

TECHNOLOGY AND INDUSTRY ADVISORY COUNCIL

**Feasibility Study into the Establishment of Collaborative
Multi-disciplinary Research Facilities focused on
Tropical Science in the Kimberley Region of WA**

FINAL REPORT

October 2013

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1. Introduction

In June 2011 the Premier, the Hon Colin Barnett MLA, announced a \$63 million package to support the Government's Kimberley Science and Conservation Strategy. The Premier stated that "the strategy is one of the most significant conservation initiatives in West Australian history, befitting of a region of such international significance." Successive Commonwealth Governments have also acknowledged this need by funding research programs. These programs are generally aimed at all of tropical Australia, not only the Kimberley. Given the current situation, TIAC agreed that there is merit in exploring whether existing and future research in the Kimberley would benefit from the establishment of new research facilities in the region, and if so, what form any new facilities would take.

Accordingly, TIAC member and Chief Scientist, Professor Lyn Beazley and TIAC member Professor Shaun Collin undertook a study into research infrastructure in the Kimberley¹

The objectives of the study² are to:

- identify research groups operating within and contributing to the region;
- map the existing research infrastructure in the Kimberley;
- identify potential growth areas for research in the Kimberley and assess any impediments to establishing appropriate research facilities in the region;
- describe the nature and scope of research facilities required to meet the future demand for research in the Kimberley;
- provide recommendations on how existing facilities might be enhanced and better utilised;
- assess the potential demand for new research facilities and the extent to which new facilities would facilitate better research outcomes;
- explore possible governance models for new facilities;
- identify potential sources of State Government funding and the extent of potential external co-investment; and
- provide draft recommendations to the Government on the feasibility of establishing appropriate research facilities and how best to meet any present gaps in regional research infrastructure.

¹ A full report is available on request.

² The study was undertaken by Professor Peter Cook and Professor Peter Davies of The University of Western Australia.

2. Summary of key recommendations

Recommendation 1 - Catalogue existing research, including agency internal reports, and create an e-library, listing all existing research.

Although a great deal of research is already happening in the Kimberley, there is currently little coordination of the research and there is no central research register. As a result there is the possibility for duplication of research effort and a waste of resources.

Recommendation 2 - Use existing indigenous networks to facilitate future research projects.

Community engagement is essential to successful research. To assist in this aspect, cross-cultural training should be made available and strongly encouraged to researchers before they start working in the region.

Recommendation 3 - Review existing procedures regarding access to country with traditional owners to develop a 'post land title' framework as a more efficient, less political means by which to negotiate.

At present these negotiations are very complex, time consuming and expensive.

Recommendation 4 - Establish a collaborative, multi-disciplinary research facility in the Kimberley in order to accommodate the wide range of research. Broome appears to be the preferred location, possibly by expanding existing facilities at the Kimberley Training Institute.

There is a great need for additional research in the Kimberley, in a wide range of research fields but research infrastructure is generally inadequate. Most people support the concept of a collaborative, multi-disciplinary, research facility, but there are differing views on how, where and under what conditions it should be established. A detailed specification and costing is beyond the scope of this study which has identified a genuine need which requires further investigation by the Government.

Recommendation 5 - Provide affordable accommodation for researchers.

Accommodation for researchers is severely lacking and this paucity is made more difficult and expensive by the high level of activity by resource companies.

Recommendation 6 - A Comparative Cost Benefit Analysis is performed between Kimberly and other regions of Western Australia and Australia.

A comparative cost benefit analysis on conducting research and maintaining research infrastructure in the Kimberly versus other regions of WA and Australia would assist in quantifying the comparative capital and operating costs.

3. Current research in the Kimberley

3.1. Research Areas

A guiding document under-pinning research programs in the Kimberley, is “The Kimberley Science and Conservation Strategy.” Although not directly a research strategy, it outlines five priority areas, several of which would require additional research to be undertaken. The five priority areas are:

- Kimberley Wilderness Parks.
- A new landscape approach to conservation to manage fire, introduced animals and weeds.
- Training and employment for Aboriginal rangers.
- Investing in knowledge and making information accessible.
- A major boost to nature-based tourism.

A report produced by *Prime Focus* (2008) listed 42 areas of research in which projects were being carried out by State agencies in the Kimberley. The current project builds on this information and, in addition, documents research projects that are currently underway as reflected from the structured interviews and online survey, and from information published by some of the government agencies.

