APPENDIX D: SELECTED NESP HUB RESEARCH PROJECTS AND DETAILS OF INDIGENOUS INVOLVEMENT OR ENGAGEMENT

In order to ascertain an understanding of the nature of Indigenous engagement in each of the NESP Hubs' research activities, SGSEP undertook a closer examination of a selection of research projects from each of the Hubs. The timeframe and budget for this review did not allow for an analysis of all of the research projects across the life of the NESP. The analysis of Indigenous engagement in NESP Hub research projects is therefore based on 108 projects that SGSEP was guided to by the Hubs or that SGSEP selected on the basis of having a high level of Indigenous involvement or engagement.

The analysis focuses on the different types of research activities where Indigenous people were engaged, including: planning, engagement, fieldwork, management, training or communications. These terms were already being used by the TSR Hub to describe how their Indigenous partners were engaged in the TSR Hub's research activities. For consistency, SGSEP requested the other Hubs to provide similar details of the level of Indigenous engagement in their identified projects.

The information in the following Tables was verified by each of the respective Hubs before their inclusion in this report.

The Tables below include:

- The NESP Hub's research theme or priority identifier;
- The NESP Hub project number and name;
- Project summary;
- The Traditional Owner (TO) group(s) and jurisdiction(s) and the Category in the Three Category Approach to Indigenous engagement;
- The nature of activities involving Indigenous partners (covering Planning, Fieldwork, Engagement, Communications, and Training); and
- Identified Outcomes and/or Indigenous Research Priorities.

Each NESP Hub's research priorities' are also included for ease of reference.

Selected CAUL Hub research projects and details of Indigenous involvement or engagement

CAUL Hub Research Priorities

Consistent with DEE's Research Priorities for NESP published in 2017, the CAUL Hub's research priorities are listed under two groups:

Group A: Increasing our understanding of the environmental and social impacts of air pollution in urban and peri-urban areas to inform management actions.

1. Contribute to the design of, and inform the development or, a program for monitoring and reducing atmospheric particulate matter levels in Western Sydney.
2. Identify and prioritise significant sources of air pollution and their impact on the environment and public health to better target government investment.
3. Identify key sources of emissions of air pollutants, including sulphur dioxide and particulate matter, in Australian urban centres and the risks they pose to the environment and human health. This work should complement the current reviews of the National Environment Protection (Ambient Air Quality) Measure relating to a) PM standards and b) the standards for sulphur dioxide, nitrogen dioxide and ozone, as well as other efforts underway to reduce point source emissions of these pollutants.
4. Identify features of Australian urban landscapes that influence the impact of air pollution on humans and the environment (e.g. landform, local climatic conditions, urban design).
5. Quantify the co-benefits for air quality, human health, biodiversity and the environment of measures to reduce greenhouse gas emissions in urban and peri-urban areas. Such measures could include active transport, improved public transport, increased energy efficiency of buildings and changes to the urban form.
6. Study the exposure and risks to the environment and human health of chemicals and persistent organic pollutants arising in everyday products, including chemicals newly listed under the Stockholm Convention, in the urban environment – from indoor and outdoor sources, flows and use through to disposal via current urban infrastructure such as sewers and landfills.
7. Identify and evaluate effective systems and tools for detecting and managing air pollution in urban areas, including a focus on monitoring, reporting and forecasting systems, strategic planning in infrastructure and urban development, and measures to reduce point source emissions.
8. Assess existing and identify new information systems and processes needed to achieve air quality objectives, identify trends and evaluate outcomes.
9. Support existing and emerging cross-government clean air initiatives such as the Clean Air Agreement.

Group B: Quantifying the benefits of urban greening for humans and other species in cities to inform Australian Government policy and programs, and management actions by all levels of government, the community and industry.

10. Work with major cities to assess the effectiveness of various current and new approaches to managing urban ecosystems, such as greening plans, and how these can be incorporated into greening plans to maximise positive outcomes for biodiversity including threatened species, air and water quality, and human health. These outcomes could support the development of a framework for greening cities which would consider multiple benefits such as absorption of

atmospheric pollutants, sequestration of carbon, mitigation of the urban heat-island effect, provision of habitat and landscape connectivity for biodiversity, strengthening of social capital, and the reconnection of humans with nature in urban areas.

11. Demonstrate the relative cost effectiveness of different approaches to planting and managing urban green spaces for air and water quality and human well-being. These approaches could include the choice of species to be planted, the location and configuration of plantings, irrigation of plantings with stormwater to improve survival and growth rates and reduce runoff to local streams, and preservation of upland drainage lines in new developments to provide green space and a range of environmental and health benefits for residents.
12. Prioritise climate adaptation measures for managing the impacts of climate change on environmental quality and human health in urban areas, such as expanding urban forests and improving the even distribution of tree cover across our major cities for equity of access.

Details of Selected CAUL Hub research projects with a high level of Indigenous involvement or engagement

The Table below includes information about a selection of the CAUL Hub's research projects with a high level of Indigenous involvement or engagement. The Table includes NESP Hub research theme or priority, NESP Hub project number, a project summary or description, the Traditional Owner (TO) group(s) and jurisdiction(s), the nature of activities involving Indigenous partners (covering Planning, Fieldwork, Engagement, Communications, and Training), the relevant Category in the Three Category Approach to Indigenous engagement, and identified outcomes and/or Indigenous research priorities.

CAUL Hub Project, Project Number & Name	Project Summary	TO group (s) (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
3: Urban Greening for Liveability and Biodiversity **3.8: Green-space governance in a changing urban landscape (Extension)**	Urban green-blue spaces (incorporating terrestrial and wetland landscapes) in public parks and streetscapes and private gardens provides multiple benefits for city dwellers. Recognition of this multi-functionality is bringing opportunities for inclusion of green-blue spaces across policy domains, but also presents challenges for largely monofunctional governance, management and budgetary systems. Green-blue spaces are governed by a complex set of institutions including Local Government Areas (LGAs), government agencies, non-government organisations (NGOs), nursery growers, landscape architects, and community groups including local people and traditional owners. These challenges are potentially	Category 2	**Research:** As part of the project an Indigenous student was employed to work on placemaking aspects including data collection. **Communications:** The CAUL Hub is currently working on ways to communicate back to Indigenous community members regarding all research projects including potentially a summary of the findings through an article and a paid advertorial in The Koorie Mail for this and other CAUL Hub research. We will be seeking input from individuals to check they would like to be acknowledged in the article for their contribution. **Training:** Research experience through the employment of an Indigenous Research Assistant.	"A synthesis of Indigenous perspectives on urban planning and urban greening. Greater levels of Indigenous input and active engagement in managing public green/blue spaces in urban environments." As above, but for Noongar people, the TOs of Peth metro area.

CAUL Hub Project, Project Number & Name	Project Summary	TO group (s) (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
	amplified by the impacts of climate change and urban densification. This project will develop guidelines, tools and frameworks for multifunctional governance and participatory approaches that link policy domains, facilitate green-blue space management and evidence-based policy processes. A key knowledge gap identified by end-users that will be addressed in this research is the need for mechanisms to improve public participation and inclusion in green-blue space decision-making processes. While this work will predominantly focus on public land, policy mechanisms for greening on private land will also be considered.			
3: Urban Greening for Liveability and Biodiversity **3.13: Indigenous Noongar perspectives in city planning and urban nature**	This sub-project (which commenced in 2019) draws from an ongoing conversation that was recently facilitated by CAUL and the Northern Australia Environmental Resources Hub in Perth on the 25th July 2018, and that brought Indigenous Noongar and non-Indigenous people working in Perth-based cultural projects to discuss what could be done that was useful from a Noongar perspective in the space of city planning and urban Nature. A clear collaboration pathway emerged from this meeting, and since then a project has been drafted, and its scope and key ideas are being finalized. This sub-project aims to collate place-based Noongar perspectives on city planning and urban Nature in Perth in a format that is recognized among urban planners and environmental managers. The sub-project proposes to employ an Indigenous researcher that will work towards the collation of information, facilitate the organization of a	Noongar (WA) Category 1	**Planning:** In late 2018, the Clean Air and Urban Landscapes Hub (CAUL) of the National Science Program held a meeting with Noongar leaders to discuss what collaborative projects or activities could be undertaken in Perth that were considered useful from a Noongar perspective on the topic of city planning and urban Nature. The current project stems from that initial meeting and from several other meetings and informal discussions that took place thereafter to draft and refine the project proposal. As feedback and support was also sought from government and non-government agencies that plan, manage and care for the Perth Region, it became apparent that these stakeholders also saw great value in and need for the proposed project. The current proposal considers and seeks to address many of the nuances and complexities that were captured both within the Indigenous and stakeholders' circles. Using a Noongar- led approach, the project aims to develop a proof-of-concept that brings Noongar and 'western' knowledge systems closer together in	As above, but for Noongar people, the TOs of Perth metro area.

CAUL Hub Project, Project Number & Name	Project Summary	TO group (s) (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
	workshop (involving Noongar people and strategic planners from State and Local Government), and be involved in the production of a report. This sub-project will seek to fund two Indigenous research assistants as well as supervisory time from an Indigenous elder. The scope of these positions is currently being finalised in collaboration with relevant stakeholders. This project is a collaboration between P3, P4, P5, P6 and P7. The delivery of this project will depend on the identification of suitable people for these positions.		their shared responsibility of caring for country in the Perth Area. **Engagement:** Desktop and cultural workshops led by Indigenous researchers (team of two researchers including an Indigenous Elder or senior Noongar leader providing cultural mentorship). **Communications:** There will be a web page developed using plain language that will be lodged with the CAUL website and an enewsletter to communicate regularly with people who are interested and have signed up for the newsletter.	
4: Urban Systems for Liveability **4.7: Towards an Indigenous-led research agenda**	The project Toward an Indigenous-Led research agenda is about working out better models for enabling Indigenous communities to define and direct research that is of importance and value to them. Overall, 4.2 represents a working model of how cities' greening performance can be benchmarked against one another as a contribution to City Deals. The focus will be on the cities of Melbourne and Sydney. The purpose is to create a model for urban environmental researchers in Universities to work in more collaborative ways with Indigenous communities. The outcome of the research will be to better inform University-based urban researchers about designing their research so that Indigenous communities are co-designing and co-governing the projects. This is important because too often Indigenous communities are only 'consulted' about the project once all the important decisions have already been made.	TBA	**Planning:** Using Indigenous engagement from the outset as this project responds to longstanding calls by Indigenous communities to consider access to land as a part of sustainable urban futures. The project has come out of previous CAUL projects with Indigenous people contributing to the framing of this research and communicating the importance and need for further research. **Data collection:** Responds to Indigenous engagement by drawing on international indigenous led studies and the political struggles for the restitution of land. Data has been produced by Indigenous people and the project is then collated together. **Engagement:** The project connects to wider sets of work that are beyond CAUL that are engaged with the question of land restitution. **Communication:**	Working out better models for enabling Indigenous communities to define and direct research in urban environments that is of importance and value to them.

CAUL Hub Project, Project Number & Name	Project Summary	TO group (s) (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
	Another outcome will be to support Indigenous communities to develop better models and practices when they work with University-based researchers. This project traces how local governments develop green infrastructure strategies and points to the pathways that urban decision-makers such as planners, arborists and environmental professionals can use in developing green infrastructure.		This project is designed to build the capacity within settler institutions and so the communications are directed towards non-indigenous practitioners to alleviate the burden on Indigenous communities.	
5: The Shared Urban Habitat 5.2: Bringing nature back into cities	This sub-project is investigating opportunities to bring species back into urban environments as a way to reverse the trend of species loss, restore ecological function and ecosystem services, and reconnect people with traditional Aboriginal knowledge. We propose the following activities/outputs for RPv6: • Develop a protocol for a practical 'Bringing nature back to cities' program, which includes a decision-tree model to assess suitability of animal species for targeted actions (Milestone 25), and an opinion piece (Milestone 24). Planned output completion mid-2019.	Category 1	**Process and planning:** Outputs from the project was conceptualised originally to be a paper and a decision making tool. The project summary was presented to the (first) Indigenous Advisory Group meeting where it was categorized as a Category 1 project. As a consequence of it being a Category 1 project, we then decided that pathways will be sought to cooperate with Indigenous scholars and practitioners, and if possible to integrate Indigenous knowledge into the project. At various stages, we explored the idea of regional and/or national workshops. However, once it was established that the workshop was not the best way to learn about and integrate Indigenous knowledge, three Indigenous colleagues from CAUL Hub, including members of the hub's Indigenous Advisory Group were generous enough to offer to co-author the paper. **Importance of engaging early:** The Indigenous component of the work – it had Indigenous dimensions from the beginning, but the Indigenous Advisory	Reversing the trend of species loss, restore ecological function and ecosystem services and reconnect people with traditional Aboriginal knowledge in urban environments.

CAUL Hub Project, Project Number & Name	Project Summary	TO group (s) (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
			Group advised it needed to be a 'key component' not just 'a component'. This is what led to the workshop ideas. **Knowledge sharing:** Knowledge was provided in different ways, in some instances as direct text to the leading author to incorporate in to the manuscript, in other instances the authors provided revisions and direct edits to the manuscript. In other instances the authors preferred to be interviewed and have the knowledge incorporated in to text to be included in the manuscript. We came to understand it would be important to foster flexible ways to express and translate the Indigenous knowledge.	
5: The Shared Urban Habitat 5.5: Indigenous-led research on biodiversity in the city	All urban environmental practices, research and policy occurs on and in Aboriginal Country. No matter the focus, approach, personnel, timing or framing, all of these practices have an impact on the lives and futures of Aboriginal people. A key challenge, then, is for urban practitioners and researchers to respond meaningfully to the expectations, rights and aspirations of Indigenous communities in urban areas. The proposed project seeks to meet this challenge within the realm of Indigenous perspectives on biodiversity in the city. The stakeholders for this work are diverse, and include local government, schools, early learning centres, urban practitioners such as landscape architects and designers, community groups, Traditional Owner groups and the general urban-dwelling public. For example, the cultural information related to indigenous plants at The	Research conducted on Wurundjeri Country Category 1	**Planning:** Research project managed by an Indigenous researcher, Barkandji woman Zena Cumpston. The project included research on Wurundjeri Country. Formal university processes meant a higher-level department were the formal direct communicator with Wurundjeri leaders. This did not seem aligned to appropriate cultural protocols for an Aboriginal person not working on their own Country and so some informal communication took place practically for cultural safety and as good practice. **Engagement and communication:** Did tour of The Living Pavilion with Aboriginal staff members from all faculties at Melb Uni, followed up with a planting session and a talk. Very well received – got many emails from Aboriginal staff members after. Paired with young Aboriginal Science student– mentored the student and developed plant workshops with her (and she co presented). Also helped the student apply for a Melb Uni	Urban practitioners and researchers need to better understand and engage in meaningful dialogue on the expectations, rights and aspirations of Indigenous communities in urban areas.

CAUL Hub Project, Project Number & Name	Project Summary	TO group (s) (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
	Living Pavilion was extremely popular and many participants asked how they could access this information after the event, specifically asking if there was a booklet that synthesised this work (see outputs below). Further, greening practitioners, schools and community groups have been contacting Research Fellow Zena Cumpston regularly to ask for more information and practical advice about their own gardens (both public and private) and discuss their educational aspirations to embed understandings of Indigenous ecological knowledge into their activities. This sub-project will allow decision-makers to engage more meaningfully with Aboriginal perspectives of biodiversity and provide practical examples to promote urban biodiversity through more active engagement with indigenous plants and Aboriginal and Torres Strait Islander peoples' ecological knowledge and practices. Zena Cumpston will also connect with decision-makers though her outreach activities, including talks and workshops on Aboriginal perspectives of biodiversity for early-learning centres, schools and local governments. Planned activities for RPv6 include: • Collation of stories of the plants used at The Living Pavilion and their significance for local Aboriginal people, in a downloadable booklet.		study grant through the work she did with Zena for TLP (and the grant was awarded). Presented TLP to the Indigenous Advisory Committee of the Comm Dept of Environment – talked through the process for community engagement and research process for the Living Pavilion. Arranged to gift the community garden plants to Wurundjeri Council for them to use in their proposed new Indigenous garden at Collingwood Children's Farm. Made contact with an Elder from the Narrup ecology team at Wurundjeri Council and shared with him all of the research (emailed it to him personally). Made contact with a second Elder at Wurundjeri Council and shared with him all of the research (emailed it to him personally). Approached by the Aboriginal Liaison Officer for Secure Welfare Services. This organisation runs several houses where Aboriginal people awaiting sentencing live. Two people from VETiS Landscaping were in the process of designing Indigenous gardens to support the wellbeing of those Aboriginal and Torres Strait Islander people being housed. Several Skype and email conversations held to support this project and sent though all of Zena's research from TLP to help with plant selection and talked them through what would be best practice for engaging Elders (i.e. Female Elder for women's facilities and Male Elder for men's). Zena also sent through book lists and advice specifically for David to start plant selection. Met with two further Wurundjeri Tribal Council contacts as part of the handover for the plants donated to Wurundjeri Tribal Council for their Indigenous Garden (teaching facility) at Collingwood Children's Farm. Zena shared all of the plant tables and research (more than 15,000 words) with the	

CAUL Hub Project, Project Number & Name	Project Summary	TO group (s) (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
	• Two conference presentations on The Living Pavilion and its success as an engagement activity. • A paper/book chapter on the implementation of Indigenous-led projects in institutional settings. • Outreach activities in local schools focused on Indigenous agriculture, knowledge systems and plant use. • A short synthesis piece for policy-makers and educators, presenting practical ideas and imperatives for those wishing to better connect with Indigenous peoples and engage with Indigenous knowledge systems in an urban context.		council and gave permissions for them to use (as long as TLP/ CAUL and Zena credited) . Introduced two people from Wurundjeri Council to two university Professors with a view to Wurundjeri Council having access to the archives of ethnobotanist Dr Beth Gott held at Monash University to aid with their biodiversity projects. Provided all of the signage/research from The Living Pavilion to Carlton North Primary for students' education and also as part of Uncle Bruce Pascoe book launch of 'Young Dark Emu'. Communicated via an interview with Noongar woman Timmah Ball for Urban Beat all about The Living Pavilion. Attended the AIATSIS Research Conference in Brisbane. Networked and attended sessions over four days. Met many other Aboriginal researchers and academics and continue to share ideas and communicate with many of them. Made contact with an Aboriginal guide at RBG. Shared the Living Pavilion research with Christopher with a continued sharing of research and contacts between the two researchers. Worked closely with Yorta Yorta woman Jirra Lulla Harvey to help create the Three-category approach workbook for CAUL Hub. Jirra ended up using Zena's work for the hub as a case study and Zena wrote a piece which was included in Three-Category Approach to Indigenous engagement workbook. Made contact and met up with young Aboriginal artist and provided support to him and sent him all of the research on eels and Aboriginal plant use (particularly related to technologies made with plants such as eel traps) for his Eel Trap Project with Footscray Arts/ Science Gallery. The artist and Zena have remained friends and Zena shares much of her	

CAUL Hub Project, Project Number & Name	Project Summary	TO group (s) (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
			work with him. Recently shared all of the plant lists for a project he is doing involving Aboriginal plant use at Footscray Arts. Presented a keynote at the welcome for the Kids Teaching Kids Conference at Melbourne University. This speech was about Aboriginal perspectives of waterways. There were many Aboriginal primary school students in the audience who were a part of the conference. These Aboriginal students were from all over Victoria. Shared all of the murnong research and signage with an Aboriginal researcher who was working with a non-Indigenous Melbourne University researcher to present Murnong subject in Science faculty. Provided further support to the researcher in advising where to buy murnong and several other aspects she needed help with. Attended the Science Gallery Indigenous panel/workshop with several other Aboriginal and Torres Strait Islander academics and researchers from the University of Melbourne to discuss best practice and the proposed Indigenous Framework for the new Science Gallery being designed by Kuku Yalanji man Luke Briscoe (facilitated by Luke).	
6: Social and Biodiversity Benefits of Urban Greening- A network of integrated study sites. **6.1: Towards an**	The Hub is working to position Indigenous knowledge as critical in environmental research, showing a cross-cultural commitment to Caring for Country. Environmental research and Indigenous philosophies represent complex knowledge systems. Both have much to offer broad audiences but can seem inaccessible. CAUL is collaborating with Indigenous story telling experts to expand our research on and share widely how university-based knowledge systems are coming to recognise Indigenous knowledge	Multiple TO groups Category 1	**Planning:** Using Indigenous engagement from the outset, this project responds to longstanding calls by Indigenous communities and is in currently in the approval phase of development. The project has come out of previous CAUL projects with Indigenous people contributing to the framing of this piece of work and communicating the importance. **Communication:** This project is designed to build the capacity within settler institutions and so the communications are directed towards	Moving beyond a model of 'inclusion' of Indigenous people in research and teaching especially within an urban context, toward genuine involvement in decision making about urban environments.

CAUL Hub Project, Project Number & Name	Project Summary	TO group (s) (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
Indigenous-led research agenda	and authority in urban environments through projects undertaken at CAUL since 2015. This approach will provide a greater understanding of Indigenous perspectives of CAUL's research and approach to Indigenous engagement and participation (IEP), which is a critical next step in our Indigenous-led research agenda.		non-indigenous practitioners to alleviate the burden on Indigenous communities.	
7 Air quality 7.1 : Emission sources of air quality	The Clean Air and Urban Landscape Hub has conducted research to better understand the drivers of poor air quality in the Sydney basin and surrounds. One aspect of this research is to characterise the seasonal variability of air quality in the region. However, the commonly used (European) description of the seasons (summer, autumn, winter and spring) does not fully represent the annual weather patterns that actually occur in the Sydney basin. In an attempt to find a more holistic way of describing Australian seasons, and thus variations in air quality in the Sydney region, it was decided to research Indigenous perspectives of seasons and weather patterns. Traditionally, Indigenous people lived alongside the land and understood that its processes, including weather patterns, are not as predictable and simple as the four European seasons of the greater Sydney region. We used to understand that we gained to create a set of Indigenous 'seasons' based on traditional concepts of weather for the summer, autumn, winter and spring. In this paper we describe our efforts to discover whether traditional Indigenous	The Darug people of Sydney Category 1	**Planning:** An advertisement was placed for an Indigenous internship, via the Indigenous Student Centre – at Wollongong University. A suitable Indigenous candidate was chosen who was studying chemistry and art for a research internship. **Fieldwork:** Measurements roadside, air quality monitoring if usually in parks whereas this was roadside and the Indigenous researcher was involved in the fieldwork. **Data collection and Communication:** The research involved interviewing local Indigenous people to discuss their local knowledge. It was revealed by the Indigenous researcher that there was a published set of seasons on BOM that the local members of the Traditional Owners group said had been invented and had no connection to their cultural knowledge. The Indigenous researcher liaised, negotiated and built relationships with the people interviewed. The project has co-created a new way of understanding by recognising dry, hot, wet and looking at 30 years of measurements.	Better understanding of Indigenous approaches to seasonal calendars and how Indigenous understandings of climate relate to air quality.

CAUL Hub Project, Project Number & Name	Project Summary	TO group (s) (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
	knowledge can define a more meaningful set of reasons or natural cycles for the greater Sydney region. Finally, this calendar is used to explore seasonal variability of air quality in the Sydney basin, to better understand the drivers of pollution events. This project was related to the Western Sydney aspect of the air quality work.		Previous research had used months and not aligned culturally as it was a different construct and then the researcher used daily data which proved useful and revealed new findings. **Publishing:** A paper was submitted and there was some trouble with gaining acceptance due to misalignment of constructs. The paper sits halfway between social science and science. The paper has just been accepted for publication and it is very exciting news. The abstract can be shared. **Training:** There were additional opportunities that emerged as the researcher had a Chemistry and Art double major which provided opportunities to collaborate in Melbourne through an art-science residency at The Living Pavilion. The researcher has completed Honours in Organic Chemistry - researching composition of natural materials used in art.	

Selected ESCC Hub research projects and details of Indigenous involvement or engagement

ESCC Hub Research Priorities

Broadly, the research priorities for the ESCC Hub are:

a) ***Building the utility of Earth systems and climate change information***

1. Work with the ESCC Hub's partners and NESP to establish a National Centre for Coasts and Climate and continue to collaborate with the National Centre for Coasts and Climate as it undertakes climate change research and activities, including blue carbon research.
2. Engage with stakeholders to ensure that the information is being provided in a manner which supports decision-making and is meeting the needs of end-users including business, government and Indigenous people. This includes contributing Australian and Southern Hemisphere climate information, analysis and expertise to global initiatives such as the Intergovernmental Panel on Climate Change and climate modelling projects (e.g. Coupled Model Intercomparison Project) to ensure that Australia benefits from the international analysis efforts that shape global discussions on climate change.
3. Collaborate across NESP hubs to ensure that Earth systems and climate change research informs the broader program. This would include provision of nationally consistent and targeted regional climate projections and information relevant to specific issues, such as threats to marine and terrestrial ecosystems and ocean acidification and the cumulative impacts of climate change and other environmental pressures.
4. Develop and enhance Australia's national capability in Earth system and climate simulation through ongoing improvement of the Australian Community Climate and Earth System Simulator (ACCESS) in the areas of accessibility and simulation performance.

b) ***Improving our understanding of how the climate system may change in the future.***

1. Investigate how human activities will continue to influence the carbon cycle and change the chemistry and physical state of our oceans, atmosphere and terrestrial systems.
2. Improve understanding and simulation of Southern Hemisphere climate drivers in our climate models (especially ACCESS) to increase our confidence in projections of likely future climate change at multi-annual to multi-decadal time scales. Improve our understanding of how climate variability (e.g. El Niño–Southern Oscillation) and the frequency, intensity and extent of extreme events (e.g. tropical cyclones and droughts) may change in the future.
3. Further develop our ability to simulate and provide regional information on future climate, from years to decades.
4. Consider low likelihood but high impact consequences of climate change for Australia to improve risk management decisions.
5. Use improved climate projections and understanding of the drivers of climate to inform understanding of climate and coastal interactions.

c) Improving our observations[1] and understanding of past and current climate

1. Use observations of greenhouse gases and the Australian regional carbon budget to track changes and improve our understanding of how the different components of the natural and human elements of the carbon cycle interact and influence each other.
2. Identify how the different scale drivers of the climate system interact in the Southern Hemisphere to generate our past and current climate.
3. Improve analysis methods used for Australian climate change research and examine the current and past patterns and trends in climate variability and extremes in the Southern Hemisphere, with an emphasis on the Australian region, including the ocean.
4. Analyse robust observational records of our atmosphere, oceans, cryosphere and terrestrial systems to undertake detection and attribution studies in order to identify and explain significant changes in our current climate.

