



engineers  
without borders  
australia



Centre for Appropriate  
Technology Limited

---

# 2020 EWB Challenge Design Brief

Centre for  
Appropriate  
Technology  
Cape York



# Introduction

The 2020 EWB Challenge is delivered in partnership with the Centre for Appropriate Technology (CfAT), an Aboriginal and Torres Strait Islander controlled not-for-profit organisation which ‘exists to support people in regional and remote Australia in the choices they make in order to maintain their relationship with Country’<sup>1</sup>. EWB Challenge project briefs explore appropriate technology which supports Traditional Owners living and thriving on homelands and outstations, with a focus on CfAT’s work with communities in the Cape York region of Far North Queensland.

Engineers Without Borders Australia (EWB) and CfAT have collaborated on the design and delivery of appropriate, enabling infrastructure and technology since 2008, beginning with the delivery of the ‘Bentinck Island Bathroom Blitz’ project. This project involved university-affiliated volunteers and staff from corporate partner organisations working alongside community members to design and build an ablutions block from recycled building material on a remote island in the gulf of Carpentaria. Since then, CfAT and EWB have collaborated on several other community-based design and construction projects, from ranger bases to water supply infrastructure. In 2011, EWB and CfAT won a Queensland Reconciliation Award for the unique community-corporate partnership model behind these projects.

Delivery of the 2020 EWB Challenge program sits within a broad, values-aligned partnership between organisations which brings together a number of EWB and CfAT program areas and stakeholders. In addition to supporting CfAT’s current and future projects, the 2020 EWB Challenge project brief scoping process, supporting resources developed, and student ideas generated will inform and support EWB’s work in the Engineering on Country space more broadly.

As you learn more about EWB and CfAT, you’ll recognise the importance of a place-based design approach and working alongside community members through the development of a project. While students and academics do not engage face-to-face with community members while working through EWB Challenge projects, a community-centred, place-based approach is manifested in the EWB Challenge process through the following steps:

- 1. A Design Brief is developed by the EWB Challenge team through meaningful community participation and based on decades of CfAT’s own community engagement. The Brief ensures students design ideas are founded on addressing community-identified priorities**
- 2. Within their university course, students use the resources provided (along with academic literature, publicly available reports, case studies and other reference material) to take a human-centred approach to research, innovation, and the generation of new insights in response to a project identified in the EWB Challenge Design Brief**
- 3. The ideas, research, and resources developed through the EWB Challenge are shared back via EWB and CfAT and investigated for further development and future implementation**

## Your role through the EWB Challenge

The 2020 EWB Challenge projects and supporting resources were developed through a scoping process which explored, compiled, then distilled an outline of priority issues and opportunities as identified by CfAT staff and the communities they work with. You will be working with the outputs of that scoping process in your course, which include this Design Brief and the EWB Challenge website resources.

You are encouraged to dive deep into the context of remote Indigenous homelands as you develop your design concept. Utilise the resources available to you to immerse yourself in the environment and culture in which your project is situated, and to start to uncover the opportunities and challenges that will influence your proposal. By taking the time to understand the broad context that your projects sits within, you will develop an idea that is not only technically feasible, but relevant and exciting for your stakeholders!

It is vitally important that you engage appropriately when working on your EWB Challenge project and respect the time and privacy of community members in Cape York.

The EWB Challenge team works with partner staff and communities to develop resources so that you can be human-centred and place-based in your approach without having to contact communities directly. Please use these resources to the best of your ability and ask your academic team or the EWB Challenge discussion forum for support if you are looking for more ideas or guidance. **Under no circumstances are students to contact community members or project stakeholders in Cape York.**

## After the EWB Challenge in Universities








The EWB Challenge is an open-ended learning experience. The breadth and depth of design is left to individual universities and design teams to scope within the context of the submission recommendations. Design ideas which consider links between the individual project areas listed in the design brief are welcome.

All student submissions provided to EWB Australia through the EWB Challenge Program will be shared with CfAT to support their work with communities.

While the focus of this EWB Challenge project brief is the Cape York region, note CfAT is also interested in exploring how top ideas might be applied more broadly to their work with communities across remote areas of Australia. The design challenge projects in this Design Brief tend to have broad applicability across remote Indigenous communities, considering the unique technical challenges that exist. Workshops and conversations at the end of 2020 will investigate what innovative design ideas might be most relevant to pursue, as well as the most appropriate pathway to further development.

*EWB Australia acknowledges the Traditional Custodians of Country throughout Australia and recognise their continuing connection to land, waters, culture and community. We pay our respects to them, their cultures and their land; to Elders both past & present; and to emerging leaders. We recognise that Aboriginal & Torres Strait Islander peoples never ceded sovereignty of what we call Australia.*

# Contents

EWB's Approach to Working on Country.....	5
About the Centre for Appropriate Technology.....	7
Thinking About Indigenous Homelands & the Cape York Peninsula.....	10
 Design Area 1: Transport & Access.....	13
 Design Area 2: ICT.....	16
 Design Area 3: Structures.....	18
 Design Area 4: Energy.....	20
 Design Area 5: Water Management.....	22
 Design Area 6: Waste & Reuse.....	24
 Design Area 7: Conservation & Land Management.....	26
Design Considerations.....	28
Further Resources.....	30



# EWB's approach to working on Country

Engineers Without Borders Australia (EWB) aims to ensure that everyone in Australia has access to the engineering knowledge and resources required to live a life of opportunity, free from poverty.

Our Engineering on Country program works to increase Aboriginal and Torres Strait Islander peoples' capability to live safely and productively on Country and pursue their community aspirations, through improved access to engineering, technology and infrastructure.

Since 2009, EWB Australia has worked with Aboriginal and Torres Strait Islander communities in Queensland, the Northern Territory, and Western Australia on a range of community-identified projects. These have mostly taken place through long-term partnerships developed directly with communities and, since 2014, through the EWB Connect pro bono program.

**EWB takes a community-centred approach to bridge self-identified gaps in access to community health, wellbeing and opportunity.**

We work with communities to design and provide access to appropriate and sustainable community infrastructure, which can include water & sanitation facilities, energy systems, housing, and other community infrastructure and services that improve people's quality of life and their ability to pursue education, employment or income generating opportunities. We also work with communities to help design solutions that enable cultural connection, and the ability for people to live on Country and care for Country.

The focus of the Engineering on Country program is on sustained engagement to build strong relationships and best practice models, strategically deploying people to achieve long-term impact through knowledge sharing and the application of engineering knowledge and resources.

We also focus on building the capabilities of the engineering sector, to ensure that more high-quality engineering, infrastructure and technology-based projects are delivered through a community-centred approach, creating the strongest possible social outcomes and community empowerment.