Research projects have been considered within research categories as follows: Marine; Natural Resource Management (land based and aquatic); Sociological and Cultural; Health Related; Agricultural and Pastoralism; Water Resources; Geoscience and Palaeontology.

In Appendix 4 of the main report (Current Research Activities), one hundred and nineteen research projects are listed. The breakdown of projects into the various categories is shown in Table 1.

Table 1. Number of projects by research category

Research category	Number of projects
Marine	43
NRM (land based)	34
Sociological and Cultural	20
NRM (aquatic)	9
Health related	7
Agricultural and Pastoralism	6
Water resources	4
Geoscience and Palaeontology	2

3.1.1. Marine

One of the most active research groups in the area is the Western Australian Marine Science Institution (WAMSI). The Institute itself does not have research buildings in the Kimberley, but many researchers make use of the Kimberley Marine Research Station at Cygnet Bay. Based on Cygnet Bay Pearl Farm, the research station offers facilities for independent research on local coastal and marine environments. The station owns boats that can be hired by visiting researchers. Cygnet Bay is located on the Dampier Peninsula, about 200Km north of Broome.

A wide range of marine research is undertaken, with the stated goal being to “undertake a program of marine research to support the conservation and management of the waters of the Kimberley, particularly the proposed State marine parks”. A guiding document underpinning the research program, is “The Kimberley Science and Conservation Strategy.” The Kimberley Marine Research Program focuses on two key areas, these being to characterize the biological, physical and social environment and, secondly, to understand key ecosystem processes and response to human impacts. To undertake this research WAMSI has received \$12 million from the State Government and a further \$18 million in leveraged support, to be invested over six years.

Although active in local research, the Department of Fisheries in Broome has very rudimentary laboratory facilities. They utilise laboratory space in the Kimberley Institute of Training.

The research vessel, RV Solander, owned by the Australian Institute of Marine Science, is currently home-based in the Kimberley and is available for marine and oceanographic research. Attention should be given to effective use of this vessel for future research.

3.1.2. NRM

The north west Kimberley is regarded as one of Australia's 15 national biodiversity hotspots and, as such, has attracted significant NRM research funding. Most of the NRM activity in the Kimberley (both land-based and aquatic) is coordinated through Rangelands NRM. Although much of the effort is directed towards on-ground works, there is often a research component of such projects. The NRM projects are often directed towards solving local problems such as cane toads, fire abatement, and the eradication of weeds and feral animals. Over the past couple of years, Rangelands NRM has administered almost \$4 million on these projects.

Another important research program is the Tropical Rivers and Coastal Knowledge Program (TRaCK). The program was conceived to address the widely-held view that the information available for making good decisions about water resources in northern Australia was currently poor and there was a clear need to increase the human capacity in the North to ensure future development occurred in a sustainable way. Designed as a 10 year, \$40m research program, the first phase of TRaCK secured \$20m to support 4 years of research (2006-2010). TRaCK established a collaborative consortium of over 80 of Australia's best tropical river and coastal scientists. The program has been a very effective way of building sufficient capacity to conduct an integrated program of research on a scale and level of coordination never seen before in river and coastal research in northern Australia.

The first phase of TRaCK focussed on acquiring fundamental knowledge about the assets and values of tropical rivers, and the ecosystem processes that underpin them. The TRaCK2 program will maintain a focus on providing the science and knowledge that governments, communities and industries need to sustainably manage Australia's tropical rivers and coasts. There is a high level of stakeholder support for this to aim to be achieved and a strong commitment from the research scientists and institutions currently involved. The TRaCK2 program will see a transition from the acquisition of fundamental knowledge to a greater focus on knowledge synthesis and targeted research to address the major issues that end users have identified as critical for tropical river and coastal management.

The Department of Environment and Conservation is involved with a range of projects, many of which are in response to the Kimberley Science and Conservation Strategy, and several of which involve working with Ranger groups. Examples of projects include the bio-control of passion vine (with CSIRO); rainforest inventory (CSIRO); cane toad research and the Teacher Toad Program; Cane Toad Busters – lung worm parasites; Rock Art research (University of New England and University of Western Australia); rock art research and recorded history (Kimberley Foundation Australia, The Dunkeld Pastoral Company and the University of South Australia); feral cat; fire, Gouldian finch and purple crown fairy wren research (Australian Wildlife Conservancy, Mornington Peninsula and Macquarie University). In addition, the agency works with WAMSI on a range of marine research projects.

