internal report



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1 Introduction to the Environmental Research Institute of the Supervising Scientist

The Environmental Research Institute of the Supervising Scientist (*eriss*) is part of the Supervising Scientist Division of Environment Australia. It has staff and facilities in Darwin and Jabiru in the Northern Territory. *eriss* was established to undertake independent research on behalf of the Australian community to establish the best methods available for the protection of people and ecosystems in the Alligator Rivers region (Alligator Rivers Region) during mining operations and rehabilitation. Following a decision by the Australian Federal Government in 1993, a program of research began on the ecology and conservation of wetlands. This has resulted in the development of the National Centre for Tropical Wetland Research (*nctwr*) which is a formalised alliance between *eriss*, James Cook University, Northern Territory University and the University of Western Australia.

eriss research activities are conducted under two main themes

- Research on and monitoring of the impact of mining on people and the environment, focussing on the effects of mining in the Alligator Rivers Region;
- Research on the ecology and conservation of tropical wetlands.

These activities are conducted by four research programs: Environmental Radioactivity, Ecosystem Protection, Hydrological and Ecological Processes and Ecological Risk Assessment. Assistance is provided by a Research Support and Communications program and with administrative and information management services being provided by staff from the Office of the Supervising Scientist.

The separate research programs provide an administrative framework for conducting research activities. Collaboration across programs is common and external input is also necessary. This enables administrative tasks to be undertaken alongside research projects that may be complemented by extra expertise. The research program is integrated and designed to address both short-term immediate goals and longer-term strategic outcomes. In these respects the operational plans prepared by Energy Resources Australia are important planning documents. The key large issues currently being considered within the research programs are:

- Baseline analyses and descriptions of ecosystem features, such as biodiveristy and ecosystem services and functions at a landscape-scale, major environmental pressures, and aspects of human health related to radionuclide transport in the region. Note that the site of the proposed Koongarra mine has not received a great deal of attention and other biotic pressures attributable to mining operations, such as weed invasion or dispersal, may need further consideration. The development of effective survey and assessment techniques and data handling procedures are included in this component of the research program.
- Operational issues and ongoing monitoring, including, for example, analyses of water management options and their long-term function, and stream monitoring which is also dependent on continued appraisal and possibly development or refinement of monitoring techniques and data management systems. Radionuclide issues in relation to the protection of people are considered; other issues of social well-being are not within the remit of the Institute.

• Rehabilitation issues and monitoring of their immediate and long term success, including land form stability and erosion, revegetation and re-establishment of near-natural ecosystems, using field measurements and modeling techniques. This includes the development of suitable techniques for assessment and monitoring, such as those needed for ecosystem rehabilitation and monitoring at Nabarlek and in the South Alligator Valley, and for human health associated with radionuclides in both the short and long-term.

The breadth of the research program requires a multi-disciplinary team that encompasses both specialist and generalist scientific staff. Integration across programs is necessary given the topics covered. Equally, a strong emphasis on corporate data and information management is essential to avoid unnecessary repetition and to ensure maximum use is made of information collected previously. The latter has been greatly assisted by the advent of new technology and a commitment to reporting and discussion of research and monitoring results. The Alligator Rivers Region Technical Committee (Alligator Rivers RegionTC) is a central feature of scientific discussions and provides a focussed forum for guidance on the scientific program. It is anticipated that Alligator Rivers RegionTC which has a high level of independent scientific expertise will keep stakeholders informed of progress with research planning and implementation. This will include links with stakeholders represented on the Alligator Rivers Region Advisory Committee (ARRAC).

The activities of the research and monitoring programs and the activities of the Research Support and Communication program for 2002–2003 are described in this workplan. The activities of the Office of the Supervising Scientist (**oss**) are described in the workplan for the **oss**. In developing the 2002–2003 workplan, consideration has been made for the relocation of most research staff from Jabiru to the new purposed built facility in Darwin.

In addition to the tasks and indicators shown in this workplan we spend considerable time attending to formal government processes that assist the implementation of our programs and contribute to program, structural and personal development within Environment Australia. They include compliance with and promotion of Occupational Health and Safety procedures, personnel development schemes, career training, responding to requests for departmental briefs and information needs. We also provide advice to national and international environmental committees and panels.

An outline of the 2002–2003 workplan is provided in this document in a standardised document that includes an objective, list of priority activities and a table of all approved projects. The table includes an outline of the aims, estimated work level, indicators and outcome. This year we have included, where appropriate, additional information that outlines the location of the projects, the type of sampling required, the dates when it will be undertaken and consultation that is required.

The outputs column refers to internal outcomes linked to the Portfolio Budget Statements for the Supervising Scientist Division and are numbered:

1 Industry

- 1.1 Supervision of uranium mining in the Alligators Rivers Region
- 1.2 Protection of the Alligator Rivers Region ecosystem
- 1.3 Radiological protection in the Alligator Rivers Region
- 1.4 Minesite erosion in the Alligator Rivers Region

2 Inland waters

- 2.1 Wetlands risk identification and assessment
- 2.2 Wetland ecology and inventory

2 Environmental Radioactivity

To provide advice on the protection of people from radiological risk during and after mining activities in the Alligator Rivers Region and to use specialist expertise in remote sensing and isotopes to assist related environmental protection work in the Alligator Rivers Region and elsewhere.

Priority activities in 2002–03 include:

- Establish a radiation detection laboratory in Darwin and provide a commercial radioanalytical facility, with a focus on low-level radionuclide analyses by alpha and gamma spectrometry;
- Develop a remote sensing facility with application across the SSD;
- Establish a monitoring regime for Ranger and Jabiluka, for radon progeny and long-lived alpha activity in air and radionuclide concentrations on sediment;
- Collect and analyse data on radon exhalation and lead-210 deposition in the Ranger region;
- Analyse and publish data related to radionuclides in flora and fauna of the Alligator Rivers Region, in particular in relation to Aboriginal bush foods.

Establishment of a new radiation detection laboratory in Darwin will be a major focus of the program during 2002–2003. This will include installation and calibration of alpha and gamma spectrometry equipment, and a beta counter to improve turnaround time on Pb-210 analyses; implementation of a new system for sample preparation for gamma spectrometry; development of a Quality Management System, including a database for sample and analysis tracking; development of analysis and reporting methods for radiological monitoring of the Ranger and Jabiluka operations; and continued development of the client base for commercial analyses.

A project on radon exhalation and lead-210 deposition in the Ranger/Jabiluka region was started in 2001–2002 and will be completed over the 2002–2003 yearly cycle; this project will provide important data needed to link existing datasets on air quality with radon and dust dispersion models.

Several new projects will build on the remote sensing facility established in 2001–2002. These include projects on use of CASI, IKONOS and airborne gamma imagery for assessment of mangrove response to coastal environmental change, rehabilitation success of minesites, and broadscale landscape mapping. Most of this work involves analysis of data recently acquired or to be acquired in 2002–2003, and initial work will focus on data manipulation and analysis as well as groundtruthing.

 Table 2.1
 Bioaccumlation-related projects for 2002–2003 in the Environmental Radioactivity program

Project and aims	Staff commitment (p/w)	Targets	Outputs				
Identification of traditional Aboriginal foods for	Identification of traditional Aboriginal foods for radiological assessment						
<i>Aim: 1)</i> Identification and cataloguing of traditional Aboriginal foods collected in the Alligator Rivers Region, including preparation techniques; 2) Measurement of radionuclide content of traditional foods for estimation of radiological significance <i>Project leader:</i> B Ryan <i>Project file:</i> JR-05-281	Res staff: 4	 <i>Commenced:</i> 1997 FAQ video for Aboriginal people: December 2002 Internal Report: review of available information on traditional foods/sites: March 2003 	1.3				
Clients: Supervising Scientist							
Location: Magela Creek system and upper Sout	h Alligator River V	alley. Ranger minesite					
Type of sampling: None required (data analysis	& publication only	y)					
Dates: Throughout 2002–03							
Consultation: Extensive past involvement of Aboriginal people in collection of samples. Dissemination of results required after analysis, particularly to Aboriginal people at Mudginberri and the South Alligator River valley, Park Rangers							
Radiological impact arising from uptake by fr	eshwater mussel	s in the Alligator Rivers Region					
Aim: Analyse and publish the data currently available on uptake of radionuclides by freshwater mussels in the Alligator Rivers Region Res staff: 4 Commenced: July 1997 1.3 Project leader: P Martin Journal paper: March 2003							
Clients: Supervising Scientist							
Location: Magela Creek system and upper Sout	h Alligator River V	'alley					
Type of sampling: This project relates to data analysis & publication of results for mussel samples collected from Georgetown and Mudginberri billabongs and the upper South Alligator River Valley between 1983 and 2000.							
Dates: Throughout 2002–03							
Consultation: Involvement of Aboriginal people in collection of samples. Dissemination of results required after analysis, particularly to Aboriginal people at Mudginberri and in the South Alligator River valley, and Park Rangers							
Collaborating partners: CSIRO Division of Land	d and Water						

Table 2.2 Air quality-related projects

Project and aims	Staff commitment (p/w)	Targets	Outputs				
Radiological impact arising from dispersion of dust							
<i>Aim:</i> Determine dust dry and wet deposition factors to enable prediction of the transport of radionuclides on dust from uranium minesites	Res staff: 4	<i>Commenced:</i> 1998Journal paper: June 2003	1.3				
Project leader: B Ryan							
Project file: SG2000/0171							
Clients: Supervising Scientist							
Location: Ranger minesite, Jabiru East, Kakadu Highway	National Park hea	adquarters, South Alligator River near Ar	nhem				
Type of sampling: Air filter and rainwater samples							
Dates: Throughout 2002–03							
Consultation: Parks Australia, Energy Resource	es Australia, Jabiru	a Town Council, Northern Land Council					
Collaborating partners: Monash University							
Use of lead (Pb) isotopes in the study of the r	neso- to long-ran	ge dispersion of dust from Ranger					
Aim: Determine lead isotope ratios on dust deposited on leaves through the Alligator Rivers Region to study the longer-range dispersion of dust from the Ranger minesite	Res staff: 1	 Commenced: July 2001 Collection of leaf samples throughout Kakadu National Park: July 2002 	1.3				
Project file: SG2001/0157		 Establish: air sampler at Mudginberri Rn station; September 2002. Lead analysis at Curtin University: Nevember 2003. 					
Clients: Supervising Scientist							
Clients: Supervising Scientist Location: Sample locations primarily on Ranger lease, some locations near Jabiru, Mudginberri and along Four-gate Road Type of sampling: Collection of leaves, air sampling							

Dates: Leaf sampling in July 2002, dust sampling throughout the Dry season 2002. Lead isotope analysis throughout the year

Consultation: Parks Australia North, especially with rangers from Nourlangie District. Dissemination of results to general public.

Collaborating partners: Curtin University of Technology

Project and aims	Staff commitment (p/w)	Targets	Outputs				
Radon concentrations within the Alligator Rivers Region							
<i>Aim:</i> Establish a network of radon and meteorological stations in the Alligator Rivers Region and collect time-series data <i>Project leader:</i> A Bollhoefer <i>Project file:</i> JR-05-302	Res staff: 11	 <i>Commenced:</i> 1997 Internal Report: February 2003 Journal paper: May 2003 	1.3				
Clients: Supervising Scientist	I		I				
Location: Mudginberri Rn station (Four gates R	oad), Jabiru East,	2 Rn detectors at Ranger uranium mine					
Type of sampling: continuous measurements of Dates: Continuous Consultation: Energy Resources Australia, Park of results to general public.	f airborne Rn cond s Australia North,	entration with Rn detectors Gundjehmi Aboriginal Organisation. Dise	semination				
Collaborating partners: Australian Nuclear Scie	ence and Technolo	ogy Organisation (ANSTO)					
Determination of Rn exhalation and Pb-210 de	eposition and so	I mixing rates in the Ranger/Jabiluka	region				
<i>Aim:</i> 1) Provide information on Rn exhalation rates from the Ranger site and region, in a format able to act as input to Rn dispersion models; 2) Obtain Pb-210 deposition rates in the Ranger/Jabiluka region, and use this information in a study of mixing in the soil column of dryand wet-deposited radionuclides.	Res staff: 10	<i>Commenced:</i> July 2001Progress report: August 2002	1.3				
Project leader: P Martin							
Project file: SG2001/0215							
Clients: Supervising Scientist Location: Rn exhalation: Ranger, Jabiru East, Jabiru Town, Mudginberri, Mirray lookout Lead-210: Jabiru East, Gunbalanya							
Type of sampling: Rn exhalation: surface soil sampling; Ranger mill samples							
Lead-210: soil cores; rainwa	ter						
Dates: Throughout 2002–2003							
Consultation : Energy Resources Australia (on-site measurements), Parks Australia North, local Aboriginal people, especially those from Mirray and Gunbalanya regions							
Collaborating partners: Queensland University	of Technology						

