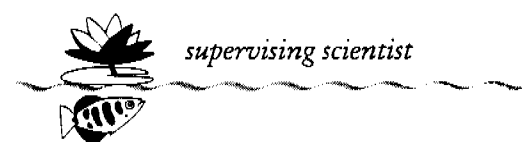




**Coastal monitoring  
node: Audit report of  
phase 1 activities**

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April 1999



**Environmental Research Institute of the  
Supervising Scientist  
(eriss)**

## **Alligator Rivers Region**

# **Coastal Monitoring Node: Audit Report of Phase 1 Activities**

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## Table of Contents

1. Introduction	1
2. Overview of the Project	1
3. Context for the ARR-CMN	2
4. Outline of the Project Phases	3
5. Assessment of the Effectiveness of Phase I Activities	5
6. Geographic Context for Future Phases	6
7. Overview of the Components of the Project	7
8. Concluding Remarks	12
Figure 1 - Framework	9
Figure 2 - Policy Setting	10
Figure 3 - Operational Systems	11
Appendix 1 - Supervising Scientists Report	15
Appendix 2 - Maps	18

## 1. Introduction

An overview audit was requested of the first phase of the establishment of a coastal monitoring node in the Alligator Rivers Region (ARR). Dr Arthur Johnston, Director of the Environmental Research Institute of the Supervising Scientist (*eriss*), made the request. The evaluation process meets one of the original conditions for funding for the Coastal Monitoring Node Project at *eriss*.

The audit had the purposes of:

- Checking that the work undertaken could attain the broad aims of Phase I;
- providing an overview of the structure and direction of the project;
- indicating the priorities for addressing any deficiencies from Phase I; and
- suggesting the priorities for ongoing phases of the project.

The first stage of the auditing process was carried out at *eriss* in January 1998. Ongoing contact has been maintained and updates obtained on work in-progress. The following material has been structured to give an overview and context for the project before indicating the effectiveness of work data, the way the project is progressing and priorities for the next phase of the program.

## 2. Overview of the Project

The Alligator Rivers Region Coastal Monitoring Node (ARR-CMN) has been initiated by *eriss* as a long-term project with the mission of:

*providing an environmental variability information system for use by all people with interests in the management of the coastal zone of the wet-dry tropics and a broad strategy for the development of similar nodes.*

The project commenced in October 1996 for a 12 month period with funding support from the Environment Australia Portfolio Marine Group. Following consultations with members of the Steering Group *eriss* extended the first phase of the project until February 1998.

The ARR-CMN was initiated as a follow-up to a project conducted under the federally supported Australian Coastal Vulnerability Case Studies as a component of the Commonwealth Coastal Action Plan. A report titled *Vulnerability assessment of the possible effects of predicted climate change and sea level rise in the Alligator Rivers Region, Northern Territory, Australia*, was produced by *eriss* as a Supervising Scientist Report. This document was also produced by the Climate Change Program as one project on the CD-ROM report for Australian Coastal Vulnerability Studies Project. An analysis of the case study and an assessment of further monitoring needs resulted in a recommendation that coastal monitoring nodes should be strategically developed. As a result of this recommendation the first of these coastal monitoring nodes has been developed for the ARR at *eriss*.

### 3. Context for the ARR-CMN

The mission for the ARR-CMN has been set within the context of the Commonwealth's coastal policy released by the Australian Government in May 1995. One of the initiatives under the Coastal policy is the establishment of a coastal monitoring system. The five objectives of the Commonwealth's coastal monitoring system are to:

- 1  determine the condition of, and detect changes in, the environment;
- 2  quantify the levels of natural variability;
- 3  determine if current and projected use is ecologically sustainable;
- 4  assess the effectiveness of management policy and practices; and identify new management inputs required to maintain or enhance environmental quality and ecologically sustainable use; and
- 5  provide a baseline for local and regional studies and development.

By working towards fulfilling the mission of the ARR-CMN, three basic requirements of the Commonwealth's coastal monitoring system will be met. Namely the need to:

- ensure that the monitoring program addresses management questions;
- coordinate Commonwealth information collection exercises and monitoring initiatives within the Portfolio and with other Commonwealth agencies; and
- generate understanding, cooperation and support of the key players in coastal management of the region through involvement and ownership rather than centralised control.

The aims of the ARR-CMN are to:

- develop a regional capacity to measure and assess change on the floodplains and coast of Kakadu National Park, its catchment area, the wider Alligator Rivers Region, and in the wet-dry tropics in general;
- increase Australia's capacity in the monitoring of coastal change through establishment of a coordinated monitoring program which can function as a benchmark for monitoring in the wet-dry tropics and eventually in low lying coastal areas subject to seasonal episodic flooding; and
- provide a regional and local benchmark against which to measure environmental changes in the Magela Creek system, which could be attributed to mining and other human activities.

The strategies to be used in order to attain the aims are as follows:

- Establish procedure for determining the coastal environment information needs of regional stakeholders.
- Instigate standing operating procedures to enable *eriss* to manage efficiently and effectively the day to day activities of personnel, consultants and researchers involved with the coastal monitoring node.