3.1.3. Sociological and Cultural Research

A number of different organisations and universities have been involved in various types of sociological and cultural research in the Kimberley. These include research carried out under the auspices of the Department of Agriculture and Food, Department of Premier and Cabinet, Department of Environment and Conservation, and the University of Western Australia. The largest contribution to sociological and cultural research has, however, been made by the Nulungu Research Institute of the University of Notre Dame. The university campus is located in central Broome and researchers there are active in a number of research fields, many of which involve interaction with Traditional Owners and local indigenous groups.

Three projects listed under sociological and cultural research in Appendix 4 of the main report (Current Research Activities), are the first of those to be listed under the newly formed entity - UWA Centre for Rock Art Research and Management (CRARM). The centre is in start-up phase, but as indicated in the interview summary, the potential impacts arising from CRARM's activities is potent and large, encompassing projects on both a national and global scale.

3.1.4. Health

Several groups are involved in various aspects of health research, primarily aimed at improving the health of indigenous communities. For example, the Shire of Wyndham, East Kimberley, is involved in research in the health sector addressing dental health; otitis media (CSOM), water quality; diabetes and kidney disease. The Rural Clinical School (UWA) works in collaboration with the Kimberley Aboriginal Health Service Council (KAHSC) on several

projects on aboriginal health. The funding for such research has been increasing over the past few years and in 2011 – 2012 totalled \$1,834,224.

The North Australia Emerging Infectious Diseases Alliance (NAEIDA) was established in 2005 in an attempt to establish a tropical health network across WA, the Northern Territory and Queensland. However, to date, the network has not been successful in attracting funding.

The Broome campus of the University of Notre Dame encompasses around 30 staff and 200 students. The focus is on reconciliation, with the aim of determining how cultures can work together. The University supports community/campus partnerships. There is a teaching arrangement with the Rural Clinical School at The University of Western Australia in the form of clinical placements for students of years 3 and 4. The Kimberley Aboriginal Health Service coordinates aboriginal health in the region and has established a web based database of Aboriginal health records. The University has established the Nulungu Research Institute with Bruce Goring as Director. The theme of the Institute is “Healthy People, Healthy Country.”

3.1.5. Agriculture and Pastoralism

Agricultural research is generally coordinated by the Department of Agriculture and Food WA, both from their Broome and Kununurra offices. The Broome office is small with little in the way of research infrastructure, with future research likely to focus on the La Grange region. The Department has more substantial research infrastructure near Kununurra including facilities that can accommodate three research students. The facility is, however, currently underutilized and although it lends itself to on ground research in the region, it has been difficult to attract suitable students to work there. Current projects being undertaken include crop irrigation and traditional agriculture (e.g. sugar cane, chick peas, cotton, maize, mangoes, corn, rice, GM cotton, wheat); investigation of water resources and potential new sources of irrigation water; beef production research; cane toad research; and market research including regional economic linkages. A relatively recent innovation in agricultural research involves investigations of the potential of carbon farming on pastoral leases.

Bio-security is an important issue that has recently been receiving more attention. In the past, inadequate bio-security protocols may have been responsible for the introduction of several noxious weeds and feral animals. Considerable funding is now being committed to

the control and eradication of such organisms. Future research should be directed towards the establishment of better bio-security protocols for the future.

3.1.6. Water Resources

The four water-related projects listed in Appendix 4 of the main report (Current Research Activities), are probably an under-estimate of the total amount of water research being undertaken in the region. This shortfall reflects many of the projects being listed under other categories (e.g. NRM, Health, Agriculture) but include an aspect associated with water sources, water quality and water use. The projects listed under the “Water” code are generally those coordinated by the Department of Water, involving direct investigations of water resources, water allocation and the inter-connectedness of different water sources. The Department currently has little infrastructure outside of Broome or Kununurra, and most of the water research is coordinated through the Kununurra office.

3.1.7. Geoscience and Palaeontology

Much of the geoscience research in the Kimberley is being conducted by mining and energy companies and is confidential and, therefore, not in the public arena. Table 1 lists only two current geoscience research projects but the figure does not include the confidential projects being carried out by the resources industry.

In terms of palaeontology, the Gogo Formation has a fauna of approximately 45 different species, mostly fish, which makes it one of the most diverse sites in the world, and it is the only site where fishes are preserved whole in perfect 3-D preservation with soft tissues. To date over 200 published pages in peer-reviewed scientific journals have been published on the structure and relationships of the Gogo fossils, making this one of the best known fossil faunas in the world.