Table 2.3 Water quality-related

Project and aims	Staff commitment	Targets	Outputs				
Radionuclides in creek sediments of the Jabiluka area							
Aim: Obtain pre-mining data on concentrations of uranium, radium, thorium, potassium, heavy metals and lead isotopes in sediments of creeks of the Jabiluka area Project leader: A Bollhoefer Project file: SG2001/0158 Clients: Supervising Scientist Location: Swift (Ngarradj) Creek and tributaries Type of sampling: Sampling of sediments Dates: October 2002 Consultation: Energy Resources Australia	Res staff: 3	 Commenced: July 2001 Collection of 2002 samples: October 2002. Internal report: November 2002 	1.3				
Baseline dataset collection for western Arnhe	em Land rivers						
Aim: Obtain baseline radionuclide concentration data for Western Arnhem Land rivers in areas currently under exploration Project leader: B Ryan Project file: SG2001/0177	Res staff: 1	Commenced: July 2001 Internal report: June 2003 	1.3				
Clients: Northern Land Council, Supervising Scientist Location: Western Arnhem Land Rivers Type of sampling: If collection eventuates in 2002-03: water samples, mussels. Otherwise, only write-up in 2002–03. Dates: Wet season 2002–03 Consultation: Northern Land Council, Traditional Owners, Bawinanga Aboriginal Corporation							
Collaborating partners: Northern Land Council	, Traditional Owne	rs, Bawinanga Aboriginal Corporation					

Table 2.4 Site assessment

Project and aims	t and aims Staff Targets		Outputs				
	(p/w)						
Radiological impact assessment of the rehabilitated Nabarlek site							
Aim: Validate radionuclide transport models and enable a prediction of radiological dose in the vicinity of the Nabarlek site Res staff: 6 Commenced: 1996 1. Project leader: P Martin Journal paper (erosion): October 2002 Journal paper (airborne survey): October 2002 Journal paper (airborne survey): October 2002 Journal paper (Rn exhalation): January 2003 Clients: Supervising Scientist Location: Nabarlek Type of sampling: Not applicable Dates: Mainly 1st half of 2002/2003 Consultation: Dissemination of results at meetings to be arranged at Gunbalanya when appropriate Collaborating partners: University of Adelaide, University of Newcastle, NT Department of Business, Industry							
Airborne gamma survey of the upper South A	Iligator River val	lev					
Airborne gamma survey of the upper South Alligator River valley Aim: Provide remotely sensed data and images giving information on the state of abandoned uranium minesites in the upper South Alligator River valley Res staff: 6 Commenced: July 2000 • Australasian Remote Sensing and Photogrammetry Association of Australia Conference Paper: September 2002 • Australasian Remote Sensing and Photogrammetry Association of Australia Conference Paper: September 2002 • Paper presented to UMH III conference Freiberg, September 2002 • Paper presented to UMH III conference Freiberg, September 2002		1.3					
Clients: Parks Australia North, Supervising Scie Location: Upper South Alligator River valley Type of sampling: IKONOS data analysis. Phot Dates: Throughout 2002–2003 Consultation: Parks Australia North, especially Supervising Scientist	ntist ographs to be acq rangers from Mary	uired. v River District, Traditional Owners, Office	e of the				
Collaborating partners: Parks Australia North							

Project and aims	Staff commitment (p/w)	Targets	Outputs				
Assessment of rehabilitation at Nabarlek minesite using remote sensing techniques							
Aim To collect, process, and interpret high resolution remotely sensed data over the Nabarlek mine site for the assessment of rehabilitation, and, to identify patterns of environmental variation and provide accurate, consistent and repeatable measurements of ecosystem satbility. Project leader: K Pfitzner Project file: SF2001/0138	Res staff: 6	Commenced: 2002 Data captured July 2002 Internal Report: December 2002 Journal Paper: June 2003 	1.3				
Clients: Supervising Scientist Location: Some site visits to Nabarlek Type of sampling: Spectrometer readings, vegetation collection and photographs Dates: Throughout 2002–03 Consultation: CSIRO Land and Water, Northern Land Council, Traditional Owners							
Assessment of rehabilitation at Rum Jungle n	ninesite using re	mote sensing techniques					
Aims To collect, process, and interpret high resolution remotely sensed data over the Rum Jungle mine site for the assessment of rehabilitation, and, to identify patterns of environmental variation and provide accurate, consistent and repeatable measurements of ecosystem satbility.	Res staff: 4	Commenced: 2002 Data captured July 2002 Internal Report: February 2003 Journal Paper: June 2003	1.3				
Project leader: K Pfitzner							
Project file: SF2001/0138							
Clients: Supervising Scientist	<u> </u>		<u> </u>				
Location: Some site visits to Rum Jungle							
Dates: Throughout 2002–03							
Consultation: CSIRO Land and Water, Tradition Development, Compass Resources Collaborating partners: Not applicable	Dates: Throughout 2002–03 Consultation: CSIRO Land and Water, Traditional Owners, NT Department of Business, Industry and Resource Development, Compass Resources Collaborating partmere: Not applicable						

Project and aims	Staff commitment	Targets	Outputs				
	(p/w)						
IKONOS data fusion: South Alligator River valley and Magela datasets							
Aims To geometrically and radiometrically correct IKONOS imagery for two datasets: (1) South Alligator River valley, and (2) Mt Brockman to East Alligator head. <i>Project leader:</i> K Pfitzner <i>Project file:</i> SG2000/0144	Res staff: 3	 Fused datasets in a format suitable for end users, including poster displays: September 2002 (South Alligator River valley) and November 2002 (Magela) 	1.3				
Clients: Supervising Scientist							
Location: Data covers (a) the upper SAR valley,	, and (b) Magela C	creek system from Mt Brockman down to	the coast				
Type of sampling: Not applicable							
Dates: First half 2002/2003							
Consultation: Hard copy posters to be provided to Parks Australia North (South Alligator River valley, Magela system), Energy Resources Australia (Ranger site)							
Collaborating partners: Not applicable							
Mangrove response to coastal environmental	change		-				
<i>Aim</i> To establish, for Kakadu National Park, past and present baselines of mangrove extent, species/community composition, structure and biomass using a combination of CASI, photography and AirSAR data; to interrogate the resulting datsets to quantify and better understand mangrove response to coastal environmental change, and; to develop saptial models that predict the future extent and condition of mangroves under scenarios of coastal environmental change, including those induced by altered climate.	Res staff: 3	Commenced: 2002 Parks Australia North internal newsletter September 2002	1.3				
Project leader: K Pfitzner							
Project file: SG2001/0308							
Clients: Supervising Scientist							
Location: West Alligator head							
Type of sampling: Spectrometer readings, man	grove sampling						
Dates: Fieldwork from late September to early C	ctober 2003						
Consultation: Parks Australia North, Traditional	Owners						
Collaborating partners: University of New South Wales, University of Wales							

Radiation anomalies in the Alligator Rivers Region						
<i>Aims:</i> Bring together information on radiation anomalies in the Alligator Rivers Region, giving an overall picture of radiation in this environment and placing radiological risk from uranium mining in perspective. <i>Project leader:</i> K Pfitzner	Res staff: 5	Commenced: 2002 • Map of radiation anomalies in a form suitable for use by non-specialists (poster, Supervising Scientist Note): June 2003	1.3			
Project file: SG2002/0095						
Clients: Supervising Scientist						
Location: Covers entire Alligator Rivers Region,	with more detaile	d study at Sleisbeck				
Type of sampling: Mainly in-situ readings using	portable Nal gam	ma spectrometer, if fieldwork required.				
Dates: Throughout 2002–03						
Consultation: NT Department of Business, Industry and Resource Development, mining companies, Parks Australia North						

Table 2.5	Radioanalytical	laboratory	projects for	2002–2003 ir	n the Envi	ronmental	Radioactivity	program
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Project and aims	Staff commitment (p/w)	Targets	Outputs	
Establishment of a radioanalytical laboratory	in Darwin			
<i>Aims:</i> Setup, calibrate and establish the alpha and gamma counting equipment in the new Darwin <i>Environmental Radioactivity</i> lab. Establish new casting technique for gamma spectrometry <i>Project leader:</i> A Bollhoefer <i>Project file:</i> None	Res staff: 17	Commenced: 2002 Setup of equipment. July- August 2002 Calibration and establishment of backgrounds. September- October 2002 Establish of new casting technique. September- December 2002	1.3	
Clients: Supervising Scientist	·			
Location: Darwin				
Type of sampling: Not applicable				
Dates: July–October 2002				
Consultation: Not applicable				
Collaborating partners: Not applicable				

Project and aims	Staff commitment (p/w)	Targets	Outputs				
Establishment of a quality management system for the <i>eriss</i> radioanalytical laboratory							
<i>Aim:</i> Establish a quality management system for the <i>eriss</i> radioanalytical laboratory <i>Project leader:</i> B Ryan <i>Project file:</i> SG2000/0187	Res staff: 10	Commenced: 2002 Establish database for sample/analysis registration: June 2003 	1.3				
Clients: Supervising Scientist							
Location: Darwin							
Type of sampling: Not applicable							
Dates: Throughout 2002–03							
Consultation: Not applicable							
Collaborating partners: Not applicable							
Operation of the commercial radioanalytical I	aboratory						
<i>Aim:</i> Provide radiological services on a commercial basis. <i>Project leader:</i> M Iles <i>Project file:</i> SG2000/0189, SG2000/0190	Res staff: 22	 Commenced: 1999 Renewal of existing contracts/ establishment of new contracts: ongoing Report results and invoice clients: ongoing Annual financial statement: 	1.3				
Clients: Commercial analyses for a number of c	lients	June 2003					
Location: Darwin	Location: Darwin						
Type of sampling: Not applicable							
Dates: Throughout 2002–03							
Consultation: Contact with clients							
Collaborating partners: Not applicable							

Table 2.6 Monitoring projects

Radiological monitoring of the Ranger uraniu	m mine operatio	n		
<i>Aim</i> To provide specialist radiation detection expertise for the collection of radiological monitoring data relating to the Ranger mine operation. <i>Project leader:</i> P Martin <i>Project file:</i> New file	Res staff: 5	 Commenced: 2001 Data provided in suitable form for posting on website: ongoing Documentation of monitoring procedure: December 2002 	1.3	
Clients: Supervising Scientist				
Location: Magela Creek, Mudginberri air monito	ring station			
Type of sampling: Water, sediment, mussels from associated activity from Mudginberri	om Magela Creek	locations. Radon, radon progeny and due	st-	
Dates: Late Dry season for sediment. Wet seaso	on for water. Year	round for airborne activity		
Consultation: Energy Resources Australia, NT I of the Supervising Scientist, monitoring team	Department of Bus	siness, Industry and Resource Developm	ent, Office	
Collaborating partners: Not applicable				
Radiological monitoring of the Jabiluka uranium mine operation				
Radiological monitoring of the Jabiluka urani	um mine operatio	on		
Radiological monitoring of the Jabiluka urani <i>Aim</i> To provide specialist radiation detection expertise for the collection of radiological monitoring data relating to the Jabiluka mine operation.	um mine operation	Commenced: 2001 Data provided in suitable form for posting on website: December 2002	1.3	
Radiological monitoring of the Jabiluka urani Aim To provide specialist radiation detection expertise for the collection of radiological monitoring data relating to the Jabiluka mine operation. Project leader: P Martin	um mine operation Res staff: 5	Commenced: 2001 Data provided in suitable form for posting on website: December 2002 Documentation of	1.3	
Radiological monitoring of the Jabiluka uraniAim To provide specialist radiation detectionexpertise for the collection of radiologicalmonitoring data relating to the Jabiluka mineoperation.Project leader: P MartinProject file: New file	um mine operatio	 Commenced: 2001 Data provided in suitable form for posting on website: December 2002 Documentation of monitoring procedure: December 2002 	1.3	
Radiological monitoring of the Jabiluka urani Aim To provide specialist radiation detection expertise for the collection of radiological monitoring data relating to the Jabiluka mine operation. Project leader: P Martin Project file: New file Clients: Supervising Scientist	um mine operation Res staff: 5	 Commenced: 2001 Data provided in suitable form for posting on website: December 2002 Documentation of monitoring procedure: December 2002 	1.3	
Radiological monitoring of the Jabiluka urani Aim To provide specialist radiation detection expertise for the collection of radiological monitoring data relating to the Jabiluka mine operation. Project leader: P Martin Project file: New file Clients: Supervising Scientist Location: Ngarradj Creek	um mine operation	 Commenced: 2001 Data provided in suitable form for posting on website: December 2002 Documentation of monitoring procedure: December 2002 	1.3	
Radiological monitoring of the Jabiluka urani Aim To provide specialist radiation detection expertise for the collection of radiological monitoring data relating to the Jabiluka mine operation. Project leader: P Martin Project file: New file Clients: Supervising Scientist Location: Ngarradj Creek Type of sampling: Water, sediment, mussels from Mudginberri	om Ngarradj. Rado	Commenced: 2001 • Data provided in suitable form for posting on website: December 2002 • Documentation of monitoring procedure: December 2002 • December 2002 • Documentation of monitoring procedure: December 2002 • December 2002	1.3	
Radiological monitoring of the Jabiluka urani Aim To provide specialist radiation detection expertise for the collection of radiological monitoring data relating to the Jabiluka mine operation. Project leader: P Martin Project file: New file Clients: Supervising Scientist Location: Ngarradj Creek Type of sampling: Water, sediment, mussels from Mudginberri Dates: Late Dry season for sediment. Wet season	om Ngarradj. Rado	Commenced: 2001 Data provided in suitable form for posting on website: December 2002 Documentation of monitoring procedure: December 2002 December 2002	1.3	
Radiological monitoring of the Jabiluka urani Aim To provide specialist radiation detection expertise for the collection of radiological monitoring data relating to the Jabiluka mine operation. Project leader: P Martin Project file: New file Clients: Supervising Scientist Location: Ngarradj Creek Type of sampling: Water, sediment, mussels from Mudginberri Dates: Late Dry season for sediment. Wet season Consultation: Energy Resources Australia, NT I of the Supervising Scientist, monitoring team	om Ngarradj. Rado on for water. Year Department of Bus	Commenced: 2001 • Data provided in suitable form for posting on website: December 2002 • Documentation of monitoring procedure: December 2002 • Documentation of monitoring procedure: December 2002 • on, radon progeny and dust-associated ad round for airborne activity. siness, Industry and Resource Development	1.3 ctivity from ent, Office	

3 Ecosystem Protection

To provide advice through research and monitoring on the protection of aquatic and terrestrial ecosystems during and after mining activities in the Alligator Rivers Region and on the conservation and management of tropical wetlands.