Details of Selected ESCC Hub research projects with a high level of Indigenous involvement or engagement

The Table below includes information about a selection of the ESCC Hub's research projects with a high level of Indigenous involvement or engagement. The Table includes NESP Hub research theme or priority, NESP Hub project number, a project summary or description, the Traditional Owner (TO) group(s) and jurisdiction(s), the nature of activities involving Indigenous partners (covering Planning, Fieldwork, Engagement, Communications, and Training) and identified outcomes and/or Indigenous research priorities.

ESCC Hub Research priority, Project Number & Name	Project Summary	TO group (Jurisdiction) and DEE Pillar of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
Supporting Communication of Climate Change Science to Indigenous Communities. **CASE STUDY 3.1: Climate**	The ESCC Hub worked with a Traditional Owner group from the Whitsunday region in Queensland to develop a package of introductory climate change information for use in outreach activities. The material, a combination of traditional knowledge from the region and the Hub's science, is being used to help Indigenous communities prepare for the impacts of climate change on country. It is intended to not only serve as an	Traditional Owner group from the Whitsunday region. (Qld) Pillar 4	**Planning:** Co-designed with a member of the Koinmerburra Aboriginal Corporation **Engagement:** Meetings with Samarla DeShong of the Koinmerburra Aboriginal Corporation to produce the products. **Communication:** A slide deck was developed for the Corporation to use to communicate climate change to their mob	TO ways of thinking about the impacts of climate change, how it will impact on Indigenous communities, and what Indigenous people can do to prepare for those impacts.

[1] This priority does not imply that the Hub undertakes primary observations. It is primarily a user of observations that are the responsibility of others. This includes national research infrastructures, such as the Marine National Facility (Investigator), Integrated Marine Observing System (IMOS), and Terrestrial Ecosystem Research Network (TERN), as well as operational agencies such as the Bureau of Meteorology and Australian Antarctic Division.

ESCC Hub Research priority, Project Number & Name	Project Summary	TO group (Jurisdiction) and DEE Pillar of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and/or Indigenous Research Priorities
change information products for Indigenous communities	introduction to climate change but also a conversation starter that gets communities thinking about how climate change will impact on them, and what they need to do to prepare for it.			
Supporting a National Dialogue on the Climate Change Science Needs of Indigenous Communities CASE STUDY 3.2: Meeting Indigenous priorities for climate change information, capacity building and engagement	The ESCC Hub supported a forum for Indigenous peoples to come together to provide recommendations regarding what climate change information, capacity building and forms of engagement they see as being of greatest value. Working with an Indigenous-led Steering Committee comprising representatives from the Yorta Yorta Nation Aboriginal Corporation (YYNAC), Kimberley Land Council, and SEED (Indigenous Youth Climate Network), and building on the 2012 National Workshop on Indigenous Knowledge for Climate Change Adaptation (PDF), we convened the National Indigenous Climate Dialogue Workshop. More than 50 traditional owners from across Australia met in Barmah, Victoria in November 2018 to share observations, talk about priorities and explore opportunities to improve knowledge of climate change and its risks for people and country.	More than 50 traditional owners from across Australia. (National) Pillars 1, 2, 3, 4, and 5.	**Planning:** Establish an Indigenous-led Steering Committee, including a collaboration agreement with committee members. Terms of Reference for the Steering Committee, by which co-development / co-design and collaboration will be a central feature and used to guide to prepare for the dialogue. **Engagement:** Co-develop program, terms of reference for the Steering Committee, consent forms with workshop participants. **Management:** Many meetings to determine the program and develop the dialogue Communication: Final report and Summary report including recommendations outcomes	This is one of the most significant gatherings of Indigenous peoples on climate science research priorities. Several research priorities were identified. Including bio cultural renewal; monitoring of seasonal indicators; impact on water cycles/flows; water rights and access; impacts of resource extraction; governance and institutional responses; cumulative impacts and many others.
Understanding climate change impacts on Torres Strait.	ESSC Hub partnered with the Torres Strait Regional Authority to gather together climate change, marine and fisheries scientists, fisheries managers and traditional owners to discuss the implications of climate change on fisheries and marine ecosystems in the region. At the technical	TSRA Pillar 4	**Planning:** This workshop was planned in collaboration with the Torres Strait Regional Authority, AFMA, TWQ Hub & Fishing Corporations. **Engagement:** Several meetings with the collaborative partners to develop the workshop	There are gaps in some of the physical and oceanographic models that are needed to couple with the biological population dynamics for species of interest in order to reliably make predictions of impacts under climate

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CASE STUDY 3.3: Climate change impacts on inshore aquatic ecosystems and coastal communities in the Torres Strait	workshop, held in Cairns in December 2017, representatives from the Hub, TSRA, CSIRO, the NESP Tropical Water Quality Hub, Australian Fisheries Management Authority, Australian Institute of Marine Science and Great Barrier Reef Marine Park Authority heard that research and on-country observations show that climate change impacts are already occurring and discussed information needs and research priorities.		**Communication:** Produced a report with recommendations etc.	change for fisheries and ecosystems (e.g. need to resolve tides in the region). (p.28 of Workshop Report) Workshop participants identified six priority areas for research that will help inform fisheries and marine ecosystem management in Torres Strait, including: Biological understanding; Monitoring; Specific species population monitoring; climate modelling; community adaptations; and Fly River impacts. (P.31 of Workshop Report)
Supporting a National Dialogue on the Climate Change Science Needs of Indigenous Communities. **CASE STUDY 3.9: Practical and empowering responses to coastal erosion in the Tiwi Islands**	Working with the Tiwi Land Council we supported a workshop to educate local communities about climate adaptation. The workshop report provides a foundation for working with the Tiwi to develop practical guidelines for monitoring and adaptive management of coastal erosion in the Islands.	Tiwi Land Council Pillar 4	**Planning:** Tiwi Land Council (TLC) requested a second workshop on climate change adaptation, following a NCCARF workshop on sea-level rise. This workshop was run through the Scientific Reference Committee that the TLC shares with the University of Melbourne. **Engagement:** Workshop hosted by Tiwi Land Council at Wurrumiyanga, November 2017. **Communication:** Final report to TLC – November 2017.	The Tiwi Islands are at risk of social, environmental, and financial damages from climate change impacts. Report identifies the following research priorities: Observe the seasonal impacts of climate change in the Wet Season; Development of systems for monitoring relevant changes, including of erosion; (p.14 of Project Report)
Supporting a National Dialogue on the	The 2018 National Indigenous Dialogue on Climate Change demonstrated an overwhelming interest by Australia's First Peoples in better understanding	Yorta Yorta Nation	**Planning:** Establish an Indigenous-led Steering Committee, including a collaboration agreement with committee members.	Planning for the 2020 Dialogue has commenced. Expected outcomes include:

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Climate Change Science Needs of Indigenous Communities **CASE STUDY 6.1: Second national Indigenous gathering on climate change – pathway to sustainable relationships**	our changing climate and what the future holds. It also highlighted the importance of an ongoing dialogue and made clear that First Peoples want to set their own agenda on climate knowledge and action. To this end, the Hub is supporting the organisation and delivery of the National First Peoples Gathering on Climate Change to be held in 2020. This Gathering will celebrate, learn from and enhance First Peoples-led climate change action.	Aboriginal Corporation; Central Land Council; Malgana Aboriginal Corporation; Koinmerburra Aboriginal Corporation; Aboriginal Carbon Foundation; Banjelungup Aboriginal Corporation; and Traditional Owners from across Australia who participate in the National Indigenous Climate Dialogue. Pillars 1, 2, 3, 4, and 5.	Terms of Reference for the Steering Committee, by which co-development / co-design and collaboration will be a central feature and used to guide to prepare for the dialogue. **Engagement:** Co-develop program, terms of reference for the Steering Committee, consent forms with workshop participants. **Management:** Workshop – June 2020. **Communication:** Final report and Summary report including outcomes – Dec 2020.	• Continuing sustained relationships with Indigenous communities. • Knowledge networking – peer-to-peer exchange in the National Indigenous Climate Change Dialogue. • Increased understanding of what climate change information Indigenous communities need. • Terms of Reference for the Steering Committee, by which co-development / co-design and collaboration will be a central feature and used to guide to prepare for the dialogue. • Increased understanding of how western science can contribute and support Indigenous enterprises that are providing solutions to climate change issues. • • Final report and summary report.
(A) Supporting Indigenous participation at AMOS 2020 conference	The first ever Indigenous session was held at the 2019 Australian Meteorological and Oceanographic Society (AMOS) conference in Darwin. Traditional Owners were invited to present on their perspective of climate change and risks to their	Traditional Owners from across Australia.	**Planning:** Co-developing the Indigenous session program. Calling for abstracts from presenters. **Engagement:**	

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	country, as well as community led solutions contributing to climate change mitigation while generating income for communities. This activity will support another Indigenous session to be convened at the next AMOS Conference in February 2020 in Fremantle.	Pillar 5.	Session at AMOS Conference February 2020. Cross cultural workshop with the researchers at AMOS to discuss the protocols and understanding of working with Indigenous communities requires. **Communication:** Abstract and presentations. A report of the outcomes of the cross cultural workshop.	
(B) Indigenous perspectives of climate risk	Indigenous peoples in Australia form the majority of populations in many remote highly vulnerable environments where climate change impacts on their country are already evident, including extreme weather events, climate variability and sea level change. For all Indigenous peoples in Australia, and most globally, climate change compounds over-arching issues of socio-economic disadvantage, chronic poor health, and the burdens of the colonial history of dispossession and hostile policy settings, which often are of more immediate concern in Indigenous peoples' lives. Indigenous peoples bring a particular perspective of climate risk related to their particular socio-economic, historical, political, cultural and environmental circumstances. This results in perceptions that are often specific to communities and their cultures, places and regions with distinctive community values, resource and policy circumstances. Understanding these risk perceptions can potentially set the foundation for new pathways of research collaboration to better tailor climate science and information to meet Indigenous communities.	Central Land Council Rangers and staff; Malgana people and Yadgalah Aboriginal Corporation; Traditional Owners from across Australia who participate in the National Indigenous Climate Dialogue. TBA.	**Planning:** Development of appropriate research protocols, Ethics Clearance, and collaboration agreements with Indigenous groups. **Engagement:** Malgana Aboriginal Corporation: May 2019 – Met with Land and Sea ranger co-ordinator and Chair of Malgana Aboriginal Corporation board. Agreed to key project activities that included knowledge sharing about perspectives of climate change, development of a seasonal calendar and mapping of important places on Malgana lands. July 2019 – PowerPoint presentation delivered to Chair and land and sea co-ordinator. Chair delivered presentation to board. Land and Sea Coordinator delivered presentation to Land and Sea Co-ordination committee October 2019 – Support for project idea from land and sea co-ordinating committee December 2019 – Board sub-committee approval January 2020 – New Chair of Malgana Aboriginal Corporation	

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			March 2020 – Chair agreed to present project to board and to a planning meeting with board members and elders. **Central Australia Land Council:** May 2019 – Meeting about project to Central Land Council Date?? (Mandy when did you and Ro travel to Alice??) – Project presentation to Central Land Council Board Sept-Oct 2019 – Draft issues paper on housing and climate change in central Australia December 2019 – Meeting with CLC staff about project opportunities January 2020 – Decision to explore project opportunities with CLC in the future than at present when other climate related work is in motion Feb 2020 – Submission of Ltyentye Apurte climate adaptation project paper Planned - Collaborative activity planning with Malgana Peoples May – June 2020 Management: Planned - Collaboration agreement/contract June. Communication: Planned - Factsheet once collaboration agreement signed.	
(C) Adapting to climate change and building	World Heritage properties are important assets. Natural sites provide ecosystem benefits, such as water and climate regulation and carbon storage in	Traditional Owners of the Shark Bay and	**Planning:** Co-designed with the Butchulla people and the World Heritage Property Managers.	"

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resilience in Australian World Heritage properties: Using climate change science information to inform risk & vulnerability assessments and adaptation planning	forested sites. Additionally, their inter-connected cultural heritage values can convey traditional knowledge that builds ecological and social resilience for change. In this way, World Heritage properties can serve as climate change laboratories to integrate knowledge systems, gather and share information on applied and tested monitoring, mitigation and adaptation practices. This case study will develop a participatory process and a methodology for using Indigenous ecological and social knowledge and science-based climate change information to inform the development a climate change risk or vulnerability assessment that can then form the basis for preparation of adaptation plans to build the resilience of World Heritage properties to climate change.	Gondwana Rainforest WHAs. Pillars 1, 2, 3, 4, and 5.	**Engagement:** Engagement beings with a meeting with the Butchulla people to discuss the cultural protocols and set the research agreement in March 2020. Larger meeting with experts from the research community and the Butchulla people to determine cultural heritage values and science required to start an adaptation planning process. **Management:** Regular meetings to discuss the case study its outcomes and process. **Communication and Training:** Communication, training and other capability development to enhance understanding and application/use of climate change data and information in World Heritage management.	

Selected MB Hub research projects and details of Indigenous involvement or engagement

MB Hub Research Priorities

The MB Hub's research themes are as follows.

- Theme A: Threatened and migratory species.
- Theme B: Supporting management decision making.
- Theme C: Understanding pressures on the marine environment.
- Theme D: Biophysical, economic and social assessments.
- Theme E: Science for a sustainable Australia.

Broadly, the MB Hub's research priorities are as follows:

- Maximising the efficacy of managing Australia's marine environment by:
  - Improving the management of marine threatened species, and
  - Supporting management decision making.
- Improving our understanding of pressures on the marine environment.
- Improving our understanding of the marine environment including biophysical, economic and social aspects.

Details of Selected MB Hub research projects with a high level of Indigenous involvement or engagement

The Table below includes information about a selection of the MB Hub's research projects with a high level of Indigenous involvement or engagement. The Table includes NESP Hub research theme or priority, NESP Hub project number, a project summary or description, the Traditional Owner (TO) group(s) and jurisdiction(s), the nature of activities involving Indigenous partners (covering Planning, Fieldwork, Engagement, Communications, and Training)), the relevant Category in the Three Category Approach to Indigenous engagement, and identified outcomes and/or Indigenous research priorities.

MB Hub Theme and Project Number & Name	Project Summary	TO group (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes and /or Indigenous Research Priorities
Theme A **A1: Northern Australian hotspots for the recovery of threatened euryhaline species**	Australia's northern rivers and estuaries are important to sustaining sawfish and river shark species listed under Australia's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This project will provide the Department of the Environment with information to improve management and facilitate the recovery of these species. Acoustic telemetry, molecular research, life history studies and Indigenous engagement and education will be central to determining the status of threatened river sharks, and establishing monitoring, management and protection.	NAILSMA, Land Councils in NT and WA, Malak Malak Rangers (NT) and Dambi-Mangari Rangers (WA). Category 1	**Planning:** Indigenous ranger groups and Marine Biodiversity Hub scientists collaborated in enduring partnerships to conceive and implement the project. **Engagement:** Indigenous ranger groups and Marine Biodiversity Hub scientists collaborated to plan and conduct field research to capture, tag and release protected species. **Fieldwork:** Indigenous ranger groups and Marine Biodiversity Hub scientists collaborated to plan and conduct field research to capture, tag and release protected species. Malak Malak Ranger Group and scientists successfully relocated more than 60 Largetooth Sawfish.	Malak Malak TOs, Rangers and scientists worked together to remove the Tyemirerriny sawfish from a tiny waterhole and release them alive into the Daly River. The Rangers decided that it would be good to do an on-country patrol every year to search for trapped sawfish which might need rescuing. This is part of the Malak Malak community's contribution to protecting the sawfish for future generations, and is the only known place in the world where this patrol and rescue occurs. (p.1 of Report)

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			Management: Included access to sites, survey design for sawfish rescue (which sites to include/not include), and development of signage for sawfish conservation (i.e. what signs looked like, artwork on signs and where signs would be sited). **Training:** Indigenous rangers where provided with training and equipment (scientists providing Indigenous people with training in capturing, handling, tagging and relocating sawfish. Provided equipment for ongoing sawfish rescue patrols (e.g. holding tanks and associated equipment) and collection of biological information (e.g. tissue sampling equipment). **Communication:** Cross-cultural communication products (videos, signage and handling protocols) where developed to communicate the findings of research and Indigenous collaborations were deeply involved in design, production and distribution of these products. Indigenous providers where contracted for services in the production of communication products.	
Theme A **A5: Defining the connectivity of Australia's hammerhead sharks**	Three of Australia's four hammerhead species - scalloped (Sphyrna lewini), great (Sphyrna mokarran and smooth (Sphyrna zygaena) hammerheads - are being considered for listing under the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). Information on the status of Australian hammerhead shark populations is needed to support this process, as well as other Australian and international conservation and management initiatives. To define the present state of	Girringun Aboriginal Corporation, Yuku Baja Muliku, and Yirrganydji Traditional Owners. Category 2	**Planning:** The project was planned to include: collation of information on Indigenous knowledge and cultural value of hammerhead sharks in northern Australia. An Indigenous provider was contracted in the production of the review. Approach included development and implementation of an Indigenous engagement and communication plan for this project. **Engagement:** The project included a series of engagements: early engagement to determine willingness to engage and	The review identifies hammerhead sharks as powerful totem species in some regions, and notes that future projects should consider including questions that Traditional Owners also have regarding these species. In Australia, which is a world leader in marine fisheries research, there is very little Indigenous knowledge

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	knowledge, this project is collating and synthesising data on the species' biology, ecology and interactions with fisheries to support conceptual models of shark population structure to inform the status of Australian hammerhead shark populations.		participate in the project; to collate TEK including use of targeted interviews planned to include; planning of field work including on-water training for shark tagging; and to develop communication products. **Fieldwork:** Indigenous rangers from the Girringun Aboriginal Corporation, Yuku Baja Muliku, and Yirrganydji Traditional Owners joined researchers in the field on tagging expeditions in Queensland. Researchers developed and implemented an Indigenous engagement plan with Girringun Aboriginal Corporation, Yuku Baja Muliku, and Yirrganydji Traditional Owners to complete a review of Indigenous knowledge and cultural values relating to hammerhead sharks. **Management:** Management activities included decision about ranger engagement and participation in project and fieldwork. **Training:** The project on-water training or Yuku Baja Muliku Ranger for tagging hammerhead sharks (see MBH report image - cover shot). **Communication:** The project included a number of activities that engaged Indigenous people: produced TEK report: production of fact sheets, newsletters and presentations to engage and report back to Indigenous people; commissioned Indigenous artwork to include in TEK report and a T-Shirt for project participants.	recorded on the hammerhead shark. In communities where sharks hold cultural significance and in places where sharks play an important role in Indigenous fishing, there is opportunity for collaborative research or planning approaches between Traditional Owners, scientists and fisheries managers. (p.18 of Report) The challenge (and opportunity) moving forward is that it will take a lot of thought and consideration in developing research that is ethically and culturally appropriate. (p.18 of Report)
Theme A	All sea snakes are listed marine species under the EPBC Act and three Australian endemic species are listed as	Anindilyakwa Land Council and	Planning:	Sea snakes have varying levels of significance and use in Indigenous

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A8: Exploring the status of Australia's seas snakes	Critically Endangered or Endangered. Recent inexplicable declines of sea snakes highlight a lack of ecological information in Australia which hampers management. This project examines sea snake abundance and diversity from broad-scale and targeted surveys at reef and coastal sites to update Conservation Advices, refine status within CMRs and inform policies of DoEE, DPaW, PA and others. This research will improve our understanding of population status to guide on-ground conservation to reduce population declines.	their Sea Ranger Group (NT) Category 2	Met with rangers and TOs to understand cultural importance of sea snakes and other protected species and interest to participate in research. **Engagement:** As part of this project, Hub scientists have collaborated with the Anindilyakwa Land and Sea Rangers: to plan field including species of interest and locations for sampling (e.g. IPA). **Fieldwork:** Rangers provided survey vessels and field support for sea snake surveys in the IPA. Surveys in the IPA will help us understand whether protected areas adjacent to heavily fished grounds provide refuge for culturally important and conservation priority species, including sea snakes regularly caught as fishery bycatch in the Gulf of Carpentaria. **Management:** Management activities included control of access to sampling sites; determination of species to target with sampling and locations for sampling. **Training:** Rangers were already trained in conducting field surveys. **Communication:** Final trip included briefing and presentation to rangers and TOs.	communities, but it is unknown how important sea snakes are, especially in remote regions of northwest Australia (e.g. offshore reefs). Therefore, engagement with Indigenous communities is an important step in research on these species.
Theme A **A12: Australia's Northern Seascape:**	Northern Australia is the current focus of substantial economic development, which has the potential to impact biodiversity and cultural values. The Northern Seascape scoping project will assess the status of knowledge of EPBC-listed Threatened and Migratory Marine species, and pressures, Indigenous priorities,	Malak Malak Ranger Group (NT) Category 1	**Planning:** Project planning included discussions with NAILSMA to include a survey of Indigenous interests and priorities for research on threatened and migratory marine species in northern Australia. Planning also included the extension of collaborative research with Malak Malak Rangers on river	This work focuses on EPBC Act listed species and related issues, and shows that many of the species accorded this formal significance are also of great importance to Indigenous people. Although the motivations

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assessing status of threatened and migratory marine species	habitats, fisheries bycatch, and EPBC referrals in relation to them across the North Marine Bioregion (coast to EEZ edge). The focus will be at the multiple taxa level, including elasmobranchs, shorebirds, turtles and cetaceans. The project will scope research needs and directions for a broad Northern Seascape project (2018–2020), by identifying future research hotspots.		shark research (this work extended research project A1 after the project concluded). **Engagement:** To conduct the review NAILSMA engaged with numerous Traditional Owner groups in Northern Australia. NAILSMA were contracted to undertake this review. Also, to plan and implement field work to collect data on river sharks with Malak Malak rangers. **Fieldwork:** Phase 2 of the project included continuance of relationships with, and participation Malak Malak rangers to capture, tag and monitoring shark movements in rivers of Northern Australia. **Management:** Indigenous people managed site access. Malak Malak rangers determined survey design for sawfish rescue and design and location of sawfish signage. **Training:** Malak malak rangers already trained from earlier project (Project A1). **Communication:** The first phase NAILSMA led and coordinated review of species of importance to Indigenous communities in the Northern Territory, including the Gulf of Carpentaria and western Cape York.	and criteria for assigning significance may be different, there is certainly a strongly shared commitment to ensure that they continue to define north Australian seascapes and maintain their spiritual and instrumental value to Australian society. The research interests identified by Indigenous people reflect the powerful obligations they accept as custodians of country and the lifeforms and ancestors depending on their management of country. (p.23 of Report)
Theme A **A14: Identification of near-shore**	In early 2018, the CSIRO provided the first estimate of abundance for the southern-western adult white shark, including trend (essentially zero or slightly negative). However, it was noted that to confirm the trend, a further decade of sampling would be required,	Yalata Land Management group (SA) Category 2	**Planning:** Yalata Land Management Group where engaged early when the project was being conceived to see if they were interested in white shark, whether they had interest to	TBA

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habitats of juvenile white sharks in Southwestern Australia	which can be reduced if near-shore habitats where juvenile white sharks from the southern-western population can be readily accessed, are identified. This pilot project will investigate credible anecdotal evidence of juvenile white sharks using near-shore habitat near the head of the Great Australia Bight, and inform future project development steps. The pilot project will include collaboration and the opportunity for capacity building with the Yalata Land Management group. The outcome of this pilot project will inform whether to proceed to future (on-water) activities.		participate in field work and training to deploy scientific equipment. **Engagement:** The project included: on country meetings to collate understanding about Indigenous interactions and knowledge of white shark sitings in the area. Also engaged to know where to go on country to access best sites (and where to go - off limits). Also engaged to understand opportunities for engaging with local Indigenous community. **Fieldwork:** Rangers accompanied researchers in some of the field trips. **Management:** Rangers managed site access. YLM facilitated engagement with Indigenous community and school. **Training:** No training was provided for this short project, but interests for future training were identified with Indigenous rangers. **Communication:** Communication included face to face interaction on country and presentation at the local Yalata Indigenous school.	
Theme B B4: Underpinning the repair and conservation of Australia's threatened coastal-	Shellfish reefs and saltmarshes are vital to the health of Australia's bays and estuaries, supporting marine life and fish production, regulating water quality and curbing coastal erosion. These valuable nearshore ecosystems are in serious decline due to coastal development and activities such as intensive agriculture. Reparation efforts have begun in some locations, with the promise of significant benefits. Further projects, however, hinge on increasing awareness and joint investment among governments,	Aotearoa (New Zealand), Narungga (SA), Mamu and Rainforest Aboriginal peoples (Qld), Woppaburra, Yawaalaraay, Bunya Bunya,	**Planning:** Approach various TOs in Australia and NZ to gauge interest in research on restoration of shellfish reefs. This was received positively and a project plan was conceived for NESP. **Engagement:** The Hub took steps to engage with / learn from TOs, including a workshop with TOs on Bribie Island, Qld. To identify Indigenous aspirations and collaborative	In 2016 TOs from around Australia and NZ with an interest in shellfish ecosystem restoration projects, came together for the work-shop on Indigenous engagement in shellfish restoration to identify Indigenous aspirations and collaborative opportunities, and to gather advice about working in partnership. The workshop developed a 'seven pearls

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marine habitats	businesses and the community. This project is distilling knowledge of shellfish reefs and saltmarshes, their distribution and ecology, to articulate the environmental, social and economic benefits of conservation and repair, as well as to provide practical guidance for repair.	Quandamooka, Joondoburriand Kabi Kabi (Qld) Category 2	opportunities, and advice about working in partnership. Participation included Indigenous people from Aotearoa (NZ), Narungga (SA), Mamu and Rainforest Aboriginal peoples (Qld), Woppaburra, Yawaalaraay,Bunya Bunya, Quandamooka, Joondoburri and Kabi Kabi (Qld). Engagement also included discussion about production of communication products. **Fieldwork:** The workshop opportunity was also combined with a field work opportunity on Bribie Island to get Indigenous participants on the water to experience what was happening with local shellfish beds and restoration efforts. Quandamooka invited the project leader to their sea country identify remnant reef sites with the view to identifying opportunities for future investments in research. **Management:** Indigenous participants scoped/planned Indigenous workshops; managed access to field sites in Moreton Bay; co-authored/ authorised access to publications (e.g. publish 7 pearl of wisdom paper). **Training:** Quandamooka people provided 'training' to project leader about shellfish reef sites and how to work with/treat them. **Communication:** Indigenous people participated Indigenous workshop and development and approval of related outputs for project including: animated shellfish reef videos, videos of personal perspectives on research for shellfish reef restoration, development and communication of publications (e.g. 7 pearls wisdom paper).	of wisdom' approach that explored the individual and collective Indigenous experience. Each pearl of wisdom, independently and collectively, is a necessary element in better engaging local Indigenous people, creating unique entry points and pathways through the seven steps, and different outcomes.