- Initiate research systems that will enable:
  - reporting on changes to environmental conditions;
  - physical and biological monitoring to be carried out in the field; and
  - the information resulting from all forms of research to be managed.
- Disseminate information for use by regional stakeholders, owners and managers in implementing coastal zone management programs and projects.
- Provide for ongoing independent review of the effectiveness of the environmental variability information system in meeting the needs of regional stakeholders, owners and managers for integrated coastal zone management.

By achieving the aims of the coastal monitoring node *eriss* should be able to provide benchmarks, both nationally and internationally, from which to measure change in wet-dry tropical environments. The ARR provides an excellent opportunity to document environmental change because of its cultural and nature conservation as well as its natural resource significance. Also, the region has a sound history of applied environmental management research. Thus, there is a considerable body of material that could be collated and synthesised to provide baseline descriptions of the essential characteristics and attributes of change in this type of environment.

The development of further expertise in monitoring changes to the socio-cultural, physical and biological conditions of the region are of both national and international significance to the management and understanding of the wet-dry tropics in general. In particular, the establishment of a broad monitoring framework will assist the overall monitoring effort in the region to differentiate changes to natural factors from those due to mining and other activities.

#### 4. Outline of the Project Phases

The ARR-CMN is being developed by *eriss* in three phases. Phase I had the specific purpose of providing a georeferencing framework as well as the information management and monitoring systems for the project. Phase II entails the systematic documentation and monitoring of environmental conditions; During Phase III it is envisaged that the lessons learnt in Phases I and II can be extended to programs in other wet dry tropical areas in Australia and overseas.

Specifically, the aims of the Phase I activities for establishing the ARR-CMN were:

- 1  to establish a survey framework for georeferencing;
- 2  to provide an information management system for storing spatial information; and
- 3  to collate existing baseline information on coastal change and management and provide an initial set of reports on the existing environmental conditions of the ARR.

On the basis of information provided by *eriss*, it is envisaged that Phase II will be divided into three broad components.

- Changes to the coastal floodplains of the Alligator Rivers Region will be monitored using baseline information and the geodetic survey framework established during Phase I of this project. This will include further analysis of head expansion of tidal creeks, saltwater intrusions and mangrove colonisation. A review of the sedimentation and stratigraphic resources and processes will also be completed.;
- Hydrological and meteorological information already collated will be interpreted and a sampling and monitoring framework devised. Changes to the coastal and estuarine shorelines and mangroves will also be investigated using sampling regimes based on ground and imagery techniques which will be comparable with techniques used elsewhere;
- Data collation will continue, and be linked to needs for coastal monitoring outside the region. Local communities adjacent to the region have been invited to participate in the collation and monitoring exercises. This will be extended to develop the utility of the approach for coastal monitoring across the wet-dry tropics.

During Phase II remote sensing technology including satellite imagery and aerial photography will also be used in conjunction with the information obtained from the differential Global Positioning Section (dGPS). This capability will extend the spatial information systems available for the management of coastal and other natural systems in the ARR. This capability is essential for monitoring natural variations in changing environmental conditions in the region as well as the potential impacts due to human intrusion (mining, pastoral, tourism).

Phase III extension activities should demonstrate the capability of *eriss* to market its expertise in coastal and wetland research and monitoring to other clients in Australia and overseas. This phase represents the value added for the investment made in developing the ARR-CMN using the professional and technical resources of *eriss*. Extension activities could be initiated through strategic partnerships and will have full cost recovery. Information generated in Phases I and II which is applicable to other areas will be used as one of the tools for marketing the capabilities of *eriss* in the field of coastal monitoring and providing issue focused information for ICZM.

## 5. Assessment of the Effectiveness of Phase I Activities.

The funds for Phase I of the project provided for one professional and one technical staff. The acquisition of dGPS technology and capability was the prime activity for Phase I. The focus on establishing spatial referencing capability was viewed as an essential tool for ongoing physical and biological monitoring in the region. Without this capability, the monitoring would not be able to be undertaken at the scale or the level of accuracy needed to document change and provide the resolution necessary to differentiate climate induced change.

A dGPS was purchased to facilitate the development of an accurate georeferencing capability and monitoring framework for the ARR. To increase the accuracy of the dGPS, a permanent GPS base station has been established at Jabiru Airport (immediately adjacent to *eriss*). The establishment of the GPS base station occurred after extensive negotiation between *eriss* and the Australian Surveying and Land Information Group (AUSLIG). This infrastructure enables *eriss* to accurately georeference (or locate) and map many of the geomorphic and biologic features on or associated with the coastal wetlands of the ARR, and will be an integral part of the ongoing monitoring.

Establishment of the geo-referencing framework has been successful. The full capability of the system has still to be fully determined. Initial project work has demonstrated the utility of the system for establishing monitoring stations for use in accurately documenting existing environmental conditions. Thus, the first aim of the Phase I activities has been attained.