Priority activities in 2002–2003 include:

- Gather chemical and biological monitoring data during the 2002–2003 period for the Ranger mine and compare and assess these with historical and other reference data;
- Acquire chemical and biological baseline/monitoring data from the Jabiluka region for the purpose of monitoring and assessing the impact of any existing disturbance or future mining at Jabiluka on adjacent streams and floodplain;
- Develop enhanced methods for monitoring, assessing and protecting aquatic and terrestrial ecosystems;
- Contribute to a landscape-wide monitoring program to assess the impact of the proposed Jabiluka mine upon the broader Kakadu landscape;
- Provide advice and assessments to non-Supervising Scientist divisions of Environment Australia;
- Support National Centre for Tropical Wetland Research (*nctwr*) activities in tropical wetlands.

Projects presented in this plan for the 2002–2003 period are grouped under four major themes: (i) continued chemical and biological monitoring (and/or baseline data gathering) for Ranger and Jabiluka; (ii) refinement of monitoring techniques and protocols; (iii) landscape inventory and monitoring for environmental impact and risk assessment; and (iv) support to the *nctwr*.

In 2002–2003 we will continue the routine program of biological and chemical monitoring (Ranger and Jabiluka) and baseline data collection (Jabiluka). This program aims to provide assurance to the Australian Government and community generally that the aquatic ecosystems of the Alligator Rivers Region are being protected to very high standards from the effects of uranium mining. Results of this program and those from past seasons will be progressively made available to stakeholders over the ensuing year, initially through the Internet. The environmental monitoring program is being accompanied by collation and analysis of past data, completion and revision of protocols, and any necessary refinement to monitoring techniques.

Other research investigations focus on the fate, control and ecological effects of mine contaminants on and off the Ranger mine site. An important ongoing project here is the field and laboratory experimentation being conducted to assess the ecological effects of Magnesium sulphate (MgSO₄) in Magela Creek. The results of this study, due for completion in March 2003, will be used to derive a new 'trigger value' (or standard) for Magnesium in receiving waters of Magela Creek downstream of Ranger.

Results from another study will also be used to develop techniques to assess the impact of the proposed Jabiluka mine upon the broader Kakadu landscape. Specifically, this landscape-wide study aims to map or catalogue important and significant aquatic (stone country) habitats and native species around Jabiluka, Kakadu and western Arnhem Land, then monitor key

components of these in order to distinguish and assess the impacts of potential threats, including mining. It is hoped to extend this project to more extensive inventory of the biota of streams and wetlands in Arnhem Land in the light of mining exploration that is currently proceeding in these Aboriginal lands.

Finally, an implementation project arising from publication of the revised Australian and New Zealand Water Quality Guidelines will be completed for the Australian Centre for Mining Environmental Research.

These and other projects are outlined in tables 3.1–3.5.

Table 3.1	Biological and	d chemical	monitorina	of	Ranger	mine	site
1 4010 011	Biological an	a onionniou	mornio	0.	i tangoi		0.00

Project and aims	Staff commitment (p/w)	Targets	Outputs
Water chemistry of Magela Creek			
Aim: Monitor water chemistry of Magela and Gulungul creeks upstream and downstream of Ranger mine Project leader: Vacant/ A Cameron Project file: SG2001/0200	Res staff: 11 Tech staff: 3	 Commenced: 2002 Conduct sampling and analysis: December–July 2003 Update intra-/internet sites: fortnightly wet season Annual report of results to Supervising Scientist and stakeholders: July 2003 Internal Report of results and data analyses for previous season: December 2002 Collect samples across different braids at monitoring sites to improve estimation of solute load at different flow rates during Wet season: May 2003 	1.2

Clients: Supervising Scientist

Location: Magela Creek:

- At gauging station GS8210009 (west and central braids) and Magela Creek upstream (central braid 300 m upstream Georgetown gauging station)
- Georgetown Billabong near gauge board
- Retention Pond 1 outflow
- Gulungul Creek: just upstream Arnhem Highway and upstream of mine influence at edge of Ranger lease

Type of sampling: Collection of water samples and field measurement of conductivity, pH, turbidity, temperature and dissolved oxygen at each site

Proposed download of conductivity data loggers at gauging station 009, Gulungul Creek and possibly Ngarradj Creek

Samples analysed by external commercial laboratory

Dates: From start of stream flow (November–December) to end of flow from Retention Pond 1 (June–July)

Consultation: All sites are within the mine lease and all activities and procedures require approval of Energy Resources Australia. Gundjehmi Aboriginal Corporation, Djabiluka Association, Gagadju Association and Northern Land Council are to be informed of monitoring activities and also asked for comment on the proposed procedures. Notification should be provided in writing and by verbal communication either by phone or meetings arranged for that purpose. This should be conducted at least two months prior to sampling.

Results to be posted on internet site at regular intervals during wet season. Progress reports to stakeholders to be given via meetings or correspondence at middle and end of wet season monitoring, or more frequently if incidents occur.

Project and aims	Staff commitment (p/w)	Targets	Outputs
Early detection of mine-related effects using	creekside testing	procedures: Ranger mine site	
<i>Aim:</i> Monitor water quality of Magela Creek using biological creekside tests <i>Project leader:</i> C Humphrey <i>Project file:</i> SG2001/0193; JR-05-116	Res & tech staff: 22	 Commenced: 2002 Conduct creekside tests: January–April 2003 Update internet site: monthly wet season Annual report of results to Supervising Scientist and stakeholders: July 2003 Internal Report of all results and data analyses for previous season: December 2002 	1.2

Clients: Supervising Scientist

Location: Two field stations beside Magela Creek on Ranger mine lease: one near Georgetown gauging station receiving water pumped from upstream of any influence from dispersed mine waste and the other downstream of the mine at GS820009 gauging station near the mine lease boundary receiving water potentially affected by mine wastes.

Type of sampling: Continuous sampling of creek water for flow-through test chambers in each field laboratory. Tests conducted using laboratory reared snails and larval fish.

Dates: Preparation and maintenance of infrastructure at field sites, July to October

Setup and testing of field lab system November–December when flow commences

Testing of water quality is conducted on alternate one week periods from January to April. Start and finish is dependant on rainfall. Feasibility of increasing frequency to weekly tests to be evaluated.

Consultation: Approval for all activities on the mine lease needs to be obtained from Energy Resources Australia. Gundjehmi Aboriginal Corporation are to be informed of monitoring activities and also asked for approval of any modifications to the infrastructure and procedures. Notification should be provided in writing and by verbal communication either by phone or meetings for that purpose.

Results to be posted on internet site at regular intervals during wet season. Progress reports to stakeholders to be given via meetings or correspondence at middle and end of wet season monitoring, or more frequently if incidents occur.

Project and aims	Staff commitment (p/w)	Targets	Outputs
Fish and mussel bioaccumulation in Magela (Creek: Ranger mi	ne site	
<i>Aim</i> : Monitor metal and radionuclide content in mussels and organs of selected fish species from Mudginberri Billabong and a control site on Nourlangie Creek <i>Project leader:</i> P Martin & R Pidgeon <i>Project file:</i> SG2000/0082	Res & tech staff: 9	 Commenced: 2002 Conduct fish sampling: August 2002 Conduct mussel sampling: October 2002 Annual report of results to Supervising Scientist and stakeholders: June 2002 Update internet site: annually after data analysis and results available Internal Report of all results and data analyses for previous season: December 2002 	1.2

Clients: Supervising Scientist

Location: Mudginberri Billabong on Magela Creek downstream of Ranger mine and Sandy Billabong on Nourlangie Creek (control site)

Type of sampling: Mussel sampling by air-lift, rake net and hand/foot collection inside crocodile exclosures. Fish sampling by gill net

Dates: Sampling of mussels is to be conducted every year (October) with fish sampling to be undertaken in alternate years (May)

Consultation: Approval for all activities on the mine lease needs to be obtained from Energy Resources Australia and sampling on Nourlangie Creek needs notification of Parks Australia North. Gundjehmi Aboriginal Corporation and Northern Land Council are to be informed of monitoring activities and also asked for comment on the proposed procedures. Notification should be provided in writing and by verbal communication either by phone or meetings arranged for that purpose. This should be conducted at least two months prior to sampling. Assistance from local aboriginal people will be sought for the field sampling.

Results to be posted on internet site. Progress reports to stakeholders to be given via meetings or correspondence after data analysis. More frequent reports would be given if incidents occur.

Project and aims	Staff commitment	Targets	Outputs
Community structure of macroinvertebrates a	(p/w)	ams: Ranger mine site	
Aim: Monitor effects of mining at Ranger on Magela Creek using benthic macroinvertebrate and fish communities Project leader: C Humphrey & R Pidgeon Project file: Macroinvertebrates: SG2001/0190; SG2000/0179 Fishes: SG2001/0191; JR-05-170	Res staff: 25 Tech staff: 9 (plus temp staff)	 Commenced: 2002 Process all macroinvertebrate sample backlogs from Magela and control streams: November 2002 Sampling in Magela Creek and control streams: April– June 2003 Annual report of results to Supervising Scientist and stakeholders: June 2002 Update internet site: annually after data analysis and results available Internal Report of all results and data analyses for previous season: 	1.2
 Clients: Supervising Scientist Location: Macroinvertebrate sampling: Magela Creek – 3 sites, one downstrear pumps and Magela Creek upstream; o Gulungul Creek – 2 sites, just upstrear lease Burdulba Creek – 3 sites upstream of H Nourlangie Creek – 2 sites, one below 	am site just below n Ranger lease n Arnhem Highwa Kakadu Highway Sandy Billabong a	GS8210009, 2 upstream sites between c y and upstream of mine influence at edge and one below Long Harry's billabong	reekside e of Ranger
 Magela Creek – Mudginberri, Corndorl Coonjimba on Ranger mine lease Nourlangie creek – Buba, Sandy chant Type of sampling: Macroinvertebrates sampled census in 2 channel billabongs and pop-net traps 	, Gulungul, Baralil nel and Sandy swa by Surber device s in shallow billabo	in Kakadu National Park, and Georgetow amp billabongs in Kakadu National Park in macrophyte-edge habitat. Fish samplir ngs	ın and ng by visual
Dates: Macroinvertebrates in April–May dependi billabongs mid May to end June Consultation: Approval for all activities on the m sampling on Nourlangie Creek needs notification Association and Northern Land Council are to be proposed procedures. Notification should be prov meetings arranged for that purpose. This should from local aboriginal people will be sought for the	ine lease needs to of Parks Australia informed of monit vided in writing and be conducted at le	Channel billabongs in early May, 2 week b be obtained from Energy Resources Au a North. Gundjehmi Aboriginal Corporation foring activities and also asked for comme d by verbal communication either by phor east two months prior to sampling. Some	s; shallow stralia and n, Gagadju ent on the ne or assistance
Results to be posted on internet site after data and correspondence when results available. Develop strategies for simple, clear communicati faunal communities at different sites and possible presentation to non-specialist audience	nalysis. Progress r on of results of ord e indications of ho	eports to stakeholders to be given via me dination analysis showing changes in rela w environmental impact would be detecte	etings or itionship of d for

Table 3.2.	Biological and	chemical	monitorina	at Jabiluka
	Biological ana	onionnioun	moning	at out indition

Project and aims	Staff commitment (p/w)	Targets	Outputs
Water chemistry of streams associated with t	he proposed Jab	iluka mine	
<i>Aim:</i> Monitor water chemistry of streams associated with the Jabiluka mine site and add data to accumulating baseline <i>Project leader:</i> Vacant/ A Cameron <i>Project file:</i> SG2001/0202; JR-05-279	Res staff: 9 Tech staff: 2	 Commenced: 2001 Refine location of sampling sites with respect to potential mine impact, accessibility and lease boundaries: November 2002 Conduct sampling and analysis: December 2001–May 2002 Update intranet and internet site: fortnightly wet season Annual report of results to Supervising Scientist and stakeholders: July 2003 Internal Report of all results and data analyses for previous season: December 2002 	1.2

Clients: Supervising Scientist

Location:

- Six sites on Ngarradj Creek and tributaries: 2 main channel sites upstream and downsteam of minesite tributaries, and 2 sites each on central and north tributaries located upstream and downstream of minesite.
- Paired sites on North Magela and 7J creeks within Jabiluka mine lease
- Paired sites on Catfish Creek in Kakadu National Park

Type of sampling: Collection of water samples and field measurement of conductivity, pH, turbidity, temperature and DO (dissolved oxygen) at each site

Dates: For Ngarradj, each site sampled weekly from start of flow to end of flow, typically December to late May; other streams sampled two to four times per wet season

Consultation: All activities and procedures at all sites within the mine lease require approval of Energy Resources Australia. Sampling in Catfish Creek requires notification of Parks Australia North. Gundjeihmi Aboriginal Corporation and Northern Land Council are to be informed of monitoring activities and also asked for comment on the proposed procedures. Notification should be provided in writing and by verbal communication either by phone or meetings arranged for that purpose. This should be conducted at least two months prior to sampling.