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Theme D **D1: National data collation, synthesis and visualisation to support sustainable use, management and monitoring of marine assets**	Australia's North and North-west marine bioregions feature diverse ecological communities, from rich sponge habitats to large populations of whales, turtles and sharks, including more than 150 protected species. Quality baseline data, and an understanding of natural variability and the impacts of human activities, are needed to guide and assess management interventions such as marine-reserve zoning, threatened-species recovery plans and industry regulation. Guided by regular consultation with managers, industries, and other marine users, this project will collate existing information, and test the application of predictive models to provide baselines and understand biodiversity patterns and ecosystem processes. The work will focus on key Commonwealth marine reserves and Key Ecological Features, and will prioritise areas for further detailed studies in the North and NW Region.	Kimberley Land Council (WA). Category 3	**Planning:** The project involved an early scoping phase, project leaders engaged with the Kimberley Land Council to understand Indigenous interests in marine environment of NW Australia **Engagement:** Engagement was designed to identify Indigenous groups with sea country interests in the Kimberly and Pilbara regions. Indigenous representatives from these regions attended research-user and stakeholder meetings, along with others from the commercial fishing and oil and gas industry and also state government. **Fieldwork:** The project was originally scoped with the view to possibility of advancing to include field surveys. Field studies did proceed but these were amalgamated into project D3 (see below) **Communication:** The project developed a 'Sea Country' page on NW Atlas to share the information it had collated. Indigenous interests for participation in field work were transferred to the project D3 - a super project focused in prioritising and undertaking ten different surveys of Australian Marine Parks in Australia's EEZ. Some of which included Indigenous participation.	TBA. The team will continue to engage with Indigenous communities that were engaged in 2015-16 to ensure generated knowledge, data and results are effectively shared with and communicated to Indigenous peoples, communities and organisations.
Theme D **D3: Implementing monitoring of Australia's Marine Parks and the**	There is a significant need to support Parks Australia in the establishment of an inventory and monitoring program for Australian Marine Parks (AMP) networks, and ensure it is integrated within broader national monitoring frameworks. This project initiates a series of surveys, utilising Standard Operating Procedures, to demonstrate a sustainable path for a national survey program. By facilitating national approaches, including	National, but also the following relevant TO groups and Indigenous land councils: Indigenous groups for	**Planning:** The first phase (first three years) of this project focused on the collation of existing spatial marine data in Australia's temperate east, south-east and south-west marine regions. Indigenous engagement commenced in the second phase of the project focused on conducting deep-water marine surveys. In developing survey plans, the survey leaders	TBA

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status of marine biodiversity assets on the continental shelf	a standards-based approach to collecting new marine data, project outcomes will include key steps to assist Parks Australia to implement and initiate an AMP monitoring program, new knowledge to inform AMP management, a national integrated framework for SOE reporting, and collaboration between State-based and Commonwealth-based programs.	Wellesley Island Sea Claim and Thuwatha/Bujimulla Indigenous Protected Areas (QLD); TOs of the Wadandi Country (WA); the Yamatji Marlpa Aboriginal Corporation (YMAC); Tasmanian Aboriginal Land Council (TAS); Northern Land Council (NT). Category varied from 1 to 3.	reached out to Indigenous organisations to understand if they had interests in the areas targeted for surveys. **Engagement:** For each of the prioritised deep-water survey sites, the survey leaders engaged with relevant traditional owner groups and Indigenous land councils to discuss the proposed survey and understand Indigenous interests in the survey area, or adjacent areas. The project prioritised 10 Australian Marine Parks (AMPs) for deep water field survey, 5 of these attracted further engagement from Indigenous groups: survey of Gulf of Carpentaria AMP (WA), survey of the Arnhem/Arafura AMP, survey of South-west Corner AMP (WA), survey of Beagle AMP (Bass Strait), survey of Ningaloo AMP (WA); and survey of Wessel AMP (NT). **Fieldwork:** Fieldwork engagements to date have resulted in participation in one of the deep-water surveys (the survey of the SW Corner AMP). Negotiations are continuing for Indigenous participation in the survey of the Arnhem/Arafura AMP. A plan was developed for a deep-water survey in the Gulf of Carpentaria AMP but we received a request from TOs to hold off till they are ready to participate - we agreed. **Management:** Indigenous participants in the south-west Corner AMP survey provided directing/leading roles in providing permission to conduct the survey on sea country defining the scope of cultural mapping and directed the process for completing the cultural mapping task. Indigenous participants for the Gulf of Carpentaria AMP survey provided a directing role in postponing planning and implementation	

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			of the survey. Hub researchers are currently submitting a survey plan to the Northern Land Council for approval to undertake the Arnhem/Arafura AMP survey. Indigenous participants provided approval for release of seafloor maps that included coverage of a sacred site in the Wessell AMP survey. **Training:** SW Corner - included shared learning for participatory mapping techniques. **Communication:** Communication has mostly focused around meetings and emails to determine interests, to advance engagement and secure permission for deep-water surveys0r release of outputs. The south-west Corner AMP survey included a presentation at a regional Indigenous forum and SWALSC to keep them informed about progress with cultural mapping and planning for the survey.	
Theme E **E6: Assisting restoration of ecosystem engineers through seed-based and shoot-based programs in the Shark Bay World Heritage Site**	This project is a collaboration between scientists and the Shark Bay Malgana Indigenous community into jointly developed seeding and shoot planting methods to assist natural recovery of seagrasses in preparation for future devastating impacts of climate change. The Shark Bay World Heritage Site (WHS) is unique globally for its natural values, including stromatolites, seagrass meadows and marine megafauna including dugongs, sharks, turtles, and dolphins. The immediate goal is to scale up the existing restoration research to assist recovery of the dominant seagrasses, Amphibolis antarctica and Posidonia australis following the 2011 marine heat wave.	Shark Bay Malgana Indigenous community. Category 1	**Planning:** The Malgana Aboriginal Corporation and Malgana Rangers have been involved in planning the research, including development of shared understanding about science objectives, cultural objectives, access to sites and training opportunities. **Engagement:** Engagement has focused on understanding mutual benefits from this research, agreeing on site access (for restoration), participation in training and communication of research findings. **Fieldwork:**	TBA

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			In November 2019 scientists and rangers joined together to collect seagrass seeds, seedlings and samples and engage in training activities for restoring seagrass habitat. A follow-up collaborative field trip is planned for March 2020. **Management:** Indigenous participants: identified restoration sites and provided directions on access to sites (where to go and not to go); ensured that training was part of the research agreement (benefits of project for Indigenous communities). **Training:** In November 2019 scientists and rangers joined together to collect seagrass seeds, seedlings and samples and engage in training activities for restoring seagrass habitat. A follow-up collaborative field trip and training is planned for March 2020. **Communication:** Communication activities have involved many meetings (phone) and on-country visits to develop a shared understanding about the project, training and communication of the findings of the study, including next steps for co-led research.	
Theme E **E7: Assessing the feasibility of restoring giant kelp beds in eastern Tasmania**	The project extends an externally funded project conducted through UTAS commencing in 2018 to select for thermally tolerant and low-nutrient-tolerant giant kelp (Macrocystis pyrifera) genotypes, and to examine effects of acclimation of selected genotypes by pre-exposure to warm, nutrient-poor conditions. The proposed project will outplant pre-exposed selected genotypes of giant kelp as micro-sporophytes in an experiment with and without provision of an added source of nutrient. The work is designed to	Weetapoona Aboriginal Corporation. Category 2	**Planning:** Indigenous group contacted researcher to express their interest to participate in research. This resulted in development of a written agreement about how they would work together **Engagement:** Engagement activities focused on: developing a clear understanding about research activities (and managing expectations of a feasibility study) and engaging to	TBA

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	assess the feasibility of this approach as a means to develop minimum patch sizes for giant kelp that can be self-replacing and self-expanding, thus providing restoration and future climate-proofing options for this EPBC-listed marine community.		communicate project progress. In 2020 engagement will focus on implement training and communicating results of trial. **Fieldwork:** Site visit to confirm locations but did not participate in on-water activity. Management: Indigenous participants: identified one of the restoration sites (culturally important) site selection; ensured that project included a training component (training in the practice of kelp restoration is an important benefit for them). **Training:** In 2020 Indigenous participants will engage in training for kelp restoration. **Communication:** The bounds of communication where outlined in the agreement, this will include communication materials for training and communication/endorsement of final project report will consult on final report. Communications will result in an understanding of next steps for this collaborative research venture.	

Selected NAER Hub research projects and details of Indigenous involvement or engagement

NAER Hub Research Priorities

NAER Hub's Research Priorities for Annual Plan V6 are as follows:

A. Effective management of northern Australia's environmental resources

A1: Identify lessons learned from the incorporation of Top End Indigenous fire knowledge into fire management, to inform the incorporation of Indigenous knowledge in fire management and carbon abatement planning nationally.

A2: Identify high-priority areas in northern Australia for threatened species and ecosystems to better target threat abatement and species recovery investments.

A3: The development and direct trial of practical techniques that underpin on-ground management for the recovery of identified threatened species, including Kakadu National Park and adjacent Indigenous Protected Areas.

A4: Develop and trial spatially explicit tools to guide planning and management decisions that support a mix of multiple uses and protected areas while maintaining environmental values.

A5: Identify evidence-based methods for the assessment of development impact on species and ecosystems which can be better integrated into planning processes and EPBC Act approvals.

A6: Develop management practices for rainforests which minimise the impact of extreme weather events.

A7: Identify management actions to address the management of waste and debris in remote locations. This includes the issue of ocean rubbish and debris washing up on Australia's northern coastline and the management of hard waste in remote locations such as Cape York.

B. Understanding the pressures and impacts on environmental resources in northern Australia

B1: Identify biodiversity impacts from changed land and water use (e.g. agricultural, development and infrastructure) to support best practice land management.

B2: Demonstrate the benefits and constraints of landscape and river connectivity to better manage biodiversity outcomes.

B3: Determine the impacts, including cumulative impacts, of natural stressors and current management regimes on biodiversity loss and landscape degradation to underpin on-ground management actions.

B4: Identify critical knowledge gaps in the understanding of environmental resources in northern Australia to better prioritise government investment.

C. Understanding and measuring the condition and trends of environmental, social and economic resources in northern Australia

C1: Develop methods, and techniques to reduce the cost of estimating changes in soil carbon over time.

C2: Participation of Indigenous people in environmental management across northern Australia, including Indigenous Protected Areas.

C3: Develop better capacity to predict ecosystem failure to improve planning and management practice.

C4: Determine the economic contribution of environmental resources across northern Australia in supporting effective policy and planning decisions.

C5: Demonstrate how to better measure environmental drivers, pressures, stressors and responses in northern Australia, taking into account remoteness and limited specialist skills base within the region, including approaches to environmental accounting.

In the 2017 review of Priorities, B1, B2, B3 and C2 were allocated a higher priority.

Details of Selected NAER Hub research projects with a high level of Indigenous involvement or engagement

The Table below includes information about a selection of the NAER Hub's research projects with a high level of Indigenous involvement or engagement. The Table includes NESP Hub research theme or priority, NESP Hub project number, a project summary or description, the Traditional Owner (TO) group(s) and jurisdiction(s), the nature of activities involving Indigenous partners (covering Planning, Fieldwork, Engagement, Communications, and Training), the relevant Category in the Three Category Approach to Indigenous engagement, and identified outcomes and/or Indigenous research priorities.

NAER Hub Theme and Project Number and Name	Project Summary	TO group (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes or Outputs and/or Indigenous Research Priorities
Theme 1 **1.3.1: Environmental Water Needs of the Mitchell River**	River catchments, particularly the Mitchell River catchment, of the Gulf of Carpentaria are home to many important freshwater assets, such as significant commercial and recreational fisheries, threatened species, and wetlands of national significance. With considerable interest in agricultural expansion in the Gulf, there's concern these assets may be impacted by intensive development. These assets depend greatly on the linkages between rivers, floodplains and estuaries. However, our current ability to predict the consequences of future development on these linkages is limited. There are also significant gaps in our understanding of environment flow requirements, such as the quantity and timing of water flows needed to trigger the migration of key aquatic species. This research is improving our understanding of the critical flow needs to sustain freshwater ecosystems in the Mitchell River catchment. In particular, the project aims to predict the impacts of future	Kowanyama Aboriginal Land and Natural Resource Management Office (KALNRMO) Rangers and Council of Elders Mitchell River Traditional Custodian Advisory Group (MRTCAG). Category 2	**Planning:** Guidance sought from Kowanyama Council of Elders through the KALNRMO rangers for development of research program in Kowanyama. **Communications:** Regular phone and emails exchanges with KALNRMO; Meetings with MRTCAG at later stages of the project. Kowanyama TOs / rangers have co-presented at conferences and meetings, and have been invited to attend NESP Northern Steering Committee field days. Training: Researchers have passed on technical knowledge about the project during fieldwork, two-way knowledge exchange has been a key part of the Kowanyama-based research. **Fieldwork:** Kowanyama rangers have been engaged in all fieldwork in the lower catchment and Rangers and Traditional Owners have co-presented with researchers conferences. **Engagement:** Kowanyama rangers have had high levels of engagement throughout the project. All in country fieldwork has been arranged with, and done in partnership with, KALNMRO rangers.	TBA. The project intends to work in collaboration with KALNRMO, Kowanyama, building on previous work undertaken within TRaCK. It will also re-engage with the members of the Mitchell River Traditional Custodian Advisory Group through an existing MOU. The co-authorship of technical papers will be undertaken as part of these collaborative arrangements.

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	development on important ecosystem linkages between the river and its floodplain wetlands, and to better understand other potential risks associated with changes to flow regimes. This information is vital to help inform decision makers about water allocation that both enables agricultural development and protects environmental assets. This project is: • Identifying and mapping key 'hotspots' of freshwater primary production within the Mitchell River floodplain associated with flow-driven flooding as high priority areas for protection • Improving our understanding of the importance of these high-priority areas for sustaining fish populations, birds, turtles, crocodiles and other aquatic species • Identifying other flow-dependent ecological assets in the Mitchell River and how they are likely to be impacted by water resource development • Increasing confidence in water planning for river catchments in the Gulf thanks to an improved understanding of ecological assets and their critical links to flow.		MRTCAG have come on board in late 2019, with a formal arrangement in progress, to enable deep engagement with middle and upper catchment traditional owners for the remainder of the project, as the fieldwork in this area in the early stages of the project was in conjunction with only one Indigenous organisation and non-indigenous land managers.	
Theme 1 **1.3.3: Environmental Water needs**	This project is working in collaboration with the Australian and Western Australian Governments, Traditional Owners and pastoralists to improve the available information on the water needs of key natural values in the Fitzroy River. This knowledge will underpin future water allocation and planning	Gooniyandi Aboriginal Corporation PBC, Walalakoo Aboriginal Corporation PBC,	**Planning:** The PBCs for each area of interest along the river were identified and all approvals for work to begin were secured from the PBCs. Research agreements were negotiated and signed prior to fieldwork or data collection. Researchers met with each group to discuss the research. Researchers showed maps of desired locations that had	TBA The project will be guided by an advisory group including individuals representing conservation, government, environment and Indigenous interests. The project will

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for the Fitzroy River	decisions. The primary aim of this project is to improve our understanding of the environmental water needs of key plant and animal species in the Fitzroy River to inform sustainable water planning and management decisions. The project includes three major components: • Reviewing the current information on environmental water needs and developing initial conceptual models to predict the impact of various water use scenarios on key environmental values • Undertaking targeted research to determine water needs of environmental values, including significant plant and fish species • Using the new research to revise conceptual models and recommendations to reduce the risk to environmental values from water resource development. Anticipated outputs: • Conceptual models of ecohydrological relationships and potential risks from water resource development • Recommendations of environmental water needs for important riverbank plants and aquatic animals in dry season pools and the implications of wet season water use for fish.	Yi-Martuwarra/Yanunijarra Aboriginal Corporation PBC and Yungngora Aboriginal Corporation PBC. Category 2	been identified remotely and discussed the cultural considerations and the requirements of the project aims. Once sites had been determined, the correct individuals to accompany the researchers to each location were identified to visit the location for researchers to discuss and demonstrate the activities that they would like to do. Once the initial visits were made the next visits did not require such prolonged negotiation as repeat visits tended to be to the same set of locations. **Communications:** Prior to visits onto country, researchers emailed schedules to PBC contacts and ranger coordinators. The research teams and ranger groups liaised to determine suitable times for field visits. **Fieldwork and engagement:** All fieldwork was conducted with, and guided by, Aboriginal co-researchers on their country. This project took a collaborative action research approach from the start of the fieldwork phase. The rangers for all groups that this project engaged with were strong on-country co-workers. The rangers were invaluable in the selection of sites and safe navigation to and from off track locations.	also report to a catchment group established by the local community and including representatives from the PBC's in the catchment. This will provide ongoing engagement with the project both in the development of the project and in reporting back on key findings.
Theme 1 1.4: Links between Gulf	The Flinders, Gilbert and Mitchell Rivers flow into the southern Gulf of Carpentaria, supporting healthy ecosystems and nationally significant wetlands as well as important recreational and commercial	KALNRMO, Kowanyama	**Planning:** Guidance sought from Kowanyama Council of Elders through the KALNRMO rangers for development of research program in Kowanyama	TBA The main engagement with Indigenous peoples will be in terms of providing information on

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rivers and coastal capacity. (This project has links to 3.6.)	fisheries. With increasing interest in developing water resources in northern Australia, further information is needed to understand how such developments will impact on the health and productivity of floodplains and coastal areas. Specifically, we need to know which flow characteristics of the rivers earmarked for future development are most important for the region's plants and animals so we can make informed management decisions.	Category 2	**Communications:** regularly updates are provided to KALNRMO, and regular communications via phone and email. In person meetings occur during fieldwork. Training: Training has been provided for shorebird counting, water sampling and other research activities. Fieldwork: Rangers/ TOs are invited to participate in fieldtrips. Engagement: Ongoing updates occur via email, and an end of project road show is planned to present findings.	proposed work, and information on outcomes of research. Selected sites will be sampled in southern Gulf of Carpentaria catchments and in areas where there are established relationships with Indigenous groups. Once sites for field work have been identified, Indigenous groups will be consulted prior to field work commencing. In the past, research in the Mitchell River the field work was undertaken in collaboration with KALNRMO, local rangers were employed to assist including with equipment and their involvement also extended to co-production of technical papers.
Theme 1 1.5: Indigenous Water Needs for the Fitzroy River	This project aims to support Aboriginal peoples' involvement in water management. It is identifying linkages between Aboriginal peoples' values, practices and water regimes, and eliciting knowledge as well as objectives for the future management of land and water resources. Results will contribute to improved water planning and management, and enhance the capacity of Indigenous organisations to influence allocation decisions, water policy and regional development solutions.	Bunuba Dawangarri Aboriginal Corporation, Gooniyandi Aboriginal Corporation, Jaru Claimant Group, Kija Claimant Group, Tiya-Tiya Aboriginal Corporation, Walalakoo Aboriginal Corporation, Warrwa Claimant	**Planning:** TOs Involved in planning for Indigenous participation. Meetings were held with participating PBCs for planning purposes prior to commencing the fieldwork phase of the project. Individual TOs participated in planning the research approach and outputs for the part of the project involving them. **Fieldwork and engagement:** All fieldwork was conducted with, and guided by, Aboriginal co-researchers on their country. This project took a collaborative action research approach from the start of the fieldwork phase. Communications: Regular updates were given at PBC and Martuwarra Council meetings. Communication products include a film (still awaiting PBC approval for publication), an article co-authored with Aboriginal partners and visual material, which will be launched on country this year prior to publication. Planning for communication materials is	TBA The project will be guided by a Fitzroy Catchment Steering Committee. This will be comprised of a Fitzroy Indigenous Reference Group made up of representatives from the PBC's in the catchment, providing ongoing engagement with the project both in the development of the project and in reporting back on key findings. The project will work with Aboriginal people to develop conceptual models of the river and its catchment and to document Indigenous knowledge where people request it.

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		Group, Wilinggin Aboriginal Corporation and Yanunijarra Aboriginal Corporation/Yi-Martuwarra. Category 1	collaborative, and feedback is sought at an intermediate step from TOs and PBC (when relevant for the latter). Approval on the final version is then sought from involved TOs and relevant PBCs before making any material public. Training: Knowledge sharing occurred throughout the project, including the training of non-Aboriginal co-researchers by senior Aboriginal co-researchers. Collaborative work with the Martuwarra Council and PBCs also included some information sharing by environmental social scientists about water planning and governance processes.	
Theme 1 **1.6: Multi Objective Planning in Northern Australia**	This project is demonstrating how to operationalise participatory, multi-objective catchment planning, where stakeholders collaboratively construct and assess the outcomes of alternative development scenarios. The scenario planning exercise aims to create a shared space for constructive and objective conversations about the future development of the Fitzroy River catchment. This process aims to develop common understandings about different development options for the region and systematically explore the possibilities as well as the potential outcomes of different development trajectories, including identifying those with multiple benefits and where trade-offs are needed.	Kimberley Land Council, Madjulla Inc, Prescribed Bodies Corporate representing the interests of Bunuba (Bunuba Dawangarri Aboriginal Corporation), Gooniyandi (Gooniyandi Aboriginal Corporation), Nyikina Mangala (Walalakoo Aboriginal Corporation), Ngarinyin (Wilinggin Aboriginal Corporation), Yi-	**Planning:** As a project that required cross catchment reach with Indigenous and non-indigenous participation, a considerable amount of planning was done in the preliminary stage of this comparatively complex project. Deliberations with PBCs and the KLC aimed to ensure proper engagement and maximise participation and input of TOs along the process. Activities involving TOs were designed and undertaken in close collaboration with Project 5.4. **Fieldwork:** The project did not engage in fieldwork. The research team delivered a range of activities based on participatory scenario planning methodology with four major workshops (one exclusively to TOs) delivered over eighteen months. These were interspersed with a number of smaller more focused meetings that enabled the methodology and workshop materials to be reworked and developed to suit the dynamics of the groups, again for both Indigenous and non-indigenous participants. It also involved an initial set of interviews to set the baseline for discussion during the workshops and several one-on-one in person meetings with	TBA This project involves close collaboration with the KLC and six PBCs and give native title claim groups whose lands intersect the boundaries of the study area and thus have rights and direct interests in the catchment. Details are yet to be finalised, but Engagement with TOs will happen at different stages to develop different outputs, which will be facilitated by focus group discussions and workshops, including those to construct and evaluate land use scenarios, validation of value maps, and scenario assessment.