Work is well underway for the establishment of an information management system for the ARR-CMN. The system integrates basic geographic information systems technology and encompasses the management of:

- spatial information gained from aerial photography, satellite imaging and field monitoring data;
- bibliographic materials documenting past research and descriptions of environmental conditions; and
- reports and publications prepared as output from the project.

The aim is to provide an information management system. From one perspective, it could be argued that this aim has been attained. From another perspective, it could be argued that the aim needs to explicitly state that this is an ongoing activity. Hence, the aim should have stated "*to provide and maintain an information management system.*" Maintenance of the system is essential for the long term viability of the ARR-CMN.

The third aim of the project was "*to collate existing baseline information on coastal change and management and provide an initial set of reports on the environmental condition of the ARR.*" Projects have been initiated that will effectively allow the aim to be attained. The scope of the projects is that outlined in the initial proposal for the establishment of the node.



Projects have progressed in varying degrees and a considerable body of information is being produced in the form of a dedicated Supervising Scientist Report, stand alone project reports, a post graduate dissertation and papers to be published in books and journals. The material assembled to date in different forms of documentation is at Appendix 1.

Collectively, the output is commendable and it could be argued that the third aim is being attained. Collation of baseline material on the environmental conditions of the region is more than one year's work. Phase II activities will continue this aspect of the ARR-CMN project and further the attainment of this aim.

## 6. Geographic Context for Future Phases

The georeferencing framework established through Phase I of the project encompasses the whole of Kakadu National Park (KNP). The park comprises a major portion of the ARR (Map 1). Phase II of the monitoring node will maintain the geographic extent of the georeferencing framework established under Phase I of the project, and where applicable extend to surrounding areas (Map 2). The maps are provided in Appendix 2 of this report.

KNP has immense heritage value and is listed as a World Heritage site for both cultural and natural values. Its extensive coastal wetlands are also listed as internationally important with the Ramsar Convention. The Park is largely Aboriginal land that is leased to the Commonwealth as a national park. It is managed jointly by a Board of Management and Parks Australia North.

The area proposed to be covered by extending Phase II activities is shown on Map 2. Biophysically, the area of interest encompasses all of the drainage systems, which flow into the Van Dieman Gulf, as well as the waters of the Gulf. This extended geographic boundary for the ARR-CMN is viewed as essential in order to take into account coastal management issues on coastal lands fronting onto van Diemans Gulf which:

- are managed either by the Northern Land Council (NLC) on behalf of the Aboriginal people; or
- are under the administration of the Northern Territory Government (being leasehold, privately owned and crown reserve properties).

The framework established in Phase I has sufficient utility to be extended in Phase II to the adjacent floodplain systems that fall under different jurisdiction and support different land uses. This extension will be conducted through liaison with local community groups and build upon existing collaborative wetland monitoring and management projects. For long term measurements, Phase III activities will continue in the area delineated on Maps 1 and 2. Other wet dry tropical areas in Australia where 'extension' activities could be covered include the river systems to the west of Darwin, the Kimberley, and the Gulf of Carpentaria. Extension activities could be conducted overseas in Africa and parts of monsoon south east Asia. Already *eriss* and Wetlands International have received support from the Asia Pacific Network for Global Change to initiate vulnerability assessments at two large Asia Pacific Wetlands. Also, *eriss* has contributed to a monitoring strategy for the Volta delta, Ghana.

## 7. Overview of the Components of the Project

Following discussions with the researchers at *eriss* who are working on the establishment of the ARR-CMN, a framework was developed for the project. This framework is shown in Figure 1 and the key components are the requirements of the communities of interest, the policy context for the coastal monitoring node, and the operational systems and implementation. These components are discussed briefly as follows:

**Policy Setting** Figure 2 outlines the interrelated aspects of the policy context for the coastal monitoring node. The key policy components are the nationally and regionally focussed coastal policy and wetlands environmental management issues, international conventions and agreements (these components are the factors that interface governmental policy and practical commitments), national intergovernmental mechanisms, the legislative base, and policy programs and projects delivered at the regional and community level.

These components may be considered as drivers which link commitments and obligations at an international level to the on the ground activities funded by governmental programs and projects which are aimed at implementing specific policy agendas related to the coastal environment. Responses to the drivers vary across the communities of interest (indigenous people, industrial and commercial, local residents and visitors). Conceptually, the coastal monitoring node enables a more integrated approach to be taken to linking national policy programs and project initiatives to the needs of regional communities.

By improving understanding of the natural variability of coastal systems local communities are in a better position to implement on the ground environmental management projects in a more cost effective manner. This can be done by developing educational materials based on that improved level of understanding. When undertaking environmental management projects communities need to be able to see how their activities are related to other higher order agendas. For example, how projects aimed at conserving wetlands and the quality of riverine systems can be linked back to meeting commitments with regard to providing habitats that may be used by migratory birds.