Results to be posted on internet site at regular intervals during wet season. Progress reports to stakeholders to be given via meetings or correspondence at middle and end of wet season monitoring, or more frequently if incidents occur.

Project and aims	Staff commitment (p/w)	Targets	Outputs
Baseline metal concentrations in fish from Ng	garradj Creek		
<i>Aim:</i> Determine baseline concentration of metals in livers and flesh of fishes from Ngarradj Creek and Catfish Creek <i>Project leader:</i> C leGras/ EPP chemist, R Pidgeon & P Martin <i>Project file:</i> JR-05-313	Res & tech staff: 11	 Commenced: 1998 Sampling and dissections: October 2002 & April 2003 Annual report of results to Supervising Scientist and stakeholders: July 2003 Update internet site: 6- monthly Internal Report of all results and data analyses for previous season: December 2002 	1.2

Clients: Supervising Scientist

Location: Ngarradj Creek at two sites, one upstream and one downstream of entry of minesite tributaries.

Catfish Creek at two sites approx 2 km apart to simulate upstream and downstream spatial effects.

Type of sampling: Gill net and seine net sampling of fish. Chemical analysis of whole small fish and tissue samples from larger fish.

Dates: Two samples collected in October 2002 and April 2003

Consultation: All activities and procedures on Ngarradj Creek within the mine lease require approval of Energy Resources Australia. Sampling in Catfish Creek requires notification of Parks Australia North. Gundjehmi Aboriginal Corporation and Northern Land Council are to be informed of monitoring activities and also asked for comment on the proposed procedures. Notification should be provided in writing and by verbal communication either by phone or meetings arranged for that purpose. This should be conducted at least 2 months prior to sampling. Field assistance will be sought from traditional owners.

Results to be posted on internet site. Progress reports to stakeholders to be given via meetings or correspondence after data analysis. More frequent reports would be given if incidents occur.

Project and aims	Staff commitment (p/w)	Targets	Outputs
Community structure of macroinvertebrates a	and fishes in stre	ams: Jabiluka	
Aim: Monitor biota of streams associated with	Res staff: 15	Commenced: 2001	1.2
accumulating baseline	Tech staff: 2	 Process all macroinvertebrate sample 	
Project leader: A Cameron & D Buckle		backlogs from Ngarradj and control streams:	l .
Project file: Macroinvertebrates: SG2001/0192; JR-05-294		November 2002	l
Fishes: JR-05-308		Conduct sampling: December 2002–April 2003	
		 Annual report of results to Supervising Scientist and stakeholders: July 2003 	
		Update internet site: annually after data analysis	l
		 Internal Reports of data and results for all Wet seasons to 2001–02: December 2002 	
Clients: Supervising Scientist			
Location: Ngarradj Creek (4 sites), 7J Creek (3	sites), North Mage	ela Creek (3 sites) on the Jabiluka mine le	ase.
Catfish Creek (2 sites) in KNP.			
Type of sampling: Macroinvertebrates sampled	by quantitative sw	veep nets of macrophyte-edge habitat.	
Fish sampled by visual census from bankside ar	nd dip net samples	<u>.</u>	
Dates : Macroinvertebrates in Ngarradj and Catfis sampled at commencement of recessional flow p	sh creeks sampled period (usually Apr	I monthly from January to April. Sites in a il).	ll 4 streams
Fish sampled twice in latter half of flow period, ty	pically March and	April.	
Consultation: All activities and procedures at all Australia. Sampling in Catfish Creek requires not Corporation, and Northern Land Council are to be proposed procedures. Notification should be provident meetings arranged for that purpose. This should	l sites within the m tification of Parks / ∋ informed of moni vided in writing an be conducted at le	ine lease require approval of Energy Res Australia North. Gundjeihmi Aboriginal toring activities and also asked for comm d by verbal communication either by phor east two months prior to sampling.	ources ent on the ne or
Results to be posted on internet site after data an correspondence when results available.	nalysis. Progress r	eports to stakeholders to be given via me	etings or

ods

Project and aims	Staff commitment (p/w)	Targets	Outputs
Development of biological and chemical mon	itoring technique	es for the Ranger mine	
Aim: Develop biological and chemical monitoring procedures for detecting any effects of Ranger waste waters in Magela Creek <i>Project leaders:</i> C Humphrey, R Pidgeon, P Martin <i>Project files:</i> Creekside monitoring: JR-05-116 Macroinvertebrates: SG2000/0179	Res staff: 43	Commenced: 1985 Supervising Scientist Report of biological and chemical monitoring protocols: December 2002	1.2
Fish communities: JR-05-170 Water chemistry: SG2001/0201			
Clients: Supervising Scientist			
Location: Jabiru and Darwin offices and laborate	ories		
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Stakeholders to be notified of the	availability of com	pleted Supervising Scientist Report	
Collaborating Partners: Not applicable			
Development of biological and chemical mon	itoring technique	es for the proposed Jabiluka mine	
Aim: Develop biological and chemical monitoring procedures for detecting any effects of the Jabiluka mine on receiving waters Project leaders: C Humphrey & R Pidgeon Project files: Macroinvertebrates: JR-05-294 Fish communities: JR-05-308 Water chemistry: JR-05-279 Metal concentrations in fishes: JR-05-313	Res staff: 29	 Commenced: 1997 Supervising Scientist Report of biological and chemical monitoring protocols: March 2003 Supervising Scientist Report describing physico- chemical characteristics of Ngarradj Creek and adjacent streams: March 2003 	1.2
Clients: Supervising Scientist		11	
Location: Jabiru and Darwin offices and laborate	ories		
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Stakeholders to be notified of the	availability of com	pleted Supervising Scientist Report	
Collaborating Partners: Not applicable			

Project and aims	Staff commitment (p/w)	Targets	Outputs
Review of the status of biological monitoring	programs in the	Alligator Rivers Region	
<i>Aim:</i> Review Ranger, Jabiluka and other monitoring programs in the Alligator Rivers Region, factoring in the changing environment in the Alligator Rivers Region with the <i>eriss</i> relocation, possible mining at Jabiluka, as well as funding for routine monitoring and the Independent Science Panel recommendations for additional studies at Jabiluka <i>Project leader:</i> C Humphrey <i>Project File:</i> SG2001/0209	Res staff. 3	 Commenced: 2000 Internal Report 'Instigating an environmental monitoring program to protect aquatic ecosystems from possible mining impacts in the Alligator Rivers Region': December 2003 Incorporation of large parts of above report into sampling protocols 	1.2
Clients: Supervising Scientist			
Location: Darwin			
Type of sampling: Not applicable			
Dates: July 2002 to June 2003			
Consultation: Stakeholders to be notified of the	availability of com	pleted report	
Collaborating Partners: Not applicable			
Statistical design and analysis for Alligator R	ivers Region mo	nitoring protocols	
 Aim: Advise eriss staff on any technical matters relevant to design and analysis arising in the (re-)drafting of monitoring protocols. This includes: Conduct power analyses associated with specific monitoring techniques; Assist with the writing of worked examples for the protocols – as would be applied in reporting to a technical audience; Review the drafted and final draft protocols and reporting pro forma; Relevant training in statistical procedures. Project leader: C Humphrey Consultant: K McGuinness, NTU Project file: SG2001/0077 	Res staff: 3 Consultant: 4	 Commenced: 2002 Power analysis of macroinvertebrate data from Jabiluka streams (3-year period, 1999-2001) under MBACIP design: August 2002 Completed review of exemplary reporting pro forma: September 2002 Completed review of four or five exemplary protocols: November 2002 Completed review of all drafted protocols and reporting pro forma, and have contributed to worked examples contained in protocols: March 2003 <i>eriss</i> staff familiarised with statistical procedures for each protocol: April 2003 	1.2
Clients: Supervising Scientist Location: Northern Territory University, Darwin Type of sampling: Not applicable Dates: March 2002 to March 2003 Consultation: Meetings between consultant and familiarisation with statistical procedures Collaborating Partners: Dr Keith McGuinness, I	project leaders; r Northern Territory	neetings between consultant and EPP sta University (consultant)	aff for

Project and aims	Staff commitment (p/w)	Targets	Outputs
Refinement of data collection procedures for	monitoring of Ra	inger and Jabiluka mines	
 Aim: Develop improved procedures for ensuring quality and integrity of monitoring data used to assess mining impact arising from Ranger and Jabiluka mine sites. This includes: Improved water supply for creekside fish husbandry to minimise maintenance labour Strategy for changing fish and snail cultures to local creek or RO water Improved creekside pumping procedures to minimise risk of pump failure Improved infrastructure for creekside laboratories to minimise effects of runoff erosion and increase site security Setup of conductivity data loggers with telemetric communication in Magela Creek and Ngarradj Creek Improved field data security, safety (clearings for helicopter landing) and data entry efficiency <i>Project leader:</i> D Buckle, A Cameron & D Elphick <i>Project file: SG2002/0143</i> 	Res & Tech staff: 12	Commenced: 2002 Fish and snail husbandry • Water system designed: August 2002 • System installed: October 2002 Creekside • Erosion and security work completed: September 2002 • Dual pump system for creek water installed: November 2002 Chemistry • Data logger system designed: September: 2002 • Equipment purchased and installed: November 2002 Field data system and safety • Strategies designed: October 2002 • Strategies tested during field sampling in wet season Relevant refinements incorporated in	1.2
Clients: Supervising Scientist Location: Most activities will be on the Jabiru Fig	l	d mine leases	
Pater: All proposed refinements to be in place for testing during wet second			
Consultation: Approval from Energy Possureou	a Australia to bo of	ti stasuli	Stakabaldara

Consultation: Approval from Energy Resources Australia to be obtained for infrastructure developments. Stakeholders to be informed of these activities by meetings and or correspondence.

Project and aims	Staff commitment (p/w)	Targets	Outputs
Ecological effects of Magnesium sulphate in	Magela Creek		
<i>Aim:</i> To assess toxicity of enhanced levels of Magnesium sulphate (MgSO ₄) in Magela Creek through laboratory and field studies <i>Project leaders:</i> C Humphrey & C McCullough <i>Project file:</i> SG2000/0036	Student: 45 Res staff: 2 Tech staff: 10 (includes temp assistance)	 Commenced: 2000 Conduct laboratory and field studies on ecological effects of MgSO₄: July-November 2002 Supervising Scientist Report, 'Ecological effects of magnesium sulfate in Magela Creek', March 2003 Student PhD thesis: July 2003 	1.2

Clients: Supervising Scientist

Location: Magela Creek adjacent to and upstream of Ranger mine; Jabiru field laboratory

Type of sampling: Laboratory ecotoxicity tests; field mesocosms using large plastic tubs to represent creek pools and to which $MgSO_4$ in varying concentrations is spiked

Dates: Field and laboratory studies completed in the period July-November 2002

Consultation: All activities and procedures are conducted at sites on the Ranger mine lease and require approval of Energy Resources Australia. Gundjeihmi Aboriginal Corporation (GAC), Northern Land Council and Parks Australia North are informed of experimental activities. GAC members are providing field assistance.