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		Martuwarra Ngurrara (Yanunijarra Aboriginal Corporation), Yungngora (Yungngora Aboriginal Corporation), other TO groups: Jaru, Kija, Tiya Tiya and Warrwa peoples. Category 2	each PBC and other TOs to obtain feedback on outputs along the project. **Engagement:** The core scenario planning participatory sessions followed familiar workshop methods such as the delivery of material to the whole group, smaller focus group discussions and the comparison of points emerging from each group. Two professional facilitators were engaged for the three core multi-stakeholder workshops. An interpreter was engaged for one week to discuss underlying concepts and to culturally translate the materials of two workshops. An interpreter was also engaged for the core workshop with TOs and one of the multi-stakeholder workshops. **Communications:** This project required the participants to read and give feedback on complex materials in stages between the three core workshops. This material was generally delivered by email and hand delivered, if necessary. It is unclear if all emailed material could be easily accessed, as not all participants have access to a computer and / or a printer. **Training:** The final session to be held mid 2020 will be designed as a training session in the use and interpretation of output data from the project, including the use of software required to explore digital maps. It will involve the researcher/s making visits locally in Broome, Derby, Fitzroy Crossing and/or Halls Creek so that each group will be small and the information delivery will be tailored to the level appropriate to each group.	

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			No accredited training has been delivered to date through this project.	
Theme 2 2.1: Waste and Marine Debris in Remote Northern Australian Communities	This project reviewed the current status of waste management in remote communities of northern Australia, and sought examples of best practice models nationally and internationally to improve waste disposal and management. The project worked with three remote northern Australian communities in a collaborative on-ground case study. Research outputs: • Desktop study documenting management bodies across remote north Australia and reviewing existing initiatives that target waste reduction and disposal; • Report from three case study communities documenting their waste profile, current waste management approach, waste management gaps and an assessment of the feasibility (including cost effectiveness) of a range of possible actions/solutions; • Information and appropriate communications material for communities on waste management issues currently impacting them and local responses to the management issues.	Communities of Lockhart River, Mapoon and Pormpuraaw on Cape York Peninsula Category 3	**Fieldwork:** fieldwork in three case study communities	TBA The primary aim of the project is to develop strategies to assist remote Indigenous communities in managing waste issues given their unique challenges, including significant proportion of marine debris that is not generated locally. The case studies will identify the appropriate local council body and local land and sea management bodies and a project plan will be developed in partnership with the relevant groups. Research learnings will be communicated directly to the communities involved.
Theme 2 2.3: Fire & weeds in the Top End	Weed invasion, land clearing and changed fire regimes have the ability to significantly alter ecosystem processes across northern Australia. This project is drawing on existing information about the combined impacts of these threats and collecting	Category 2	**Planning:** As part of the biodiversity sampling, we sought approval from Traditional owners for a permit to conduct fauna surveys on Mary River National Park. A detailed study proposal was provided to the NT Parks and	TBA

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	additional data to model fire behaviour and scenarios of altered ecosystem function over the next 30 years in the Darwin and Daly regions. It is also developing remote sensing methods to map areas of high biomass grass invasions across the north. This information is critical to land use planning and management to predict, and hopefully prevent, ecosystem failure.		Wildlife and Traditional Owners for feedback, and was approved by Indigenous Traditional Owners (July, 2018) As part of the Gamba grass mapping and soil erosion sampling, we sought approval from Traditional Owners for a permit to map gamba grass on the Finnis River Land Trust. A detailed study proposal was provided to the NLC and was approved by Indigenous Traditional Owners (Batchelor, Oct 2019) **Fieldwork:** As part of the Gamba grass mapping project, Indigenous Traditional Owners for the Finnis River Land trust site took us onto country, and provided paid cultural monitoring services (Batchelor, Dec 2019). **Communications:** *Gamba fire and weed management* We presented the results of our NESP gamba grass research to Indigenous ranger groups from Cape York (NESP 2.10 gamba grass workshop, Cairns, July 2019). We presented results of our NESP gamba grass research to Indigenous Traditional owners in the Batchelor region (presentation at the Finnis River NRM group meeting, Batchelor, Feb 2020). We presented results of our NESP gamba grass research to Indigenous Traditional owners and ranger groups from across northern Australia as part of the Northern Australian Savanna Fire Forum (Northern Australian savanna Fire Forum, CDU, Darwin Feb 2020).	
Theme 2 **2.5: Defining Metrics of Success for Feral Animal**	The research is exploring the extent of the damage being caused by feral animals to aquatic ecosystems and the methods to best control them. The researchers are working with Indigenous ranger groups, local communities and agencies to achieve	Kalan Enterprises, Aak Puul Ngantam (APN Cape York) and Balkanu (Qld)	**Planning:** This project was codeveloped with traditional owners, and builds on previous work in areas where the researcher has strong, existing relationships. Communications: Rangers and Traditional Owners have co-presented with researcher at conferences and meetings. The researcher/s have face to face meetings with TOs in	TBA Indigenous values and aspirations form the basis of this research and project planning has been in consultation with two long term indigenous research partners (APN

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Management in Northern Australia	this goal. By ensuring that all key management groups are involved in the project, the researchers aim to foster a shared understanding of the most effective and efficient ways to manage feral animals to deliver joint social, environmental and cultural benefits. This project builds on and works alongside state and federal funding programs that have been awarded to Indigenous groups Balkanu, Aak Puul Ngangtam and Kalan Enterprises over the past five years to control feral animals in Cape York's Archer River Basin. With support from Balkanu and funding awarded through the Australian Government's Biodiversity Fund, Kalan and APN rangers installed pig exclusion fencing around key wetlands and compared the results to unfenced sites.	Category 1	community and on country. NESP project outputs are approved by TOs. **Training:** Two-way knowledge exchange has been integral to this project – shaping the design, fieldwork and outputs. **Fieldwork:** Indigenous rangers and/or Traditional Owners are present (and are research partners) during fieldwork. **Engagement:** joint collaboration process. Workshops and field trips are held in conjunction with APN / Kalan and involve rangers, traditional owners and school students – on country. Travel to homelands from Aurukun is difficult and this project has supported that to happen. Rangers and Traditional Owners have co-presented with researchers' conferences.	and Kalan). This project has been built on the foundations of five years of collaborative research including a substantial participatory action research program partially funded by NERP. The researchers will work directly with Indigenous groups to develop a robust understanding of the cultural values of wetlands in the ARB.
Theme 2 2.6: Managing savanna riparian zones	Riverbank vegetation supports important ecosystem, economic and cultural values. It is however vulnerable to pressures such as invasive plants, feral animals and fire, which can be compounded by new development. The project is using case studies in Kakadu National Park and the West Kimberley to deliver improved knowledge on the role of riparian zones in supporting savanna systems, and on where resources could be directed for improved riparian health.		**Planning:** Project planning includes consultation with Indigenous landowners. This includes agreements about project activities, engagement and employment of indigenous advisors and rangers. **Communications:** Prior to visits onto country as part of the assessment of monitoring tools, researchers emailed schedules to PBC contacts and ranger co-ordinators. The research teams and ranger groups liaised to determine suitable times for field visits. It is anticipated that outcomes, particularly the efficacy of different monitoring tools, will be communicated through workshops with PBCs and ranger groups, to support Healthy Country Plans and on-going management. **Training:** No formal training was completed as part of the assessment of monitoring tools, however rangers were	TBA This research aims to guide improved management of riparian habitats and will deliver knowledge on the health of these key environmental areas and where resources should be directed to protect them. The project involves three complementary case studies to develop practical guidelines to support the sustainable use of riparian habitats. the project has been designed in such a way that the relevant local TOs will be integrally involved in the various components.

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			shown methods in the use of drones and mapping using GPS. The project collaborates with Project 5.5 which has undertaken training of indigenous collaborators **Fieldwork:** As part of the assessment of monitoring tools component of project 2.6, Indigenous Traditional Owners and ranger groups (Nyikina-Mangala, Noonkanbah and Yi-martuwarra) took us on country (along the Fitzroy River) and provided paid cultural monitoring services. UWA/CSIRO collaboration (Nov 2019). As part of the Kakadu Riparian vegetation project, we liaised with Traditional Owners about working on country at Nourlangie, Cooinda, Kapalga and Wildman River. UWA/CDU/Chris Brock collaboration (May/June 2018)	
Theme 2 **2.7: Tree water use and sensitivity to contaminated mine water**	Riverbank, or riparian, vegetation provides many ecosystem benefits that keep creeks healthy, including habitat and food for fish and wildlife, shade to cool water temperatures and roots to stabilise banks. Because groundwater likely meets more than half of the dry season needs of riparian vegetation in the Top End, groundwater contamination here could significantly impact riparian vegetation and associated river health. Weathering of waste rock from the Ranger Uranium Mine releases contaminants, including magnesium sulfate. These contaminants are washed out by rain and are predicted to move through the local groundwater towards Magela Creek. Depending on the concentration, magnesium sulfate (a salt) has the potential to affect the trees, other plants and ecosystems along riverbanks downstream from the Ranger mine site. This project will:	Gundjeihmi Aboriginal Corporation, Djurrubu Rangers, Kakadu Native Plants Pty Ltd Category 2	**Planning:** Project presented to and accepted by Gundjeihmi Aboriginal Corporation prior to starting, project staff underwent tailored cultural competency training. **Communications:** Discussions with Dr Lynley Wells, Cultural Heritage Advisor, Gundjeihmi Aboriginal Corporation.. Informal meeting with Dennis at CDU re project. **Training:** Dr Clement Duvert attended a cultural awareness training. **Fieldwork:** Djurrubu Rangers attended a project field day Nov 2018 where soil, vegetation and water sampling was undertaken, Magela Creek, Kakadu NP. **Engagement:** Indigenous-owned Kakadu Native Plants Pty Ltd engaged to provide advice on riparian species selection for pot trial. KNP Ltd have delivered seed stock for greenhouse experiments for 7 common and targeted riparian tree species.	Engagement with Indigenous stakeholders will occur via linkages with Kakadu Board of Management and the Supervising Scientist Branch. Djurrubu Indigenous Rangers could be co-investigators involved in identifying riparian species that may be highly dependent on groundwater (based on knowledge of particular phenological patterns, micro-site preferences), vegetation surveys, soil and groundwater sampling with training. As such there would there would be co-authorship opportunities.

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	• identify where the trees along the creeks in the Magela catchment get their water from – from the soil, from the creek itself or from the shallow groundwater – and the relative quantities from each • assess how sensitive common tree species are to magnesium sulfate levels • assess risks to riparian vegetation from the contaminated water, predict its impact and identify where ongoing monitoring should be focused • identify which tree species grow best in salty areas if rehabilitation is needed • inform mine closure criteria.			
Theme 2 **2.8: Rehabilitated mine sites and Top End animals**	Effective rehabilitation is a major challenge for the many active and legacy mines across northern Australia. Rehabilitation has historically focused on site stabilisation and re-establishing vegetation cover. Best practice mine site rehabilitation now aims for ecosystem restoration. This means sustainably integrating the site with the surrounding landscape – re-establishing animal and plant communities, as well as ecological processes like nutrient cycling, pollination and seed dispersal. This project: • surveyed natural reference sites surrounding Ranger Uranium Mine to identify invertebrate animals (ants, beetles, spiders and wasps) for informing mine closure criteria • analysed existing data to determine how best to use vertebrate animals for informing mine closure criteria	Gundjeihmi Aboriginal Corporation, Djurrubu Rangers Category 2	**Planning:** Project presented to and accepted by Gundjeihmi Aboriginal Corporation prior to starting. **Communications:** factsheets, presentation. **Engagement:** Project results presented to Gundjeihmi Aboriginal Corporation.	TBA

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	• designed a robust sampling methodology for ongoing vertebrate animal monitoring and assessment • provided valuable information on how the trial revegetation sites are helping animals to re-establish in the area • will help inform rehabilitation at other mine sites in northern Australia.			
Theme 2 2.9: Fish movement and sensitivity to contaminated mine water	Flowing through the Ranger uranium mine lease and into Kakadu National Park, Magela Creek is home to important populations of native fish species that need to be able to move between the river, floodplain and escarpment country at different times of the year. Weathering of waste rock from the Ranger mine releases contaminants, primarily magnesium sulfate. These contaminants are washed out by the rain and are predicted to move through the local groundwater towards Magela Creek. Depending on the concentration, the magnesium sulfate (a salt) has the potential to affect fish, trees and other ecosystems in and near Magela Creek downstream from the Ranger mine site.	Gundjeihmi Aboriginal Corporation, Djurrubu Rangers Category 2	**Planning:** Project plan presented to and accepted by Gundjeihmi Aboriginal Corporation prior to starting, project staff underwent tailored cultural competency training. **Communications:** videos, factsheets, pictorial figures, presentation. **Training:** demonstrations of fish surgery techniques and acoustic telemetry to Djurrubu Rangers. **Fieldwork:** Djurrubu Rangers hired to assist with fieldwork **Engagement:** Project update presented to Gundjeihmi Aboriginal Corporation.	TBA The proposal will be communicated to key Indigenous stakeholders of the Magela Creek catchment through the various Alligator Rivers Region community consultation processes, including Ranger minesite technical committee, ARRAC and ARRTC. Opportunities for Indigenous employment and participation in the research (includling authorship of publications) are envisaged for this study.
2.10: Improving Gamba Grass control on the Cape	Gamba grass was planted across northern Australia as a pasture species in the mid-1980s and has spread rapidly. In north Queensland, gamba infestations are found near Bamaga, Coen, Weipa, Cooktown and Mareeba. The grass is also widespread along Cape York roadsides and in isolated patches in the Gulf region. Despite being declared as a Weed of National Significance in 2012, and listed as a key threatening process under the Environmental Protection and Biodiversity Conservation Act, it continues to spread,	Nanum Wunthim (Napranum) Rangers Lama Lama Rangers (Yintjingga Aboriginal Corporation) Jabalbina	**Planning:** broad consultation with these groups (previous column), and other traditional owners have occurred from the being of the project via phone. Rangers and traditional owners from Nanum Wunthim, Lama Lama and Jabalbina attended the first project planning workshop to have input on the project design **Communications:** The project leader has had one-on-one phone conversations with groups, plus information has been shared via email.	TBA The Joint Traditional Owner managers of Cape York National Parks will be partners and research-users on the project as appropriate to the field trial locations. Representatives of the relevant Traditional Owner groups and/or ranger groups will be invited to the workshop and involved in project

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	increasing fire risks and significantly disrupting biodiversity and ecosystem services. Environmental, social and economic costs will increase unless control is improved. This project is reviewing herbicide and integrated management approaches to controlling gamba and trial various control methods in natural ecosystems to inform best practice and herbicide registration processes. The trials are assessing off-target herbicide effects and recovery following treatment and biomass removal. The project is developing best-practice management guidelines to control gamba incursions and infestations in natural areas, including control methods for selective herbicide application. The guidelines are assisting land managers to better manage gamba, and project outcomes are relevant to the entire gamba grass range across the NT, WA and Qld.	Category 2	**Training:** training resources will be developed during the project **Fieldwork:** The plots have been established on private property. **Engagement:** The project leader has have one-on-one phone conversations with groups, plus information has been shared via email. Rangers and traditional owners from Nanum Wunthim, Lama Lama and Jabalbina attended the first project planning workshop to have input on the project design. Ongoing updates will occur via email, and further workshops are planned.	planning and operation. Opportunities for capacity building will be sought through the project phases of experimental design and setup, herbicide application and trials, and in the design and content of communication materials.
Theme 3 **3.3 Prioritising Threatened Species in Northern Australia**	Northern Australia's rich biodiversity is both nationally and internationally significant. The tropical north is home to hundreds of thousands of plant and animal species, many of which are only found in the region and some of which are threatened with extinction. However limited knowledge of the current distributions of threatened species across the region is a major impediment to effective management. This project is guiding improved management and investment to reduce the impact of threats on threatened species and to bolster their recovery in high-priority areas of northern Australia. The project team is drawing on knowledge, data and expertise from a wide range of people to produce	Several TO groups across the entire Northern Hub region Category 3	This is a *Category Three* project that is laboratory or desktop based and does not have direct collaboration with an Indigenous community, organisation, group or individual.	TBA The project here is largely a desktop exercise that uses available information, people's knowledge and experience, and novel techniques to enhance prioritization of resource allocation in mitigating losses and enhancing recovery of threatened species; the knowledge and experience of Indigenous people and communities will greatly add to the project especially where data is limited. We will ensure to request both conventional and unconventional information where

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	maps and modelling that is helping support land assessments for future development, guide investments in conservation efforts and inform many other stakeholder activities. Researchers are working with those likely to use the outputs, such as government agencies, Natural Resource Management bodies and Traditional Owners, to ensure the project meets specific and broader needs.			appropriate, ensuring we provide information back to these communities.
Theme 3 3.4: Kakadu National Park's Threatened Species Note: This is also a TSR Hub project 1.1.1, they are leading this project.	The research provided evidence on where feral cats occur across Top End landscapes and the factors that may influence this occurrence. The research team is using existing large datasets to investigate current relationships between mammal diversity, cat and dingo occupancy, fire regimes and habitat characteristics. The data is elucidating the role of cats relative to other potential threats in the observed mammal declines, and assess potential suppressive effects of dingoes on cat.	Anindilyakwa, Tiwi Island, Warddeken and Djelk Traditional Owners and rangers Category 2	**Planning:** All components of field work for this project were undertaken prior to NESP, but in all cases TOs were consulted and in some cases, participated in the field work. Communications: Some groups such as Djelk, Warddeken, the Tiwis and Groote have had on –going engagement and communications about the results of the field work. **Fieldwork:** Camera trap analysis. **Engagement:** Some groups such as Djelk, Warddeken, the Tiwis and Groote have had on –going engagement and communications about the results of the field work. **Training:** Training was delivered to some TO groups as part of the field work.	TBA
Theme 3 3.5: Monitoring, Mapping and Safeguarding Kimberly Bilbies	The West Kimberley region, especially the Dampier Peninsula, La Grange region and southern parts of the Fitzroy River catchment, appears to be a stronghold for wild bilby populations. Consequently, more data is needed from this region to inform land use planning and development decisions, as well as assist ongoing management. In the Fitzroy River catchment, bilbies occur across a range of tenures such as pastoral leases, Native Title lands and conservation estates, and a collaborative	Nyul Nyul, Bardi Jawi Oorany, Nyikina Mangala Rangers and Yawuru Country Managers and others. the NESP / Fitzroy Catchment Ranger groups are: Kija, Bunuba,	**Planning:** The researcher has made contact with all PBCs and ranger groups that are relevant to this project. The main participants are the rangers now that the PBCs have given their approval. **Communications:** A start-up sheet has been produced to date as the project has not yet started on the ground. **Training:** Fieldwork: **Engagement:** Working with Traditional Owners, rangers and pastoralists to monitor bilbies, refine survey methods,	TBA

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	approach is required to effectively conserve and manage the species. This project is bringing together on-Country Traditional Owner land managers and researchers to build management capacity and help secure the future for bilbies in the Fitzroy River catchment. Project teams are collaborating with pastoralists to undertake studies of bilby populations and provide outcomes for effective coexistence of pastoral land use and the persistence of wild bilbies. This project is providing an accurate understanding of where bilbies occur and how they use their habitat in the Fitzroy River catchment. This information is being used to identify and implement on-ground actions that are helping ease the impacts of threats to bilbies. As well as gaining an understanding of the status of bilbies in the catchment, this project is contributing to species recovery planning and threat abatement programs. Broader natural resource management and conservation planning is also being supported through the research. The project is extending existing bilby research and management efforts and contribute to the Kimberley Bilby Network. It is also linking with work outside the catchment, such as the Dampier Peninsula Bilby Offset Project and bilby projects in the Pilbara. This project is: • delivering information on the distribution, abundance and habitat suitability for bilbies in the study area, including data on the connectedness of bilby colonies.	Nyikina Mangala, Yi-Martuwarra/Ngurrara and Gooniyandi Category 2	undertake threat management and help build local capacity in these areas.	

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	• improving understanding of how current pressures impact bilbies in the catchment and how they can be reduced or prevented to stop the species' ongoing decline. • working with Traditional Owners, rangers and pastoralists to monitor bilbies, refine survey methods, undertake threat management and help build local capacity in these areas. • supporting land use planning, healthy country planning and co-existence of grazing and wild bilby populations.			
Theme 3 3.6: Links between Gulf rivers and food for migratory birds	Rivers flowing into the Gulf deliver freshwater, sediments and nutrients to estuaries and nearby coastal areas, nourishing the mudflats where shorebirds rest and forage for shellfish, crustaceans and worms. Developments that use significant water or changes in climate that alter river flows may therefore impact the survival of the shorebirds. This project aims to quantify and compare the shorebird food resources produced by three Gulf river systems that flow alteration may affect – the Flinders, Gilbert and Mitchell Rivers. It is identifying the relative importance of the estuaries and adjacent mudflats in terms of food resources for shorebirds. This information is informing future water planning, environmental impact assessments, and migratory shorebird habitat protection and management.	Carpentaria Land Council Aboriginal Corporation. Category 2	**Planning:** A formal contract with CLCAC is in place for 3.6 with a wages component to support Indigenous ranger involvement in the project, and outlining knowledge sharing/ownership and TO involvement in project **Communications:** regularly updates are provided to CLCAC, and regular communications via phone and email between Research leader and CLCAC liaison. In person meetings occur during field work. **Training:** Training has been provided for shorebird counting, water sampling and other research activities. Fieldwork: Rangers/ TOs are invited to participate in all fieldtrips. **Engagement:** Ongoing updates occur via email, and an end of project road show is planned to present findings.	TBA
Theme 3	This project is trialling a revised ecological monitoring framework in Kakadu National Park and evaluating its effectiveness for detecting and	Kakadu Indigenous Research	**Planning:** Consultation with Kakadu Indigenous Research Committee. Consultation with TOs about site locations for field work.	TBA

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3.7: Monitoring Terrestrial Animals in Kakadu	reporting trends in terrestrial vertebrates and habitat condition. The monitoring undertaken will also inform Park managers on the effectiveness of management actions to address threats to biodiversity including feral cats, introduced species and fire regimes. The findings from this project will help further optimise the framework so it suits Kakadu and contributes to an integrated monitoring system across major protected areas in the northern NT. The trial builds on previous work across the NT's protected areas and will help optimise monitoring to maximise cost-effectiveness and to ensure alignment with Park priorities. The findings will greatly improve our ability to detect and evaluate ecological changes across the region and will lead to better management of national parks and other areas managed for biodiversity. This project is: • Providing precise and timely information on biodiversity trends and responses to management and environmental change. • identifying monitoring gaps for threatened species and other environmental management issues. • identifying options to meet Kakadu's management and reporting priorities. • improving processes to use monitoring information to review and adjust management actions	Committee, Kakadu Rangers Category 2	**Communications:** Summaries, booklet and factsheets Fieldwork: fauna surveys **Engagement:** Consultation with Kakadu staff and Traditional Owners to identify monitoring sites across major ecosystems in the Park that build on previous long-term monitoring. **Training:** Some training offered where Aboriginal staff were employed to assist with field work	

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	• demonstrating best practice in broad-scale ecological long-term monitoring for protected area management in northern Australia.			
Theme 4 **4.3: Developing eDNA methods for tropical waters**	The pressure to develop the water resources of Northern Australia is increasing. In order to make appropriate management decisions, water resource managers and policy makers need a good understanding of the distribution and abundance of aquatic species, as well as their presence or absence at individual sites. This is particularly so for species of conservation concern, for invasive species, and for cryptic species that are difficult to detect. Aquatic field surveys generally require specialised equipment and expertly trained staff. In remote northern Australia, they are expensive, difficult and often dangerous. Yet all organisms constantly shed DNA into their environment as they release faeces, urine and mucus or shed their skin cells. Modern genetic sequencing techniques enable scientists to identify a species from these tiny traces of its DNA. Aquatic environments are especially suitable for eDNA approaches, as a sample can be obtained by simply collecting water in a bottle.	Anindilyakwa Land and Sea Rangers (Groote Eylandt, NT) Category 2	**Planning:** Sampling sites were determined based on the traditional knowledge of occurrence of sawfish in Groote Eylandt. **Communications:** Phone or email with the Anindilyakwa Land and Sea Ranger Coordinator and the Ecologist. Training: An eDNA sample collection manual was sent along with the eDNA collection kits. **Fieldwork:** Anindilyakwa Land and Sea Rangers collected and shipped samples to test for the presence of largetooth sawfish **Engagement:** Anindilyakwa Land and Sea Rangers identified the sites were there was historical presence of sawfish, collected water samples following the TropWATER's sample collection protocol and shipped samples. TropWATER is committed to screen the eDNA samples for presence of largetooth sawfish and send a report with the results to Anindilyakwa Land and Sea Rangers.	TBA
Theme 4 **4.4: Assessing Mangrove Dieback in the Gulf**	A better understanding of patterns, trends and causes of mangrove dieback is informing monitoring and management. Project activities: • Initial Rapid Assessment of dieback recovery using the Shoreline Video Assessment Method and LiDAR – an airborne technology which takes precise, three-dimensional	Carpentaria Land Council Aboriginal Corporation, Li-Anthawirriyarra Sea Rangers Category 2	**Planning:** Researchers used existing relationships with Indigenous groups to conduct research. Communications: Research liaises with CLCAC, and has on site (in person) meetings with TOs and rangers. **Training:** A field guide to assessing mangrove health has been produced and used in training with rangers. Engagement: CLCAC rangers have co-presented at 2019 Indigenous Ranger conference. Researchers have presented findings and had meetings in community.	Anticipated Outcomes include increased coastal monitoring and reporting capability in the Gulf, including increased capacity of local Indigenous ranger groups (e.g. extension of MangroveWatch training courses and joint fieldwork) to continue coastal monitoring after the project has ceased.