**Operational Processes** Figure 3 summarises the components of the strategic framework for the ARR-CMN. They are:

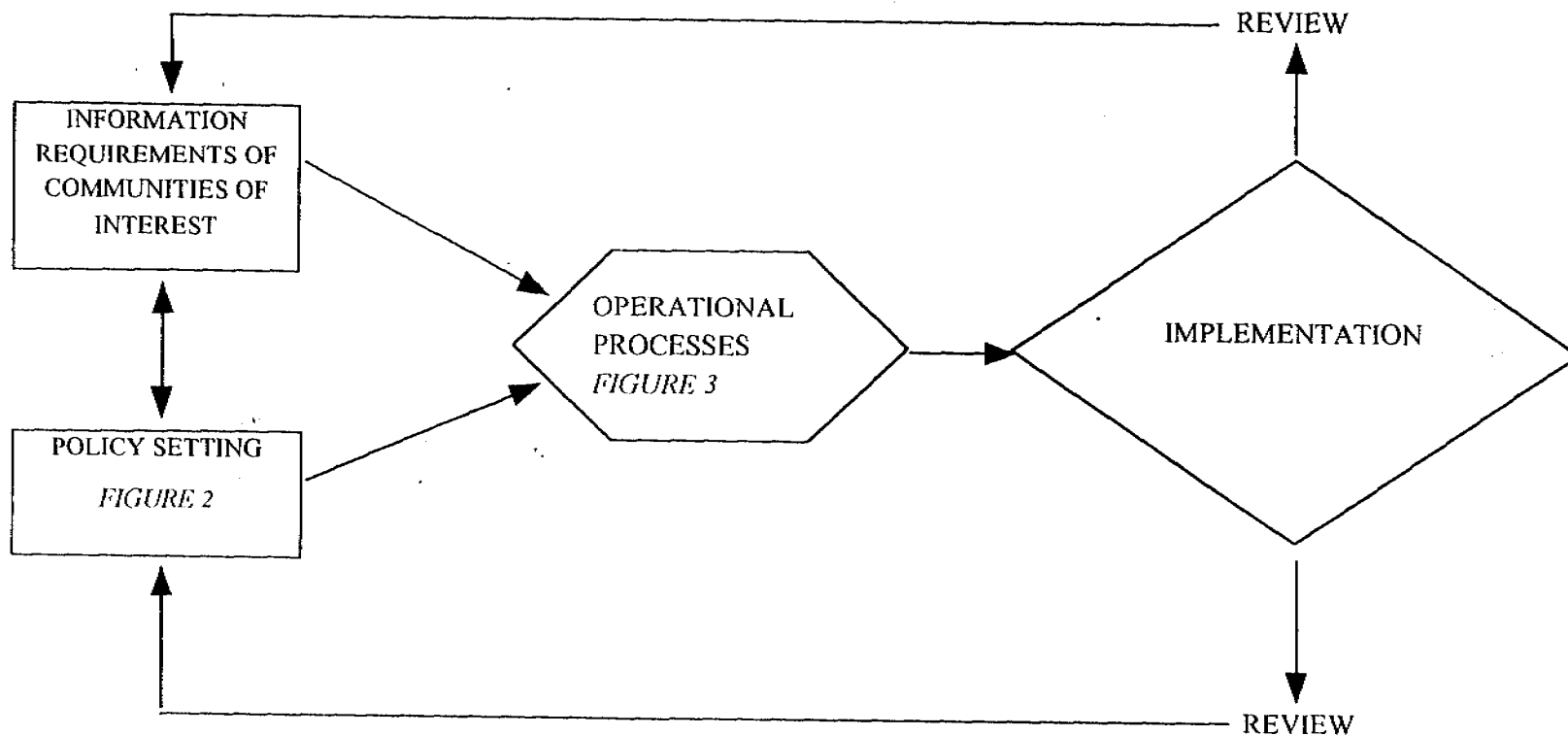
- a needs analysis to determine information needs in relation to research capacities and capabilities;
- guidelines and systems for the establishment of operational processes to generate environmental information;
- the application of environmental information for integrated coastal zone management; and
- the review processes to ensure that the information being provided is useable by regional stakeholders.

*Implementation: Community and Governmental Involvement* Maintaining community and governmental involvement in the application of information generated through the coastal monitoring node is a major thrust of the systematic approach adapted for the establishment of the ARR-CMN. The core mechanisms for monitoring involvement relate directly to the utilisation of appropriate information for the implementation of on the ground programs and projects. Such projects have the purpose of managing components of the coastal environment of wet-dry tropical regions. The tools for initiating this mechanism are training, education and awareness which can be achieved using electronic and hard copy publications, the scientific journals, departmental notes, video materials as well as facilitated field trips and workshops.

Phase I was implemented in KNP after consultation with traditional Aboriginal land owners and community representatives identified by Parks Australia North. The framework has been developed with support from The University of Western Australia, Northern Territory University, Bureau of Meteorology, Parks Australia North, NT Department of Lands Planning and the Environment and the Northern Land Council. Local community (such as Lower Mary River Landcare Group) and Aboriginal groups (such as The Bawinanga Aboriginal Corporation) have been included on the Phase I steering group. CSIRO has also expressed an interest in the monitoring node program, as has AGSO. AUSLIG has already provided support.

