better technical result, but leads to a sense of ownership for those involved which goes beyond mere possession. This pride in the finished building, in turn, leads to increased care and maintenance and a stronger commitment to what goes on inside the building.

There are many examples of buildings designed with Aboriginal client involvement that perform well environmentally, support social and economic development, are well utilised and maintained by the clients. Many of these buildings also display a richness which comes through cultural overlay, and which sustains cultures within communities.

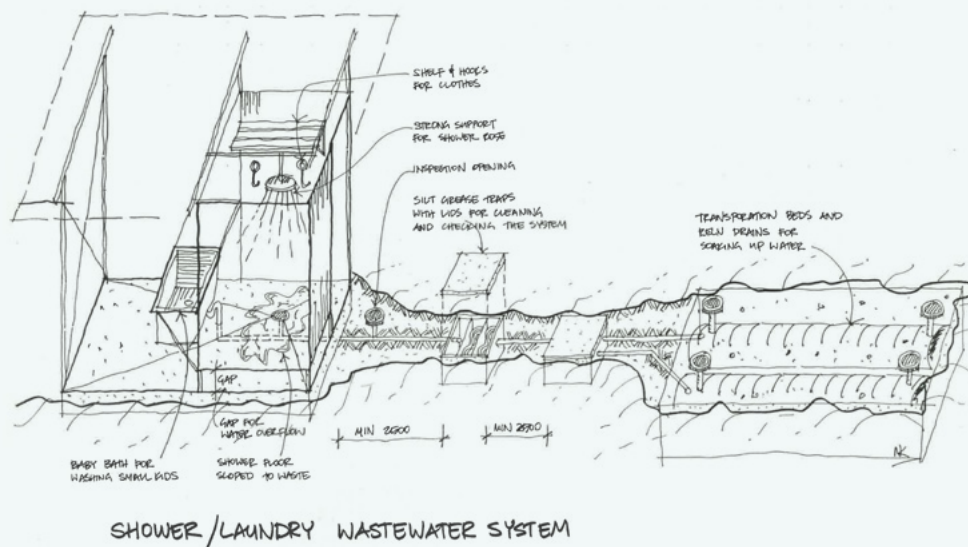


Figure 4: Shower and laundry wastewater system

(Sketch courtesy Build Up Design)

Effective participatory planning relies on the consultant's ability to communicate effectively. In cross-cultural situations, where English is a second language for the client, it is helpful to employ a local person to provide guidance on cultural or social protocols and act as interpreter. It is important to convey the nature, size and extent of the proposed works and the options that are available. Questions should be open ended: "What colour should we paint this?" rather than "How about we paint this blue?" Aids such as photographs, sketch plans, drawings and models can assist in the process, as will physically marking out the location and size of the development on the actual site.

Provide a reasonable timeframe for clients to consider the proposal and contribute. In many remote areas, the consultant is one of many visitors with important business who demand people's time. Be aware of the other commitments and priorities of the community.

Documentation

Documentation should be thorough and of high quality. The cost of bringing in additional materials can be high. A bag of screws that costs a dollar can be very expensive if it has to be flown in by charter plane. Remote building camps are often autonomous units with generators, kitchen and ablution facilities. The consequences of delays in sorting out documentation problems can include idle workers on site who have to be fed, housed and paid.

Leaving elements to be resolved on site is problematic, as distances to site will restrict the number of

inspections possible by the design consultant. The construction documents should clearly detail what is to be done and where it should happen, to prevent the delay of materials, or guesswork by the builder in the absence of accurate guidance.

Costs

Assessment of the various costs associated with the construction and operation of buildings is an important part of the design process. As discussed earlier, an assessment of the ability of the client to manage the technical aspects of the infrastructure should be conducted early in the design process. A life-cycle cost assessment will inform the process and may result in the selection of systems and materials which have, for example, high embodied energy or initial cost but which over time result in a positive outcome. For example, solar power systems in remote areas may be expensive to install, but will compare favourably with diesel generator systems when the costs associated with fuel consumption and delivery and generator servicing in remote areas are taken into account.