The Gogo fish fossils have made an enormous contribution to our understanding of early vertebrate structure and evolution, and together with a diverse array of well-preserved invertebrate fossils from the sites (3D preserved early crustaceans termed ‘conccavcarids’, as well as ammonoids, nautiloids, molluscs etc), the entire ecosystem of an early tropical equatorial reef can be reconstructed. Studies on early vertebrate evolution continue today.

In addition, these ancient reefs are used as reference sections by the resources industry (both National and International) to better understand how sedimentary basins form, and

how minerals form within these basins. In addition a new magnetostratigraphic technique, vital to the oil and gas industry, is being trialled in the area.

3.2. Conclusions about current and future research

The main conclusions from the structured interviews and the online surveys concerning current and future research, were as follows:

1. A great deal of research is already happening in the Kimberley, carried out by a wide range of organisations and individuals.
2. There is currently little coordination of the research and there is no central register of research being undertaken, sometimes leading to duplication of research effort and waste of resources.
3. There is a great need for additional research in the Kimberley, in a wide range of research fields.
4. Well established indigenous networks already exist across the Kimberley (the level of complexity is not often appreciated nor understood by external researchers) which can be accessed to facilitate research projects.
5. Research infrastructure is generally inadequate. Good infrastructure such as accommodation, transport and new facilities are a must to attract permanent researchers rather than “fly-in-fly-out”. All interviewees commented on the major lack of infrastructure overall. **A greater number of researchers residing in the region will create greater efficiencies, increase the relevance of the work undertaken, and give researchers greater ownership of the research.**
6. Many interviewees considered accommodation to be severely lacking in the region, making it difficult for researchers to stay in the community. Accommodation that does exist is often made available through the ‘good will’ of the community.
7. Good community engagement is essential. Establishing relationships with the local indigenous community will greatly help with research activities. Research that is community driven and aligns with local and state government priorities is seen as a success factor.
8. The Kimberley is seen as an exciting and attractive place to live and work due to its remoteness and vast areas of unexplored/unstudied areas. However, some people see remoteness as a barrier. Long travel times, the expense of travel, access issues and isolation are all major concerns. The extreme weather variance and unpredictability also create a significant barrier

9. There are insufficient researchers to achieve critical mass and there is a lack of overall skills and expertise in all fields of research and development. Although field work is undertaken in the Kimberley when necessary, most analysis is conducted elsewhere (Darwin, Albany, Perth, etc.) This situation is partly due to lack of infrastructure as well as costs and lack of human capital. “fly-in-fly-out” is the current standard.
10. A number of interviewees referred to the highly political nature of the Kimberley environment which must be taken in to account, including issues that exists between traditional land owners and State Government, such as native title claims. Another problem is past experience with some external researchers considering indigenous people as research subjects, especially in fields of health and medicine.
11. Lack of appreciation of the high level of complexity of legal compliance, time and cost required to broker agreements with land councils (such as the Kimberley Land Council); and the importance of undertaking a review to develop a ‘post land title’ framework as a more efficient, less political means by which to negotiate.
12. There is difficulty in competing with the resources industry, remuneration in particular. The industry and its presence push up costs in the region, especially for accommodation.
13. Most people support the concept of a collaborative, multi-disciplinary, research facility, but there are differing views on how, where and under what conditions it should be established. Basic facilities will be more sustainable.

3.2.1. Areas where further research is needed

In response to the question of whether additional research is needed in the Kimberley, an overwhelming majority of respondents, in all of the categories of research, suggested that there is a wide range of new research that should be undertaken. The list of required research is presented in Appendix 2.

4. Possible structure of a collaborative, multi-disciplinary research facility

Based on the views expressed in the structured interviews and the online survey, some suggestions are made in this section about the possible location, structure and governance of a collaborative, multi-disciplinary research facility in the Kimberley.

Location

The majority of current research is being carried out either in Broome or Kununurra, and this is where most research infrastructure is currently located. Research facilities and infrastructure are very sparse in other centres such as Derby, Fitzroy Crossing and Halls Creek. If a new collaborative, multi-disciplinary research facility were to be developed, it would probably make the most sense to locate it either in Broome or Kununurra. Although these locations may not help to increase research activity in the smaller centres, it could greatly stimulate additional research activity in whichever of the major centres it was established. In addition, if the facility were to be set up in a way that helped researchers visit the smaller centres (e.g. purpose-built and equipped caravans for specific activities), then additional research may be facilitated in the smaller centres.