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	measurements of the shape of the mangrove forest and forest floor. • Field verification and detailed monitoring including building the capacity of local Indigenous ranger teams to help monitor mangroves • Formal assessment of the condition of affected forests and what proportion are recovering • Analysis of the patterns of impact across the extent of dieback – in some areas, all mangrove species in all tidal elevations have been affected but it can be different in other areas Anticipated outcomes: • A best practice standard baseline assessment of the affected shoreline to underpin future assessments of mangrove forests and/or associated environmental changes • More informed management options in response to mangrove dieback events, i.e. deciding on whether to intervene in the recovery process, and if so, where and how • Better informed management policies for fishery species and biodiversity that depend on mangrove habitats (e.g. catch quotas, seasonal closures), for carbon accounting, and for water resource planning where freshwater flows influence mangrove health		**Fieldwork:** Field verification and detailed monitoring including building the capacity of local Indigenous ranger teams to help monitor mangroves.	Anticipated Outputs include: - Contributions to an online, interactive portal for displaying the dieback imagery collected by rangers, scientists and others, including a baseline dataset and associated condition metrics for each assessment location for monitoring change and recovery into the future. - An evaluation of risks to shorelines and recommendations for the on-going standardised monitoring of tidal wetland vegetation bordering Gulf dieback areas.

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Theme 4 **4.5: Developing eDNA methods to detect Top End animals**	Detecting animals, especially species that are rare or cryptic, is challenging in the remote and potentially hazardous environments of northern Australia. Traditional survey techniques are time and resource intensive, and so we have little reliable data for many species. Yet knowing whether a species is present or absent at a site is critical for conservation management and land-use planning. Species detection using environmental DNA (eDNA) has great potential to contribute to cost-effective assessments of biodiversity. eDNA techniques are well established for freshwater and some semi-aquatic species. Detecting the eDNA of terrestrial species can be more challenging but studies have shown that eDNA from terrestrial species can be detected in soil or in water bodies where they bathe or drink. This project is trialling eDNA detection on the endangered Gouldian finch, a seed-eating species that drinks daily from small waterholes. We are also extending the application of eDNA methods to other terrestrial species of conservation or management concern in the Top End.	Jawoyn Rangers Category 3	**Communications:** Waterhole scorecard results, in-person project updates and reporting back of results Training: rangers trained in water sampling and bird counting techniques **Fieldwork:** Jawoyn Rangers participated collaboratively in discussions of potential waterhole sampling sites and assisted with bird counts and water sampling	TBA Anticipated output: The project will develop a survey tool which will be used by many aboriginal groups, including IPA managers and Aboriginal ranger programs that operate, or are seeking to develop, monitoring programs for significant fauna species.
Theme 4 **4.6: Environmental Economic Accounting for the Mitchell River**	It's hard to track the impacts of development and conservation investments on interconnected environmental, socio-economic and cultural values. Environmental-economic accounts (EEAs) help inform development and conservation investments by tracking the extent and condition of ecosystem assets, the ecosystem services produced by those assets, and the direct benefits delivered to individuals and society over time. This research is developing an EEA approach that is appropriate for northern Australia. The team is	Kowanyama Aboriginal Land and Natural Resource Management Office Rangers; Mitchell River Traditional Custodian Advisory Group	**Planning:** Advise from Kowanyama sought in the early stages on the project. Communications: Entering into a formal agreement with MRTGAC for guidance, project information has been distributed. **Fieldwork:** There is fieldwork in Kowanyama, being undertaken by researchers with long-standing community relationships. **Engagement:** apart from one-on-one meetings, there will be workshops for project material to be presented and guidance sought. Ongoing updates occur via email, and an	TBA

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	working in Queensland's Mitchell River catchment to develop a set of EEAs that reflect interconnected assets and the regional socio-cultural context. As well as being useful for informing decisions in the Mitchell River catchment, these accounts are helping inform Australia's evolving approach to EEA as one of several pilot accounts being considered through the national EEA Strategy and Action Plan. As part of this broader work, researchers are considering the extent to which a common national approach to EEA can represent the full suite of ecosystem-related values relevant to regional populations.	Category 2	end of project community engagement is planned to present findings.	
5.1: Research Priorities for Indigenous Protected Areas Across Northern Australia	This project provided an assessment of the research priorities for IPAs in northern Australia, and identified environmental, social, economic and cultural benefits associated with IPAs. In collaboration with IPA managers, government, non-government and research stakeholders across the north of Australia, this project undertook literature reviews, interviews and workshops to assess research priorities for northern Australia's IPAs. The project identified core environmental, social, economic and cultural benefits associated with IPAs. It identified ways in which IPA managers, government and non-government stakeholders could use this information in decision-making contexts, such as policy development and land and sea management.	Entire Northern Hub region, focusing on current and proposed future Indigenous Protected Areas (TOs across WA, NT and QLD) Category 2	**Planning:** Project overseen by an Indigenous majority steering committee. Communications: research findings. **Engagement:** Interviews, workshops, steering committee.	TBA However, worth noting that two northern Australia Traditional Owners are part of the research team and that an engagement and knowledge networking approaches are part of the research design.

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	Priorities were identified using a collaborative and systematic process, designed to build the confidence of both IPA managers and potential government, private and not-for-profit research investors. Attention was particularly focused on research needs that support Indigenous peoples' goals for managing their land and sea country, and sustaining their participation in environmental management.			
Theme 5 5.2: Lessons from Top End Indigenous Fire Management	The research has reviewed existing Indigenous fire management partnerships and activities across northern Australia, focusing particularly on what is meant by Indigenous knowledge and practices, how that meaning is locally interpreted into fire management activities, and how it is likely to be shared with others. Perspectives have been drawn from interviews and workshops held with key Indigenous fire managers and partners (Traditional Owners, NGOs, scientists and government agencies) across northern Australia who are actively participating in, or are interested in participating in, fire management projects. Research outputs: • Report that draws on the literature review and subsequent case study analysis to identify the key lessons learned from the incorporation of Top End Indigenous fire knowledge into fire management, as well as key protocols and pathways for future IK incorporation • Summaries written for Indigenous communities, and government agencies, both	Cape York Land Council, Northern Land Council, Kimberley Land Council, Djelk Rangers, Gurruwilling Rangers, Gooniyandi, Kakadu rangers, Kowanyama, Mimal Rangers, Olkola , Tasmanian Aboriginal Centre, Tiwi Land Council, Wannyi Garawa Rangers Warddeken Land Management, Wilinggin, Wunambal Gaambera	**Communications:** Summaries written for Indigenous communities, and government agencies, both of which outline key messages, with a focus on key lessons learned from the incorporation of Top End Indigenous fire knowledge into fire management, and protocols for effective and appropriate ways to incorporate IK into fire management goals and practices. **Engagement:** Interviews and workshops held with key Indigenous fire managers and partners (Traditional Owners, NGOs, scientists and government agencies) across northern Australia who are actively participating in, or are interested in participating in, fire management projects.	TBA The team's networks across Northern Australia will help to inform the creation of a project committee, consisting of key Indigenous fire management partners (Indigenous, government and corporate). The committee will help guide the project team's efforts, review the draft, final and summary reports; and assist in finding appropriate pathways to communicate the review's results.

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	of which outline key messages, with a focus on key lessons learned from the incorporation of Top End Indigenous fire knowledge into fire management, and protocols for effective and appropriate ways to incorporate IK into fire management goals and practices.	Category 2		
Theme 5 **5.3: Multiple Benefits of Indigenous Land and Sea Management Programs**	Indigenous land and sea management programs (ILSMPs) are gaining a reputation for providing a core function in communities, with growing evidence of a variety of environmental, cultural, social and economic outcomes being delivered. This research provides quantified and comparable information about multiple, local to national scale socio-economic and wellbeing benefits associated with ILSMPs.	In WA, this project partnered with Bunuba, Gooniyandi, Yanunijarra and Nyikina-Mangala Traditional Owners. In Queensland, this project partnered with Ewamian Traditional Owners Category 1	**Planning:** The lead researcher worked on maps and discussed contacts in 15 communities across the Fitzroy Valley. A travel plan with a radius of c. 200km from Fitzroy Crossing was developed. **Communications:** The survey dates and times were communicated through the community contacts. The research findings were delivered in person during a follow up visit. The final paper was emailed with a cover note requesting feedback. This has been successfully completed by all but one participating groups. A solution to this is hopefully imminent. **Training:** Two young local Indigenous people were employed for two periods of the survey process. In interviews at the completion of the first stage of the project these two spoke in detail about the benefits that they derived from the project. In particular the opportunity to speak to their family and 'countrymen' in a way that was impactful to both. The insights that they got from the process about local priorities were also notable. Their delivery of the project findings to government reps in Canberra was hugely successful with strong feedback received on the impact that they made on the bureaucrats. No accredited training has been delivered to date through this project.	TBA It is worth noting that a core member of the research team is an Aboriginal and Torres Strait Islander, and that many of the other Aboriginals who are involved in this research project as core points of contact for communities, or who are indirectly involved as community members have significant research skills and also traditional knowledge that is integral to the success of this project. Where ever appropriate, Indigenous people will be included as authors on research outputs.

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			Fieldwork: The work involved visits to 15 communities to complete surveys with individuals. A second phase of the project involved meetings with PBC representatives to gain information relating to aspirations of each group. **Engagement:** Two young local Indigenous people were employed on this project as junior researchers. They travelled with the researchers to most of the communities. One community member was identified in the planning phase as the person to contact once in the community. It was also expected that this person notified people about the research and to get them to come to be interviewed. These were paid positions however it did not always work smoothly as the individuals were involved in other activities or were away from the community.	
Theme 5 **5.4: Knowledge Brokering for Indigenous Land Management**	Indigenous land management (ILM) occurs over significant proportions of northern Australia that contain many high-value environmental assets. Effective land management is vital to northern Australian development and Indigenous land managers have a strong desire to engage in the increasing level of development planning. Traditional Owners hold substantial knowledge about using, managing and safeguarding northern Australia's natural and cultural resources, and a significant body of scientific research is also available. However, these knowledge resources have not yet fully empowered Traditional Owners' land management and development capability. Effective knowledge brokering can help overcome barriers and the project's co-research approach places Indigenous people as central to driving the design, and testing of	Bunuba Dawangarri Aboriginal Corporation, Garawa Traditional Owners, Gooniyandi Aboriginal Corporation, Jaru Claimant Group, Kija Claimant Group, , Tiya-Tiya Aboriginal Corporation, Waanyi Traditional	**Planning:** Indigenous-led project methodology. This project was preceded by a co-planning meeting prior to the commencement of the workshop phase. Our Knowledge Our Way Guidelines Indigenous-led and co-authored. **Fieldwork:** The project did not engage in field work. It ran a series of three workshops and a roadshow to use the 3d model to trigger catchment relevant discussions beyond the workshops. It travelled to Derby, Fitzroy Crossing, the KLC 40th Anniversary AGM and Halls Creek. It was also part of the AIATSIS Native Title Conference held in Broome, 2018. **Engagement:** This was facilitated during the workshops in both interactive mapping using a data projector with a range of overlays such as fire scars and flood levels. Cultural information was added to the model using ephemeral materials to ensure that	TBA It is worth noting that two northern Australia Traditional Owners are part of the research team for this project.

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	knowledge brokering tools. Two case studies will support Indigenous land managers to a) explore stakeholder influence mapping and build a 3D model of country to assess risks and opportunities in the Fitzroy River catchment of Western Australia, and b) evaluate the potential of walking in country for land management with the Waanyi and Garawa people in the Nicholson region of the Northern Territory, and use the results for more holistic planning. The project has additionally produced the 'Our Knowledge Our Way in caring for Country' guidelines for strengthening Indigenous knowledge in land and sea management. The guidelines are based on 23 case studies from across Australia illustrating best practice for working with and strengthening Indigenous knowledge. The project will deliver: • tailored knowledge brokering tools and guidelines for their use; • knowledge-sharing among Indigenous land managers across northern Australia through workshops and digital networking activities; • a diagnosis of the conditions under which knowledge brokering can improve Indigenous adaptive management of environmental assets; and • Our Knowledge Our Way in caring for Country: best practice guidelines for strengthening Indigenous knowledge in land and sea management.	Owners, Walalakoo Aboriginal Corporation, Warrwa Claimant Group, Wilinggin Aboriginal Corporation, and Yanunijarra Aboriginal Corporation are collaborators in this research. Many other groups contributed to the OKOW Guidelines through case studies. Category 1	potentially sensitive information was not embedded into the map. NB: There was no cultural data recorded or retained during the course of this project. National call for case studies for OKOW Guidelines. **Communications:** Results of each workshops were provided as draft summary reports around a week after each workshop. These were in powerpoint format with images used effectively as triggers to review the workshop activities. The method of disseminating these reports varied from post, email to individuals, a representative body the PBC directors and where possible, hand delivery. It is unclear if all emailed material could be easily accessed as not all participants have access to a computer and / or a printer. Three short videos and a project summary video have also been produced through this project All comms material is approved by the project partners before being released publicly. Some of the material listed above can be accessed through the project portal on the NESP website and more is loaded as the material is approved. The OKOW Guidelines will have a limited print run to ensure project partners and case study providers receive copies. It will be hosted on the NESP NAER, CSIRO and IUCN websites. **Training:** knowledge sharing is occurring among Indigenous land managers across Northern Australia through workshops and digital networking activities No accredited training has been delivered to date through this project however this project has linked with project 1.6 and training will be delivered as part of handover of the 3D model, interactive projector and associated data. <u>Waanyi/Garawa Case Study</u>	

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			The Waanyi/Garawa Case Study approached the issue of increasing Traditional Owner capacity in land and resource management with a conversation. This conversation revealed deep anxieties about the social and economic forces that are felt to be eroding traditional owner capacity. The potential for better management was appreciated, but this was overshadowed by the perceived threats arising from people's alienation from country, Dreaming and history. The question that arose was: "how can Aboriginal people hope to manage country well, when so much crucial Law and knowledge is being lost?" The project then explored two ways of addressing this perceived alienation trend: Firstly, through walking in country, creating (nowadays rare) experiences where the physicality, and numinosity of the land could be experienced, and in which "story", became relevant. The second part, strongly driven by Traditional Owner interest was the recording of the old people's knowledge on film. A professional filmmaker was engaged, and a series of vignettes produced according to the wishes of the senior people. The ultimate use of these works is still under discussion, but it is likely that they will be rendered into a form useable by schools in the region.	
Theme 5 5.5: Phase 1: Bininj/Mungguy Natural resource management research	This project identified research priorities involving Indigenous natural resource management in Kakadu National Park. Phase 1 was a collaborative process to identify and develop action-research priorities and projects involving Binninj/Mungguy, Hub researchers and Kakadu National Park staff. It identified a number of targeted research projects that are a priority for Bininj/Mungguy, address NESP NAER Hub	Bininj/Mungguy Traditional Owners; Northern Land Council; Kakadu National Park Rangers and Staff;	**Planning:** Project approved by Kakadu Board of Management (indigenous majority Board) and a Bininj/Mungguy Steering Committee was formed through the project to review findings from the desktop study and set and prioritise Indigenous NRM research topics. **Communications:** Project updates presented to the Kakadu Baord of Management and an Indigenous Research	TBA

NAER Hub Theme and Project Number and Name	Project Summary	TO group (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes or Outputs and/or Indigenous Research Priorities
priorities for Kakadu National Park	priorities, and support the Kakadu Plan of Management. Phase 2 involved undertaking research to address some of these priorities.	Bininj/Mungguy co-researchers; and Njanjma Rangers, Njanjma Aboriginal Corporation. Category 1	Committee. Individual consultation were also undertaken throughout the Park to validate findings of the desktop assessment. **Engagement:** Bininj/Mungguy reviwed desktop findings and through a series of workshops finalised the research priorities for Kakadu. **Fieldwork:** Desktop study, no fieldwork undertaken.	
Theme 5 **5.5: Phase 2: Bininj/Mungguy Healthy Country Indicators**	Bininj/Mungguy Traditional Owners have led the co-design of this research project through their Steering Committee. The project will develop and trial an adaptive approach to co-management using Bininj/Mungguy indicators to monitor and evaluate the health of important values on country. These indicators will be used to empower Bininj/Mungguy to monitor and evaluate if and how natural resource management objectives in Kakadu are being met. The work will focus on three pilot sites representing woodland, floodplain and stone country of Kakadu. At each pilot site, Bininj/Mungguy co-researchers, Rangers and the research team will engage in an action-learning process of adaptive co-management. This will involve co-developing indicators that can be used to illustrate the health of important values on country, and methods for monitoring those indicators. The team will also determine on-ground actions at each site and monitor the health of country before and after each management activity. Bininj/Mungguy co-researchers, Rangers and the research team will then reflect on the results to improve future natural resource management	Bininj/Mungguy Traditional Owners; Northern Land Council; Kakadu National Park Rangers and Staff; Bininj/Mungguy co-researchers; and Njanjma Rangers, Njanjma Aboriginal Corporation Category 1	**Planning:** Bininj/Mungguy Steering Committee meetings; planning workshops at all case sites with Bininj/Mungguy TOs, Kakadu Rangers and Njanjma Rangers. **Communications:** Bininj/Mungguy co-designed presentations, summaries and factsheets; Project updates from fieldtrips and workshops provided to Bininj/Mungguy TOs, Kakadu Staff, Rangers and Njanjma Rangers; Ongoing workshops at all case sites with Bininj/Mungguy TOs, Kakadu Rangers and Njanjma Rangers; Presentations to the Bininj/Mungguy Steering Committee. **Engagement:** Action-learning process of adaptive co-management; Employment as co-researchers. **Training:** Informal training provided to *Bininj/Mungguy* in using drones, time lapse cameras and participatory video at all case sites. **Fieldwork:** Bininj/Mungguy are always involved in all project fieldwork activities, including in paid positions as co-researchers.	This project is: § identifying Bininj/Mungguy indicators and methods that can be used to monitor and evaluate the health of country in Kakadu National Park; • Increasing Bininj/Mungguy involvement in adaptive co-management and decisions; • Informing Kakadu National Park's reporting efforts on natural resource management activities; • Contributing to improving cross-cultural monitoring and performance reporting approaches in protected areas. Anticipated outputs include: • A description of Bininj/Mungguy indicators and methods for monitoring the health of important landscapes in Kakadu

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	activities and contribute to monitoring, evaluating and reporting efforts in Kakadu. This project is: • identifying Bininj/Mungguy indicators and methods that can be used to monitor and evaluate the health of country in Kakadu National Park • increasing Bininj/Mungguy involvement in adaptive co-management and decisions • informing Kakadu National Park's reporting efforts on natural resource management activities • contributing to improving cross-cultural monitoring and performance reporting approaches in protected areas.			National Park that can be incorporated into the park's evaluation and reporting activities. • A handbook on best practice cross-cultural monitoring and evaluation approaches that can be used for adaptive co-management in protected areas. • Reports and scientific publications. • Bininj/Mungguy co-designed presentations, summaries and factsheets.
Theme 5 5.6: Investing in Indigenous cultural and natural resource managers	Indigenous cultural and natural resource management (ICNRM) creates many environmental, social and economic benefits. Indigenous communities and government have invested to build rapid growth in the sector. Yet ICNRM remains vulnerable to policy changes, inadequate resourcing, and a lack of diversity in funding. Expanding and diversifying non-government investment into ICNRM will ensure its long-term future. Novel partnerships between Indigenous communities, research agencies, private industry, and non-government organisations are needed to support Indigenous ICNRM enterprises to grow Indigenous-led opportunities on the ground. This project supports that effort and showcases ICNRM agencies as a key pathway for achieving the sustainable management of Australia's natural and cultural resources.	**Steering committee:** Chair: Ricky Archer (NAILSMA) Deputy Chair: Tania Major (Abm Elgoring Ambung RNTBC) Membership: Nerida Bradley (CEO, Australian Land Conservation Alliance) Will Durack (KLC) Mathew Salmon (NLC) Tim Jaffer and Dion Creek (Kalan Enterprises)	**Planning:** Indigenous Steering Committee, Indigenous led project methodology. **Communications:** Co developed information sheets for policy makers, investor friendly products, guidelines for adapting existing metrics and reporting, scientific publications, brochures and fact sheets. **Engagement:** Co developed participatory methods, workshops, project updates, project steering committee.	Anticipated project products: • Providing evidence for the wider business case that attracts, guides and evaluates non-government investment into ICNRM enterprises, by generating: • Information sheets for policy-makers including key outcomes, issues and messages. • Investor-friendly products to understand ICNRM performance, impact, and future investment pathways. • Guidelines for adapting existing metrics and reporting to better reveal the multiple benefits of

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	The research is focusing on three key investor types – Indigenous corporations and communities, shareholder corporations, and philanthropic investors – to help investment in the ICNRM sector continue to expand and diversify into the future. Using Indigenous led and co-developed participatory methods, this project is supporting non-government investment in ICNRM by: • investigating why non-government funders invest. • identifying what investors need from performance and impact assessment. • showcasing the multiple benefits of ICNRM. • assisting ICNRM practitioners to highlight their value in investor-friendly ways. The project is enabling conversations between ICNRM investors and practitioners, aligning investor assessment needs to reduce management workload, and providing advice, tools and recommendations to guide future investment.	John Clark (Kowanyama Land and NRM Office?) Tom Vigilante (Bush Heritage) Duane Fraser (affiliation tbc). **Case study Organisations/ communities** Kalan Enterprises, Coen, QLD Kowanyama L&NRM Office, Kowanyama QLD. Discussions underway for third case study with Organisation from the NT. Category 1		ICNRM and guidelines to meet the needs of new non-government investment. • Scientific publications, brochures and factsheets. The project complements related research initiatives that address government investor priorities, including fee-for-service impacts and the multiple benefits of Indigenous land and sea management programs.
Theme 6	Four Hub projects in WA's Fitzroy catchment are working together to create knowledge around water resource management. This new project is	Western Australia's Fitzroy River catchment	**Communications:** Publications identifying the challenges and opportunities for research teams doing transdisciplinary research, and advantages and disadvantages associated with	TBA Anticipated outputs:

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6.2: Trans-disciplinary Environmental Research	facilitating these four projects to work together in a transdisciplinary approach (see diagram below) that includes collaborating closely with research users such as governments, Traditional Owners, industry and environmental groups. This project is: • evaluating the use of a transdisciplinary – interdisciplinary, participatory and applied – research approach in WA's Fitzroy River catchment; • contributing to water management in the Fitzroy catchment by facilitating co-production and integration of knowledge generated by four research projects; • contributing to addressing complex sustainability issues in northern Australia and beyond by informing the design of future research approaches. This project aims to: • contribute to the design and implementation of strategies that enhance the transdisciplinarity of the four Fitzroy catchment projects, increasing the potential uptake of research outputs in decision-making; • draw lessons that can inform the design, implementation and evaluation of future transdisciplinary environmental research.	Kimberley Land Council; Prescribed Bodies Corporate representing the interests of Bunuba (Bunuba Dawangarri Aboriginal Corporation), Gooniyandi (Gooniyandi Aboriginal Corporation), Nyikina Mangala (Walalakoo Aboriginal Corporation), and Yi-Martuwarra Ngurrara (Yanunijarra Aboriginal Corporation). Category 2	this approach; a report with recommendations to research funders aiming to support transdisciplinary research projects; a list of questions that researchers could address before they decide which (and what level of) transdisciplinary research to use; an evaluative approach that can be used by researchers and funders in assessing the impacts of transdisciplinary research. **Training:** No accredited training has been delivered to date through this project. **Fieldwork:** **Engagement:** Interviews.	• Publications identifying the challenges and opportunities for research teams doing transdisciplinary research, and advantages and disadvantages associated with this approach. • A report with recommendations to research funders aiming to support transdisciplinary research projects. • A list of questions that researchers could address before they decide which (and what level of) transdisciplinary research to use. • An evaluative approach that can be used by researchers and funders in assessing the impacts of transdisciplinary research. At this stage, we foresee that our aim to enhance the transdisciplinarity of the NESP research in the Fitzroy catchment can contribute to improving the collaboration between projects that focus mainly on Indigenous matters (i.e., projects 1.5 and 5.4) and those that have a broader environmental and planning focus (i.e., projects 1.3.3 and 1.6) but also encompass issues relevant to Traditional Owners.