We do this through a variety of mechanisms, including:

- Community visioning: facilitating co-design processes and community visioning to support our community partners to identify their priorities and needs. This ensures communities have a shared vision and agreed roadmap for how they will lead the process.
- Community partnerships: strengthening the capacity of our partner organisations to access or deliver people-centred engineering and technology outcomes. This can include professional secondments, capacity building and/or mentoring.
- Pro bono projects: providing and brokering pro bono engineering and professional services to communities. Often, this will support communities at the feasibility or concept design stage of a project, in order to provide the necessary technical resources for the community partner to progress with capital raising, funding applications or contracting for the project implementation.



- Research and Development: creating new knowledge and approaches in engineering innovation and technology to benefit remote communities and develop appropriate technologies.
- Professional skills development: building the skills of the engineering sector to ensure more projects deliver strong social outcomes and community empowerment.

Read more about EWB Australia's Engineering On Country strategy in the [2018/2019 EWB Australia Annual Report](#)

## The EWB Australia and CfAT Partnership

EWB has partnered with the Centre for Appropriate Technology in Queensland for over 10 years.

The Centre for Appropriate Technology (CfAT) is an Aboriginal and Torres Strait Islander controlled business that supports people in regional and remote Australia in the choices they make in order to maintain their relationship with Country. CfAT achieve this by providing solutions to infrastructure challenges that people face in maintaining their relationship with Country, primarily: reliable power, water supply, digital connectivity, built infrastructure, training and skills development.

EWB works with CfAT in Cape York to leverage the assets of both organisations to deliver appropriate, sustainable and manageable infrastructure and services to remote Aboriginal and Torres Strait Islander communities in Northern Queensland.

Specific partnership activities include:

- Access to Energy – exploring and developing self-reliant models including community enterprise and impact investing;
- Appropriate Technology development – appropriating technology to make it more suitable for Indigenous communities for sustainable livelihoods on Country;
- Land-use planning – supporting Ranger programs and the Healthy Country Planning process with appropriate enabling infrastructure; and
- Specific community infrastructure support projects.

You can see a video of a previous project undertaken by Bana Yarralji Bubu Corporation, EWB, CfAT and our partners here: Shipton's Flat project [video](#).





# About the Centre for Appropriate Technology

Given CfAT is a key stakeholder, your EWB Challenge design project will benefit from embedding an understanding of the organisation's approaches and values. You are encouraged to think about how your proposal, from technical design to proposed implementation mechanisms, might align with CfAT ways of working and the key considerations outlined here.

About the [Centre for Appropriate Technology website](#), '[Our Story](#)'

## Why we exist:

CfAT Ltd exists to support people in regional and remote Australia in the choices they make in order to maintain their relationship with Country. Maintaining a relationship with Country may include a desire to live on Country, visit Country, develop Country for economic benefit or protect Country. We achieve this by providing solutions to infrastructure challenges that people face in maintaining their relationship with Country, primarily: reliable power, water supply, digital connectivity, built infrastructure, training and skills development.

## Our vision:

Sustainable and enterprising communities of Aboriginal and Torres Strait Islander People underpinned by appropriate 'fit for purpose' technology.

## Our mission:

Through their unique knowledge of and engagement with remote people and place CfAT delivers practical, integrated project design, technical innovation, training and infrastructure products and services – supporting livelihoods and growth in economic opportunities across remote areas.

## Our history:

CfAT was born from and has been instrumental in the history of the Indigenous Homelands Movement. The Homelands Movement is a product of the Indigenous land rights movement that saw Australian First Nations people exert their rights to self-determination on their own traditional Country. CfAT was launched in 1980 to support this post colonisation movement back to Country, with the appropriate technology to make life comfortable, safer and more sustainable. You can read about CfAT's long history in the book "[Alternative Interventions](#)" compiled in 2014.

CfAT is most renown for its ground breaking and multi-award winning work with the Bushlight Renewable energy program designing and building over 130 remote standalone solar power systems in remote indigenous homelands. In 2011 CfAT [won the Sir William Hudson Engineering Excellence award for humanitarian engineering](#) for taking the Bushlight program to India.

## Ekistica

Building on CfAT's renewable energy capabilities built by the Bushlight program, in 2007 CfAT's board established Australia's first fully Indigenous owner engineering company. [Ekistica](#) (formerly CAT Projects) is a highly successful profit for purpose full spectrum Engineering Consultancy specialising in renewable energy. Ekistica is 100% owned by CfAT, returning its profits to support CfAT's mission. Ekistica provides a professional engineering foundation that often provides technical support CfAT work in Indigenous communities.

## Values and approaches to consider

Over decades working with Aboriginal and Torres Strait Islander communities across Australia, CfAT has developed and consistently demonstrated core values-based ways of working. Diving into CfAT project case studies, newsletters, other publicly available resources will support your understanding of key ways of working you might embed in your proposal.

## Co-designed and place-based

CfAT places authentic participatory engagement with community at the core of their work. Community members are the experts on what 'success' and many of the solutions look like for projects on Country, as well as what living comfortably on Country means for them.

- [Read more about the importance of and CfAT's approach to community engagement](#)

Community members also have valuable understanding of what will and won't work when it comes to projects on their land. [Healthy Country Planning](#) is an example of an Indigenous community-focused participatory planning process that is based on achieving conservation outcomes. Well-designed, genuine involvement of communities across a project is also rooted in an understanding of different stakeholders along with how and when they need to be included in conversations or decision-making to move a project forward to a meaningful and sustainable outcome.

- Read more about what 'Community Involvement' principles and examples in [Section A1 of the National Indigenous Infrastructure Guide](#)

## Enabling infrastructure and innovation to support self-reliance on Country

Given the remote locations of many communities CfAT works with, it is extremely beneficial when projects can be built, maintained and sustained locally. Many 'standard' infrastructure solutions are either unaffordable or require a niche level of technical skill which is challenging to access. CfAT works with communities to innovate infrastructure solutions that provide the same function whilst being more affordable and easier to build, maintain and sustain. This is supplemented by capacity building to transfer the knowledge and skills required to operate and maintain solutions. A critical component of project design is ensuring that technical knowledge is communicated clearly. A 'technically appropriate' solution may actually be entirely inappropriate for a community context if it is unnecessarily complex and therefore inaccessible.

Great examples of accessible knowledge sharing are the [BushTechs available on the CfAT website](#).