Structure

A multi-disciplinary research facility would need to cater for the interests of a wide variety of different types of research, each with its own specific needs in terms of equipment and infrastructure. Some aspects, such as administration, secretarial assistance, logistical support and technical assistance, may be common to several types of research and, in such cases, efficiencies of scale could be achieved. It may also be possible to share field equipment such as vehicles and boats. The necessity to use 4WD vehicles, and the high cost of hiring them, was noted as one of the difficulties of conducting research in the Kimberley. Vehicles owned by the research facility and available for hire by visiting researchers at a reasonable cost may help to solve this problem.

Some types of laboratory equipment, such as those for microscopic and chemical analyses equipment, may be common to several types of research and could, therefore, be used on a shared basis. In other cases, however, certain research groups may require access to highly specialized equipment that could probably not be shared. Even in these cases, however, the idea of housing the equipment in the Kimberley, rather than transporting it with “fly-in-fly-out” researchers, may also offer some advantages.

A common conclusion emerging from the structured interviews and the online survey was that there is currently inadequate laboratory space available to researchers. Whether referring to “dirty” laboratories to process field samples, general laboratories to accommodate students, or highly specialized clinical and analytical laboratories, respondents generally felt that current facilities are inadequate. A multi-disciplinary research facility should, therefore, incorporate laboratories, preferably of several different types. Such laboratories should be accessible to resident staff and students as well as visiting researchers.

The high cost of accommodation in the Kimberley was also noted as an impediment to research, particularly for visiting scientists. A multi-disciplinary research facility including accommodation for students and visiting researchers, would make doing research in the Kimberley much more attractive.

Collaboration in research is facilitated by conferences, workshops, training schemes and extension activities. A collaborative research centre should, therefore, include conference and small group facilities with teleconference facilities.

Governance

An aspect that was emphasized in the structured interviews and the online survey, was that to be successful, a collaborative, multi-disciplinary research facility would need to be independent, and not managed under the auspices of any existing agency, university or other organisation. A facility administered by an existing agency would, most likely, be perceived to be biased and may not, therefore, be supported as widely as could be achieved. Whilst it may be acceptable for a wide range of different research organisations to contribute (including financially) to a multi-disciplinary facility, a structure and business plan should be developed to ensure that no one organisation becomes dominant. This aim could be achieved if the centre was overseen by a Board consisting of members of a range of different agencies, universities and research organisations. The Kimberley Institute of Training is generally held in high regard, and might be a possible venue.

An important aspect of a Kimberley research centre is that it should encourage collaborative research. To some extent, a trend towards collaborative research is already happening as companies establish relationships with others with whom they both collaborate and compete. Research and non-exclusivity from development costs are high, so many organisations seek

to spread the risk of innovation by working together to benefit from economies of scale and scope.

Research and development policies and systems need to facilitate and encourage knowledge generation, collaboration and knowledge sharing between organisations. Innovative activity has been shown to be positively correlated with knowledge spill-overs, such as through informal face-to-face communications and collective learning. These aspects are facilitated and encouraged through co-location (clusters, technology parks) and through networking initiatives, such as conferences and trade association activities. Such initiatives provide feedback loops for ideas and innovations. Regular interactions (formal and informal) between all levels of participants to share challenges, successes and findings also help with engagement, understanding, and the creation of strong personal links between teams and individuals.

Around the world, there are many examples of government-led initiatives to facilitate and encourage research collaboration, knowledge sharing and innovation. These include developments such as cluster-based initiatives; centres of excellence; small business incubators; learning region initiatives; technology and science parks; supply-chain initiatives; conferences and training; networks and industry associations; and university-based industry outreach. In terms of a collaborative, multi-disciplinary research facility in the Kimberley, it is debatable which of these might be most appropriate. However, the concept of a “Kimberley Centre of Excellence in Tropical Science” would capture the essence of Government aims.