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Theme 6 **6.3: Mitchell River Story map (new project)**	Research conducted in the Mitchell River under project NESP Project 1.3.1, *Critical Water Needs of the Mitchell River*, brings together a range of data sources, analysis methods and models. The synthesis of scientific findings into animated online tools has emerged as a highly effective avenue to increase the reach and impact of scientific research and has been identified as a crucial step to ensure the potential impacts on biodiversity from the development of catchment can be mitigated. This project will synthesise and integrate these results into a single online management tool that tells the story of the Mitchell River and its relationship to river flow and inundation. Importantly, this management tool will consist of live animations of research data, showing how the aquatic ecosystems of the Mitchell River respond to seasonal variations in river flow. The wetland info website, maintained by the Wetlands Team at the Queensland Department of Environment and Science receives over 1,000 visits per month to the range of Catchment Stories, which are syntheses of available science. This project will work collaboratively with the Wetlands Team and stakeholders in the Mitchell River Catchment to develop the Dynamic Catchment Story as a novel online tool to present and synthesise research conducted under Project 1.3.1, supporting effective engagement, information and decision making across a range of stakeholders.	Kowanyama Aboriginal Land and Natural Resource Management Office Rangers; Mitchell River Traditional Custodian Advisory Group Category 2	**Planning:** Consulted with groups, Kowanyama are a partner for this project, as are MRTCAG. Communications: Entering into a formal agreement with MRTCAG for guidance. **Fieldwork:** There is no fieldwork for this project, it is predominately desktop work. Engagement: Apart from one-on-one meetings, there will be workshops for project material to be presented and guidance sought.	TBA (still in early development)

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Theme 6 **6.3.3: Cultural Connections**	This project is: • advising the federal Department of Agriculture, Water and the Environment of how best to acknowledge Indigenous cultural values within, or alongside, their experimental ecosystem accounting system, including estimates of value (if possible); • developing and testing methods for estimating (prioritising) values and reciprocal relationships between people and Country; • assisting our partners prioritise different caring for Country activities; • facilitate networking opportunities between Indigenous project partners; and providing Indigenous groups with a stronger voice in discussions about ecosystem accounting.	In Queensland, this project partnered with Ewamian Traditional Owners. In Northern Territory this project partners with Bininj/Mungguy Traditional Owners for Kakadu National Park, and the Indigenous Research Committee for Kakadu National Park. Category 1	**Planning:** The lead researcher worked with the General Manager of the Ewamian Aboriginal Corporation to co-develop the project methodology as phase one of the project. After phase 2 – data collection in QLD – the Indigenous Research Committee for Kakadu National were introduced to the project, and assisted with refining the methodology for the next phase – data collection within Kakadu National Park. **Communications:** The project aims were described by the Researchers in person, to the Ewamian Board and to the Indigenous Research Committee for Kakadu National Park. Following the completion of the workshops the intention is to hold a meeting with the participants from QLD and from Kakadu to share the key ideas and insights arising from each workshop. The research findings will then be delivered in person during a follow up visit. Prior to completion of the final report, the intention is for Researchers plus representatives of the TO groups to visit DAWE in Canberra to share the findings of the project in person. For final reporting, the intention is that the final report and academic papers was emailed with a cover note requesting feedback and approval prior to publication; the report/papers will also be presented in person if requested by the TO groups. Co-authorship of journal article(s) will also be offered to the TOs involved in the research where appropriate. **Training:** No accredited training has been delivered to date through this project. **Fieldwork:**	TBA

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			The work is intended to involve visits to one community in QLD and three communities in Kakadu to hold workshops with key representatives of the communities, nominated by the communities themselves. During these workshops the researchers and TOs have a yarn about cultural connections to Country, and the activities that are undertaken to look after Country. Cognitive mapping exercises and an information market-based prioritisation tool are also used during the workshops. **Engagement:** Co-developed participatory methods, workshops, project updates, co-communication of the findings to DAWE, communication of final reports. It should also be noted that one of the Chief Investigators of the project, Dr Daniel Grainger, is Yadhaigana of North East Cape York (north of Wuthathi country), and also has Torres Strait heritage from his Grandfather, Ali Drummond.	

Selected TSR Hub research projects and details of Indigenous involvement or engagement

TSR Hub Research Priorities

The TSR Hub's research priorities in its V6 Annual Research Plan are:

D1. Effective on-ground responses to reduce threats and promote recovery of threatened species

- D1.1 The development and direct trial of practical techniques for the recovery of identified threatened species to underpin on-ground management. Including the development and trial of practical actions for recovery of at least 10 of the highest priority threatened species and the trial of exclusion/enclosure methods.
- D1.2 The development and direct trial of practical techniques for the restoration of degraded habitat and re-establishing natural succession processes.

- D1.3 Demonstrate the costs/benefits and effectiveness of methods to mitigate the impact of invasive animals, plants and disease.
- D1.4 Improved information on management techniques to recover threatened freshwater and estuarine species and ecosystems.

D2. Better understanding, measuring and reporting on the condition and trend of threatened species

- D2.1 Meaningful and accessible information on trends in threatened species, to inform the targeting of Government investment and build community awareness and support.
- D2.2 Early warning tools for extinction risk and identification of the most at risk species.
- D2.3 Better prediction of threatened species trajectories, for example using indicators, proxies, triggers and thresholds.
- D2.4 Improved information on the distribution of threatened species and ecological communities to better pinpoint their location. Including the review of current species distribution models, and incorporating the capacity for species to adapt to climate change.

D3. Using social and economic opportunities for threatened species recovery.

- D3.1 Identifying better ways to use offsets under the EPBC Act to conserve threatened species.
- D3.2 Identifying better methods for communication and community buy-in to threatened species issues including threatened species listing, and initiatives to engage the community in the protection of our threatened species, including the development of flying fox management options in urban/township areas.
- D3.3 Opportunities for mutual benefit to threatened species and business in a streamlined regulatory environment.
- D3.4 Collaborations with, and participation of, Indigenous people in threatened species research and management.
- D3.5 The role of citizen science in threatened species conservation and in building greater community support for threatened species management.

Details of Selected TSR Hub research projects with a high level of Indigenous involvement or engagement

The Table below includes information about a selection of the TSR Hub's research projects with a high level of Indigenous involvement or engagement. The Table includes NESP Hub research theme or priority, NESP Hub project number, a project summary or description, the Traditional Owner (TO) group(s) and jurisdiction(s), the nature of activities involving Indigenous partners (covering Planning, Fieldwork, Engagement, Communications, and Training), the relevant Category in the Three Category Approach to Indigenous engagement, and identified outcomes and/or Indigenous research priorities.

TSR Hub Research Priorities and Project Number & Name	Project Summary	TO group (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes or Outputs and/or Indigenous Research Priorities
D1.1 D1.3 D3.4 1.1.12: Mitigating cat impacts on the brush-tailed rabbit-rat.	The project will evaluate the extent of cat predation on the Brush-tailed Rabbit-rat (BTRR), whether manipulating fire frequency can mitigate cat impacts, or whether cat control is needed to secure BTRR. The project will compare the cost-effectiveness of fire management with cat control, utilise a long-term fire experiment to examine how fire frequency affects BTRR and cat populations, and habitat attributes required by small mammals.	Tiwi Land Council; Tiwi Rangers (NT) Category 2	**Planning:** Developing a research agreement with Tiwi LC to cover the work, and Tiwi representation on a project steering committee. Rangers provide logistic support for the project. **Communications:** Project factsheet has been developed by Indigenous partners. Training: Take students from Tiwi College on field trips; future support for work experience students would be useful.	Tiwi Land Council, through the Tiwi Land Rangers, able to use the research results to better tailor fire management to mitigate cat impacts, as well as evaluate the cost-effectiveness of future control of cat populations.
D1.1 D1.2 D3.4 1.3.3: Saving an endangered bettong with fire – a controlled fire and predator experiment in the Wet Tropics.	The Northern Bettong is only found in a tiny section of Queensland's wet tropics, and has declined severely in range in the last decade. Inappropriate fire is thought to be a major threat to the species and experience from other bettong populations suggests cat predation could be a factor in their decline. This project will investigate the effect of alternative fire regimes on population persistence of the endangered Northern Bettong and the potential interactive impacts of cat predation. The research will enable conservation managers to better manage populations of Northern Bettongs and aid in the recovery of the species.	Girringun (Qld) Category 2	**Planning:** Girringun involved in planning workshops. Girringun Aboriginal Corporation, Western Yalanji Aboriginal Corporation, Jabalbina Aboriginal Corporation, Tableland Yidinji and the Mbabaram people have all been involved in NB work to date, especially re fire knowledge. **Fieldwork:** regular fieldwork with Girringun rangers.	Indigenous partnerships maintained and developed. Indigenous groups able to participate in trapping and fire management as a training and capacity building opportunity.
D1.2 D2.1 D3.4 1.3.4: Pirra warlu: Contrasting the outcomes of contemporary	Landscape-scale fire management in arid areas is uncommon, although very extensive, intense fires also occur in these regions, albeit at a lower frequency than in the tropics. Interest in using techniques like aerial incendiary for fire management in deserts is growing, but it is unclear whether this approach will deliver the same cultural practice, fire and biodiversity outcomes, as	Karajarri (WA) Category 1	**Planning:** Monitoring project co-designed. **Fieldwork:** Mostly by rangers and TOs, with input and some training from Hub personnel. **Engagement:** Workshops to establish design and field plans, then share results. **Training:** Supporting rangers to attend ESA Nov 2019.	Indigenous led project. Traditional Ecological Knowledge (TEK) transmission, reinvigorate cultural burning practices, and compare environmental outcomes, including for threatened species, of

TSR Hub Research Priorities and Project Number & Name	Project Summary	TO group (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes or Outputs and/or Indigenous Research Priorities
and traditional fire management approaches in the desert	traditional, very fine-scale burning carried out from the ground. This project aims to establish a monitoring program to measure the effectiveness of different approaches to fire management over a large IPA in north-western WA. The monitoring program will include a range of indicators of conservation and cultural significance, with some data collection that will be carried out by community members as part of regular back-to-country trips. Thus, the project also aims to support the transmission of traditional ecological knowledge, and embed this in enduring monitoring programs that will allow the IPA to measure and report on their management effectiveness.			contemporary burning practices with cultural burning in the Karajarri IPA.
1.3.5: Managing fire to recover Monsoon Vine Thickets on the Dampier Peninsula	The monsoon vine thickets of the Dampier Peninsula are an Endangered Ecological Community of great Indigenous cultural significance. Intense fire in the adjacent woodland is a key threat, damaging the edge of vine thickets. We will use current and historical satellite imagery to assess whether the vine thickets have contracted over recent decades, and whether changes are correlated with fire history. Indigenous ranger groups are actively managing fire and other threats to the monsoon vine thickets; together we will evaluate whether recent efforts to reduce the incursion of fire into the vine thickets has been effective.	Bardi Jawi, Nyul Nyul, Yawuru (WA) Category 1	**Planning:** Project co-designed. **Engagement:** Workshops to establish methods then share results. **Training:** Training workshop to transfer methods in mid-2020.	Project instigated by Indigenous Rangers as part of the Dampier Fire Working Group and the Monsoon Vine Thicket Working Group. Development of effective fire management strategies to protect monsoon vine thicket patches from high-severity wildfires and showcase Indigenous management and monitoring for the conservation of a threatened ecological community.
D1.1 **D1.3** **D1.4** **D2.1**	This project seeks to create safe havens for threatened Australian frogs and co•occurring threatened species by tackling the key causes of amphibian decline: disease caused by chytrid	n/a Category 3	**Training:** A Western Australian Indigenous student did a third-year research project (at Edith Cowan) to understand threats in frogs. Research (training, travel, accommodation, research costs) partly funded by CAUL Hub. Hoping to set up	Research taking place in southern Australia. Two Indigenous students engaged to carryout specified research and analysis.

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D2.3 D3.2 D3.4 D3.5 1.4.1: Chytrid, fish, and fragmentation: Conservation of frogs, fish and crayfish achieved by managing multiple threats at a landscape level	fungus, predation by non-•native fish, and habitat loss and fragmentation caused by urbanization. Safe havens may be created by either directly managing threats or identifying sites where the impact of threats on frog populations is low.		a program for Masters or PhD student now. The student has produced a project report, and presented her work at ECU. The data collected is now feeding into an Honours project at ECU. **Engagement:** Scoping opportunities to engage with Indigenous community members in the Shire of Murrindindi (regional Victoria). In 2019, Stakeholder workshop involved Taungurung Land and Waters Council and Wurundjeri.	
D1.1 D1.3 D2.4 D3.4 Related to 2.5: Night parrot workshop	Paruku rangers with KLC support hosted a night parrot workshop at Handover Site to facilitate knowledge exchange between rangers and scientists. Traditional Owners and rangers build their network around night parrot conservation; exchange knowledge about Night parrots, including survey techniques and management priorities. The aim of this project is to build relationships between Traditional Owners and scientists, and to share information to enable detection and management of Night Parrots in northern Western Australia.	Paruku, Ngururra, Ngurrurpa, Kiwirrkurra, Ngura Kayanta, Karajarri, Nykina Mangala, Nyangumarta (WA) Category 2	**Engagement:** Ranger-hosted workshop to exchange knowledge about night parrot discovery and conservation management.	National research programs for the Night Parrot are desirable; however, subtle differences in land tenure, title, and the TO engagement in different locations will need careful and respectful management.
D1.1 D1.3 D2.1 D2.2 D2.3	Reintroductions and long-term monitoring will be used to identify causes of declines and extinctions of threatened mammals at Booderee National Park. The project will also 1) examine factors required for successful re-establishment and	Wreck Bay (NSW/ACT) Category 1	**Fieldwork:** Monitoring activities carried out by employed TOs and also by Parks Indigenous rangers. Rangers do preparatory work through activities like fox work, supplementary feeding (paid for by PA), and carry out monitoring.	Wreck Bay Aboriginal Community Council (WBACC) is a partner in this project. The project sought to scope out and seek interest in promoting the

TSR Hub Research Priorities and Project Number & Name	Project Summary	TO group (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes or Outputs and/or Indigenous Research Priorities
D3.4 3.2.2.1: Using reintroductions and long-term monitoring to unravel causes of decline and extinctions of threatened mammals	persistence of reintroduced threatened mammals, 2) consider possible impacts on the existing ecosystem and how to mitigate them, and 3) determine best-practice translocation procedures for selected mammals. New knowledge will have broader application beyond the park to improve understanding of threatening processes and appropriate management to improve the conservation status of threatened species.		**Engagement:** Local community have become very engaged in the reintroduction program. Schools (Wreck Bay and Jervis Bay), painting road signs to control traffic in release area. Communications: Community event about reintroductions supported by Hub (food and employment). Key Indigenous contacts instrumental in advocating for the project; regular informal communication with community members. Training: supported rangers to attend Firesticks Workshop 2018.	threatened species reintroduction within the community via newsletters, community talks, local junior ranger programs and events during NAIDOC week. And Indigenous training in field-based methods associated with translocations and reintroductions.
D2.1 D2.3 D2.4 D3.4 3.2.2.2: Monitoring threatened species in IPAs: Bilbies in the Martu Determination	As land rights hearings award more land to their traditional owners, better methods are needed to foster collaboration between Indigenous land management and western conservation science. This project aims to design a best-practice monitoring program to assess population trends of the Greater Bilby on Indigenous land in the western deserts. The NESP TSR researchers will steward the monitoring program through the first year of implementation, develop a tailored data management system and increase capacity for the partner to implement the program into the longer term. The project is a collaboration with the traditional owners and will apply Indigenous knowledge combined with western scientific techniques to create a monitoring program suitable for Indigenous ranger use.	Martu (WA) Category 1	**Planning:** The project is co-directed by Martu to guide the development of methodology and ensure that outputs are useful to end-users including on-going consultation, communication, outputs, training. **Fieldwork:** 4 ranger groups collect the data **Communications:** TSR project researchers and Communications have produced a report 2017 - Martu knowledge of mankarr (greater bilby): distribution, habitat, management. TO partners also communicate findings through their own networks **Training:** TSR provided funds for the led researcher and members of the Martu community to attend and present at WA Conference, and at ESA in 2018.	This is an Indigenous led project. The project provides opportunities for two-way knowledge sharing, training, capacity building and on country employment. Martu ecological knowledge is being recorded for threatened species monitoring and management Martu ranger groups, and will be archived for Martu community access and dissemination.
D1.3 D2.1 D2.4 D3.4	Monitoring animal populations in Australia's sandy deserts is challenging. Desert species can be patchily distributed, at low densities, and have boom-bust cycles. As a result, we know little about	Over 30 ranger groups and Indigenous organisations, 8	**Planning:** Indigenous Project Officer employed. Workshops and meetings for project planning and consultation.	As well as filling many knowledge gaps about the distribution, trends and ecology of desert species, this project showcases and celebrates the

TSR Hub Research Priorities and Project Number & Name	Project Summary	TO group (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes or Outputs and/or Indigenous Research Priorities
3.2.5: Developing a coordinated monitoring program for threatened vertebrates, their threats and the effectiveness of management investment across arid and semi-arid Australia	the distribution, abundance, and status of desert wildlife. However, over the past decade many Indigenous ranger groups, desert ecologists, NGOs and government agencies have combined traditional Indigenous tracking skills with a scientific approach to data collection to survey wildlife and their threats, usually at a local scale.	NGOs and NRM groups, 4 gov agencies, several institutions and experts. (SA, WA, Qld, NT) Category 1	**Engagement:** Extensive engagement with Indigenous groups planned, with funding for TOs to support travel and meetings. **Fieldwork:** Hub will support field work by rangers.	management and monitoring work being carried out by over 40 Indigenous and other groups across vast areas of Australia, and lays the groundwork for creating ongoing, national-scale monitoring for desert wildlife.
D1.2 **D2.4** **D3.4** **3.2.7: Managing Jilas on Ngurrara country**	Jilas (desert waterholes) are critical components of the ecological and cultural fabric of desert ecosystems. After Indigenous people moved out of the deserts, many jilas became damaged or were lost through lack of maintenance. The Ngurrara rangers are reopening jilas in their people's traditional lands in the Great Sandy Desert, to look after country and reinvigorate culture. Reopening jilas may benefit native species that depend on water, but it may also support increased activity by feral animals like camels, cats and foxes. Ngurrara aim to develop a monitoring program to chart the outcomes of jila management, so they can respond to changes appropriately. The project will support the design and initial implementation of a robust monitoring design to help Ngurrara rangers understand the outcomes of the management of jilas. It will allow the rangers to	Ngurrara (WA) Category 1	**Planning:** The project has been instigated by Ngurrara Rangers, and they will guide the shape of the project. Project co-designed with Indigenous partner. Project progress and outcomes will be discussed with Indigenous ranger groups throughout the year, especially during two on-country field trips. **Fieldwork:** Rangers involved in co-designing the field work and then undertake the monitoring. The ranger groups will be listed as co-authors (i.e. as organisational authors) of any scientific papers/reports arising from this work. Training: In field methods and data recording. **Communications:** Communication materials including factsheets and videos will be developed in collaboration with Ngurrura to communicate the project within the local community and also with other indigenous groups. **Engagement:** This project is related to project 1.3.4, working with the Karajarri IPA (which neighbours Ngurrara country). In the next Karajarri field trip (October 2019), elders from both Ngurrara and Karajarri will be present to share	This project was instigated and shaped by Ngurrara Rangers. Ngurrara requested the help of the TSR Hub to design a monitoring program to better understand and manage the jilas (desert waterholes) on their country. This project is related to TSR Hub project 1.3.4, working with the Karajarri IPA (which neighbours Ngurrara country) and other partners to design and implement a monitoring program that can track the effects of Karajarri fire management on threatened species, other declining species, and culturally important species. In the field trip to Karajarri in October 2019, elders from both

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	showcase the results of their work on country, and thus build the case for ongoing investment in Indigenous NRM.		knowledge with each other, with rangers, and with scientists.	Ngurrara and Karajarri were present to share knowledge with each other, with rangers, and with scientists.
D1.1 **D1.3** **D2.1** **D3.4** **D3.5** **3.3.5: Malleefowl Adaptive Management Experiment**	Jilas (desert waterholes) are critical components of the ecological and cultural fabric of desert ecosystems. After Indigenous people moved out of the deserts, many jilas became damaged or were lost through lack of maintenance. The Ngurrara rangers are reopening jilas in their people's traditional lands in the Great Sandy Desert, to look after country and reinvigorate culture. Reopening jilas may benefit native species that depend on water, but it may also support increased activity by feral animals like camels, cats and foxes. Ngurrara aim to develop a monitoring program to chart the outcomes of jila management, so they can respond to changes appropriately.	Ninghan Station IPA (WA) Category 1	**Planning:** Project co-designed with Indigenous partner: on-going consultation, communication, outputs, training. **Fieldwork:** Rangers collect the data **Training:** In field methods and data recording.	Pindiddy Aboriginal Corporation (Ninghan Station IPA) are active partners in this project. Along with TO groups in the other adaptive management sites for mallee fowl management. A number of potential new Malleefowl monitoring sites occur on IPAs and the possibility of working with TOs was pursued to develop monitoring practices that complement local knowledge.
D1.1 **D1.2** **D1.3** **D3.2** **D3.4** **4.1.1: Optimising the design of a network of havens for vulnerable mammal species**	With the likely increase in translocations to islands, fenced areas and predator-controlled areas over the next few decades, forward planning of the locations, sizes and the candidate species to islands, fenced and predator-controlled areas will ensure the largest number and diversity of the most threatened species are protected by these programs. This will require strategic analysis of existing, planned and potential island, fencing and predator-control projects, drawing on principles of complementarity and cost-effectiveness. The research will provide a valuable tool for managers to prioritise areas and species for future projects.	Yawuru (WA) Category 2	**Planning and Engagement:** The project leader has presented project findings to Yawuru who are considering building a haven on their IPA. The Hub subsequently supported a fact-finding trip for a Yawuru delegation to Canberra, to visit Mulligans Flat, DoEE, Env Minister, TSC, as part of Yawuru's scoping for a fenced area project on country. The project leader has attended community meetings to share knowledge about havens and what would be involved in establishing one and is continuing to provide support as the proposal is developed. Once complete it will be the first haven owned and operated by an Indigenous group and the first in Northern Australia. **Training:** Supported a ranger to attend ESA 2019.	The TSR Hub supported a fact-finding trip for Yawuru to visit Mulligans Flat, DoEE, Env Minister, TSC, as part of Yawuru's scoping for a fenced area project on country. If Yawuru proceeds with installing a fenced haven, it will be the first haven owned and operated by an Indigenous group and the first in Northern Australia.

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D1.1 D1.2 D1.3 D3.2 D3.4 4.1.2: Benefits of feral predator control in the absence of fencing (Bettongs beyond fenced reserves in ACT)	Mulligans Flat Woodland Sanctuary (a 485ha predator-proof fenced area) and neighbouring Goorooyarroo Nature Reserve (about 1500 ha) represent one of the largest and best examples of Critically Endangered Box-Gum Grassy Woodland (that contains at least 23 threatened species). This project is undertaking research to support (a) the restoration of this ecosystem type (b) the reintroduction of threatened species both within and beyond predator-proof fences. In particular, our research focus on the restoration of missing species that return long-lost ecological processes. Our science has potential to have broad-scale, cascading, and positive effects on Australian ecosystems.	Ngunnawal (ACT) Category 2	**Engagement and Communications:** Engaging Indigenous people in developing stories about the animals we have been reintroducing – for publication on websites, signs and the Sanctuary App. Contributed to the employment of Indigenous translators who formed part of the Mulligans Flat Woodlands Sanctuary engagement program which included Indigenous people developing stories about reintroduced animals, Twilight tours and exploring engagement and ecotourism initiatives.	The key IE activity was a collaboration with Ngunnawal involving cultural signage at Mulligan's Flat, coordinated by TSR's Indigenous facilitator.
D2.1 D2.2 D2.3 D2.4 D3.4 4.1.8: Understanding genomic variation in the western ringtail possum for adaptive conservation	The western ringtail possum is Critically Endangered. It faces numerous threats that have resulted in highly fragmented populations, including habitat loss, predation by introduced predators and climate change in the south-west of Australia. It is vital to understand genetic variation among these remnant western ringtail possum populations and to incorporate this knowledge into recovery efforts before genetic variability is lost. This project will assess genomic variation across the range of the possum to: 1) determine whether there are genetically distinct and evolutionarily significant lineages of the western ringtail possum; 2) assess the impact of recent population declines on genetic variation; 3) seek evidence of local adaptation to forest type, diet and/or climate; and 4) calculate the survival probabilities of current populations.	SW Aboriginal Land and Sea Council (WA) Category 2	**Engagement:** SW Aboriginal Land and Sea Council presented project to SW Boojarah Working Group.	Not specified

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D2.3 D2.4 D3.3 D3.4 5.1.1: Strategic planning for the Eastern Curlew	The Eastern Curlew (CE) is the largest migratory shorebird in the world. Recent research has highlighted the importance of high quality non-breeding habitat, but it is difficult to provide strategic guidance to developers and decision-makers because too little is known regarding the exact requirements of the bird. The threat of coastal development affecting Eastern Curlew populations in Northern Australia is quite high but the use by curlew of artificial habitat for roosting demonstrates that some development can be consistent with the species' needs. This project will analyse Eastern Curlew feeding and roosting habitat and the relationship between the two with the aim of developing strategic guidelines for Eastern Curlew conservation that will give certainty to Departmental policy decision makers, assessment officers, proponents, developers, planners and regulators about habitat protection and offsets. The project will be undertaken in close cooperation with Darwin Port who are providing $150,000 in cash towards the project. Darwin Port currently manages a high tide roost habitat visited by Eastern Curlew and several other migratory bird species. Darwin Port is planning to develop and expand its operations and seeks to understand how it can achieve these objectives in a manner that does not negatively and materially impact the quality of habitats available to migratory birds visiting the Port lands. The project will assess the overall availability of suitable habitats, the impacts of developments within the port and the ways in which these impacts could be mitigated.	Larrakia (NT) Category 2	**Fieldwork:** Up to 15 Indigenous rangers from Larrakia Nation work on this project in a Fee for Service capacity, in surveys by air and by sea, they have also been monitoring microhabitats and invertebrates on saltpans. **Training:** Two Larrakia Rangers were supported by Darwin Port to attend the North-Western Australia Wader Expedition in Broome in 2018. In 2019, held a workshop on bird research carried out by Indigenous groups. 15 Larrakia supported to attend AOC in July. **Communications:** Project has produced progress reports, 1 booklet, on-ground training in the field and training in the lab. 1 report co-produced with rangers, on the trip to Broome, funded by Darwin Port. Video.	Current habitats in Darwin Harbour need to be maintained and preserved so as to protect the population of shorebirds in the region. Future coastal developments in Darwin Harbour will have to consider habitat offsetting and will require an understanding of site connectivity and habitat use by all species found in the region as responses to the environment and conditions is species' specific. (Progress Report 5, p.13)

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D1.1 **D1.2** **D2.4** **D3.4** **6.2: Collaborating with Indigenous people in threatened species research and management**	The project will identify opportunities across the country for Indigenous land and sea management that will advantage threatened species and communities, and where it is already occurring. The project is analysing national level information to identify potential gaps in threatened species management that could represent opportunities for further engagement with Indigenous people. The project is developing a set of guiding principles for engagement with Indigenous people on the topic of threatened species research and management that are most likely to lead to positive outcomes. This guide will provide the basis for a framework for a national Indigenous people's threatened species strategy (this would need additional resources). This work is being complemented by a number of case-studies to help co-develop and implement cross-cultural approaches to threatened species conservation (see case studies a-d).	Arakwal Aboriginal Corporation (NSW and (National) Category 3	**Desktop:** National level analysis of Indigenous threatened species management needs, identifying potential locations where threatened species conservation could benefit from increased management by Indigenous people. Identify overlaps between potential cultural and conservation benefits, and areas where Indigenous people have management rights and opportunities. **Engagement and survey:** Indigenous (and non-Indigenous) rangers and groups involved in threatened species research and management projects were surveyed (March - April 2018) across the country to examine some of the opportunities and barriers surrounding participation in threatened species research and management. IRG-led project on culturally significant species started mid-2019.	The research team worked with case-study Indigenous partners to prioritise and deliver strategies to achieve threatened species conservation where there are multiple objectives. The on-ground co-research approach aimed to target outcomes for threatened species at sites more likely to be incorporated into long term management as part of holistic land and sea stewardship approach than projects with short time frames and little consultation.
D1.1 **D1.2** **D2.4** **D3.4** **6.2a: Cross-cultural monitoring and evaluation program for an orchid (Diuris byronensis) on Arakwal land**	The Diuris orchid is culturally significant to the Arakwal people. This case study is using decision science to support the TOs to set priority activities for operational planning, and then helping to evaluate the success of those activities using Green List approaches. Across Australia and around the world there is growing interest in this standard to enable cross-cultural approaches to encourage, measure and celebrate conservation efforts on Indigenous lands. in Northern NSW, Indigenous and park joint managers have adapted the Green List Standard to recognise and enable their efforts to manage focal threatened species or	Arakwal (NSW) Category 1	**Planning:** Arakwal Traditional Owners and joint managers engaged in cross-cultural decision-support workshop that identified priority actions to care for Diuris orchid and surrounding clay heath habitat. Further, gendered workshops are being planned. The research team supported a Back on Country day for 75 Traditional Owners as part of this effort where key research activities - including the innovative approach to reframe the IUCN Green List standard to cross-culturally care for the Diuris byronensis Byron Bay orchid at Arakwal national park. **Management:** These actions are now being implemented	Effective cross-cultural conservation planning for significant species. Best practice guidelines developed to care for the Byron Bay Orchid habitat @ Arakwal National Park, Australia. These Guidelines describe a set of steps to assist with planning, management and evaluation for significant endangered species in a cross-cultural setting.