Progress reports to stakeholders are provided by Supervising Scientist Annual Report, newsletters or via meetings/correspondence when results available

Collaborating Partners: Northern Territory University

 Table 3.4.
 Landscape scale monitoring of impact of Jabiluka mine

Project and aims	Staff commitment	Targets	Outputs
	(p/w)		
Changes to important and significant habitats	s and native spec	eies in Kakadu National Park	
<i>Aim:</i> Map or catalogue important and significant habitats and native species in Alligator Rivers Region, then monitor key components of these in order to distinguish and assess the impacts of potential threats. <i>Project leader:</i> C Humphrey <i>Project files:</i> SG2000/0138; SG2001/0204	Res staff: 2	 Commenced: 1998 Field sampling of significant aquatic (stone country) habitats and native species around Jabiluka, Kakadu and western Arnhem Land: September-November 2002 Internal Report, 'The aquatic invertebrates of streams and wetlands around Jabiluka': November 2002 Consultancy report: 'Taxonomic descriptions of isopods of the genus, <i>Eophreatoicus</i>, found in the NT': June 2003 	1.2
 Clients: Supervising Scientist Location: Strategic seeps and springs in the stone country around Jabiluka, and more broadly, Kakadu and western Arnhem Land (including King River) Type of sampling: Sampling of invertebrates using dip nets and fish and higher vertebrates using visual observations. Range of fauna studied is restricted by limited access opportunities Dates: Periods of 3-4 days each at various times during the late Dry season (2002) Consultation: Requires permission of relevant traditional owners to access these sites and hence assistance of Research Support and Communication, Parks Australia North and Northern Land Council 			
Fish communities of Gulungul Creek: A lands	cape analysis		
Aim: Assess whether fish communities in Gulungul Creek have changed over a 22-year period as a consequence of mining activities in the catchment Project leaders: C Humphrey & R Pidgeon; Consultant – K Bishop Project file: SG2001/0077	Res staff: 1.5 Tech staff: 2 Consultant: 1	 Commenced: 1978 Convert two consultancy reports into Supervising Scientist Report, 'Spatial and temporal patterns in Gulungul fish communities, 1978 to 2001: October 2002 	1.2
Clients: Supervising Scientist	repared in Danwin		
Type of sampling: Not applicable			
Pates: Completion by October 2002			
Consultation: Advise stakeholders on completion of Supervising Scientist Report			
Collaborating Partners: Consultant on fish ecology			

Table 3.5 Support for NCTWR activities

Project and aims	Staff commitment (p/w)	Targets	Outputs	
Preparation of a handbook for ACMER on im	plementing the ne	ew Water Quality Guidelines		
<i>Aim</i> : Prepare a handbook on implementing the revised Australian & New Zealand Water Quality Guidelines for the mining industry (viz Australian Centre for Mining Environmental Research) <i>Project leader</i> : C Humphrey (with CSIRO Lucas Heights) <i>Project file</i> : SG2001/0211	Res staff: 3	Commenced: 2001 Draft Handbook submitted to Australian Centre for Mining Environmental Research: July 2002 Evaluate possible provision of training in Water Quality Guidelines through the National Centre for Tropical Wetland Research	2.2	
Clients: Australian Centre for Mining Environmental Research Location: Darwin				
Dates: Not applicable				
Consultation: Stakeholders to be notified once	Handbook has bee	en published		
Collaborating Partners: CSIRO Energy Technol	blogy			
Baseline sampling needs for Arnhem Land st	reams			
<i>Aim:</i> Develop with Northern Land Council a strategic approach to acquiring (aquatic) biological inventory data from mine exploration sites in Arnhem Land, as well as conduct limited surveys <i>Project leader:</i> C Humphrey <i>Project file:</i> SG2000/0175	Res staff. 2	 Commenced: 1999 Develop strategic approach to acquiring biological inventory data from mine exploration sites in Arnhem Land; assist Northern Land Council in seeking funds: September 2002 Collaborative report with NT Museum on Mann and Katherine Rivers aquatic fauna: November 2002 	1.2	
Clients: Supervising Scientist and Northern Lan	ds Council			
Location: Strategic surface waters in Arnhem L	and			
Type of sampling: Sampling of invertebrates u	sing dip nets and f	ish and higher vertebrates using visual ol	oservations	
Dates: Periods of 3–4 days each at various times during the late Dry season (2002)				
Consultation: Requires permission of relevant traditional owners to access these sites and hence assistance of Research Support & Communications and Northern Land Council				
Collaborating Partners: Northern Land Council	l			

4 Hydrological and Ecological Processes

To provide advice on landscape processes to detect impacts that could arise during and after mining activities in the Alligator Rivers Region and on the conservation and management of tropical wetlands.

Priority activities in 2002–03 include:

- Develop a technological framework to assess the impact of mine site erosion products on stream systems;
- Maintain and expand a stream flow database for the Ngarradj catchment (Swift Creek) to assess erosion impacts from the Jabiluka mine site;
- Establish a stream flow database for Magela and Gulungul Creeks to assess erosion impacts from the Ranger mine site;
- Characterise and map landscapes in the Alligator Rivers Region for the purpose of environmental impact and risk assessment;
- Support the National Centre for Tropical Wetland Research (NCTWR) in inventory, survey and monitoring of tropical wetlands; and
- Ongoing development of GIS framework to support program priorities across *eriss*.

Projects presented in this plan are grouped under four major themes: (i) Development of technology to assess mine site impact; (ii) Landscape characterisation and monitoring for environmental impact and risk assessment; (iii) Provision of support to the NCTWR in the inventory and survey of tropical wetlands; and (iv) *eriss*-wide support for collection and management of spatial data.

The strategic direction for mining related research for the Hydrological and Ecological Processes Program is to develop technology and implement monitoring regimes which align with mine rehabilitation timeframes and can be used to assess the stability of post-mining rehabilitated landforms, assess the impact of current mining operations on stream sediment transport and assess the performance of rehabilitated landforms with respect to stream sediment transport. For wetland ecology research the program's directions are further development in the areas of community consultation, conservation assessments, wetland inventory, and wetland monitoring. In accordance with the strategic directions the major roles of the program are to develop technology to assess rehabilitated landform stability and monitor erosion impact on stream systems. The Jabiluka mine is currently in care and maintenance. There are two proposed scenarios for rehabilitation at the Ranger mine: (i) should tailings be disposed to RL 0, then mining will cease in 2007 and rehabilitation will be completed by 2010, or (ii) should tailings be disposed to RL 14, then mining will cease in 2008 and rehabilitation will be completed between 2013 and 2014. In addressing this rehabilitation schedule, HEP is continuing work on technology development and have now applied a landform evolution model on a catchment-wide basis to assess landform stability and impact. Model refinement will continue in the area of reliability assessment and practical application. With respect to stream monitoring, a program is in place at Jabiluka with four years of data collected and impact assessment techniques being investigated. A monitoring program is now being implemented in the Ranger mine catchment with the aim of collecting stream data and establishing monitoring protocols to assess rehabilitation integrity.

In 2002–2003 we will continue hydrological research and monitoring in the Ngarradj catchment and continue reporting of the first four years of the monitoring program. We will establish a monthly reporting system for monitoring of stream sediment movement in the Ngarradj catchment. GIS development will continue and an initial physical risk assessment of Jabiluka mine will be finalised using landform evolution modelling (SIBERIA) in a GIS framework and erosion rates derived from the Jabiluka rainfall simulation study. An assessment of the hydrology of the rehabilitated Nabarlek minesite will be finalised. A small amount of work will be continued on testing a spatial and temporal soil development model in the Tin Camp Creek catchment to determine weathering and erosion rates for landform evolution modelling. A stream gauging network will be implemented in Gulungul Creek and studies commenced to determine the rate of sediment movement through the Ranger minesite tributaries and billabongs. Investigation will also be conducted to assess the feasibility of collecting suspended sediment data in Magela Creek which can be used to assess mine erosion impact.

On the wetland ecology front there will be further development in the areas of community consultation, conservation assessments, inventory, and monitoring. The range of projects to be undertaken will include projects within the Landscape Wide Analysis program; on-going collaboration with Wetlands International on the development and implementation of the Asian Wetland Inventory; wetland inventory and risk assessment with partners in the NCTWR and Northern Territory government, and participation in the proposed Earth Observation Co-operative Research Centre.

Project and aims	Staff commitment (pw)	Targets	Outputs
Application of GIS to assessment and manager	ment of mining im	pact	
Aim: Establish a temporal and spatial database (GIS) on sediment movement and hydrology of the Jabiluka mineral lease catchments and link to physical models to assess impact <i>Project leaders:</i> K Evans <i>Registry file:</i> JR-05-327, JR-05-298	Res staff: 2 Tech staff: 0	 <i>Commenced:</i> 1999 PhD thesis to be reviewed prior to submission: December 2002 	1.2 & 1.4
Clients: Supervising Scientist Location: No field work Type of sampling: Not applicable Dates: Not applicable Consultation: Not applicable Collaborative Partners: Northern Territory Univer	sitv		

Table 4.1 Projects relating to development of technology to assess mine site impact

Project and aims	Staff commitment	Targets	Outputs
	(pw)		
Erosion rates from disturbed areas within the J	labiluka mine site		
Aim: Use rainfall simulation to derive erosion	Res staff: 10	Commenced: September 2000	1.4
and derive sediment delivery to Swift Creek		Internal Report: June 2003	
Jabiluka project			
Project leader: D Moliere			
Registry file: SG2001/0026			
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborative Partners: The University of Newcas	stle, Landloch Pty I	_td	
Application of landform evolution modelling to	the Nabarlek Min	e site, Arnhem Land	
Aim:	Res staff: 10	Commenced: August 2002	1.2 & 1.4
Develop a GIS to manage and store		Develop GIS for Nabarlek: Soptember 2002	
data and information. To establish a temporal and spatial database (GIS) on		Develop DTM and conduct	
sediment movement and hydrology of		landform simulations: March 2003	
the Nabarlek mine site;		• Internal Report. June 2003	
 Assess minesite landform stability of the Nabarlek mine site using landform 			
evolution modelling			
Project leaders: J Lowry & D Moliere			
Registry file: New Project			
Clients: Supervising Scientist			
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborative Partners: Not applicable			
Calibration of the SIBERIA weathering module	– Energy Resourc	es Australia Ranger mine waste rock due	mp natural
weathering processes			
Aim: To gain an understanding of the rates that	Tech staff: 1	Commenced: July 1998	1.4
under natural conditions to aid in the calibration		Conduct annual measurements:	
of the SIBERIA weathering module		September 2002	
Project Leaders: B Smith			
Registry file: JR-05-291; JR-05-238			
Clients: Supervising Scientist			
Location: No fieldwork			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborating Partners: Leeds University, United Kingdom			

Project and aims	Staff commitment	Targets	Outputs
	(pw)		
A physically based method for spatial interpola	tion of soil measu	irements	
<i>Aim:</i> Test a spatial and temporal soil development model in the Tin Camp Creek catchment to determine weathering and erosion rates	Res staff: 1 Tech staff: 1	<i>Commence</i>: June 2001Journal paper: 2003	1.4
University of Newcastle)			
Registry file: SG2001/0136			
Clients: Supervising Scientist			
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborating Partners: Dartmouth College USA,	The University of N	lewcastle, NSW	
Natural soil movement and soil loss at Tin Cam	p Creek, Arnhem	Land	
<i>Aim:</i> Determine soil erosion rates at Tin Camp Creek using caesium 137 <i>Project leaders:</i> K Evans <i>Registry file:</i> SG2002/0112	Res staff: 1 Tech staff: 2	 Commence: May 2002 Completion of field work and data collation: August 2002 Journal paper: 2003 	1.4
Clients: Supervising Scientist			
Location: Tin Camp Creek			
Type of sampling: Surface soil samples using sm	all cores 10cm dee	Q	
Dates: 19–23 August 2002			
Consultation: Northern Land Council permits obta	ined by G Hancock		
Collaborating Partners: The University of Newcas	stle. NSW		
Changes in hydrology of a mine-impacted catcl	hment . Nabarlek.	Arnhem Land	
Aim: Develop catchment hydrology models pre- and post-mine site construction for catchment impact assessment Project leaders: D Moliere Registry file: SG2000/0135	Res staff: 2	Commence: January 2002 Reporting: December 2002 	1.4
Clients: Supervising Scientist			
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborating Partners: The University of Newcas	stle, NSW		
Project and aims	Staff commitment (pw)	Targets	Outputs
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Sensitivity/error analysis of 3-dimensional land	form evolution m	odelling applied to mine sites	
<i>Aim:</i> Conduct sensitivity/error analysis of landform evolution modelling <i>Project leaders:</i> K Evans <i>Registry file:</i> new file	Res staff: 2	 <i>Commence</i>: August 2002 Finalise contracts: September 2002 Appoint PhD student: June 2003 	1.4
Clients: Supervising Scientist			
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborating Partners: Leeds University, United Kingdom			

 Table 4.2 Projects relating to landscape characterisation and monitoring for environmental impact and risk assessment

Project and aims	Staff commitment (pw)	Targets	Outputs
Hydrology of the Ngarradj (Swift Creek) Catchn	nent		
<i>Aim:</i> Obtain baseline data on hydrology of catchments in the Jabiluka mining lease (JML) and calibrate a hydrology model for long-term 'total catchment' management. <i>Project leaders:</i> D Moliere <i>Registry file:</i> SG2000/0145, JR-05-298	Res staff: 7 Tech staff: 1	 Commenced: 1998 Supervising Scientist Report: December 2002 International Association of Hydrological Sciences conference presentation: September 2002 Complete annual Wet season monitoring program and reporting: May 2003 	1.2 & 1.4
Clients: Supervising Scientist			
Location: Ngarradj Catchment at eriss gauging s	tations		
Type of sampling: Downloading data loggers			
Dates: Fortnightly from October 2002 to May 2003	3		
Consultation: Existing project. Parks Australia North and Northern Land Council previously notified. Parks Australia North to be contacted 1–2 days prior to site visits in accordance with protocols			
Collaborating Partners: Not applicable			