5. Recommended Actions

- **Seek funding to create an e-library of all existing research, both in published scientific literature and in Agency reports, and seek an appropriate website on which to host and maintain this information.**
- **Establish a collaborative, multi-disciplinary research facility, probably based in Broome, in order to accommodate a wide range of research, possibly by expanding existing facilities at the Kimberley Training Institute.**
- **Create a mechanism to use existing indigenous networks to facilitate future research projects and to negotiate access to country with traditional owners.**
- **Seek funding to provide affordable accommodation for both resident and visiting researchers.**

6. Appendix 1

Methodology

6.1. Outline of process

An outline of the process undertaken in this study is shown in Figure 1.

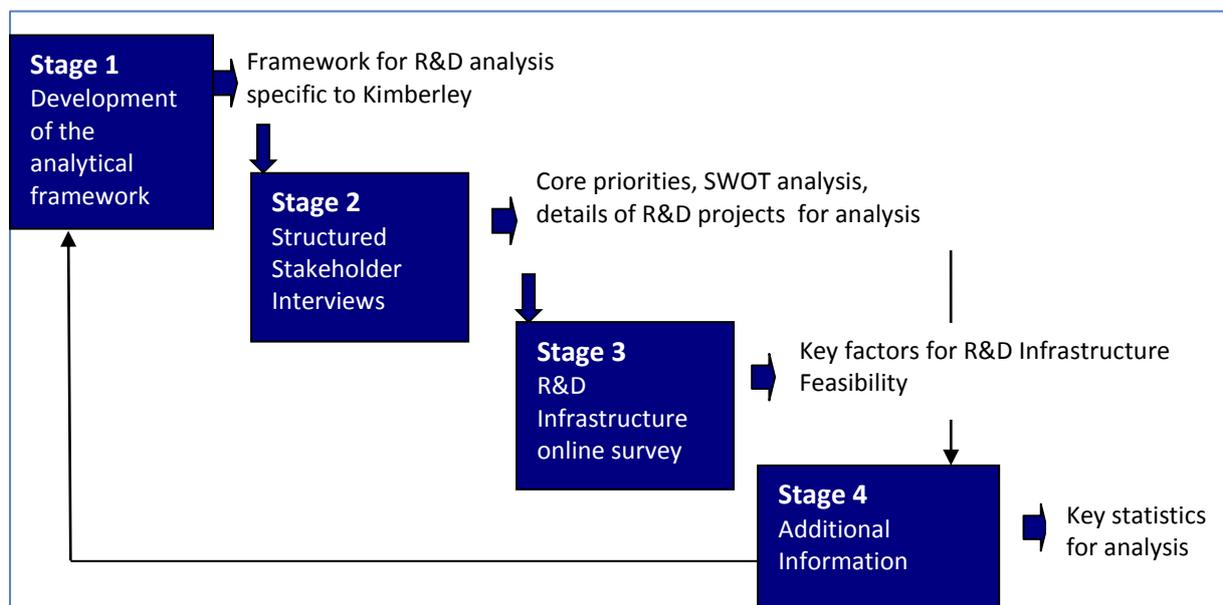


Figure 1. Outline of methodology

The overall analytical framework constructed for the study is as follows:

Table 1. Analytical framework

Element	Sub-element	Description
Research Activities	Current Research Activities	Research currently being undertaken wholly or in part in the Kimberley
	Potential Future Research	Research that could potentially be undertaken in the Kimberley but which is not currently
	Research funding	The sources, priorities and adequacy of funding for research in the Kimberley
Research Infrastructure	Research networks	Formal and informal, physical and virtual networks supporting research in the Kimberley
	Research facilities	Physical facilities and hardware supporting research in the Kimberley
	eResearch Infrastructure	Information and Communications infrastructure supporting research in the Kimberley
	Supporting Infrastructure	Non-research infrastructure supporting research in the Kimberley. E.g. accommodation.
	Human Capital	The availability of the skills, expertise and labour to conduct research in the Kimberley

6.1.1. Structured Interviews

Structured interviews were organised with key stakeholders. Key stakeholders included agencies, research organisations and researchers. Stakeholder consultations were conducted by telephone and results analysed to develop the SWOT analysis.

Respondents were also asked to provide detail on R&D projects underway in the Kimberley with results used to map both terrestrial and ocean research projects currently being undertaken.

Of the 24 key stakeholders invited to participate, 21 accepted and were interviewed. The list of stakeholders is recorded in

Table 2.