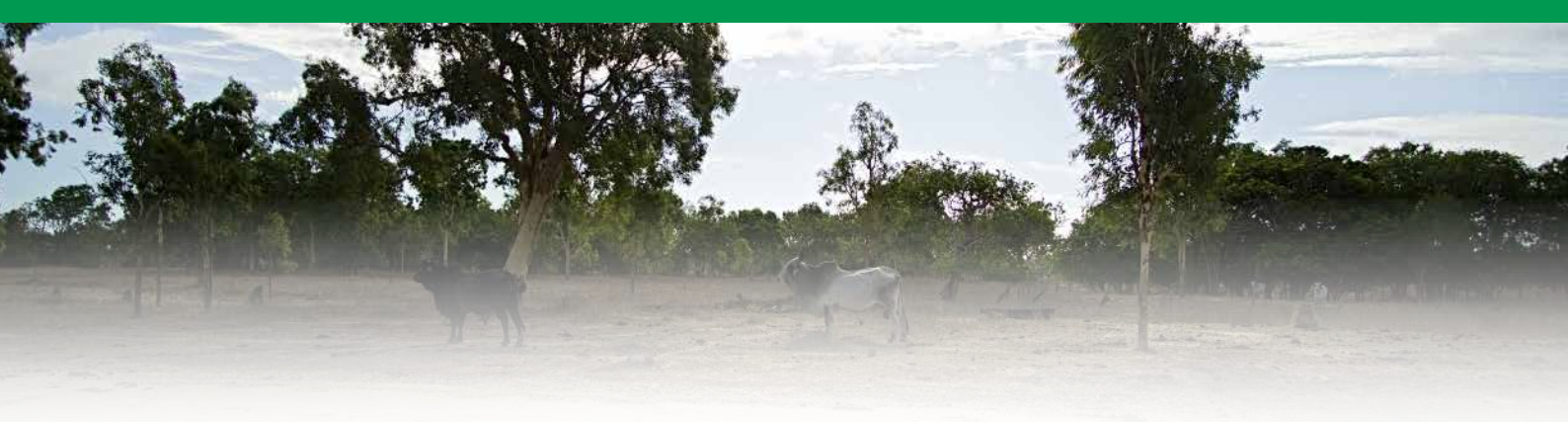
**“Humanitarian engineering is not necessarily just designing or providing a solution but providing information in a clear and concise way, translating it from engineering speak into community speak across cultures and across technical abilities”**

*Andre Grant, CfAT Queensland Regional Manager*

## To Learn More

- Listen: [to Peter Renehan, Chairperson for the Centre for Appropriate Technology](#) provide a short background to the organisation and what engineers should consider when working with Indigenous communities
- Read: Centre for Appropriate Technology, [‘Community Planning with the Lama Lama People’](#)
- Explore: Centre for Appropriate Technology [Strategic Plan 2016-21](#)





---

# Thinking about Indigenous Homelands & the Cape York Peninsula

This year's EWB Challenge project briefs explore appropriate technology to support Traditional Owners living and thriving on homelands and outstations, with a focus on CfAT's work with communities in the Cape York region of Far North Queensland.

The Centre for Appropriate Technology was established from a need to support Traditional Owners returning to Country after land, which was never ceded, began to be formally returned to Indigenous communities by the Australian government. Today, CfAT continues to work with communities across the Cape York Peninsula, as well as other parts of remote Australia, to develop enabling infrastructure which is appropriate to remote contexts.

## Land Tenure on Cape York

Through the 1990s and 2000s, via legislation such as the Aboriginal Land Act 1991 and Cape York Peninsula Heritage Act 2007, the process of recognising Traditional Owners and returning land rights across Cape York moved forward. From 2007, the Cape York Tenure Resolution Program set the stage for the current state of land tenure and environmental management on the Cape York Peninsula. The Australian government began purchasing existing pastoral leases and negotiating with Indigenous communities recognised as Traditional Owners

to determine how the land might be returned and divided for different uses in line with conservation goals. This program set the stage for land management under Indigenous Land Use Agreements (ILUAs) which addressed key types of land tenure:

- Aboriginal freehold is land which may be used for any purpose provided there is compliance with all relevant laws.
- Jointly-managed National Park known as CYPAL, 'Cape York Peninsula Aboriginal Land' unique to Cape York. This land is managed jointly by Traditional Owners and government departments through Indigenous Management Agreements (IMAs) to achieve conservation outcomes.
- Nature refuges managed under a Conservation Agreement associated with the Nature Conservation Act 1992 (Qld) - land which is not national park but has significant conservation value and will be managed as such.

Some government funding is available through Indigenous Management Agreements (IMAs) for National Park maintenance and associated activities such as ranger programs. Follow the links provided at the end of this section to learn more about the background of land transfer and current management on Cape York.

## Living on and Managing Country

Many of the remote Indigenous homelands on Cape York are former cattle stations which were purchased by the Australian government and then restored to the Aboriginal communities who are the Traditional Owners of this land. In many cases, before a transfer of ownership the cattle station land would see little to no investment, maintenance, or be stripped of assets. Traditional Owners would be required to address existing infrastructure deficiencies before being able to move back onto and manage Country.

[Look around an example of a former cattle station recently returned to Traditional Owners](#)

Decades of cattle farming has also disrupted natural ecosystems and means those moving back onto the land may be challenged to live sustainably on Country as their ancestors did for 10,000's of years. Many traditional livelihood strategies are no longer viable.

A common vision CfAT staff hear articulated across many Indigenous communities is that of access to Country through basic infrastructure and an ability for some, especially elders, to live on Country. The refurbishment of cattle stations and establishment of ranger bases are also common goals that provide a great foundation for access to Country.

Land management activities which take place on Country can be linked to the concept of 'ecosystem services', in that traditional land management tasks support entire ecosystems to thrive and deliver key requirements such as clean air, biodiversity, and healthy forests.

Indigenous Ranger programs across Australia have seen success linking environmental outcomes with both connection to Country and meaningful employment for Aboriginal and Torres Strait Islander people.

In Cape York, land management activities revolve around the wet season (see Design Area 1. transport and access) and fire season (see Design Area 7. conservation and land management). October, November, and December be particularly busy (and tricky for community engagement or project work) as rangers are responding to fires or setting up backburns and these activities will take priority over other projects or planning.

## Community and Governance

Part of the landmark 1993 Native Title Act, the 'law passed by the Australian Parliament that recognises the rights and interests of Aboriginal and Torres Strait Islander people in land and waters according to their traditional laws and customs', outlines the requirement for a Prescribed Body Corporate (PBC) to be established for management, representation, and decision-making purposes. Guided by the Corporations (Aboriginal and Torres Strait Islander Act 2006 (CATSI Act), the group must then be registered with and will receive support from the Office of the Registrar of Indigenous Corporations (ORIC).