Services

Local power generation, water collection and waste water reuse and other service options that may not be suitable or permissible in urban areas may suit a remote site. In general, the lack of (or very high cost of) grid connection makes stand alone systems a viable option. Services are best kept simple and low-maintenance. Additional initial expenditure is justified if the outcome is a reduced maintenance requirement.

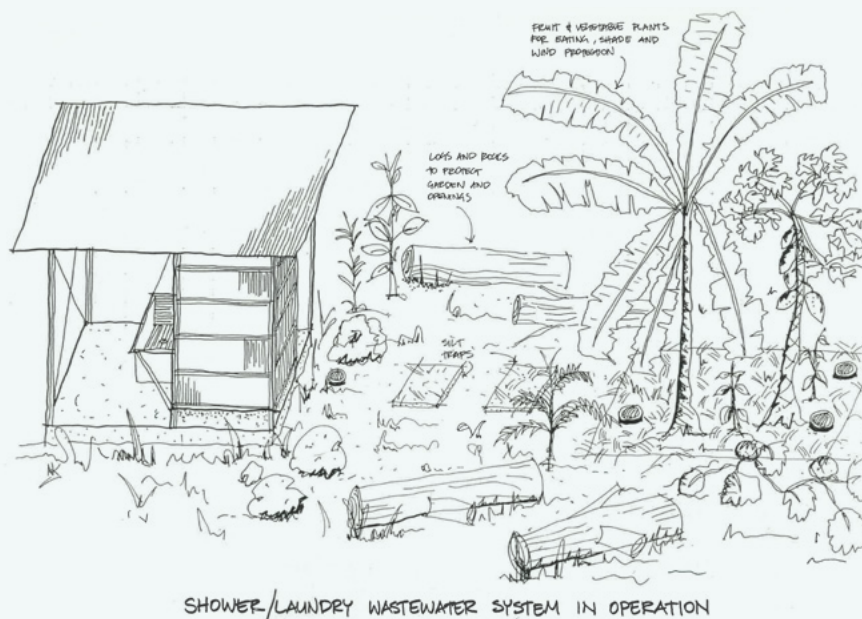


Figure 5: Shower and laundry waste water system in operation
(Sketch courtesy Build Up Design)

Construction Process

Transport

In remote locations the costs associated with transporting materials and labour are high. Poor design decisions will result in a high dependence on the continued importation of materials and fuel, and/or regular visits by maintenance specialists. The distances involved will compound the costs associated with this ongoing requirement. Therefore construction technology should promote the owners' ability to manage and maintain the asset using locally available labour and materials.

Waste Disposal

Waste produced by the building and its occupants will generally be dealt with on site or close by. Waste should be looked upon as a resource rather than a disposal problem. In many remote areas soils are deficient in nutrients and water is scarce. Disposal of waste water and organic waste provides an opportunity to address these deficiencies. Care should be taken to ensure the systems are within the management capability of the client. They should be safe, hygienic and properly tested and evaluated for the location and climate. The production of waste should be minimised and appropriate locations for disposal identified.

CASE STUDY: MANINGRIDA OUTSTATIONS

On outstations in the region of Maningrida in central Arnhem Land, the health regulations called for two 4000L septic tanks for grey water and a 5000L septic tank for black water, with absorption drains to dispose of the waste after it had passed through the septic tanks. The community organisation had no pump truck to empty the tanks and many of the outstations are cut off by floodwater during the wet season. High water table conditions over the wet season resulted in overloading of the absorption drains.

After a period of trials monitored by the Northern Territory Health Service, a system was developed which used long drop pit toilets and reduced the grey water tank sizes to 600L with transpiration beds. The tanks are now emptied using a fire fighter pump mounted on a four-wheel drive. In the event that the roads are closed, tanks can be emptied by hand with residents using appropriate safety equipment and protocols. The transpiration beds are planted with bananas and paw paws which provide a food source. During the six-month dry season, when there is no rain, the plants are watered each time a person showers.

Local Employment

Employment opportunities in rural and remote areas are often scarce. Supporting local employment through the sourcing of local materials and labour assists in skills development and injects much-needed cash into regional economies. Use of local materials usually has a positive environmental result with reduced energy use in transportation.

The development of skills is vital to the ongoing sustainability of projects in remote communities. An end user in the bush may not need to build another house if they have learnt enough to perform basic maintenance such as replacing a door handle or fixing a toilet cistern.