Table 2. Stakeholders interviewed during the consultations

Agency / Institution	Respondent	Structured Questionnaire
Dept of Agriculture & Food Western Australia (DAFWA)	Noel Wilson Manager - Kimberley (n/a) Geoff Strickland Director, Irrigated Agriculture Innovation, Dept. Agriculture & Food WA	Agency
Dept of Environment and Conservation (DEC)	Daryl Moncrief Kimberley Regional Manager	Agency
Department of Water (DoW)	Chris Gunby Regional Manager (n/a) Rob Cossart Program Manager of Water Resources	Agency
Department of Fisheries	Peter Godfrey Manager - North Region	Agency
Kimberley Development Commission	Jeff Gooding Chief Executive	Agency
UWA, Institute of Agriculture	Prof Siddique Kadambot Winthrop Prof, Hackett Professor of Agriculture Chair and Director	Research
TRaCK (Tropical Rivers and Coastal Knowledge). NERP (National Environmental Research Program)	Prof Michael Douglas Director, TRaCK NERP Northern Australia Hub – Leader.	Research
CSIRO	Dr Tim Munday Principal Research Scientist, CSIRO Earth Science and Resource Engineering	Research
Murdoch University	Belinda Robson	Research
Nulungu Research Institute	Bruce Gorring	Research

The University of Notre Dame Australia	Research Co-ordinator Nulungu Research Institute	
University of Sydney	Prof Rick Shine Federation Fellow (ARC) Professor in Evolutionary Biology - Cane Toad Research	Research
Independent researcher	Dr Sean Doody	Research
Shire West Kimberley/Derby	Peter Kneebone Councillor	Agency
Shire of Broome	Leah Pearson Environmental Officer	Agency
Shire of Wyndham and East Kimberley	Gary Gaffney, CEO (n/a) nominated: Janet Takarangi ACEcD Economic Development and Remote Service Delivery Officer	Agency
Shire of Halls Creek	Warren Olsen, CEO	Agency
Dept Premier and Cabinet	Simon Taylor Director (Approvals Reform/Kimberley Strategy)	Agency
Dept of Mines and Petroleum	Dr Kath Grey Chief Paleontologist	Agency
Western Australian Marine Science Institution (WAMSI)	Dr Peter Roger WAMSI Chairman	Research
Kimberley Land Council	Nolan Hunter, CEO (n/a) Ari Gorring, Manager Land and Sea Management Unit, Kimberley Land Council.	Agency
Rangelands NRM	John Silver Operations Manager	Agency
UWA Rural Clinical School of WA	Winthrop Professor Geoff Riley Head of School	Research
UWA Centre for Rock Art Research and Management (CRARM)	W/Prof Peter Veth Chair	Research
WA Museum	Dr Paul Doughty Curator Herpetology	Research

6.1.2. R&D Infrastructure online survey

Key stakeholders were also asked to complete an online survey in order to capture feedback that can be analysed in a more quantifiable way and on a consistent basis. Additionally, invitations to participate in the online Survey were emailed out to 157 potential respondents. The group included representatives from selected:

- Government Departments
- Universities/ Education / Research institutions
- NGOs and NRM groups
- Key Indigenous groups
- Other Indigenous organisations
- Pastoralist Groups
- Other relevant industry sectors and organisations

- Commonwealth bodies
- Regional Kimberley businesses

7. Appendix 2

Areas where further research is needed

In response to the question of whether additional research is needed in the Kimberley, an overwhelming majority of respondents, in all of the categories of research, suggested that there is a wide range of new research that should be undertaken.

In the field of NRM research, an important, recently-published State Government document, that is likely to be used to guide some aspects of future research, is the Kimberley Science and Conservation Strategy (2011). Although not directly a research strategy, it outlines five priority areas, several of which would require additional research to be undertaken. The five priority areas are:

- Kimberley Wilderness Parks
- A new landscape approach to conservation to manage fire, introduced animals and weeds
- Training and employment for Aboriginal rangers
- Investing in knowledge and making information accessible
- A major boost to nature-based tourism

In a scoping study aimed at cataloguing required research in tropical Western Australia, *Prime Focus* (2008), listed the key research themes as:

1. Building detailed knowledge of the marine, coastal and riverine ecosystems
2. Protection of biodiversity of the tropical savannahs
3. Biosecurity of the northern border region
4. Research infrastructure in the North West.

In 2012, the *Regional Australia Institute* produced a report entitled “Stocktake of Regional Research: Summary Report and Gap Analysis”. Whilst not concentrating specifically on the Kimberley, the report contains conclusions applicable to research in regional Australia in general. Those considered relevant to the present study are:

- the research literature of relevance to regional Australia is large but highly fragmented;
- the research literature is largely unknown to and often considered irrelevant by policy makers;
- there is enormous scope and demand for additional research work.