The structure and membership of a PBC is usually reflective of traditional clan or family groupings or decision-making structures. The board of directors is often complimented by a council of elders in some form (formally or informally) who provide guidance and oversight in recognition of traditional decision-making protocols.

Consider further research around native title, governance, and management systems as you begin thinking about the context your design proposal sits within.





## Key background you can assume within your EWB Challenge project proposal

Across nearly 30 years of working with a number of communities across Cape York, Centre for Appropriate Technology staff have recognised a common framework of the requirements to live on Country. You might consider how these areas interact with your specific project as you develop your design idea. Living comfortably on Country requires, broadly:

- Clean water supply with a back up system
- Reliable power supply
- An appropriately designed dwelling
- Fans
- Large, reliable refrigeration for extended food storage
- Year round emergency access
- An internet connection or other means of telecommunication

Inherently linked to these themes are the 'Design Considerations' such as reliability and materials choice described at the end of this brief.

## To Learn More

- Explore: The State of Queensland and Commonwealth of Australia, 1995. *'Cape York Peninsula Land Use Strategy (CYPLUS)',* including the three stage 1 thematic reports on 'Natural Resources and Ecology', 'Land Use and Economy', and 'Society and Culture'.
- Read: Queensland Government, Parks and Forests website: *'Aboriginal freehold land and jointly managed parks on Cape York Peninsula'*
- Read: Queensland Government, Media Statement, 25 October 2017: *'Celebrating 10 years of Cape York's land legacy'*
- Listen to: Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS): *Cape York Peninsula Aboriginal freehold and national parks – Agreements and achievements 2005 - 2014.* Presented AIATSIS Native Title Conference, Port Douglas, Queensland, 17 June 2015
- Read: *Ecosystem services: Key concepts and applications,* Department of the Environment, Water, Heritage and the Arts, 2010. Occasional Paper Series No.1
- Explore: *Stories from Country 2015 - 2017,* How Indigenous Rangers and Indigenous Protected Areas are strengthening connections to Country, culture and community. National Indigenous Australians Agency
- Read: Australian Conservation Foundation, 15 December 2016: *Wuthathi people return to Shelburne Bay*





# Design Area One

## Transport and Access

*Distance and remoteness from urban centers or services are aspects of life across much of Cape York. Areas of the region are only accessible in 4-wheel drive vehicles or sometimes most efficiently reached by light aircraft.*

The Peninsula Development Road (PDR), the main arterial road which runs generally north to south, is progressively being bituminised through government support.

Local and distributor roads across Cape York are primarily gravel or dirt and can vary significantly based on the time of year and traffic patterns. For example, dirt roads which are heavily trafficked by large road trains, like the PDR, will not stay smooth for very long.

### Wet season on Cape York

The wet season on Cape York runs from approximately December to April, however rains can impact travel and the accessibility of certain areas anywhere from November to June. Flooding along the Peninsula Development Road means communities north of the town of Laura are regularly inaccessible by vehicles. Critically, however, locations where people remain during the wet season are serviced by airstrips. Airstrips enable access to remote locations and also enable the transport of goods across the year.





Weekly mail planes deliver food and can be available to transport individuals if necessary. Helicopters are sometimes used in emergency situations as short airstrips limit the size of aircraft that can land. Limits on travel often mean that, when it comes to project delivery, the wet season is the time for thinking, planning, designing, and lots of talking. The lead into wet season (September/October/November) is filled with land management tasks which need to be completed before rains and flood make them much more difficult. Hot temperatures also become challenging from mid-October until the first rains, with regular peaks in the 40's. Project activities and construction are then picked up again as the dry season approaches mid-year.

## Transport Systems and Environmental Impact

Levels of freight and tourist traffic are increasing as roads are bitumised across the Cape, and this growth in vehicle movement is associated with increases in the introduction of invasive weeds across sensitive ecosystems. Weed corridors can develop along main roads which require significant time and money to remove. Rangers managing Indigenous Protected Areas have a significant focus on weed management, especially after wet season when weeds grow most rapidly in areas that are inaccessible until water levels go back down. Gravel is extracted for road construction via large 'borrow pits', which require significant land clearing and excavation, leaving scars across the landscape. There are currently limited controls in place to manage the environmental impact of gravel extraction, and moving gravel from borrow pits to be spread across a road network can be a significant mechanism for weed spread. Heavy rains and flooding during the wet season can also cause significant runoff from gravel roads which then flows directly into river systems. Indigenous communities are increasingly noticing the silting up of water bodies after wet season potentially linked to washed out roads.



# Project Opportunities

## 1.1 Road design to reduce environmental impact

Basic gravel roads are very common across Cape York frequently and become washed out by heavy rain and flood during the wet season. With no specific run-off management in place, the soil and gravel from this infrastructure flows into adjacent river systems and causing issues with silting. As bitumensing roads is a slow and expensive process, this project looks at alternative techniques for road construction and run off management to reduce negative environmental impacts. Teams can consider a key stakeholder for this project to be Aboriginal Corporations who are often engaged in the construction of roads on their Country and have experience with road construction or other types of civil contracting work.

## 1.2 Methods to reduce the spread of weeds

Vehicle washdown facilities are available in some locations across Cape York to reduce the movement of weeds, however these can be very expensive both to install and operate especially due to the associated ongoing energy requirements. This project looks at innovative mechanisms that could be utilised at 2-3 controlled entry points around Indigenous Protected Areas to reduce, or ideally eliminate, the introduction of weeds from vehicles.

## Additional Information

Below are a few resources that you might find helpful to get started working on these design projects. Please see the 'Resources' section for a full list as you might find others that help to inform your project.

- Watch: a snapshot of [\*traveling around Cape York\*](#) and the movement of people and materials across a different seasons
- Explore: Queensland Government, Department of Agriculture and Fisheries: [\*Weeds of National Significance \(WONS\)\*](#)



# Design Area Two

## ICT

*There is limited internet and mobile phone coverage across much of Cape York. Remote Indigenous communities may have telecommunications access through satellite dishes within their community that provides either access to a landline or a limited range of connectivity.*

Satellite phones are a requirement when travelling, as standard mobile phone service cannot be relied upon. Some communities have access to a community phone also. This is shared amongst the community members and is a standalone box fixed with screw piles with solar powered satellite dish providing a phone line (with some latency) and wifi with purchasable data packs. Limited connectivity can make remote operations and maintenance of infrastructure and technology challenging. Often the location where someone can get coverage is not the location where a particular pump or piece of equipment is malfunctioning, meaning it can be difficult to talk through how a system is failing and what actions someone on-site might try to fix it.