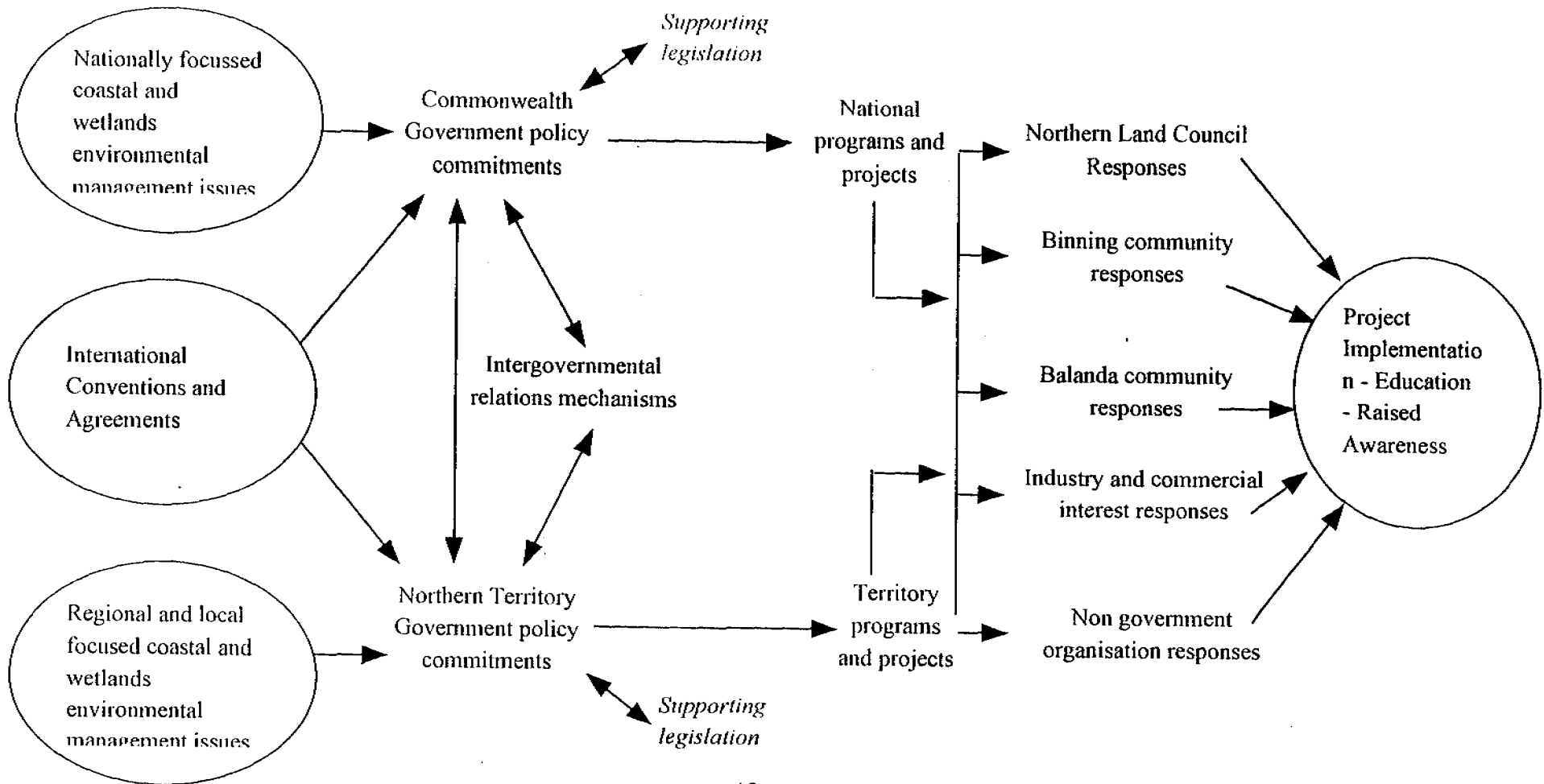
FIGURE 1

FRAMEWORK FOR THE  
ALLIGATOR RIVERS REGION COASTAL MONITORING NODE (ARR-CMN)