Project and aims	Staff commitment (pw)	Targets	Outputs
Suspended sediment loads in the Ngarradj (Sw	ift Creek) Catchm	ent	
<i>Aim:</i> Monitor and assess suspended sediment loads in streams within the Ngarradj catchment against calibrated sediment transport equations. <i>Project leaders:</i> K Evans <i>Registry file:</i> SG2000/0146, JR-05-298	Res staff: 34 Tech staff: 6	 <i>Commenced</i>: 1998 Journal paper: RUSLE (Revised Universal Soil Loss Equation): September 2002 Journal paper: Sediment Transport: April 2001 – addressing reviewers' comments. Environment conference: June 2003 Complete annual Wet season monitoring program and reporting: May 2003 	1.2 & 1.4
Clients: Supervising Scientist Location: Ngarradj Catchment at <i>eriss</i> gauging st	ations		
Type of sampling: Annual station maintenance an	d retrieving bulk w	ater samples from automatic sampler	
Dates: Maintenance September and October 2002	and fortnightly from	m October 2002 to May 2003	
Consultation: Existing project. Parks Australia Not to be contacted 1–2 days prior to site visits in account	rth and Northern La rdance with protoc	and Council previously notified. Parks Austra ols	alia North
Collaborating Partners: Not applicable			
Stream bedload characterisation in the Ngarrad	lj (Swift Creek) Ca	tchment	
<i>Aim:</i> Monitor and assess stream bedloads in catchments in the Jabiluka mineral lease and determine bedload size distributions and derive bedload fluxes in Ngarradj which can be used for long-term 'total catchment' management of the Jabiluka mineral lease <i>Project leader:</i> M Saynor <i>Registry file:</i> SG2000/0149, JR-05-298	Res staff: 6 Tech staff: 2	 Commenced: 1998 Internal Report: Intra-Wet season X section: Mar 2003 Internal Report: Bed material flux: May 2003 	1.2 & 1.4
Clients: Supervising Scientist Location: Ngarradj Catchment at <i>eriss</i> gauging stations Type of sampling: Bed sediment collected by Helley-Smith sampler during the Wet season Dates: Fortnightly from October 2002 to May 2003 Consultation: Existing project. Parks Australia North and Northern Land Council previously notified. Parks Australia North to be contacted 1–2 days prior to site visits in accordance with protocols Collaborating Partners: The University of Western Australia			

Project and aims	Staff commitment (pw)	Targets	Outputs
Assessment of stream channel stability in the N	Ngarradj (Swift Cr	eek) Catchment	
<i>Aim:</i> Monitor and assess rates of change in stream channel characteristics in Ngarradj to predict the evolution of channels within the catchment and impact on tailings storage <i>Project leader:</i> M Saynor <i>Registry file:</i> SG2000/0150, JR-05-298	Res staff: 9 Tech staff: 6	 Commenced: 1998 Internal Report: Erosion pins: August 2002 Internal Report: PSA (Particle Size Analysis): August 2002 Complete annual Dry season field program and reporting: December 2002 International Association of Hydrological Sciences conference: Poster paper: September 2002 Australian and New Zealand Geomorphology Group conference paper: October 2002 	1.2 & 1.4
Clients: Supervising Scientist			
Location: Ngarradj Catchment at eriss gauging stations			
Type of sampling: Installation and retrieval of scour chains in stream bed, survey cross sections using theodolite, erosion pin measurement and bedload grab samples			
Dates: September and November 2002			

Consultation: Existing project. Parks Australia North and Northern Land Council previously notified. Parks Australia North to be contacted 1–2 days prior to site visits in accordance with protocols

Collaborating Partners: The University of Western Australia

Sediment routing and hydrogeomorphic processes in Gulungul Creek and Ranger minesites billabongs				
Aim:	Res staff: 14	Commenced: August 2002	1.2 & 1.4	
Derive sediment transport conditions for Gulungul Creek	Tech staff: 11	 Install gauging stations in Gulungul Creek: November 2002 		
 Derive sediment transport rates through small minesite catchments/billabongs to Magela Creek 		 Collect initial year of Gulungul data: June 2003 Establish PhD program and 		
Project leaders: K Evans, M Saynor & W Erskine		contract: October 2003		
Registry file: SG2002/0141; SG2002/0148				

Clients: Supervising Scientist

Location: Gulungul Creek Catchment downstream of Ranger mineral lease to Magela Creek and Magela Creek to GS821028

Type of sampling: Installation of two gauging stations, stream gauging, stream bedload collection, water samples using automatic sampler and channel surveys using theodolite

Dates: August 2002 to July 2003

Consultation: Energy Resources Australia, Parks Australia North and Northern Land Council to be notified. Parks to be contacted 1–2 days prior to site visits in accordance with protocols. Northern Land Council notification to be conducted through Research Support & Communications

Collaborating Partners: Notre Dame University, Western Australia

Project and aims	Staff commitment	Targets	Outputs	
	(pw)			
Suspended sediment movement in Magela Cree	ek			
Aim: Determine mud transport conditions in	Res staff: 6	Commenced: September 2002	1.2 & 1.4	
Magela Creek for impact assessment of Ranger mine	Tech staff: 3	• Establish MSc program with the		
Project leaders: D Moliere		University of Newcastle: June 2003		
Registry file: SG2002/00081				
Clients: Supervising Scientist				
Location: Ranger mineral lease upstream along M	lagela Creek to GS	821028		
Type of sampling: Installation of water samplers a	and channel survey	s using theodolite		
Dates: August 2002 to July 2003	Australia North an	d Northorn Land Council to be potified. Park	re to bo	
contacted 1-2 days prior to site visits in accordance through RSC Group.	e with protocols. No	orthern Land Council notification to be condu	ucted	
Collaborating Partners: Not applicable				
Stratigraphy of a Chenier Plain, East Alligator F	River, Northern Te	rritory		
Aim: Determine late-Holocene stratigraphy of a	Res staff: 1	Commence: July 2001	2.1	
chenier ridge near Point Farewell at the mouth of the East Alligator River	Tech staff: 1	• Completion of field work: July 2002		
Project leader: M Saynor				
Registry file: SG2001/0240				
Clients: Supervising Scientist				
Location: Point Farewell				
Type of sampling: Surveys using Theodolite and Dates: 15-17 July 2002	sediment samples	from auger noies and shallow trenches		
Consultation: Parks Australia North and Tradition	al Owner J Nadii c	onsulted		
Collaborating Partners: Notre Dame University, I	Jniversity of Weste	rn Australia		
Saltwater intrusion and its impact on the geom	ornhology of the t	loodplain catchment of a tidal creek at P	oint	
Farewell, Alligator Rivers Region	orphology of the l	locupiant cateriment of a tidal creek at r	onn	
Aim: Determine the rate of sediment loss from	Res staff: 1	Commence: July 2001	2.1	
shore embayment and rate of expansion of		Journal paper: December 2002		
of saltwater intrusion		• SSN: December 2002		
Project leader: M Saynor				
Registry file: SG2001/0105				
Clients: Supervising Scientist				
Location: No field work				
Type of sampling: Not applicable				
Dates: Not applicable				
Consultation: Not applicable				
Collaborating Partners: The University of Western Australia				

Alligator Rivers Region soils database			
<i>Aim:</i> Archive and describe existing Alligator Rivers Region soil samples	Tech staff: 2	Commence: July 2001	1.2
Project leaders: B Bayliss		Internal Report: November 2002	
Registry file: SG2001/0180			
Clients: Supervising Scientist			
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborating Partners: Not applicable			
Mapping changes to Melaleuca distribution on	the Magela flood	plain using aerial photography	
Aim: Use aerial photography to perform temporal	Res staff: 1	Commenced: December 2001	1.2 & 2.1
analysis of changes in distribution of Melaleuca species on the Magela floodplain		Internal Report: August 2002	
Project leader: J Lowry		Conference paper: September 2002	
Project file: SG2001/0314			
Clients: Supervising Scientist			
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborating Partners: Not applicable			
Mapping biophysical features of Magela Creek	and floodplain		
Aim: Produce a 1:50 000 base map of the	Res staff: 4	Commenced: May 2002	1.2 & 2.1
Ranger uranium mine.		Project outline finalised: April 2002	
Project leader: J Lowry		Data acquisition: July 2002	
Project file: SG2002/0101		Base map start: August 2002	
		 1st phase desktop mapping component: October 2002 	
Clients: Supervising Scientist			
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Parks Australia North and Northern	Land Council		
Collaborating Partners: Not applicable			

Project and aims	Staff commitment (pw)	Targets	Outputs	
Landscape mapping of the Alligator Rivers Reg	jion			
<i>Aim</i> : Collate, compile and integrate data sets in a GIS to delineate land systems within the Alligator Rivers Region. <i>Project Leader</i> : John Lowry <i>Project file</i> : SG2001/0049	Res staff: 3	<i>Commenced:</i> March 2001Supervising Scientist Report: June 2003	1.2	
Clients: Supervising Scientist	I I			
Location: No field work				
Type of sampling: Not applicable				
Dates: Not applicable				
Consultation: Not applicable				
Collaborating Partners: NT Department of Busine	ess, Industry and R	esource Development		
GPS (Global Positioning System) marking of m	angrove transects	s in Kakadu National Park		
<i>Aim</i> : Locate and record GPS co-ordinates for mangrove transects formerly positioned in early 1980s <i>Project leader</i> : G Begg & Gordon Claridge (consultant) <i>Project file</i> : new file	Res staff: 1	 Commenced: Project planning: July 2002 Field work and Internal Report: October 2002 		
Clients: Supervising Scientist				
Location: East Alligator, Kakadu National Park				
Type of sampling: No sample collection required. Project restricted to locating sites using GPS and where appropriate labelling with aluminium tags and/or steel pickets				
Dates: First two weeks of October 2002				
Consultation: Project will be conducted collaboratively with Parks Australia North staff and local Aboriginal people advised. Parks Australia North staff are to participate in field work to locate the transects				
Collaborating Partners: Consultant, Parks Austra	Collaborating Partners: Consultant, Parks Australia North and Traditional Owners			

Table 4.3	Projects relating to provision of support to the NCTWR in the inventory and survey of tropical
wetlands	

Asian Wetland Inventory				
Aim:	_	Commenced: September 2000	2.2	
Develop a protocol for the Asian Wetland Inventory	Res staff: 2	Finalisation of AWI manual: August 2002		
Project leader: G Begg		Journal article: December 2002		
Project files: SG2000/0055 SG2000/0184 (MRC) SG2001/0039				
Clients: Wetlands International				
Location: No field work				
Type of sampling: Not applicable				
Dates: Not applicable				
Consultation: Not applicable				
Collaborating Partners: Wetlands International a	nd private consulta	ants		

Project and aims	Staff commitment (pw)	Targets	Outputs
Comparison of estimates of wetland area in the	wet-drv tropics		
Aim: Compare different estimates of wetland areas from existing data Project leader: J Lowry Project files: JP 05 199 (CAIM)	Res staff: 1	Commenced: September 2000 Supervising Scientist Report: September 2002 	2.2
JR05-296 (IGBP –DIS) JR03-023 (CIESIN) SG2000/0151			
Clients: Supervising Scientist			
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborating Partners: Not applicable			
An analysis of the accuracy of selected global National Park	andcover data se	ets for wetland inventory — a case study	in Kakadu
Aim: Extract estimates of wetland area through analysis of existing remote sensing data.	Res staff: 1	Commenced: October 2001	1.2 & 2.1
Project leader: J Lowry		Remote sensing Conference: September 2002	
Project files: SG2001/0289		Internal Report: September 2002	
Clients: Supervising Scientist	I		
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborating Partners: University of New South	Wales, University	of Tasmania	
Inventory and Risk Assessment of wetlands in	the Daly Basin		
Aim: Provide a mapping base and risk	Res staff: 1	Commenced: March 2000	2.1
assessment framework for determination of the environmental flow requirements of aquatic habitats in the Daly basin		River Symposium paper: September 2002	
Project leader: G Begg		Journal article: December 2002	
Project file: SG2000/0091			
Clients: NT Department of Infrastructure, Planning	and Environment		
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborating Partners: Not applicable			

eriss GIS (Geographic Information System) support			
Aim: To develop a framework for the provision of	Res staff: 5	Commenced: July 2001	1.2
GIS services to <i>eriss</i> programs		Maintenance GIS and training: ongoing	
Project leader: J Lowry			
Project file: New File			
Clients: Supervising Scientist			
Location: No field work			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborating Partners: Not applicable			
Implementation of eriss dGPS (Differential Glo	bal Positioning S	System)	
<i>Aim:</i> Establish an Institute differential global positioning system and ensure staff has the skill to apply the technology	Res staff: 2	<i>Commenced</i> 1996 Maintenance of dGPS and training: ongoing	1.2
Project leader: M Saynor			
Registry file: SG2001/0006			
Clients: Supervising Scientist			
Location: Field work as required by projects			
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborating Partners: Not applicable			

Table 4.4 Projects relating to *eriss*-wide support for collection and management of spatial data

5 Ecological Risk Assessment

To provide advice on the significance of threats to the biological diversity and functioning of tropical wetlands in the Alligator Rivers Region and elsewhere.