### The CAT Hotspot

The CAT mobile phone hotspot is an appropriate technology design which extends existing mobile phone coverage in remote areas struggling with connectivity. The design works by focusing and amplifying a signal and, importantly for remote areas, does not require connection to an energy supply. In production now for approximately 8 years, CAT Hotspots have been installed across remote areas of Australia and not just associated with Indigenous communities.



# Project Opportunities

## 2.1 Visitor management on Indigenous Protected Areas

Where ranger bases create control points to an Indigenous Protected Area, there is an opportunity to support the visitor experience through a downloadable welcome and offline guide accessible on mobile devices while visitors are on Country. The aim of an offline guide would be to provide the information visitors require to enjoy the Country respectfully, comfortably, and with minimum environmental impact. Considerations include maps of the area with a tracking feature, and information such as drinking water access, ecologically sensitive locations, and areas which are restricted due to cultural significance.

## 2.2 ICT infrastructure to support appropriate tourism

CfAT and community representatives see considerable scope for increased connectivity and the further development of ICT infrastructure to support the management of respectful tourism on Country. Much of Cape York is environmentally and culturally significant land and it is important that tourist activities are respectful of this, however that is not always the case. This project looks at how to best support rangers monitor National Park land and other protected areas to ensure visitor compliance, specifically reduce unpermitted access to sites with visitor restrictions.

## 2.3 Offline solar-bore diagnostic assistant

Solar-powered bores are very common water supply systems across remote Indigenous communities in Cape York. When these systems encounter some type of failure, it can be challenging to diagnose and address remotely as bores are not located close to a home or site which has phone coverage and so the issue cannot be discussed with a technician in real-time. In this project teams will develop a solution which can be used offline as a diagnostic and troubleshooting guide, also incorporating standard maintenance procedures. Strong consideration should be given to the user interface of the proposed solution. See also 'remote diagnostics' in the Design Considerations and design opportunity 2.4 below.

## 2.4 Remote monitoring & diagnostic system

Many of the remote Indigenous communities CfAT work with have limited mobile phone reception on Country. Many of the installed engineering solutions are located in remote locations that are challenging to access, particularly in the wet season. As such, it is expensive and time consuming for technicians to understand when preventative main tenance is required at one site and how this should be scheduled relative to other sites. In addition, a critical challenge for appropriate design is the sheer cost of mobilising technical expertise to site to resolve system breakdowns in a timely manner. In this project teams will develop an online/ offline remote monitoring and diagnostics tool that can be used to improve the efficiency of operation and maintenance programs for infrastructure like: solar-bore pumps and solar-battery systems.

## 2.5 Increasing internet access in remote areas

Mobile phone coverage and internet access is limited in Cape York, particularly in remote communities. CfAT have developed a Mobile Phone Hotspot that is a one-user-at-a-time facility to extend mobile coverage in fringe areas with poor coverage by concentrating signals from existing communication towers. In this project, teams will develop solutions to improve mobile phone and data coverage in remote communities who have no mobile phone signal and further improve access to coverage in fringe areas.

## Additional Information

Below are a few resources that you might find helpful to get started working on these design projects. Please see the 'Resources' section for a full list as you might find others that help to inform your project.

- Read: Engineers Australia News, 12 May 2017: [\*Ingenious mobile HotSpot technology connecting remote NT\*](#)
- Read: ABC Far North, 9 November 2017: [\*No internet, no phones: Roadhouse owners build own mobile tower in desperate bid for reception\*](#)





# Design Area Three

## Structures

*Across decades of working with Indigenous communities throughout Cape York, the CfAT has been involved in a number of projects in which the aim was to build fundamental structures which would support people living on and managing Country. Simple shelters can be a key initial starting point to enable access to Country after land has been returned to Traditional Owners.*

### The impact of design choices

When looking at structures in remote areas across Cape York, it's clear that clever design thinking around decisions like materials, building layout, and construction techniques can have significant impact on the final outcome. For example, across the Cape York region the primary point of purchase for most materials is Cairns and therefore the cost associated with getting required materials to site can be significant. Utilising locally available materials, such as bush timber, and reducing the need for difficult, labour-intensive materials such as concrete (which must be transported then mixed on site) can reduce the cost associated with a project while also ensuring maintenance can easily occur as required over time.

Given the limited energy access in remote areas, achieving thermal comfort with low energy requirements is also key in the design of structures. Utilising active cooling inside a building, such as a split system air conditioning unit, would drastically increase the energy requirements of a space. These are not commonly in use in the communities CfAT works with so, given the tropical Cape York climate, it is critical that structures are designed to harness shade and air flow so that spaces are as comfortable as possible.

### Community involvement in construction

The CfAT approach embeds community involvement in every stage of a project process, including construction itself. CfAT experience demonstrates that involving community members in construction can not only reduce the cost of a project but also increase the quality and longevity of project outcomes. The cost of bringing in external contractors to work remote areas can be very high - even the base payment to get someone to a project site, before considering payment for their work, can be a significant. In contrast, people who live and/or work in a community often invest additional attention and care to a construction process and while developing skills and understanding which will be locally available in the future when maintenance is required. Wherever possible, structures will be consciously designed to leverage the fundamental construction skills which exist in most communities, rather than relying on niche technical knowledge, skills, or equipment.



# Project Opportunities

## 3.1 Shelter design to enable access to Country

A common statement across the communities CfAT works with is that ‘a home on Country starts with a roof on Country’. Land that has been returned to Traditional Owners frequently has extremely degraded structures, if any remain at all. A simple, modular shelter design utilising locally available materials could support Traditional Owners to access and stay on areas of Country that were previously difficult to visit. Projects in this area should consider how construction might be phased so it can occur as money becomes available (rather than all at once) and the cultural appropriateness of design proposals.

## 3.2 Keeping places for artifacts on Country

Some aboriginal communities are getting cultural artifacts which were taken during colonisation returned into their ownership. Communities would like to keep these items on Country, rather than in a museum potentially some distance away, however the fragile nature of the items means they must be kept in controlled environments so they do not quickly degrade. This project aims to develop a climate-controlled environment with low energy requirements that could serve as a ‘keeping place’ for artifacts such as spears or other wooden items and woven reed dilly bags.

## 3.3 Simple, replicable visitor shelters

There is a recognition of the tourism potential across Cape York, with a specific focus on supporting the growth of tourism that involves low numbers of visitors

but high-value experiences. A simple, comfortable tourist cabin design which would provide shelter for visitors and could be easily replicated across different locations could enable a positive increase in tourism on land where the community is interested in supporting this activity. Designs should consider local and/or repurposed materials and mechanisms (including raised sleeping areas) to keep the visitors safe from snakes.