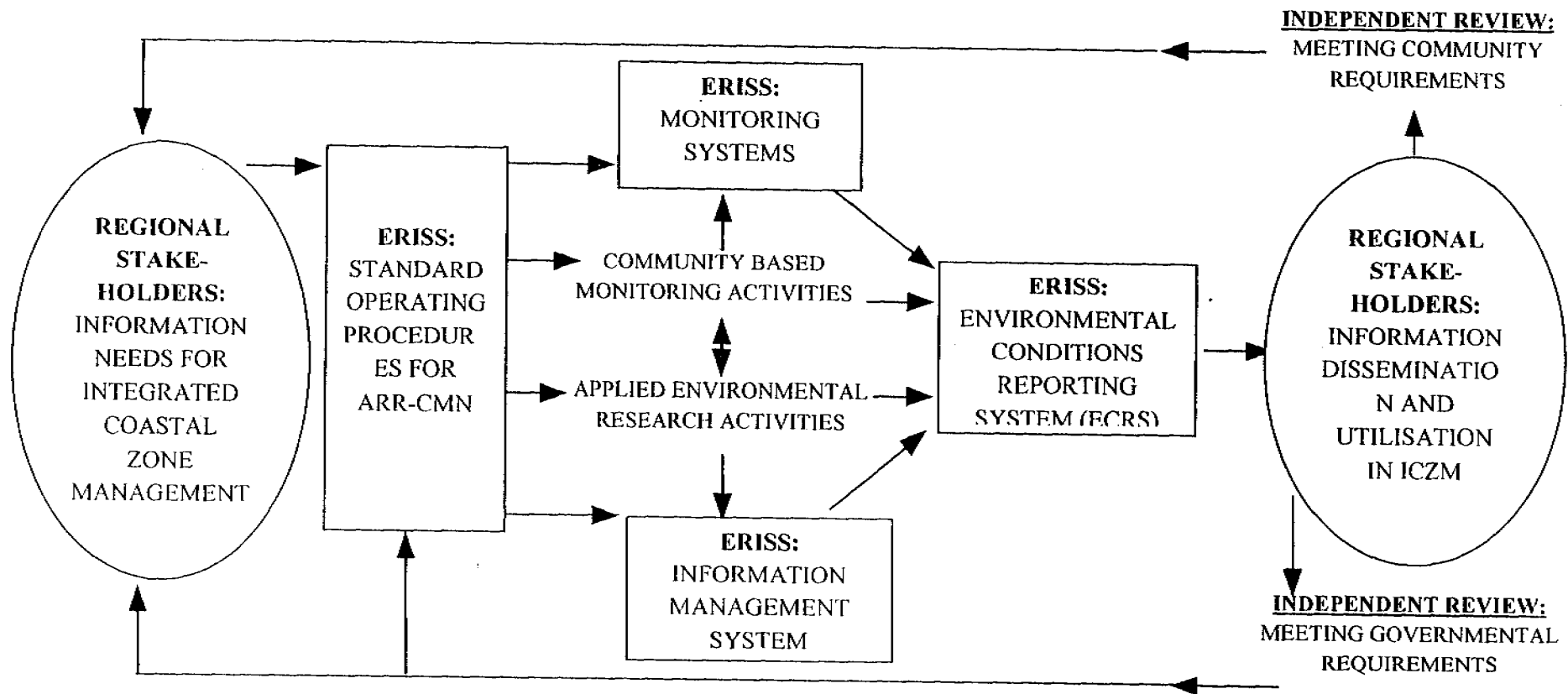


## FIGURE 2

### POLICY SETTING FOR THE ALLIGATOR RIVERS REGION COASTAL MONITORING NODE



**FIGURE 3**  
**OPERATIONAL SYSTEMS FOR THE**  
**ALLIGATOR RIVERS REGIONAL COASTAL MONITORING NODE (ARR-CMN)**



## 8. Concluding Remarks

Establishment of the ARR-CMN is an innovative and difficult project. There is no other project in Australia or overseas on which to model:

- the scope of work to be undertaken;
- the research methodology; and
- the anticipated outcomes.

The only similar coastal monitoring project is at Jervis Bay, NSW and this is too dissimilar to be used in the ARR.

Monitoring environmental change with the purpose of documenting the natural variability of biophysical system is a long-term venture. To be able to differentiate between natural change and changes that could be due to human or other forcing factors requires a high level of scientific rigour. However, the rigorous approach needs to be tempered with flexibility to allow for adaptation of methods and techniques in the light of the results being obtained. Putting in place a geo-referencing framework on which to carry out physical and biological monitoring. The framework will ensure that the documentation of existing conditions and the measurement of change is rigorous yet flexible.

Attainment of this aim is essential to the long-term success of the project. Although the other two aims of Phase I of the project have not yet been fully attained; as stated earlier the second aim of the ARR-CMN should have been stated as being ongoing, the work completed has been effective. As stated earlier, the wording of the aims could be taken to mean that the work could be ended at a specific point and progress measured. This is not possible. Both aims relate to ongoing work. Nevertheless, putting semantics aside, the successful commencement of this work for the second and third aims and the results obtained augers well for the success of Phase II and III of the project.

With regard to providing an overview of the project, this has been done. A solid framework has been developed for the ARR-CMN and the links established between policy, the operation of the node and the implementation of projects at the community level. Having a clear focus on the provision of information on environmental variability should ensure that the products of the process have wide utility. Further, the model developed is specifically generic to be applied to other coastal monitoring situations.

The further two phases envisaged for the project provide a clear direction for the ARR-CMN. For the effort put into the project to date to be optimised, the following priorities should be considered.

The methodology developed for the ARR-CMN should be fully documented and disseminated. The documentation should include a detailed explanation of the policy linkages (Figure 2) and the operational processes used by *eriss* to establish and run the node (Figure 3).

All documentation should be completed, peer reviewed and published by the end of the financial year 1997/98. Consideration should be given to establishing a web-site through ERIN and having all materials available as electronic publications.