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	communities and guide potential sources of funding for that work in the protected areas that they are responsible for http://www.environment.nsw.gov.au/parktypes/Green-•List.htm.		**Evaluation:** success of these joint management activities being evaluated using the Green List framework to guide evaluation efforts. **Training:** supported Arakwal to attained National Indigenous Fire Workshop in 2018; supported two people to attend ESA 2019.	
D1.1 D1.2 D2.4 D3.4 6.2b: Conserving Alwal, the golden-shouldered parrot	The project will support the conservation of the Golden-Shouldered Parrot, carried out by Olkola Aboriginal Corporation.	Olkola (Qld) Category 1	**Planning:** Rangers supported for work on the recovery planning process, and **Training:** 3 rangers supported to attend AOC in July 2019.	
D1 D2 6.2.2: Cross-cultural TS management: species that matter	This project is working with TOs on Tiwi to survey perspectives on which species are important, and why.	Tiwi Land Council (NT) Category 2	**Engagement and surveys:** Tiwi TOs and rangers engaged as interviewees in Duncan PhD research. **Communication:** Project update and interim results presentation at Tiwi Land Council meeting. Summary of research also sent to joint management and Board for sign-off (march 2018). Project information and feedback session at Tiwi Climate Change workshop.	This project was guided by the Tiwi Land Council and Tiwi Land Rangers. A community factsheet has been prepared and was distributed on the Tiwi Islands with the local newspaper.
D1.1 D1.2 D2.4 D3.4 6.2.3: Conservation management for	The project will describe distribution of yellow chat, and response to fire regimes.	Kakadu (NT) Category 2	**Fieldwork:** Field surveys for yellow chat, with assistance from rangers, in a fee-for-service model.	Local TOs closely involved in this project. The TOs requested monitoring of invasive animals and weeds because they are hindering customary hunting practices.

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the yellow chat (Alligator Rivers)				
D3.4 6.3.4: Iconic species in schools	This project will investigate and quantify the environmental and cultural benefits associated with reconnecting children with Australia's unique biodiversity and cultural heritage through the development of an Iconic species in Schools program.	TSR Hub has well-established links to Wirrundjuri, but other possibilities. (NSW, Vic) Category 2	**Engagement and survey:** The project was led by an Indigenous researcher Michael Harrison (0.5 FTE), recruited in late 2018, and start in early 2019, to ensure proper engagement, and appropriate species selection. The project aims to hold a workshop, involving Indigenous leaders.	This project is being conducted by an Indigenous researcher, with supervisory support from the research team and aims to have broader educational outcomes about importance of Indigenous culture for protecting and maintaining the environment.
D3.2 D3.4 D3.5 6.6: Key factors for effective partner integration and governance for threatened species recovery	This project seeks to build on NESP research to date, analysing the long-term value of partnerships in threatened species recovery and governance arrangements that are most effective at building/maintaining partnerships and influencing conservation outcomes. The project will draw on case studies suggested by stakeholders but, where possible, building on the success stories already told in 'Recovering Australian Threatened Species: A Book of Hope' and its successors, analysing them through the lens of the partnerships on which success relied and the governance arrangements under which the threatened species recovery was undertaken.	TBD Category 2	**Engagement:** Indigenous partners will be engaged through existing connections under project 6.2. Communication: Findings on Indigenous partnerships will be reported back to Indigenous partners in formats to be codeveloped with those partners.	This project is closely with Project 6.2 (Collaborating with Indigenous people in threatened species research and management), piggybacking on their consultation and engagement activities.
D1.1 D1.3 D3.2 7.4: Cat management knowledge exchange	In recent years, there has been considerable research, including work carried out by the TSR Hub, to improve our understanding of the impacts of feral cats on native wildlife, and to improve our capacity to manage those impacts. In this project, we will synthesise information on cat impacts, cat management and how to measure the management effectiveness of cat control and	TBD Category 1	**Communication and Training:** Knowledge sharing and training event planned for 2020.	Many Indigenous groups incorporate cat monitoring and control into their existing activities. However, cat management is rarely identified as a priority in Healthy Country Management (HCM) plans, even though cats affect many of the cultural/biodiversity targets

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	investigate the most appropriate means to disseminate this information. We will work closely with diverse stakeholders to create information products tailored to these groups that maximise utility and uptake for each sector.			identified in the HCMs. Also, the information needs of Indigenous groups is highly variable, ranging from dialogues about cat impacts on Country for some groups, to guidance on monitoring and management approaches for other ranger and TO groups. This project supports the activities of ranger groups across this variation.
D2.1 **D2.2** **D2.3** **7.5: National monitoring priorities, process and prospectus for threatened species**	Monitoring should be a critical component of recovery for threatened species and ecological communities. In a comprehensive review, the hub noted some exemplary monitoring programs for some threatened species; however, for many threatened species there was no monitoring, and the existing monitoring programs for most threatened species were suboptimal. Reasons include the challenges of coordinating diverse stakeholders, and the perception that monitoring programs for threatened biodiversity are difficult and expensive. This project aims to develop plans for monitoring programs for key groupings of threatened species, plus costed pathways for their implementation. It will also identify threatened species that have had little or no monitoring to date, and prioritise those threatened species for which new or enhanced monitoring is most critical.	TBD Category 2	**Case studies:** to develop monitoring program.	Indigenous Australians have interests and responsibilities for caring for country across most of Australia. Lands with some form of Indigenous owneship, management or custodianship overlap with the distribution of a high proportion of threatened species. With appropriate Indigenous input, this project will help contribute to the identification, design and interpretation of monitoring programs that can help measure the impacts of IPAs and Indigenous ranger programs.

Selected TWQ Hub research projects and details of Indigenous involvement or engagement

TWQ Hub Research Priorities

The TWQ Hub's research priorities have evolved over time.

The TWQ Hub's website shows that the three overarching themes and their respective research priorities are:

1. Improved understanding of the impacts, including cumulative impacts, and pressures on priority freshwater, coastal and marine ecosystems and species.
2. Maximise the resilience of vulnerable species to the impacts of climate change and climate variability by reducing other pressures, including poor water quality.
3. Natural resource management improvements based on sound understanding of the status and long-term trends of priority species and systems.

The TWQ Hub's Research Plan states that the Hub's research prioritisation is a rolling process and key milestones in each activity year, and like the Annual Progress Report and submission of the next Research Plan, will inform the process. The Biennial Program Evaluation, which reviews the impact and success of the program, also plays an important role in informing research priorities. This constant consideration and evaluation of research output and impact is intended to give confidence in the performance of the Hub and the effectiveness of the program. It also provides the basis for the flexibility needed in the TWQ Hub to engage in new themes of research in an adaptive manner and ensures that the Hubs' focus is fixed on the delivery of relevant and practical research.

In the TWQ Hub's Research Plan V4 (which commenced in January 2018), the Research Priorities were:

1. Improved understanding of the impacts, including cumulative impacts, and pressures of priority freshwater, coastal and marine ecosystems and species.
2. Maximise the resilience of vulnerable species to the impacts of climate change and climate variability by reducing other pressures, including poor water quality.
3. Natural resource management improvements based on sound understanding of the status and long-term trends of priority species and systems.
4. Indigenous co-management for tropical marine and coastal systems.
5. Identify and prioritise regionally-specific management interventions to achieve or maintain realistic desired states for tropical environmental, social, cultural and economic values.

In the TWQ Hub's Research Plan V5 (which commenced in November 2018), the Plan continued to address priorities developed under Research Plan v4, with a continued research response to both the 2016 and 2017 coral bleaching events that affected most of the Great Barrier Reef, as well as impacts from Severe Tropical Cyclone Debbie in 2017. To address these impacts, the research emphasis shifted towards prioritisation and direct management interventions within the marine environment. This shifting emphasis maintains alignment with the research priorities and strongly supports the first cross-cutting issue (current and future climate risks). As all projects relate to the Great Barrier Reef, all are relevant to the third cross-cutting issue, improving water quality emanating from catchments.

Unlike previous research plans, which were mostly developed via an open-call basis and therefore subject to more broadly-worded priority descriptions, the TWQ took a different approach. All projects within this round were directly brokered by the Hub Leader after seeking advice from the Hub Steering Committee. Many of

the projects in Research Plan v5 are extensions to existing or previously completed projects from Research Plans v2 and v3. The 15 research projects proposed for RPv5 were grouped within the following priority areas:

1. Supporting Direct Interventions in the Marine Environment
2. Informing Reef Management in a Post-Bleaching/Increased Cyclone Frequency World
3. Improving Water Quality Emanating from Catchments.

In Research Plan V6, the TWQ Hub has continued to refine its research priorities focus on both targeted applied research projects and the successful transfer of knowledge to decision-makers and stakeholders in useful and accessible formats in order to deliver a positive impact on the environment. The TWQ Hub Research Plan V6 makes the astute observation that failure to transfer new knowledge to those who need it risks devaluing the government's investment in the NESP. Synthesis is therefore a focus of investment for RPv6, with projects being planned, resourced and delivered strategically and appropriately, in partnership with stakeholders.

The synthesis projects will have the capacity to draw together information from projects across the entire scope of the NESP TWQ Hub, including external material where relevant. The Hub will use existing meetings and working groups where feasible rather than duplicating effort in bringing stakeholders together for synthesis planning and delivery. Synthesis products will range from technical reports (with brief, plain-English summaries), to policy briefings, visual documentation of research results, as well as stakeholder impacts. eAtlas will be not only the data repository but a visualisation tool as well.

As endorsed by the NESP TWQ Hub Steering Committee, areas of highest priority for synthesis are as follows:

- Innovations in Crown of Thorns Starfish (COTS) control on the Great Barrier Reef.
- Restoring ecosystems from catchment to reef.
- Reducing nitrogen runoff without reducing industry productivity.
- Reducing end-of-catchment fine sediment loads and ecosystem impacts.
- Improving coral condition through better-informed resilience-based management.
- Influencing agriculture practice behaviour change to increase impact including guidance for sensoring up a catchment.
- Delivering stakeholder-driven environmental science for impact: lessons learned from the MTSRF (2006-2010), NERP TE (2011-2015) & NESP TWQ (2016-2021) Hub.
- Integrated environmental assessment to inform environmental decisions (cross-Hub project led by Threatened Species Hub).

Details of Selected TWQ Hub research projects with a high level of Indigenous involvement or engagement

The Table below includes information about a selection of the TWQ Hub's research projects with a high level of Indigenous involvement or engagement. The Table includes NESP Hub research theme or priority, NESP Hub project number, a project summary or description, the Traditional Owner (TO) group(s) and jurisdiction(s), the nature of activities involving Indigenous partners (covering Planning, Fieldwork, Engagement, Communications, and Training), the relevant Category in the Three Category Approach to Indigenous engagement, and identified outcomes and/or Indigenous research priorities.

TWQ Hub Research Theme and Project Number & Name	Summary	TO Groups (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes or Outputs and/or Indigenous Research Priorities
Theme 1 **3.1.1: Implementation of the crown of thorns starfish research strategy: regional strategies**	Crown-of-thorns starfish (COTS) management requires decisions be made about where to invest control effort in order to achieve regional scale objectives, e.g. to modify COTS spread or to facilitate coral recovery. However, no objective basis for choosing sites exists, beyond their economic importance, meaning that achieving these important goals is largely left to chance. This project will leverage past and current research to develop a decision support framework to assist in prioritizing reefs for control and for assessing alternative strategies by integrating the full range of ecological and management information available. Field and desktop research will also be conducted to fill critical knowledge gaps and to assess the prospects of new control technologies.	Category 2	**Fieldwork:** Indigenous COTS trainees under the Skilling Queenslanders for Work Program put their learning into practice at priority reefs. **Engagement:** There were a total of two management tools for Indigenous waters and land that benefitted from NESP research and outcomes (including but not limited to Plans of Management for IPAs, Co/Joint managed parks, Marine Park Plans of Management, Conservation Agreements). **Communications:** Communication with Traditional Owners has not yet been conducted beyond discussions with particular groups to encourage young people to participate in the training program and in working with Indigenous graduates of the training program to participate in an assessment of the social return on the training. **Training:** Indigenous COTS trainees are trained in COTS control, diving and vessel operations.	Not specified
Theme 1 **3.1.7: Reducing sediment loads to the Great Barrier Reef: developing optimal approaches for treating alluvial** gully erosion	Alluvial gullies have been shown to be major sources of fine sediment and nutrients to the GBR lagoon, and yet to date there is no accepted practice as to how these major pollution sources can be stabilised and rehabilitated. Working in collaboration with delivery partners implementing gully rehabilitation works through the Reef Trust phases 2 and 4, and various other gully mitigation programs currently being developed by Greening Australia, WWF and GBRF, this project will develop a series of large field trials that will test the effectiveness of different treatments for large active alluvial gully rehabilitation in different soil types in different catchments. These trials will	Laura and Balnggarrawarra Rangers Category 2	**Fieldwork:** Indigenous rangers at Crocodile Station assisted in the collection of 270 water samples over the 2018/19 wet season at 5 gullies (4 treatments & 1 control), bringing the total number of samples over the two years to around 460. **Engagement:** Collaboration continued with of the Laura Rangers in the monitoring program (undertaking equipment maintenance throughout the wet season), and through the establishment of an additional monitoring site on Normanby Station, a property owned by local Traditional Owners. This is supporting the gully rehabilitation the Normanby Station TOs are doing through the Reef Trust IV project funded on their property.	Not specified

TWQ Hub Research Theme and Project Number & Name	Summary	TO Groups (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes or Outputs and/or Indigenous Research Priorities
	complement similar research effort currently underway through NESP on hillslope gullies.		**Communications:** Oral, written and visual communications (particularly on-country site inspection and discussion) through several workshops have been used to communicate research results with Indigenous people. **Training:** Crocodile Station is an ILC owned property and a field site used in the training program for Traditional Owners. Some training workshops – which are informal cultural awareness training exercises have occurred.	
Theme 1 **4.1: Crown-of-thorns starfish: surveillance and life history**	This project supports the implementation of the NESP Crown-of-Thorns Starfish Integrated Pest Management Project's management and research strategy by i) describing ecological parameters key to parameterizing the tools underpinning the management strategy, ii) analysing existing data sets to assess management performance and describe the interaction between CoTS and bleaching, and, iii) scoping new technologies and surveillance strategies for detecting and monitoring primary and secondary outbreaks. The work will involve a combination of field ecological research, statistical analysis of existing data, technology and strategy development (the latter through workshops) and inform decision making through incorporation into decision support tools and recommendations.	Category 2	**Fieldwork:** Indigenous COTS trainees under the Skilling Queenslanders for Work Program put their learning into practice at priority reefs. **Engagement:** There were a total of two management tools for Indigenous waters and land that benefitted from NESP research and outcomes (including but not limited to Plans of Management for IPAs, Co/Joint managed parks, Marine Park Plans of Management, Conservation Agreements). **Communications:** Communication with Traditional Owners has not yet been conducted beyond discussions with particular groups to encourage young people to participate in the training program and in working with Indigenous graduates of the training program to participate in an assessment of the social return on the training. **Training:** Indigenous COTS trainees are trained in COTS control, diving and vessel operations.	The project provided an opportunity for Traditional Owners to identify Traditional Ecological Knowledge relating to CoTS and their management.
Theme 1 **4.3: Best practice coral restoration for the Great Barrier Reef**	As coral cover in the Great Barrier Reef (GBR) continues to degrade, pressure is growing for direct interventions to assist the recovery of corals at important sites. A range of coral restoration and assisted recovery techniques have been trialled overseas and in Australia, however there has not	Yirrganydji Ngaro Darumbul Taribelang Bunda Gurang	**Fieldwork:** Coral and fish identification and coral disease identification. **Engagement:** Knowledge sharing and communication event held with Traditional Owners.	Not specified

TWQ Hub Research Theme and Project Number & Name	Summary	TO Groups (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes or Outputs and/or Indigenous Research Priorities
	been an evaluation of what will work best in GBR conditions. This project will: • Summarise and evaluate the success of coral restoration and assisted recovery techniques worldwide and identify the techniques most likely to help the GBR. • Experimentally test the most promising techniques. • Come up with best practices for post-impact coral reattachment and reorientation. • Explore options for training courses, offset models and Indigenous employment.	Category 2	**Communications:** Media release, video and Traditional Owner video produced after the Reef Leadership and Restoration workshop held on Orpheus Island. **Training:** Seven Indigenous people trained in the use of environmental management tools and techniques for reef leadership, coral restoration and identification of coral disease.	
Theme 1 5.1: Matching the Crown-of-Thorns Starfish Integrated Pest Management to the scale of the new Control Program	The Crown of Thorns (CoTS) Integrated Pest Management (IPM) program is designing an ecologically informed control program that integrates knowledge of the spatial and temporal dynamics of CoTS outbreaks and the operations of on-water control to provide i) the most efficient strategies for investing management effort at all scales of management, ii) an operational framework for the control program, and, iii) to identify and fill key research gaps. This project will support the expansion of the IPM's tools to match the expansion of the control program, finalize scenario testing to assess appropriate control objectives, and, assess the social benefits of the CoTS training program.	Category 2	**Training:** For young people in management and tourism on the GBR as well as serving to transition under and unemployed youth into the workforce more generally, with a particular focus on Indigenous youth.	Not specified, but training opportunities provided.
Theme 1 6.1: Innovations in COTS control on the GBR	For decades, crown-of-thorns starfish (COTS) research effort has been fragmented and failed to inform improvements in the effectiveness of COTS control. However, under the NESP Tropical Water Quality Hub's Integrated Pest Management (IPM) research program, a more collaborative and		**Communications:** Research results will be shared and communicated with relevant Indigenous peoples/communities.	This is a synthesis project and will involve communication of research results to Indigenous peoples and communities.

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	targeted approach has harnessed research effort and enabled delivery of significant improvements in effectiveness and efficiency of COTS control, while also looking to develop methods for the future. Wholescale adoption of this IPM approach by the Great Barrier Reef Marine Park Authority (GBRMPA) and operators is already demonstrably saving live coral cover on the Great Barrier Reef (GBR).			
Theme 2 **2.2.1: Identifying the water quality and ecosystem health threats to the high diversity Torres Strait and far northern GBR from runoff from the Fly River**	Runoff from the Fly River in Papua New Guinea influences water quality conditions in the Torres Strait (TS) region however the extent and frequency of this influence, and the potential ecological impacts, are not well understood. Further investigation is required to understand the prevalence and frequency of the extension of the Fly River plume into TS, and the characteristics of plume constituents, particularly metals. This project will build on previous efforts to determine the spatial extent, temporal patterns and constituent pollutants of Fly River discharge, and to a lesser extent, assess the vulnerability of ecosystems in the TS exposed to the discharge.	Guda Maliguilgal Kemer Kemer Kulkulgal Category 1	**Fieldwork:** Weekly salinity monitoring by TSRA Rangers in northern locations is continuing until all CSIRO field work is completed, with excellent progress from the Masig, Erub, Warraber, Poruma, Iama and Saibai Island teams. Good working relationships maintained with the TSRA Land and Sea Management Unit and the TSRA Rangers at Saibai, Erub, Masig, Warraber, Poruma and Iama Island. **Engagement:** The project team works closely with the TSRA Rangers and the Land and Sea Management Unit to conduct the salinity monitoring. The project has engaged with TSRA Rangers from Erub, Masig, Warraber, Poruma, Iama, Saibai and Boigu. **Communications:** The project team has met with the island communities on a number of occasions to share and discuss the results, including potential implications of the results. there has been regular weekly contact with TSRA Rangers on Masig, Erub, Warraber, Poruma, Iama and Saibai to support the weekly salinity monitoring program (results and equipment. **Training:** TSRA have incorporated a water salinity data entry form into their Fulcrum reporting system which is a tablet-based system. Rangers now trained in salinity monitoring enter	Conclusions in Final Report: Full risk assessment to ecosystems and communities is required to assess the overall implications of exposure to sediments and trace metals in the ecosystems in the northern Torres Strait. In the longer term, investigations to include a repeated and in-depth examination of biological indicators and seafood as conducted as part of the Torres Strait Baseline Study in the early 1990s, to consider potential human health issues.

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			the data through Fulcrum which provides an automatic notification and collates the data into a spreadsheet. This has assisted to provide consistent and more efficient data collection and submission.	
Theme 2 2.2.2: Impacts of mine-derived pollution on Torres Strait environments and communities	This study addresses concerns regarding the impacts of mine-derived pollution on the marine resources of the Torres Strait. Using state of the art procedures, trace metal concentrations in marine waters and sediments will be determined at locations across the Torres Strait. Chemical signatures of mine pollution will be measured in waters and sediments and hotspots of contamination identified. The water quality data generated will allow informed management decisions to be made on how to best address trans-boundary mining related pollution.	Guda Maliguilgal Kemer Kemer Kulkulgal Category 2	**Fieldwork:** Collected water and sediment samples with Traditional Owners in their sea country and IPAs. **Engagement:** Community members on Saibai and Boigu islands participated in the community survey. **Communications:** Community meetings have been held at Boigu, Saibai, Iama, Erub, Poruma, Masig and Warraber to present results. A presentation was also made to the Torres Strait Treaty Environment Management Committee which has TS traditional owner representatives. **Training:** N/A	Recommendations in Final Report: (a) Development of methods for tracing mine-derived sediments in the Torres Strait. (b) Understanding the factors governing trace metal distributions around Saibai and Boigu. (c) Characterising trace metal distributions in the northern Torres Strait. (d) Characterising trace metal distributions in the Torres Strait region.
Theme 2 2.2.3: Early warning systems to minimize the risk of box jellyfish stings by empowering stakeholders	This project will minimise the risk of box jellyfish stings by empowering stakeholders with an early warning system. The project will first develop an openly-accessible database based on information from existing sting datasets, hospital records, and surf lifesaving and research data. The project will use this database to develop real-time forecasting models in major stinger hotspots on the GBR, based on environmental conditions and water quality. These forecasts will be tested with the project partners, SLSQ and AMPTO. This project will empower tourism operators, Traditional Owners and the public to mitigate stinger impacts.	Yirrganydji Category 1	**Fieldwork:** Yirrganydji Rangers conducted some jellyfish beach drags on country. **Engagement:** Face-to-face training sessions with Yirrganydji Rangers. **Communications:** Jellyfish identification with Yirrganydji Rangers from stinger drags and sensor cameras. **Training:** Yirrganydji Rangers trained in stinger drags and jellyfish identification on country.	None specified in final report.