## 3.4 Mobile amenities for campsites

A variety of stakeholders including rangers, small tourist groups, or Indigenous families who don’t permanently live on Country frequently camp on Indigenous land across Cape York. This project explores at simple, mobile amenities to service these campsites with minimal environmental impact. Proposals may investigate toilet facilities, sleeping platforms, cooking areas, or other basic facilities.

## Additional Information

Below are a few resources that you might find helpful to get started working on these design projects. Please see the ‘Resources’ section for a full list as you might find others that help to inform your project.

- Walkthrough: an example of a *Ranger Base and Community Building* to learn about appropriate building design on Country
- Watch: *an overview of bush timber availability and common use*
- Explore: a series of 360 photos demonstrating the Cape York context, innovative building design, and the potential for tourism





# Design Area Four

## Energy

*Access to energy is a key enabler to living and thriving in remote areas across Cape York. Remote, stand alone energy provision has been a significant area of CfAT's work over time.'*

Availability of refrigeration is essential in remote communities and makes up the majority (estimated up to 70%) of total energy use. In addition to refrigeration for food storage, other common energy uses are for lighting, fans, and charging mobile phones.

Energy is most commonly sourced from solar power systems with back-up diesel generators. Importantly, solar power systems can continue operating when residents aren't on site, meaning that appliances like freezers and refrigerators will continue to run and food can be stored for periods when community members are away. Solar power systems in these locations require quality inverters given the way freezers are often used - if a large animal is killed, for example, storing the meat in the freezer can create a massive power spike as the solar power system attempts to meet this demand.

### CfAT and the 'Bushlight' system

Between 2002 and 2013 CfAT delivered the Bushlight renewable energy program, installing over 130 renewable energy systems across Queensland, Western Australia, and the Northern Territory. A Bushlight system generally consists of a solar array, battery storage, distributed energy management units (EMUs), and a diesel generator back up.

An important aspect of the Bushlight program is the process of 'community energy planning' through which a community energy budget would be calculated. Community energy planning generally involves a series of meetings to determine the energy needs across a community and how this could be allocated to each space, while also consider the total energy a system might supply. The solar power system and distribution would then be built to align with this community agreement to ensure equity of access. Allocations can be revisited and adjusted periodically if required.

# Project Opportunities

## 4.1 Alternatives and improvements to refrigerators and freezers

Remote Indigenous communities rely on refrigeration and freezers to store large amounts of food over time, ensuring traditional hunting practices can be maintained and people can come and go from Country as needed. This project looks at mechanisms for freezing and storing food beyond the generic available appliances which are dependent on connection to a large, pre-existing solar power supply.

## 4.2 Mobile solar power supply

Energy requirements across locations on Cape York vary across wet/dry seasons and as people move from place to place (i.e. ranger groups working on Country). While solar power is a proven and accepted technology in use across the Cape, this is often in the form of a complete remote, standalone solar power system in one location and is a significant investment. In this project you are challenged to explore opportunities for mobile solar power supply which are robust enough to be transported between sites. Project teams may assume the availability of a 4-wheel drive trailer and an approximate desired supply of 3-10kWh per day.

## 4.3 Appropriate energy supply for vehicle washdown facilities

Reliable washdown facilities can be a key mechanism to reduce the introduction of weeds across Cape York (see 'transport and access' design area 1). Currently, water pumps at washdown facilities are powered by large (approximately 45 KvA) generators, which can be very expensive to run given the sporadic nature of traffic in these locations, estimated at about 10 vehicles across the course of a day. In this project you are challenged to design an efficient, low cost energy supply for washdown stations which will address the need for short bursts of energy alongside long periods of idling. Projects might investigate opportunities such as the use of cars in the washdown station as energy sources or the use of battery storage and can, if required, explore vehicle washdown methods which are slower or require more steps to complete the process.

## 4.4 Innovations in energy storage

CfAT is aware that innovations in the area of energy storage are happening quickly, and are interested in ways that new developments in this space might further enable their work. While CfAT currently relies on lead-acid batteries for most uses (these are 'tried and tested' in the context), they are interested in research and innovation that looks at alternative energy storage with a particular focus on affordability, effectiveness, and reliability. Design ideas and research in this area might choose to focus on direct links to further enabling CfAT fixed solar power systems or may explore other options, and should consider the common challenge of battery overcycling. Projects should clearly consider and outline the criteria for assessing energy storage options.

## Additional Information

Below are a few resources that you might find helpful to get started working on these design projects.

Please see the 'Resources' section for a full list as you might find others that help to inform your project.

- Read: Off-Grid Guide: Best practice guide to the procurement, deployment and maintenance of remote off-grid solar power systems in the Northern Territory and beyond. Written by Ekistica, in collaboration with the Intyalheme Centre for Future Energy
- Read: Renewable Energy in Remote Australian Communities (A Market Survey). Australian Cooperative Research Centre for Renewable Energy (ACRE) and the Centre for Appropriate Technology (CfAT). The outcomes of this research informed key design criteria for the Bushlight program, including the development of a continuous improvement process across the life of the program
- Explore: the Bushlight Energy Archive





# Design Area Five

## Water Management

*When considering whether a location might be appropriate a future project, such as the construction of a ranger base, the availability of water is a key consideration.*

Initial scoping will look at river access, groundwater availability, existing boreholes, and other features of a site to determine the feasibility of water supply.

The water supply on many remote Indigenous homelands consists of a borehole connected to a solar-powered pump, with rainwater tanks available as a back-up system.

The photo gallery in this section provides an example walkthrough of these systems including information on design features. [Another case study resource](#) walks through a more recently completed CfAT project which developed a community water supply from a nearby river.





# Project Opportunities

## 5.1 Water treatment system for saline bores

Access to drinking water in remote communities is often through boreholes drilled to enable groundwater access. However, where boreholes are pumping increasingly saline water, these water points are no longer able to support nearby communities. This project looks at low-cost mechanisms for water purification which would bring currently brackish water up to drinking water standards.

## 5.2 Mobile solar-powered bore pumps

Solar-powered bores are very common water supply systems across remote Indigenous communities in Cape York, providing water for domestic purposes as well as occasional agricultural uses such as fruit trees or mustered cattle. Many locations where bores are in operation are not required to be consistently operating as people are only on site at certain times of year i.e. the dry season, when specific work in that location must be completed, etc. This project explores options for solar-powered bore pumps (and associated flexible piping required) which can be readily moved from place to place as needed and connected to in-situ, approximately 100m bore holes and pvc-pipe casing. Mobile solar-powered bore pumps would reduce the expense associated with building and maintaining a pump at each water supply location.