Physical and biological monitoring projects identified in the initial proposal documentation and subsequent *eriss* papers should be reappraised in the light of the results of Phase I activities. Specifically, in the context of material assembled in the Supervising Scientist's Report, key projects where links to readily identifiable changes should be commenced in the 1998 dry season. These should include all facets of the project from changes to the shoreline and channel morphology to the delineation of areas where changes in habitats and biota can be recorded.

Focus for the dry of 1998 and the wet of 1998/99 should be on perfecting the use of the geo-referencing tools and assorted information management techniques. This activity will be based on key field projects identified in consultation with the stakeholder groups. Special attention will need to be given to confirming:

- firstly the links that these activities have to the overall program for the project; and
- secondly the utility of the result for the stakeholders.

The field monitoring research will be supported by the information management system outputs, in terms of information on the physical, biological, social, and cultural component of the environment are the focus of the environmental variability information system. These outputs will need to be documented and presented so that the information provides essential input to implementable projects being undertaken in the ARR. A derivative of the output should be papers which can be used as marketing tools for Phase II of the ARR-CMN project.

As such, the papers should demonstrate how the research capability developed by *eriss* is transferable to other wet-dry tropical areas.



**APPENDIX 1**

**SUPERVISING SCIENTISTS REPORT**

## Supervising Scientists Report

The list of projects contained in Annex 3 of the minutes from the steering committee meeting have essentially been maintained. The titles might have varied slightly but have all been scheduled for inclusion in a Supervising Scientist Report, titled "**Environmental Baseline for Coastal Monitoring in the Alligator Rivers Region**". The status of the various papers which collectively make up the text of the report (section by section) are as follows:

### 1 Introduction

Towards a Coastal Monitoring Node for the Alligator Rivers Region  
*CM Finlayson, MJ Saynor, R Hall & I Eliot.*

Not started, will be written when the other papers are completed.

### 2 Coastal Monitoring Node for the Alligator Rivers Region

Establishing the Monitoring Framework  
*MJ Saynor.*

Text completed and edited, waiting on diagrams to be drafted.

Coastal Monitoring Node: Information Management  
*A Bull*

Draft document written requires editing.

### 3 Environmental Baseline for the Alligator Rivers Region

History of Land Use and Environmental Change in the Alligator Rivers Region  
*AG Spiers*

Completed, ready for final editing.

Surface Hydrology of the Alligator Rivers Region  
*D Walden*

Completed, ready for final editing

Climate of the Alligator Rivers Region  
*MJ Saynor, A Walden, R Hall & B Ryan*

Draft document written requires editing and drafting of diagrams

Coastal Change and Shoreline Movement in the Alligator Rivers Region  
*MJ Saynor*

Initial draft only

The Physical Oceanography of van Diemen Gulf: Baseline Information  
*I Eliot & MJ Saynor*

Draft document written requires editing and drafting of diagrams

Changes in Mangrove Distribution  
*R Hall & MJ Saynor*

Text completed and edited, waiting on diagrams to be drafted.

Sediments and Stratigraphy of floodplains and coastal margins of the Alligator Rivers Region  
*MJ Saynor*

Literature obtained, initial draft only

Changes in distributions of Salt Flats

*R Hall*

Literature obtained, initial draft only

Use of Remote Sensing Techniques to monitor changes in the Alligator Rivers Region  
*A Bull*

Literature obtained, initial draft only

**Other outputs include:**

Cobb, S.M. (1997) Channel Expansion and the Geomorphology of Tidal Creeks in Kakadu National Park, Northern Territory. Unpub. Hons. University of Western Australia.

Cobb, S.M., Saynor, M.J., Hall, R., and Eliot, I. (In Prep) Tidal Creek extension and saltwater intrusion of coastal wetlands in the Alligator Rivers Region, Northern Territory. To be submitted to the Journal of Coastal research.

Cobb, S.M., Saynor, M.J., Hall, R., Bull, A., Eliot, I. ??? (In Prep) Companion paper to above not sure of title etc as very early initial drafts. To be submitted to the Journal of Coastal research.

Eliot, I. Waterman, P. & Finlayson, C.M. (1998) Wetlands of the Alligator River Region: climatic change and sea level rise. Wetland Ecology & Management (submitted)

Finlayson, C.M. Eliot, I. & Eliot, M. Monitoring and assessment of coastal change in Australia's wet-dry tropics. Supervising scientist report, Supervising Scientist for the Alligator Rivers Region, Canberra. (In Prep).

Finlayson, C.M. & Eliot, I. Wetland monitoring in Australia's wet-dry tropics: A paradigm for elsewhere. In Establishing A Protocol for Monitoring Wetlands on the Swan Coastal Plain. Eds. P, Horwitz & J, Davis. (In Press)

Finlayson, C.M. Stows, M.J. & Linder, G. (1998). Degradation and rehabilitation of wetlands in the Alligator Rivers Region of Northern Australia. Wetland Ecology & Management (in press)

Finlayson, C.M. Thurtell, L. Stows, M.J. Applegate, L. Barnes, P. & Wellings, P. (1998). Local communities and wetland management in the Australian wet-dry tropics. In Wetlands in a Dry Land: Understanding for Management. Ed W.D. Williams. Environment Australia, Canberra

Finlayson, C.M. Yinarkuk, D. Thurtell, L. Stows, M.J. & Cooke, P. Local community management of Blyth/Liverpool Wetlands, Arnhem Land Northern Territory, Australia. In "Indigenous and Local People's Involvement in Wetland Management - Case Studies" ed A de Sherbinin, IUCN, Glad, Switzerland (submitted).