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Theme 2 3.2.1: Deriving ecologically relevant load targets to meet desired ecosystem condition for the Great Barrier Reef: a case study for seagrass meadows in the Burdekin region	This project will derive ecologically relevant targets (ERTs) for water quality and sediment loads by: 1) defining seagrass desired state targets; 2) calculating water quality guidelines (light); and 3) calculating ERTs for terrestrially sourced sediment loads. Historical and new data collections will be used to derive ERTs via statistical models and eReefs (RECOM), and the seagrass sub-model in eReefs will be used to test ERTs. A framework for setting seagrass desired state will be developed for the entire GBR and water quality guidelines and sediment load ERTs will be quantitatively defined for the Burdekin basin where suspended sediments affect seagrass condition.	TBA Category 2	**Engagement:** Held a session on adaptive management for Indigenous Rangers attending Seagrass-Watch training. This focused on setting management objectives (e.g. to maintain dugong and turtle populations), having targets for seagrass condition (e.g. what was Sea Country like in the past – if known – based on descriptions by elders), and what can Rangers do to protect seagrass in Sea Country. Rangers completed a form/questionnaire designed to help them think through management priorities for their own Sea Country. **Training:** The project team will follow up with the Indigenous Ranger groups in 2020 after they have had an opportunity to consider how their Seagrass-Watch training fits in with local priorities and management options in their Sea Country.	None specified.
Theme 2 4.7: Indigenous coral reef tourism	Despite the seemingly abundant opportunities, Indigenous Traditional Owners of the Great Barrier Reef appear to show little interest in participating in the lucrative coral reef tourism industry. This project seeks to understand why this is so, canvass TO attitudes to the industry, map out the opportunities for their participation in both mainstream and Indigenous-initiated ventures, and provide an assessment of current obstacles and what can be done to mitigate them. Research will be undertaken through a combination of surveys (e.g., of tourism industry literature), consultations with TO groups and regulatory authorities, and interviews with mainstream tourism operators (and their representative bodies). The project will result in a report with recommendations relevant to TO groups interested in coral reef tourism, mainstream tourism stakeholders and enterprises,	41 TOs along the length of the GBR (Qld) Category 1	**Fieldwork:** No fieldwork component **Engagement:** Structured and participatory surveys and interviews with TO's along the GBR. **Communications:** Held meetings with TEQ, & DITID, QTIC **Training:**	Targeted research regarding the relationship between Indigenous coral reef communities and the potential mutual benefits that could be realised through coral reef tourism has to date been significantly limited, and more work in this space would be welcomed. (Final Report p.15)

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	industry bodies and regulatory and management authorities.			
Theme 2 **5.14: Identifying the water quality and ecosystem health threats to the Torres Strait from the Fly River runoff**	Runoff from the Fly River in Papua New Guinea (PNG) influences water quality conditions in the Torres Strait region. Recent work (NESP Project 2.2.1 and 2.2.2) has clearly demonstrated that this influence is largely constrained to the northern Torres Strait, as far east as Bramble Cay and at least as far west as Boigu Island. The southern extent of influence is considered to be limited to within 40-50km of the PNG coast in the western areas, and around 80km in the eastern areas. The intensity of this influence, and the potential ecological impacts, are still not well understood. Trace metal concentrations are higher in the northern Torres Strait around Boigu and Saibai, however it is not clear whether this enrichment is natural or the result of mine derived inputs of trace metals. Further investigation is required to understand the prevalence and frequency of the extension of the Fly River plume into the northern Torres Strait, and further characterisation of plume constituents, particularly sediment and trace metals in comparison to previous results including the Torres Strait Baseline Study.	Guda Maliguilgal Kemer Kemer Kulkulgal Category 1	**Fieldwork:** Weekly salinity monitoring by TSRA Rangers in northern locations is continuing until all CSIRO field work is completed, with excellent progress from the Masig, Erub, Warraber, Poruma, Iama and Saibai Island teams. Good working relationships maintained with the TSRA Land and Sea Management Unit and the TSRA Rangers at Saibai, Erub, Masig, Warraber, Poruma and Iama Island. **Engagement:** The project team works closely with the TSRA Rangers and the Land and Sea Management Unit to conduct the salinity monitoring. The project has engaged with TSRA Rangers from Erub, Masig, Warraber, Poruma, Iama, Saibai and Boigu. **Communications:** The project team has met with the island communities on a number of occasions to share and discuss the results, including potential implications of the results. there has been regular weekly contact with TSRA Rangers on Masig, Erub, Warraber, Poruma, Iama and Saibai to support the weekly salinity monitoring program (results and equipment. **Training:** TSRA have incorporated a water salinity data entry form into their Fulcrum reporting system which is a tablet-based system. Rangers now trained in salinity monitoring enter the data through Fulcrum which provides an automatic notification and collates the data into a spreadsheet. This has assisted to provide consistent and more efficient data collection and submission. Six TSRA Rangers have been provided with direct training, and a further 16 are currently involved in salinity monitoring.	None specified. Awaiting final report.

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Theme 2 5.4: Deriving ecologically relevant targets to meet desired ecosystem condition for the Great Barrier Reef: A case study for seagrass meadows in the Burdekin region	This project will derive Ecologically Relevant Targets (ERTs) for sediment loads for the Burdekin basin and provide the seagrass desired state across the Great Barrier Reef (GBR) by: 1) defining seagrass desired state for the GBR; 2) calculating light requirements; and 3) calculating ERTs for terrestrially sourced sediment loads, using Cleveland Bay as a case study. Historical and new data collections will be compiled and used to derive ERTs via statistical models and eReefs Relocatable Coastal Model (RECOM), and the seagrass sub-model in eReefs will be used to test ERTs.	Gooreng Gooreng Taribelang Bunda Bailai Gurang Category 2	**Communications:** Held a session on adaptive management for Rangers attending Seagrass-Watch training. This focused on setting management objectives (e.g. to maintain dugong and turtle populations), having targets for seagrass condition (e.g. what was Sea Country like in the past – if known – based on descriptions by elders), and what can Rangers do to protect seagrass in Sea Country. Rangers completed a form/questionnaire designed to help them think through management priorities for their own Sea Country. **Training:** The project team will follow up with the Indigenous Ranger groups in 2020 after they have had an opportunity to consider how their Seagrass-Watch training fits in with local priorities and management options in their Sea Country.	None specified. Awaiting final report.
Theme 2 6.5: Improving coral condition through better informed resilience-based management	Resilience-based management and integrated monitoring and reporting through the Reef Integrated Monitoring and Reporting (RIMRep) program are key initiatives for managing the Great Barrier Reef (GBR). A wide range of NESP TWQ Hub projects have focused on resilience-based management and decision making for maintaining and improving coral condition in the GBR. These projects directly contribute to the goals outlined in the *Great Barrier Reef Blueprint for Resilience* (2017) and support the development of RIMRep. Many of these research investments are in direct response to the 2016-17 mass thermal bleaching events. This synthesis will bring together the learnings of many research projects and initiatives driven by the same goals into a succinct coherent story.	Category 3	**Communications:** Research results will be shared and communicated with relevant Indigenous peoples/communities.	None specified.

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Theme 2 6.6: Influencing agriculture practice behaviour change and trust frameworks	The ecologically-determined water quality improvement targets for the Great Barrier Reef can only be met with significant improvement in farm management practices. Numerous programs over many years, utilising a variety of approaches, have worked with land managers and representative farmer groups, seeking to achieve high levels of uptake of recommended farming practices. However, these have only met with low-moderate success. There has been significant work encouraging and facilitating behaviour and practice change in recent years, including through, but certainly not limited to, the NESP TWQ Hub. Programs encouraging behaviour and practice change are set to remain a feature of contemporary reef funding programs. Thus it is timely to coordinate a synthesis of learnings in this domain. Increasing understanding of, and improving trust frameworks and behaviour change of land managers will lead to improved water quality to the Great Barrier Reef. Understanding the impetus, benefits and barriers of behaviour change for agricultural practice is a large step in improving water quality to the Great Barrier Reef.	Category 3	**Communications:** Research results will be shared and communicated with relevant Indigenous peoples/communities.	None specified.
Theme 3 2.3.3: Building Indigenous livelihood and Co Management Opportunities in the Northern GBR-ecosystem	This project supports Indigenous co-management and livelihoods by scoping and developing culturally-appropriate ecosystem services (ES) products focused on water quality. Local and regional Indigenous development agencies in CYP will collaborate with researchers with expertise in Indigenous water, co-benefits, ES, wetland ecology, and governance issues. The project will: i) evaluate international examples of nutrient offsets	Southern Kaantju Category 1	**Fieldwork:** This included working with three Kalan rangers to collect biodiversity data in fenced and unfenced waterholes where feral animal impact was recorded. **Engagement:** Indigenous engagement, traditional knowledge and practices contributed to or enhanced existing scientific knowledge of environmental issues (including but not limited to, threatened species, land and water management, climate change) in the project was met for this project. Also,	The Final Report concludes: • Indigenous ES (and their governing context) remain at a preliminary phase of awareness and associated development on CYP; • Success in securing payments for such ES will require building

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Services and Conservation Governance for Water Quality	and watershed ES; ii) scope investor demand and develop innovative water quality ES products suitable for Northern GBR geographic, demographic, and market conditions; and iii) improve wetland protection, co management, business, and governance capability. Key project objectives are to leverage existing ES-based livelihood opportunities and to realize social co-benefits.		traditional knowledge and practices contributing to the development of environmental solutions (including but not limited to, threatened species, land and water management, climate change) in the project. Additional Indigenous consultation relating to project goals was undertaken during field trips to Southern Kaantju territory. **Communications:** The workshop provided an important forum for Traditional Owner communication, and the support and strategic direction provided by Traditional Owners at that workshop to the project team was a crucial demonstration of higher order Indigenous community engagement with the project and its potential. The film produced in excess of the project plan is extremely popular, with elder feedback stating that the final version should be shown to the whole community. **Training:** Project activities prepared key Kalan Enterprises staff and Southern Kaantju people to talk with potential investors about water assets and water quality management opportunities, and about commercial opportunities more generally.	capability and sophistication in a range of areas; • At the level of a local Indigenous provider, a further series of important factors need to be accounted for, details listed on p.81 of final report. To be locally successful long term, ES development must be seen as consistent with the continuing resolution of tenure and resource rights, including the One Claim processes over both land and sea on CYP. It must also be supportive of the wider Indigenous lifeways, community connections, and governance. regimes that these changes should enable.
Theme 3 **2.3.4: Working with Traditional Owners and local citizens to better manage GBR estuarine wetlands**	Traditional Owner rangers and local citizens of the Port Curtis Coral Coast (PCCC) TUMRA will be engaged in developing a Mangrove Management Plan (MMP) that provides a strategic basis for estuarine repair activity and maximizes water quality outcomes in the southern GBR. Development of this MMP will build capacity within the Gidarjil Development Corporation (GDC) and local community to undertake scientifically-rigorous, ecological monitoring and assessment.	Gooreng Gooreng Taribelang Bunda Bailai Gurang Category 1	**Fieldwork:** Conduct of field vegetation surveys and monitoring the health of mangrove ecosystems has been implemented. **Training:** Rangers trained in Shoreline Video Assessment Method (S-VAM) and mangrove identification. There were 11-15 rangers and other staff with the Gidarjil Development Corporation. Completed Mangrove Watch training courses (use of cameras, GPS and boat handling) are received formal achievement certificates and skills recognition in shoreline monitoring data acquisition.	Recommendations include: • Continue supporting Gidarjil rangers in the monitoring of estuarine shorelines in their region; • Support on-going shoreline video assessment analyses along with the development of

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	These management and rehabilitation strategies will protect sea country resources through partnerships between community, scientists and NRM agencies. The MMP will enable rangers and citizen scientists to conduct scientifically valid surveys of estuarine monitoring, management and rehabilitation within the PCCC TUMRA area.			a regional report card on southern Great Barrier Reef estuarine waters. (Final Report V1 and V2)
Theme 3 **3.2: Improving historical estimates of abundance and distribution of dugongs and large green turtles in western and central Torres Strait**	This project will improve the accuracy of aerial survey estimates of the size and distribution of dugong and green turtle populations in western and central Torres Strait by: (1) collecting and analysing data on their movements and diving behaviour, and (2) estimating the proportion of turtles seen during aerial surveys that are the large female green turtles harvested by Indigenous hunters. These data will then be used to (re)estimate the size and distribution of the populations of dugongs and harvestable green turtles in Torres Strait by (re) analysing historical aerial survey data collected in 2001, 2005, 2006, 2011 and 2013.	Kulkulgal Malauligal n/a	**Fieldwork:** There were 7 indigenous people employed part-time for the project, along with 7 hunters and 6 rangers observed what the research team was doing and played a major role in catching the animals. **Engagement:** Community engagement with the following communities: Boigu, Badu, Mabuiag. **Communications:** Regular communication with TSRA, Mura Badulgal RNTBC, Badu Rangers and the Torres Strait community via 4MZ and the Torres News. **Training:** Seven hunters and six rangers trained in observation of what the research team was doing and played a major role in catching the animals. To increase rangers' capacity, rangers were involved in the dugong and turtle capture and transmitter deployment and trained in tag deployment.	Recommendation (Final Report 1 p.30): That a systematic multi-year further satellite tracking of dugongs and sea turtles be designed and implemented jointly by Torres Strait communities and JCU researchers to enhance collaboration, increase the evidence base for community-based management of these cultural keystone species and build trust in and knowledge of western science in the local communities. Recommendations (Final Report 2 p.34:) That the major priority for dugong and green turtle management in Torres Strait be on-going support for the implementation of community-based management. With specific recommendations for the TS Protected Zone Joint Authority and TSRA.

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Theme 3 3.3.2: Science evaluation of coastal wetland systems repair projects across GBR catchments	State and Federal agencies are funding many GBR wetland system repair projects (Mungalla wetlands $1.2M; Reef Trust/Greening Australia $4M; Restoring Burdekin Coastal Ecosystems $837K; Roundhill Creek wetland/FHA $65K, Babinda Swamp Constructed Wetland ~$1.97M). The problem is no scientific data evaluates their success; this project partners with NRMs to fill this R&D gap. Using advanced scientific hydrological and ecological techniques we will generate data to evaluate repair efforts, providing surety to government funding agencies. This project will provide a platform to attract significant private and philanthropic investors, looking to fund large-scale wetland repair projects, via emerging carbon and nutrient trading schemes.	Nywaigi Category 1	**Fieldwork:** Traditional Owners assisted with fish biodiversity sampling, water quality sampling, bund wall removal. **Engagement:** Numerous site inspections, field work, community events, progressing meetings, planning meetings. **Communications:** Meetings with Mungalla Aboriginal Corporation for Business and Goodnoi Arts Aboriginal Corporation. **Training:** Transfer of wetlands scientific skills to NRM & indigenous communities was established, transferring knowledge via presentations, assisting with field trips, assisting with data analysis, and report/scientific publication preparation.	Not specified.
Theme 3 3.5: Assessment of key dugong and turtle seagrass resources in the northern Torres Strait	This project fills a critical information gap for dugong and turtle habitat management in the Torres Strait. It describes seagrasses in a recently identified data deficient region in northern Torres Strait that contains large dugong and turtle populations and is the subject of a proposed extension of the existing Dugong Sanctuary. The baseline assessments will form the foundation for ongoing monitoring, and provide essential information to the TSRA, Australian and Queensland governments for dugong and turtle management plans, complimenting dugong and turtle research studies in the region and building skills and capacity of Traditional Owners and Rangers.	Guda Maluilgal Kemer Kemer Kulkulgal n/a	**Planning:** Approximately monthly planning meetings with end-user TSRA between May and November when field surveys commenced. **Fieldwork:** Subtidal survey work completed November 2015; Majority of intertidal survey work completed November 2015. Based on indigenous involvement in the field for this project, the success of the subtidal surveys was in large part due to the TSRA rangers' knowledge of and familiarity with the remote survey area. **Engagement:** Information flyers distributed to Island Communities to inform of upcoming surveys in the area; Community talks to present research findings at Boigu Island and Thursday Island in March 2016. **Training:** Seagrass Watch monitoring and survey training.	Recommendations: • Establish baseline seagrass information in high-very high dugong density areas between Turnagain and Gabba Islands, Orman Reefs and the eastern boundary of the Dugong Sanctuary; • Establish a seagrass long-term monitoring program in regions of high-very high dugong density; • Continue collaboration with TSRA LSMU Rangers for seagrass surveys and monitoring. (Final Report p.33)

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Theme 3 3.9: Indigenous capacity building and increased participation in management of Queensland sea country	This project intends to facilitate targeted consultations with key individuals and institutions (i.e. Torres Strait Regional Authority, GBR TO's and Land Councils, etc.) to seek feedback on the implementation of the NESP TWQ Hub Indigenous Engagement and Participation Strategy (IEPS). This will enable the evolution of a strong Implementation Strategy for the IEPS. A number of Indigenous community liaison officers (part-time) will be engaged to work at the local level to analyse, scope and prioritise Indigenous specific targets/actions identified within and arising from the 2050 LTSP and to inform future TWQ Hub research priorities (the Research Plan). The project will set the parameters for, and commence development of an Indigenous specific Implementation Strategy and investment framework for the future co-management of sea country.	Members of 70 Traditional Owner groups along the GBR n/a	**Engagement:** Joint workshop across the region in coordination with the GBRMPA Indigenous Reef Advisory Committee, including both IRAC and a number of other Traditional Owners, thereby ensuring good participation from across the region. **Communications:** There was Investigation and analysis of the coordinated framework for increasing Indigenous engagement in sea country. Despite commonwealth and state governments engaging well on key occasions, there has been no lasting, continuously improving GBR-wide level of Traditional Owner engagement; more so, inconsistency with emerging international guidelines for Traditional Owner engagement in protected area management.	The Final Report provides a coordinated Indigenous framework for Indigenous participation in sea country management of the Reef. See Summary for more details.
Theme 3 4.13: Assessing the Gulf of Carpentaria mangrove dieback	In early 2016, extensive dieback of mangrove forests was recorded along the southern and western Gulf of Carpentaria coastline. Landsat analysis suggests that 7,400 hectares of mangrove forest suffered dieback over a relatively short and synchronous time period around November 2015, along a >1,000km wide front from Karumba in the east to Limmen River in the west. Recent field visits to a limited range of affected sites suggest that a relatively low percentage of trees have recovered and most are dying/dead. This is the largest event of natural dieback of mangroves ever recorded in the world. This project will provide a survey, description and analysis of the extent of	Kurtijar Gangalidda Garawa Yanyuwa Category 2	**Fieldwork:** Mapping and engagement with Indigenous Land and Sea Rangers including aerial surveys in 2016, 2017, 2018 and in Sept 2019; major field surveys in 2018. Mapping for quantification of diversity and extent of dieback damage throughout the region. Ranger groups in this program include Land & Sea Rangers in Normanton & Burketown with Carpentaria Land Council Aboriginal Corporation, and Borroloola with Mabunji Land and Sea Rangers. **Engagement:** Through meetings with the above corporations and field work. **Communications:** Queensland Indigenous Ranger Conference; Torres Strait Environmental Management Committee; DAWE; Indigenous Corporations – Normanton, Burketown, Borroloola.	Not specified.

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	the dieback across its range, as well as examining patterns of dieback. The assessment will include training and participation of local Indigenous ranger groups in mangrove assessment and monitoring methods, as well as providing recommendations for recovery, potential intervention, future monitoring and further studies. A synthesis workshop will also be held to present the findings of the assessment to a wide audience.		**Training:** Training in aerial survey techniques; Other trips have been made for the delivery of training to Land and Sea Rangers in the Gulf region for MangroveWatch shoreline monitoring. For Burketown – Carpentaria Land Council Aboriginal Corporation ranger training workshop and community meeting/s were conducted in September 2019, as well as the Borroloola – Mabunji Aboriginal Corporation ranger training workshop. Later in December'19, the Darwin – NESP NAER NT Government research user workshop also contributed to the training. As part of the training provided by the NESP Project, some of the Indigenous groups of the Gulf region were also active participants in the future monitoring of environmental condition/s. A draft MangroveWatch training manual is in review.	
Theme 3 **6.2: Restoring ecosystems from catchment to reef**	A range of NESP TWQ Hub funded projects have delivered insights into improved ways of restoring and evaluating ecosystem restoration efforts, from catchments through to the reef and other marine environments. This work has mostly focused on sediments, nutrients and freshwater, estuarine and marine wetland restoration in a wide range of projects. The diversity of approaches and contexts in which restoration has occurred, make it very difficult for anyone not intimately associated with the work to appreciate the overall outcomes and learnings. This synthesis will provide the ability to see across this range of projects and outcomes. Synthesis of the outcomes across these projects will provide easy to access practical recommendations for land and sea managers.	Category 3.	**Communications:** Research results will be shared and communicated with relevant Indigenous peoples/communities	TBA
Theme 3	Many NESP TWQ Hub projects have contributed to an improved understanding of nitrogen (N) management in sugarcane farming leading to	Category 3	**Communications:** Research results will be shared and communicated with relevant Indigenous peoples/communities.	TBA

TWQ Hub Research Theme and Project Number & Name	Summary	TO Groups (Jurisdiction) and Category of Indigenous Engagement	Activities involving Indigenous partners	Identified Outcomes or Outputs and/or Indigenous Research Priorities
6.3: Reducing nitrogen runoff without reducing industry productivity	reduced dissolved inorganic nitrogen (DIN) losses via improved management advice and practical solutions. The synthesis project will bring together a range of approaches that are addressing mechanisms for reducing N-losses, with a particular focus on real-time water quality monitoring, detection of N- loss hot-spots, on-farm N management, reef credit trading and other economic levers that incentivise improved farm management practices.			
Theme 3 **6.4: Reducing end-of-catchment fine sediment loads and ecosystem impacts**	A wide range of NESP TWQ Hub projects have focused on the source, transport, fate and impact of sediments on estuarine, coastal and reef ecosystems. These projects have responded to the Reef 2050 Plan water quality targets and Water Quality Improvement Plan aiming to reduce the loss of sediments from catchments to the marine environment. To better manage sediment losses and prioritise remedial actions, it is important to be able to understand and contextualise all of the issues that are involved in this sediment story, from managing catchment sources to defining which types of sediment cause the most harm in the marine environment. The synthesis report will include a list of gully prioritisation tools and sampling methods for detecting sediment and bioavailable nutrients. This project will provide a narrative and synthesis to bring all these threads together. Synthesis of this new knowledge will provide advice on practical on-ground actions for land and sea managers, policy implications and identify remaining gaps for future research and management investments.		**Communications:** Research results will be shared and communicated with relevant Indigenous peoples/communities.	TBA

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Theme 3 **6.7: Learnings from applied environmental research programs: Elements for success**	The structure, governance and administration of large multidisciplinary applied environmental research hubs is critical to their ability to deliver new knowledge that funders and stakeholders need. While the MTSRF, NERP TE and NESP TWQ have differed in model and delivery since 2006, they have operated in the same region and delivered to similar stakeholders over that period of time. This is a unique opportunity to review and report on what has been learned about effective and efficient delivery of new knowledge for impact, for the benefit of future Commonwealth-funded applied environmental science programs.		**Communications:** Research results will be shared and communicated with relevant Indigenous peoples/communities.	TBA
CROSS-HUB SYNTHESIS PROJECT				
6.8: Integrated Environmental Assessment to inform Environmental decisions	This project is a cross-hub research collaboration that draws on the considerable experience, regional knowledge, data and networks in the NESP Hubs to explore the potential application, and benefits, of integrated environmental assessments (IEA), focusing on Northern Australia. The project will develop a process framework to guide IEA, identifying available information and critical knowledge gaps, methods for synthesis and analysis, and participatory approaches and governance settings. The project will review the existing tools and systems to support IEA and identify opportunities and potential location/s to test implementation in Northern Australia. The project will provide decision-makers in the Department (and State and Territory regulatory and planning agencies) with pathways for undertaking IEA approaches in Northern Australia, to underpin sustainable regional development and,	TBA Category 1	**Engagement and Communications:** Indigenous involvement in this project is crucial. Indigenous land tenures cover more than half of Australia, and Indigenous-managed land overlaps with the distribution of a high proportion of threatened species and internationally and nationally important biodiversity and cultural values in Northern Australia. Experiences of Indigenous groups with existing and current strategic approaches will be central to the recommendations about IEA approaches and the prospects for uptake of this work in future planning. Indigenous interests will be incorporated by engaging with representative bodies, the TSR Indigenous Reference Group, and by using the networks of the TSR Indigenous Reference Group and those of other Hubs, particularly the Northern Australia Hub.	TBA While this project may not identify specific environmental and climate science priorities, it may well contribute to Indigenous peoples and communities being more able to identify topics or areas requiring research as IEA is rolled out or applied.

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	avoid environmental harm to internationally important biodiversity assets and cultural heritage values.			