## 5.3 Mobile showers for ranger programs

The land management activities conducted by rangers through Indigenous Ranger Programs often require groups of staff to camp on Country for days or weeks at a time. While these locations can be serviced by basic infrastructure such as toilets and water tank, the availability of an appropriate, environmentally-benign showering system would be of great benefit. In this project teams will explore options for portable shower devices, along with a water management system that ensures run-off from showers does not negatively impact the surrounding environment. Projects should assume limited availability of water on site and use by 5-15 rangers per day.

## 5.4 Increasing natural disaster resilience of riverbank pump systems

Portable fire-fighting pumps are commonly used to pump water up to an accessible central location from a river as either the primary or back-up water source for a community. Regular, fast-moving flood events are a significant issue for these systems as the pumps can quickly be washed away and need to be replaced.

This project investigates techniques which might enable pumps to withstand flood and cyclone events.

## 5.5 Grey water management

When groups camp on Country, there is a certain amount of water runoff (from activities such as showering) that is released into the environment. There is interest in possible alternatives to grey water trenches, which are expensive based on the ground conditions at many sites, which will enable the appropriate management of grey water runoff so any negative environmental impacts are avoided or mitigated.

Alternative to grey water trench (specifically around the greywater from showers when people are camping)

**See also:** 2.3 Offline solar bore diagnostic assistant

## Additional Information

Below are a few resources that you might find helpful to get started working on these design projects.

Please see the 'Resources' section for a full list as you might find others that help to inform your project.

- Walkthrough: [\*an example of a CfAT supported water supply system\*](#)
- Explore: Queensland. Department of Natural Resources, Mines and Energy. Water Services, North Region. Water Planning. [\*'Cape York water atlas : covering the 15 river catchment regions that make up the Cape York water plan area'\*](#)



# Design Area Six

## Waste & Reuse

*The remote location of many Indigenous communities in Cape York makes involvement in municipal waste collection services challenging. Generally waste is processed within a community and this involves separation followed by landfill or incineration.*

Currently one of the most challenging waste streams to manage is white goods, i.e. refrigerators, washing machines, etc. Relatively inexpensive white goods are purchased in urban areas and when they break, which is generally quite quickly, they are cheaper to replace than they are to repair. In addition to effects on waste management, practices around refrigerator purchase, use, and disposal can have significant implications for the pace of climate change. Current refrigerants in use (HFCs) have ‘1,000 to 9,000 times greater capacity to warm the atmosphere than carbon dioxide’ and ‘refrigerant management’ is ranked at number one in Project Drawdown’s modeling of climate solutions.

Waste that accumulates along coastlines is an ongoing challenge. [Ghost nets](#), for example, are discarded or lost plastic fishing nets from overseas which wash up in considerable quantities. This dispersed waste is challenging to collect and dispose of, and can have negative impacts on biodiversity.

### The CfAT ‘CATFab’

The Alice Springs CfAT location hosts [an enterprise workshop known as ‘CATFab’](#) where creative appropriate technology design, enterprise, and skill development meet. The CATFab workspace contains a variety of different types of machinery which is used to repurpose available materials into creative products. Chip heaters, drum ovens, and the CfAT Hotspot are examples of items constructed in this facility.

# Project Opportunities

## 6.1 Remote re/upcycling opportunities

The challenges of centralised waste collection and disposal in a remote area open up opportunities to more deeply explore recycling or upcycling the most common forms of waste found on Country. This project explores appropriate repurposing of common waste items, including ghost nets and plastics which commonly wash up on shorelines on the east coast of Cape York.

## 6.2 CATFab alternatives to electric goods

CfAT are interested in harnessing the creativity and fabrication skills of the CATFab employees to develop simple, sustainable alternatives to currently available generic white goods. Generic white goods in remote bush locations can be difficult to maintain, repair, and appropriately dispose of, so simple alternatives to these products can extend the life of a functional product while also reducing the level of waste that must either be transported to a city or disposed of in the bush. Key activities of interest are clothes washing (i.e. reducing the need for electrical washing machines), refrigeration (see possible links to design project 4.1), white goods in general and communication (i.e. simple mobile phones).

## 6.3 Appropriate collection and management of plastics

Plastics are a growing waste stream with currently limited management processes. In this project teams will investigate appropriate ways to manage the different types of plastic waste produced in remote indigenous communities and propose mechanisms through which the negative impact of this waste stream might be reduced or mitigated.

## Additional Information

Below are a few resources that you might find helpful to get started working on these design projects.

Please see the 'Resources' section for a full list as you might find others that help to inform your project.

- Read: Northern Australia Environmental Research Portal. Waste and Marine Debris in Remote Northern Australian Communities. July 2017 Final Report '[\*Remote recycling, rubbish and marine debris management in north Australia needs strong helping hands: Summary of Cape York Peninsula community case studies\*](#)'
- Explore: Queensland Government website, [\*Queensland's new waste strategy\*](#)





---

# Design Area Seven

## Conservation and Land Management

*Through supporting basic appropriate infrastructure development, CfAT is aiming to enable Traditional Owners to be on Country and take care of Country.*

Taking care of Country often involves a variety of traditional land management activities and aligns with the growing presence of Indigenous Ranger Programs across Queensland.

Indigenous Ranger Programs operate in coordination with the Queensland Parks and Wildlife Service on jointly-managed national park land. Land management responsibilities include ‘fencing, cattle management, cultural and natural values protection’ . [\*CfAT has seen success supporting the construction of ranger bases\*](#) that further enable the work of Indigenous Rangers through controlling visitor access to Country and creating a central point for activities like coastal monitoring.

### Fire Management and Carbon Farming

Indigenous communities have traditionally managed landscapes through the use of fire, and this knowledge is being increasingly recognised by others involved in environmental management including government policy makers. Traditional practice involves burning strategic areas of savannah woodland just after the wet season - called ‘cool burning’, these fires are low intensity and reduce the fuel available for fires which might otherwise occur later in the year.

In addition to reducing the intensity (and resulting damage to biodiversity, property, etc) of fires when they do occur, cool burning on a location releases far less carbon into the atmosphere than would if that location were to be unmanaged and experience a large, hot fire in the dry season. The difference between the baseline carbon released on unmanaged land versus the carbon released on managed land can be calculated through a detailed verification process including live satellite monitoring (See NAFI website link below), and Aboriginal corporations are generating income from the sale of these carbon credits on the open market. ‘Carbon farming’, as this is known, brings the economic benefit of income associated with traditional land management activities alongside the significant environmental benefits of carbon emissions reduction and maintenance of biodiversity.