Saynor, M.J. *Eriss's* Differential Global Positioning System: User's Manual. Internal Report for the Supervising Scientist for the Alligator Rivers Region, Canberra. (In Prep).

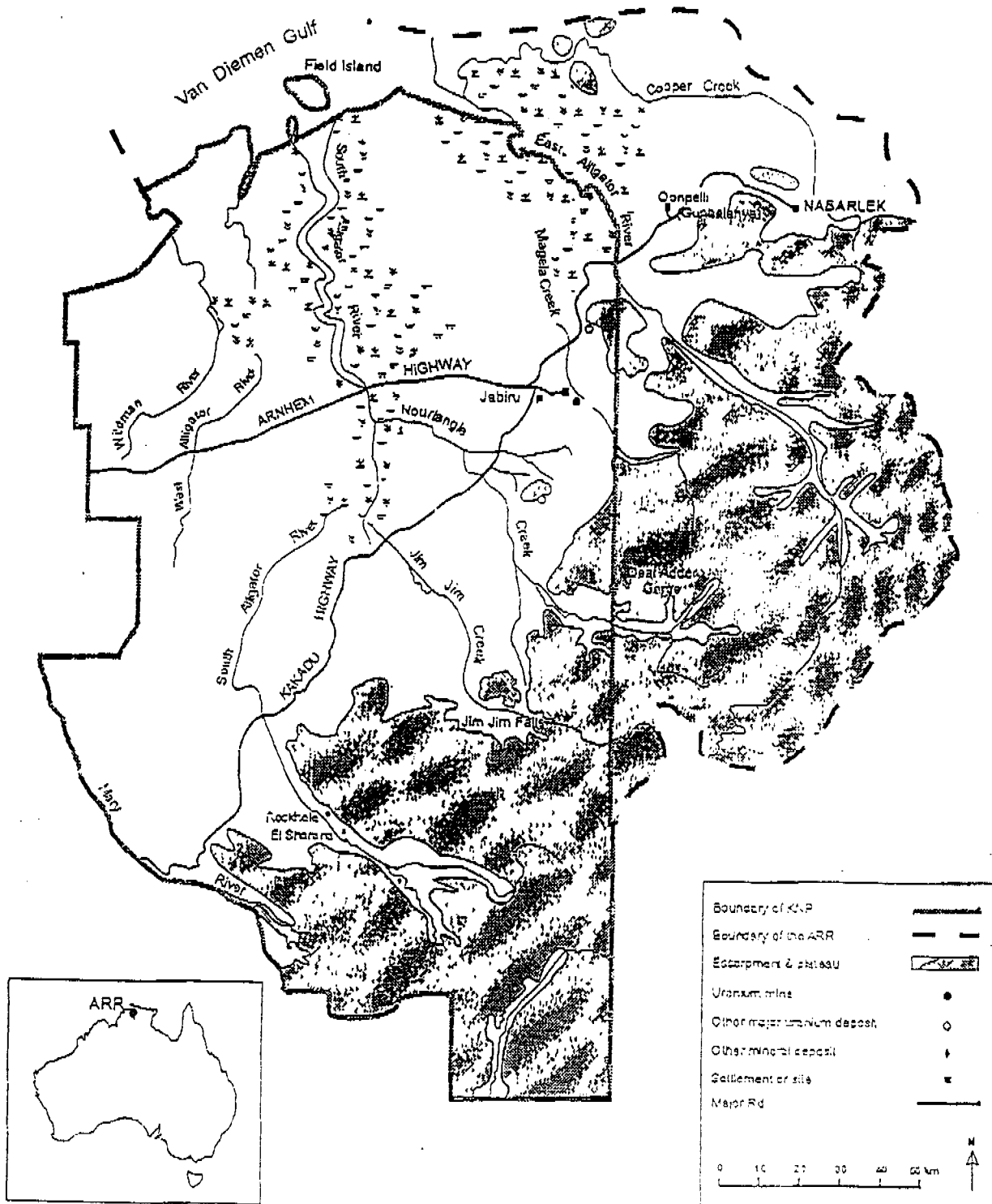
**Other Documents and Papers:**

Establishment of a bench mark register (Jabiru Registry File **JR-05-274**) and working document - Survey Benchmarks, Geodetic Marks and GPS marks in Kakadu National Park are key outputs of the project.

**APPENDIX 2**

**MAPS**

# MAP 1 - ALLIGATORS RIVER REGION FOR PHASE I ACTIVITIES



# MAP 2 - EXTENDED REGION FOR PHASE II ACTIVITIES