Bearing the above strategies and themes in mind, the information in the following section is a summary, from both the structured interviews and the online survey, of suggested areas where respondents felt that further research is needed in the Kimberley. Suggested research will again be separated into categories. No attempt has been made in this section to place required research into an order of importance.

7.1.1. Marine

- Marine ecosystem management.
- Ocean circulation modelling.
- Research into cetacean species.
- Lyngbya blooms in Roebuck Bay.
- Impact of commercial fishing on Threadfin salmon and barramundi stocks to assess if current fishing practices are sustainable.

7.1.2. NRM

- Biodiversity and ecosystem management.
- Wild fire and the impact on bio-diversity, especially micro-fauna.
- The effect of changed fire regimes on water quality.
- Feral animal eradication, - cats, foxes, wild dogs, cane toads.
- Shorebird research to investigate a serious decline in migratory shorebird numbers arriving on Roebuck Bay and 80 Mile Beach.
- Ethno-ecology and ecology - vegetation communities descriptions/threats/status, threatened species (Bilbies, Marsupial Mole, scaly tail possum, gouldian finch, golden back tree rat, golden bandicoot).
- Climate change – effects on biodiversity.
- Impacts of major land uses, particularly cattle grazing.
- Threats to natural ecosystems, particularly from introduced plants and animals but also from tourism and climate change.
- Threats to natural ecosystems from mining projects requiring pre-project heritage surveys and assessments.
- An understanding of ecological processes under natural conditions to act as a baseline for informed planning and management of future development.
- Identification of gaps existing in taxonomic knowledge and Museum collections (Berkley Gap).
- There is still a lot of scope for biodiversity discovery on the Mitchell Plateau (able to use the Ranger Station).
- The Prince Regent region is also good for discovery but has even less infrastructure than the MP Ranger Station.
- NW Peninsula; Port Walcott to the top of the Kimberley and Anjo Peninsula are also super diverse for plants and animals and has both ruggedness and rainfall. A research base is needed here. The rest of the region is diverse but not as radical.

7.1.3. Sociological and Cultural Research

- The use and reliance of Indigenous communities (including cultural, customary and economic development opportunities) on the Kimberley's natural resources, and their capacity to manage resource development and future threats.
- There is a need to increase Indigenous research in natural resource management, in particular to build the skills of Aboriginal people in the region to develop their research capacity.
- Collaborative research with Traditional Owners to address ecological and cultural management questions that acknowledge indigenous land interests.
- Most research undertaken to date with regard to rock art has been in the Pilbara due to the intensive industry and level of rock art that is there and the Western Desert. In terms of geographic scope, Heritage and Rock Art R&D is not Kimberley-centric but field trips are scheduled to the Kimberley in the second half of 2013.

- Key areas of research need are in rock art analysis, archaeological context, archiving and managing rock art conservation and cultural tourism, use of rock art to understand client environments, Aboriginal economies and tourism, and surveying and documenting heritage value of sites for mining (all mining projects require a survey).

7.1.4. Health

- Increased medical research into indigenous health.
- There are significant opportunities to do more health related research but the main obstacles are the high costs, the lack of infrastructure
- Current level of health related research in the Kimberley could easily triple.

7.1.5. Agriculture & Pastoralism

- Further work is required in irrigated agriculture for new production systems, new markets and environmental impact of irrigated agriculture. There is also further work required to identify potential areas for increased irrigated agriculture.
- Increased production for the beef industry and alternative markets are also areas that require further work.
- Carbon economy.
- Cattle/rangeland management - water points, rotational grazing, trucking yard design & location, supplementary fodder production.
- Market opportunities for economic development.
- Alternative land uses for the rangelands.
- Diversification into new crops, rotation cropping.

7.1.6. Water Resources

- Groundwater management
- Water research - sources of water and interactions of different sources - e.g. ground water, surface water, aquifers.
- Water sampling of drains that empty into Roebuck Bay and Cable Beach.

7.1.7. Geology and Palaeontology

- Some projects being carried out by the resources industry are confidential and this makes it difficult to access results.
- Palaeontology research is hampered by difficulties with access to sites. Generally access has been negotiated with Traditional Owners but, in some cases, permission to access sites is also required from pastoralist, mining lease-holders, and the DEC.