A participatory planning process with a skills audit early in the project will identify opportunities for local employment, and influence decisions in relation to materials, construction systems and services. It will also identify skills shortages in areas fundamental to the ongoing sustainability of the community, which can be addressed through training or education.

Transportable Buildings

Prefabrication of buildings and transport to site is often seen as an easy answer to remote area building. Financially, prefabrication often displays substantial construction cost benefits. Environmentally, there are advantages including minimal site impact. The risks include a loss of quality control, which may result in poor detailing or the omission of important materials, such as insulation. Errors and oversights such as these may result in higher than necessary initial and ongoing costs.

A prefabricated off-the-shelf building may not be designed to withstand the rigours of remote areas, including high-usage, low-maintenance regimes, and they are often difficult to modify or renovate. Prefabricated buildings also provide little opportunity for local employment. There will be instances however, where prefabrication is the best option.

No matter if buildings are prefabricated or not, quality control remains a concern of the design professional. It is important to specify the quality of materials and construction methods used and confirm the delivered building is built as specified.

Contract Issues

Building contracts should include clauses relating to appropriate behaviour by builders on site. In remote locations there can be a perception that the usual environmental requirements and even social protocols do not apply. Builders in the bush, where health and safety inspections are less likely to happen, sometimes pay only lip service to these requirements. In such locations, it is easy to ignore the legal requirements to safeguard employees and the environment. The supervisor needs to have an understanding of the issues and ensure that they form part of the building contract. A worker may decide to risk their own life and spray termite poisons in thongs and a singlet, however they do not have the right to put the adjoining residents and the local environment at risk simply because they are in a remote location.

Contract clauses should confirm the Australian Standards that apply and identify special conditions. These conditions may include the hours and days to be worked so as not to disturb nearby residents; protocols to be followed to gain permission for hunting and fishing; restrictions in relation to the consumption of alcohol; and clear instructions on disposal of building waste to ensure it is not dumped in the bush.

Supervision

Regulatory controls which apply in urban areas may not apply in remote locations. In the Northern Territory, only sixteen major towns and strips of land adjoining the major highways come under the Building Control Act. Outside these areas, the Building Code of Australia is not enforced by statute. The responsibility for construction quality rests with the builder and the supervisor.

Contract administration and adequate site supervision can be difficult in remote areas, as site visits will be limited due to the time taken to get to site. Poor supervision on site can result in badly constructed buildings with poor environmental performance and a high ongoing maintenance requirement. Inspection times should be clearly identified in contract documents and adequate notice given to ensure inspections take place with minimal site delays.

Summary

A number of factors combine in remote locations which can make it easier to achieve a sustainable outcome than in an urban or less remote location. A long-term commitment to the place by the landowners encourages a life-cycle approach to any development. And a lack of reticulated services and high costs associated with establishing and maintaining services makes renewable power and water reuse systems economically viable.

Designers need to conduct thorough site assessments to understand environmental and cultural site issues and climatic considerations. They should work with their clients so that they understand their needs and capabilities, in particular their ability to operate and maintain building services and systems.

Regulatory controls which apply in urban areas may not apply in remote locations. The designer cannot rely on government inspections and control, and may need to perform these services. To assist in this process the designer should ensure documentation is thorough and of a high quality, inspection times during construction are identified, and everyone involved in the project is aware of the standards that apply.

Further Reading

EDG Note 65 EP, *"Climate Responsive Design: Cooling Systems for Hot Arid Climates"*, Emilis Prelgauskas, November 2010

EDG Note CAS 41, *"Filter House, Broome, Western Australia"*, Chris Jensen and Nicki Taylor, November 2006

www.housing.nt.gov.au/remotehousing

About the Author

Simon Scally graduated from the University of Melbourne in 1987. In 1992 he moved to Darwin and established Build Up Design Architects. This firm specialises in remote area projects throughout the Northern Territory with a focus on the delivery of high quality, culturally appropriate housing, schools, clinics, community buildings and infrastructure for Aboriginal communities. Build Up Design has received a number of Territory awards, including the 1994 Institutional Award for the Bawinanga Women's Centres and the 2000 Institutional Award for Belyuen School.

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