# Project Opportunities

## 6.1 Tools to enable remote fire management

The 'cool burn' fire management technique involves setting small fires in a mosaic pattern which ensures appropriate areas are burnt and any wildlife present is able to move away from danger through safe corridors. Fires are set and managed by Rangers, who have access to drones and mapping equipment to assist this work. As some areas which would be most appropriate for burning are difficult or impossible for rangers to access (due to vegetation, terrain, creeks, etc), it has been recognised that fire management could be supported through safe tools, which would enable rangers to remotely distribute the small incendiaries from a nearby location. Projects in this area could consider the use of drones and must include comprehensive risk management plans.

## 6.2 Protection of turtle nests

The east coast of Cape York contains many unique and ecological-sensitive areas. Undisturbed beaches provide important nesting locations for turtles, however feral pigs are having an increasingly negative impact through digging up and eating the eggs. This project investigates mechanisms to protect turtle nests on Cape York coastlines.

**See also: 1.2 Methods to reduce the spread of weeds**

**See also: 2.2 ICT infrastructure to support appropriate tourism**

## Additional Information

Below are a few resources that you might find helpful to get started working on these design projects. Please see the 'Resources' section for a full list as you might find others that help to inform your project.

- Explore: *Stories from Country 2015 - 2017*, How Indigenous Rangers and Indigenous Protected Areas are strengthening connections to Country, culture and community. National Indigenous Australians Agency
- View: Anne Davies and Carly Earl in The Guardian, 20 December 2018: *'Life on the land with the Lama Lama rangers – a picture essay'*
- Read: Emilie Ens and Alana Grech in The Conversation, 15 January 2018: *'Indigenous ranger programs are working in Queensland – they should be expanded'*
- Explore: North Australian & Rangelands Fire Information (NAFI) [website](#)
- Watch: ABC Education, Bruce Pascoe: Aboriginal agriculture, technology and ingenuity, *Chapter 13, Fire*
- Watch: Indigenous rangers in West Arnhem Land, Northern Territory have offset more than one million tonnes of CO<sub>2e</sub> through strategic early dry-season burning to prevent devastating uncontrolled bushfires later in the year. See more [here](#)





# Design Considerations

*Below are listed a few considerations we recommend you factor into your EWB Challenge design idea to ensure it is appropriate to the context. You might ask yourself these questions a few times throughout the design process – it's okay if you don't have all the answers in week one!*

**Sustainability** – Consider the long-term sustainability of your project proposal. What measures could be put in place to ensure the successful continuation into the future?

**Impacts on community** – What impact will your design have on members of the community? Who are your key stakeholders? Is there anyone you haven't included?

**Impacts on environment** – What impact, both positive and negative, will your design have on the local environment? What measures can you put in place to mitigate any negative impacts?

**Cultural and social factors** – Does your design align with or celebrate the cultural and social practices of people who live and work on Country?

**Community engagement** – How would you propose that EWB and CfAT engage and consult the community throughout the project? Think about the initial design right through to implementation. What avenues are there for community members to become involved? What form(s) of community engagement might be required for your particular design response?

**Cost and economic benefits** – What is the estimated cost of the project? Think about the 'Capital Expenditure' (initial cost to start) and Operational Expenditure (ongoing costs over time), which might include material costs,

implementation, operation/program delivery costs, and maintenance costs. Consider if there are any potential economic benefits to the community which could result from the project.

**Effective technical design** – Is the technical design the most appropriate and effective for this context? Take the time to show what alternatives were considered and why you are proposing your design as the most appropriate. Previous EWB Challenges show that the most successful designs are often ones that are simple in design and can be implemented / prototyped (tested) rapidly.

**Materials** – Have you considered the use of locally available materials that are culturally acceptable and environmentally friendly wherever possible. Transportation of project materials and availability of materials which might be required for future maintenance are a significant consideration for projects in remote locations. Where might your proposed materials be sourced from?

**Delivery and ongoing management** – Who might construct and/or implement the project? Is the design response one that considers local capacity for ongoing management, repair, and maintenance? As much as possible, does your design or system proposal align with locally available expertise?





*You are encouraged to include a response to each of the above in the design proposal submitted for the EWB Challenge.*

## Additional Considerations for the CfAT and Cape York context:

**Remote diagnostics** - Many of the remote Indigenous communities CfAT work with have limited mobile phone reception on Country. When considering options for ongoing maintenance, you may explore opportunities for remote diagnostics. In other words, how can you make it easy as possible to figure out and address an issue if a key element of your design proposal breaks? How might you better engage key community members or users in assisting the process of remote problem identification and troubleshooting to avoid (as much as possible) the requirement for external support to be brought in, or make this as efficient as possible when required? A critical challenge for appropriate design is the sheer cost of mobilising technical expertise to site to resolve system breakdowns.

**Simplicity and Aesthetics** - Two criteria specifically identified but often not considered in the design and development of engineering solutions are simplicity and aesthetics. ‘Simplicity’ of design was interpreted as how a project would be both built and maintained - ‘there’s no need to complicate things!’. Aesthetics are how your design solution looks and feels - the most cost effective solution does not have to be ugly!

**Seasonality** - A number of remote homelands become inaccessible in the rainy season, which is typically from December to April but can stretch from November - June (or even later in some more remote areas). How might your project plan work around the varying levels of site access associated with the wet season?

**Disaster resilience** - A number of remote homelands are subject to extreme weather conditions. For example much of Cape York is classified as Australia wind region C (cyclonic) and may be upgraded to D (severe cyclonic) as the number of severity of cyclones increases with the change in climate. Are there design decisions which might increase the cyclone or flood resilience of your proposal?





# Further Resources

*The EWB Challenge Design Brief is the foundation from which students can begin developing design ideas to address the priority areas identified by our 2020 EWB Challenge partner organisation and the communities they work with.*

Further resources to support students with exploring the context of remote indigenous homelands on Cape York Peninsula and the development of a feasible, viable, innovative design solutions are available on the [EWB Challenge website](#), including:

- Background on the Centre for Appropriate Technology approach and project examples
- Baseline data including community demographics, material costs, etc
- Photos and videos to build contextual understanding
- A student discussion forum moderated by EWB Australia staff

## And more generally

- EWB 'Key Development Concepts' focused on the principles behind sustainable development projects
- Links to previous EWB Challenge award-winning student reports
- A downloadable 'reviewer assessment criteria', used by our external team to evaluate the top submissions to be invited to the annual Finalists' Showcase Event