Ecological risk assessment projects fall into two outcome areas: ecotoxicological impacts and landscape-wide impacts.

Priority activities in 2002–2003 include:

Ecotoxicology Impacts

- Assessment of the aquatic toxicity of regionally relevant toxicants, and the associated derivation of site-specific water quality guidelines;
- Refine and develop ecotoxicological procedures using local aquatic species;
- Maintain the quality control and quality assurance system of the *eriss* ecotoxicology laboratory; and
- Assessment of the ecological risks of threats (eg herbicides, invasive species) to wetlands.

Landscape Impacts

- Assessment of World Heritage values of wetlands of Kakadu National Park (interaction between waterbirds & invasive species, fire & habitat heterogeneity);
- Advise the Ramsar Convention on the impacts of climate change to wetlands and methods of assessing their vulnerability;
- Advise the Ramsar Convention on incorporating indigenous community perspectives in the management of wetlands and methods to assess impacts on the cultural values of water;
- Assessment of threats to marine and coastal ecosystems in the Alligator Rivers Region and regional implications;
- Develop an ecosystem model of wetlands of the Alligator Rivers Region to be used as a decision support tool for ecological risk assessment and management; and
- Integrate socio-economic frameworks and indigenous perspectives into ecological risk assessment and management frameworks.

Table 5.1 Ecotoxicological Impacts projects

Project and aims	Staff commitment (p/w)	Targets	Outputs
Toxicity of the green alga, Chlorella sp.			
<i>Aim</i> : Assess the toxicity of uranium to the green alga, <i>Chlorella sp</i> in Magela Creek.	Res staff: 8 Tech staff: 4	Commenced: April 2000 Results to be presented at Interact Conference July 	1.2
<i>Project leader:</i> Alicia Hogan <i>Project file:</i> SG2000/0093		2002 Internal Report August 2002 Isurral articles submitted	
		• Journal anticle. Submitted December 2002	
Clients: Supervising Scientist			
Location: Jabiru laboratory now transferred to [Darwin		
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborative Partners: Not applicable			
Toxicity of Magnesium sulphate (MgSO ₄) to lo	ocal aquatic orga	nisms	
Aim: Assess the toxicity of MgSO ₄ to local	Res staff:8	Commenced: June 2001	1.2
aquatic organisms and relate the results to	Tech staff: 6	Internal report: March 2002	
downstream of Ranger mine		 Journal paper: submitted January 2003 	
Project leader: Caroline Camilleri		Interim results presented at Interact Conference: July	
Project IIIe. SG2000/0188		2002	
Lection: John John John John John John John John	Donvin		
Type of sampling: Not applicable	Darwin		
Type of sampling. Not applicable			
Consultation: Not applicable			
Collaborative Partnere: Not applicable			
Appual pro-release toxicity testing of Dialkma	vra Billahong & B	estantion Bond 1 using local aquatic bi	ota
Aim Assess the toxicity of Dialkmara		Commoncod: Docombor 2001	1.2
Billabong to three local aquatic animals, and determine the minimum dilution rate for release of this water into Magela Creek	Tech staff: 4	Full suite of concurrent toxicity test: January 2002	1.2
		Internal Report: July 2002	
Project leader: Alicia Hogan		Consultancy report & Internal Report: January	
Project file: SG2001/0275		2003	
Clients: Supervising Scientist			
Location: Djalkmara Billabong & Ranger Reten	tion Pond 1		
Type of sampling: Water sampling in conjunction	on with Energy Re	esources Australia	
Dates: Final toxicity testing to be carried out over	er pre-release peri	od of 02–03 Wet season	
Consultation: Ongoing on Ranger mining lease)		
Collaborative Partners: Energy Resources Aus	tralia		

AusAid project – help establish ecotoxicology labs in the Asia-Pacific region				
<i>Aim</i> : Investigate potential of AusAid & other sources of funding to help establish ecotoxicology laboratories in Indonesia and the Philippines, and to develop & implement ecotoxicity testing & risk assessment training courses. <i>Project leader:</i> Alicia Hogan <i>Project file:</i> New file	Res staff: 2	Commenced: January 2002 Scoping paper & briefing: July 2002 Application to AusAid: June 2003 Applications to other external funding sources: ongoing 	2.2	
Clients: Asia-Pacific Region				
Location: Asia-Pacific (Indonesia, Philippines)				
Type of sampling: Not applicable				
Dates: Depending on success of funding application	ations, 2003–04			
Consultation: Commenced with AusAid, University Philippines & University Technology Sydney				
Collaborative Partners: AusAid (AYAD Program), Chemisty Department University of Philippines, University Technology Sydney				
Ecotoxicological protocol compilation				
<i>Aim</i> : To compile all the toxicity test protocols ever developed or used at <i>eriss</i> in one document. Each protocol will be written as a stand alone document within the entire paper <i>Project leader:</i> Caroline Camilleri/Alicia Hogan <i>Project file:</i> SG2000/0194	Res staff: 3	 Commenced: July 2000 Internal Report: October 2002 Supervising Scientist Report: December 2002 	2.1	
Clients: Supervising Scientist	•		•	
Location: Jabiru laboratory now transferred to E	Darwin			
Type of sampling: Not applicable				
Dates: July 2000 to December 2003				
Consultation: With relevant ecotoxicologycollea	agues as necessa	ry		
Collaborative Partners: Not applicable				

Table 5.2 Landscape Mapping projects

Project and aims	Staff commitment (p/w)	Targets	Outputs
CRC Application of Earth Observations bid			
<i>Aim:</i> To develop a Sub-program on 'Healthy Tropical Wetlands' in the Environment Program of the CRC bid 'Application of Earth Observations', and to participate in the bid process (assessment, interview, if successful formation of governance structures etc) <i>Project leader:</i> Max Finlayson/Peter Bayliss <i>Project file:</i> New file	Res staff: 3 Tech staff: 2	Commenced: May 2002 Develop wetlands sub- program: July 2002 Develop supplementary funding bid for a Marine & Coastal Program: December 2002 Possible interview: October 2002 Notification: November 2002 Successful CRC formation:	2.2
Clients: All Commonwealth/state/territory natural	resource manage	December 2002 ement agencies, Indigenous land councils a-Pacific various	s, mining

Location: Northern Australia — King Sound (WA) to Cape York (Qld)

Type of sampling: Remote sensing and ground truthing

Dates: June–December for preparatory effort: implementation June 2003–June 2010

Consultation: Government agencies, non-government organisations, indigenous organisations, regional communities, university centres

Collaborative Partners: 28 supporting and core partners in Cooperative Research Centre bid (see Business Plan); Wetlands Sub-program to be facilitated by nctwr core partners (Northern Territory University, James Cook University, The University of Western Australia) & Gecoz Pty Ltd

Project and aims	Staff commitment (p/w)	Targets	Outputs
Management of feral animals Kakadu Nationa values of pests and costs of damage	I Park — Part I. C	Consultation with Traditional Owners to	o determine
 Aim: Sub-contract from Northern Territory University Key Centre for Tropical Wildlife Management, as part of larger contract from Parks Australia North to develop pest management frameworks and strategies for Kakadu National Park in consultation with Traditional land owners. Project is in two parts: 1. Determine how Traditional Owners value pigs and buffalo, and the acceptable levels of damage to natural and cultural values. 2. Develop conceptual cost-of-control models using a GIS spatial dynamics framework. <i>Project leader:</i> Peter Bayliss <i>Project file:</i> New file 	Res staff: 7 Tech staff: 3	 Commenced: July 2002 Progress report: July 2002 Prototype spatial population model for pigs & buffalo: September 2002 Training workshops for Kakadu National Park staff & Traditional Owners: December 2002 Final report: July 2003 	2.2
Clients: Parks Australia North, Traditional Owne	rs on Kakadu Nati	onal Park, Supervising Scientist	

Location: Whole of Kakadu National Park

Type of sampling: Ground and aerial survey of buffalo & pig damage with Traditional Owners

Dates: July 2002 – July 2003; continuous monthly consultations & field work.

Consultation: Consultant engaged to facilitate all consultations on behalf of Northern Territory University, Parks Australia North and *eriss*; develop similar consultation protocols for *eriss*'s independent feral pest research (see Part II below) and develop collaboration with Victorian Department of Natural Resource and Environment.

Collaborative Partners: Northern Territory University Key Centre for Tropical Wildlife Management, Parks Australia North, Victorian Department of Natural Resources and Environment, Jawoyn Association, all Aboriginal organisations on Kakadu

Project and aims	Staff commitment (p/w)	Targets	Outputs	
Management of feral animals KNP — Part II.	Develop pest con	trol framework		
 Aim: In collaboration with Parks Australia North, develop a pest control framework to manage buffalo and pig impacts/damage to natural and cultural values of Kakadu National Park. Project is in two parts: 1. Determine the current distribution & abundance of feral pigs & buffalo on KNP, using standardised low-level helicopter survey. 2. Adopt adaptive management process to experimentally parameterise conceptual control model developed in Part I above on a landscape basis (= 3 key density relationships: damage-density; catch-effort-density; & rate of population increase-density). Project leader: Peter Bayliss Project file: New file 	Res staff: 4	 Commenced: June 2002 With Parks Australia North staff undertake helicopter survey for buffalo and pigs and map distribution and abundance. August/September 2002 With Parks Australia North staff develop cost-of-control and population models for buffalo and pigs by January 2003 With Parks Australia North staff and Northern Territory University PhD student, develop damage-density functions for pigs and buffalo by July 2003 	2.1	
Clients: Parks Australia North, Traditional Owners on Kakadu National Park, Supervising Scientist				
Location: All of Kakadu National Park				
Type of sampling: Aerial and ground survey for buffalo, pigs and their damage (via ground disturbance)				
Dates: August–September 2002				
Consultation: As above for Part I. Joint project with Parks Australia North, Northern Territory University Key Centre for				

Tropical Wildlife Management and Traditional Owners. Cost sharing with Parks Australia North. **Collaborative Partners:** Parks Australia North, Traditional Owners on Park, Northern Territory University Key Centre for Tropical Wildlife Management, Victorian Department of Natural Resources, Northern Territory Government

for Tropical Wildlife Management, Victorian Department of Natural Resources, Northern Territory Government departments (eg NT Department of Infrastructure, Planning and Environment).

Project and aims	Staff commitment (p/w)	Targets	Outputs
Assess weed invasion on Magela catchment	& Alligator Rivers	s Region in general	
<i>Aim:</i> Assess the risk of three major weeds that occur on the Magela floodplains (mimosa, salvinia & paragrass) using a risk assessment framework. Specifically determine:	Res staff: 4 Tech staff: 12	Commenced: August 2002 Consultation with Parks Australia North: June 2002	2.1
1. areas that are at risk of invasion (i.e. current distribution & trend analysis);		 Further consultations with Parks Australia North: August 2002 	
2. likely consequences of invasions;		Compile all weed survey	
 management actions that are being undertaken, or need to be undertaken, to minimise risks of further invasions across Kakadu and Alligator Rivers Region; and how the presence and spread of the weed species could confound assessment of any mining-related activities. 		data from relevant Parks Australia North Kakadu Districts (eg GPS spot locations etc), register data in GIS. Compile data on control effort/costs & targets achieved: December 2002	
<i>Project leader:</i> Dave Walden <i>Project file:</i> New file		 Use best documented weed control data from Mary River District as comparative model (on Simon's advice): December 2002 Complete risk assessment on Magela by July 2003; include cost-of-control model for Mimosa. 	

Clients: Parks Australia North, relevant Traditional Owners and Supervising Scientist

Location: Magela Catchment in particular, others in general (eg Boggy Plain-South Alligator, Mary River District)

Type of sampling: Weed surveys by Parks Australia North staff, ground truthing (air boat, foot, helicopter etc) of remote sensing imagery & maps by *eriss* staff

Dates: Wet season-Nov/Dec 2002

Consultation: With Parks Australia North staff & relevant Traditional Owners. Needs to start immediately

Collaborative Partners: Parks Australia North, Northern Territory Government departments (eg Department of Infrastructure, Planning and Environment), Northern Land Council, relevant Traditional Owners

Project and aims	Staff commitment (p/w)	Targets	Outputs
Assess World Heritage waterbird values of M	agela wetlands &	for context Alligator Rivers Region	
<i>Aim:</i> In general: (1) Assess World Heritage values of waterbirds (migratory waders/shorebirds, waterfowl, seabirds) on Magela wetlands & Alligator Rivers Region; and, (2) Integrate study with proposed national & existing international waterbird monitoring programs. <i>Project leader:</i> Peter Bayliss/Dave Walden <i>Project file:</i> New file	Res staff: 6 Tech staff: 3	 Commenced: August 2002 Internal Report: Gap analysis using existing data: November 2002 Re-design monitoring surveys and commence monthly samples: January 2003 Survey, analyse & assess monitoring data: monthly between 2003 & 2004 Investigate potential remote sensing to monitor & assess condition of waterbird habitats: December 2003 Develop trophic interaction models by December 2004 	2.2

Clients: Supervising Scientist, Parks Australia North, relevant Traditional Owners

Location: Multi-scale: (1) Magela Catchment (intensive surveys of Steve Morton's Office of the Supervising Scientist air/ground transects; (2) Alligator Rivers Region (extensive surveys of Bayliss et al.) – floodplains of Murganella-Coopers Creeks; East, South & West Alligator Rivers, Wildman & Mary Rivers.

Type of sampling: Fixed-wing aerial & ground counts of waterbirds; collection plant/seed specimens; sampling of waterbodies for macro-invertebrates & fish; water samples for nutrient analysis

Dates: Waterbird & habitat surveys are monthly throughout year for two years

Consultation: Collaboration & coordination with Traditional Owners/ Northern Land Council, Parks Australia North, Parks and Wildlife NT, Birds Australia, Environment Australia Wetlands Unit and Wetlands International. Consultation required with Traditional Owners on KNP, particularly Magela Catchment.

Collaborative Partners: Parks Australia North, relevant Traditional Owners, Birds Australia, Environment Australia-Wetlands Unit, Wetlands International, Ramsar, Northern Territory University Key Centre for Tropical Wildlife Management, Johnston Centre Charles Sturt University, National Centre for Tropical Wetland Research partners

LANDSCAPE: Multiple landscape impacts at Boggy Plain, South Alligator, KNP			
<i>Aim</i> : In general: investigate ecological effects of key multiple impacts on the composition, structure & heterogeneity of floodplain vegetation at Boggy Plain, and quantify flow-on effects on abundance of key wildlife food resources used by indigenous people (e.g. magpie geese, turtles, plants etc). Key landscape effects are: Dry season burning; saltwater intrusion; weeds & feral animals (primarily buffalo & pigs). Burning by Traditional Owners is perceived to maintain habitat heterogeneity by preventing <i>Eleocharis</i> from being dominated by a monoculture of native <i>Hymenachne</i> . <i>Project leader:</i> Peter Bayliss <i>Project file:</i> New file	Res staff: 3 Tech staff: 7	 Commenced: August 2002 Helicopter survey for pigs & buffalo: October 2002 Commence detailed surveys and ground truthing: February 2003 	2.1

Clients: Supervising Scientist, Parks Australia North, relevant Traditional Owners

Location: Boggy Plain, South Alligator River-Nourlangie Creek system

Type of sampling: Aerial (helicopter & fixed-wing) & ground survey geese, pigs, buffalo, turtles, *Eleocharis* bulbs & traditional food plants. Plant specimens collected. Post-burn intensive helicopter surveys of floodplain vegetation (250m² grid cells) to ground truth contemporaneous remote sensing (IKONOS & Radarsat) imagery.

Dates: Late Dry season 2002 (October-November) & peak Wet season 2003 (Feb/March)

Consultation: Discussions commenced by Max Finlayson & Peter Christopherson. Rod Kennett (Parks Australia North) has commenced consultations with other Traditional Owners. Traditional Owners participation in project, Parks Australia North takes lead, *eriss* provides support.

Collaborative Partners: Parks Australia North, relevant Traditional Owners, Northern Territory University Key Centre for Tropical Wildlife Management & Faculty of Science, Information Technology and Education NTU, Gecoz Pty Ltd

Project and aims	Staff commitment (p/w)	Targets	Outputs	
Ecosystem modelling Alligator Rivers Region	I			
 Aim: Develop complex cross-scalar ecosystem model to be used as a decision support tool for management & policy development. Phase 1 –Desk top study. Investigate a variety of modelling concepts to simulate & predict mass and nutrient transfer processes Phase 2 – Meta-data analysis to identify knowledge gaps to fill to parameterise model components. Phase 3 – Parameterise model components using adaptive management strategies if necessary & old & new survey data (see Landscape projects above). Project leader: Peter Bayliss Project file: New 	Res staff: 6 Tech staff: 12	 Commenced: August 2002 Phase 1 – attend workshop run by Vic. DNRE to scope ecosystem modelling approaches & to establish an Australian Centre for Ecosystem Modelling: September 2002 Phase 2: January 2003 	1.2	
Clients: Supervising Scientist, Parks Australia North, relevant Traditional Owners				
Location: Alligator Rivers Region — hydrological (e.g. stream gauge) data for all major catchments. Waterbird data for Alligator Rivers Region. Fish, plant & macro-invertebrate data for Magela system				

Type of sampling: Desk-top study in phase 1 using meta-data from previous publications & new surveys (see above)

Dates: See new Landscape projects above

Consultation: Not applicable

Collaborative Partners: Parks Australia North, Northern Territory Government departments (eg Department of Infrastructure, Planning and Environment), Victorian Department of Natural Resources (Ecosystem Modelling Centre), University of British Columbia (Carl Walters)

Project and aims	Staff commitment (p/w)	Targets	Outputs
Catchment management planning with Indige	nous communiti	es, Arnhem Land	
<i>Aims</i> : In collaboration with Northern Land Council, help Arnhem Land Aboriginal communities develop (or finish) catchment management plans <i>Project leader:</i> Caroline Camilleri <i>Project file:</i> New file	Res staff: 4	Commenced: August 2002 Detailed consultations: September 2002 Commence planning in selected two catchments: December 2002 Commence planning in further third catchment: June 2003 Implement planning process & training program: Sepetmber 2002	2.2

Clients: Relevant local Aboriginal organisations & corporations, Northern Land Council, relevant Northern Territory Government departments, Environment Australia Wetlands Unit

Location: All of coastal Arnhem Land

Type of sampling: None, basically community consultation & capacity building

Dates: Commence Catchments 1 & 2 in 2003, & 3 & 4 in 2004. Ongoing for several years

Consultation: Will be done in collaboration with Caring for Country Unit & *eriss* Research Support and Communications unit

Collaborative Partners: Wetlands Officer Northern Land Council (Fiona Fraser), Djelk Rangers/Bawinanga Aboriginal Corporation, Dhimurru Land Management Board, relevant local Aboriginal organisations, Northern Territory University Key Centre for Tropical Wildlife Management & Centre for Indigenous Natural and Cultural Resource Management, Environment Australia-Wetlands Unit, nctwr partners

Project and aims	Staff commitment (p/w)	Targets	Outputs
Assess threats to marine & coastal ecosyster	ns in Alligator Ri	vers Region & NT generally	
 Aim: 1. Phase 1: For Alligator Rivers Region – initiate coastal assessment & monitoring process. Map temporal changes in distribution of mangroves since 1980 to assess potential impacts of global & local changes; & monitor & model oceanic processes that may drive significant changes in inland wetland condition. 2. Phase 2: For NT generally – commence broad-scale coastal wetland inventory process to be used as baseline to assess & monitor local & global changes. Use experience in 1 above to guide process. 3. Integrate with same projects in Wetlands Sub-program of the Application of Earth Observations Cooperative Research Centre bid should it succeed. <i>Project leader:</i> Caroline Camilleri <i>Project file:</i> New 	Res staff: 4	 Commenced: August 2002 Commence consultations with Northern Land Council Caring for Sea Country program in August 2002, relevant Alligator Rivers Region Aboriginal communities via Northern Land Council, NOO, relevant Northern Territory Government Departments, Northern Territory University Key Centre for Tropical Wildlife Management /Centre for Indigenous Natural and Cultural Resource Management, World Wildlife Fund & ATRF (Australian Institute of Marine Science /Australian National University). Phase 1: to be completed by July 2003. Phase 2: to commence by July 2004. 	1.2

Location: Alligator Rivers Region & Northern Territory generally

Type of sampling: Remote sensing & mapping. Consultations with relevant Aboriginal communities

Dates: See above

Consultation: Extensive, see above

Collaborative Partners: Northern Territory Government (Department of Infrastructure, Planning and Environment – Fisheries; Lands, Planning & Environment, Conservation Commission), National Oceans Office, Arafura-Timor Research Facility (Australian Institute of Marine Science, Environment Australia & Australian National University), Northern Land Council Caring for Sea Country Manager, relevant local Aboriginal organisations, nctwr partners.

Project and aims	Staff commitment (p/w)	Targets	Outputs
A catalogue of research undertaken in the All	igator Rivers Reo	gion	
<i>Aim</i> : To provide a complete as possible listing of all published information on the Alligator Rivers Region in the form of an updated, comprehensive database.	Res staff: 4 Tech staff: 3	Commenced: • Project planning (June 2002)	1.2
Project leader: George Begg Project file: SG 2002/0017		 Finalising database design and conducting on-line search procedures (August 2002) Sourcing ancillary material externally (October 2002) Updating of Alligator Rivers Regionl database (December 2002) 	

Clients: Supervising Scientist, Parks Australia North

Location: Alligator Rivers Region

Type of sampling: Not applicable

Dates: June to December 2002

Consultation: The project will be undertaken collaboratively with a variety of external organisations. These include Parks Australia North, Australian Geographical Survey Organisation, Environmental Resource Information Network, Australian Centre for Remote Sensing, Australian Nuclear Science and Technology Organisation, Northern Territory University, Northern Land Council, University of New South Wales, The University of Western Australia, Australian National University, Energy Resources Australia, Earth Water Life Sciences, Commonwealth Scientific and Industrial Research Organisation, NT Department of Infrastructure, Planning and Environment, NT Department of Business, Industry and Resource Development, Power and Water Authority, Bushfires Council, Bureau of Meteorology, Northern Territory Museum, Northern Territory Archives, National Archives and the Australian Museum. Each organisation will be asked to add to the database anything that the initial search may have missed.

Collaborative Partners: Parks Australia North, Australian Geographical Survey Organisation, Environmental Resource Information Network, Australian Nuclear Science and Technology Organisation, Northern Territory University and Northern Land Council

Project and aims	Staff commitment (p/w)	Targets	Outputs
Describing the ecological character of Austra	ılia's Ramsar site	S	
Aims : To pilot test an approach for developing descriptions of ecological character for Australia's present and future Ramsar sites Project leader: G Begg Project file: SG 2002/0017 Client: MainStream Environmental Consulting Pty Ltd	Res staff: 4 Tech staff: 2	 Commenced: October 2001 Development of a proforma for data gathering (Dec 2001) Desk top study and preparation of full descriptions of selected sites in NT, Qld and WA (March 2002) Comments on draft report sent to Australian and New Zealand Environment and Conservation Council Task 	2.1
Clients: MainStream Environmental Consulting Pty Ltd			
Location: Selected sites for desktop study - Mag	gela floodplain (NT); Bowling Green Bay (Qld); Lake Toolibi	n (WA)
Type of sampling: Not applicable			
Dates: Not applicable			
Consultation: Not applicable			
Collaborative Partners: Brett Lane & Associates Pty Ltd, Monash University & James Cook University			

6 Research Support and Communications

To develop and implement communications programs to involve and inform Aboriginal communities and other stakeholders about the activities of the Supervising Scientist Division.

Priority activities in 2002–2003 include:

- Identify and coordinate involvement and employment of local and other Aboriginal people in monitoring and research programs;
- Develop interactive methods to disseminate information on monitoring and research to stakeholders;
- Coordinate consultation for research and monitoring with Traditional Owners and other relevant groups;
- Build and strengthen communication networks within the community and with other stakeholders;
- Ensure all staff have a high level of cultural awareness and are familiar with current issues and events that affect the Aboriginal community;
- Identify new stakeholders and forge new professional partnerships for Supervising Scientist Division;
- Play an active roll in the strategic planning of the Supervising Scientist Division;
- Provide support to the Board and Committee of the National Centre for Tropical Wetland Research.

The Research Support and Communications section will be focusing on internal and external mechanisms to facilitate effective communication with stakeholders in the Alligators Rivers Region (ARR) and in the Darwin region during 2002–2003. Particular attention will be focused on ensuring that AAR communities are familiar and confident with the dedicated monitoring team in Jabiru and the work they do. Emphasis will be placed on increasing the Supervising Scientist Division profile to stakeholder groups in Darwin. Consultation with Traditional Owners and other stakeholders over research, monitoring and landscape mapping projects will increase and will allow the further development of employment and training opportunities for Traditional Owners with *eriss*.

 Table 6.1
 Communications and liaison

Project and aims	Staff commitment (p/w)	Targets	Outputs		
Identify internal and external communication communication	Identify internal and external communication needs and implement strategies to ensure effective communication				
<i>Aim:</i> To ensure that information on research and monitoring is disseminated to the relevant stakeholders effectively and on time. <i>Project leader: J Rovis-Hermann</i> <i>Project file:SG2000/0092</i>	Staff:	 Commenced: September 2000 Develop an Issues Management Plan for the Jabiru Field Station to ensure staff are aware of what procedures to follow when issues of community concern arise: November 2002 Develop a Communications Strategy that promotes and disseminates the research and monitoring work of Supervising Scientist Division, the National Centre for Tropical Wetland Research and the Jabiru Field Station. Initial strategy developed: January 2003 			
Coordinate the employment and training of lo	ocal Aboriginal pe	eople in <i>eriss</i> research			
<i>Aim</i> : Identify and coordinate the involvement and employment of local and other Aboriginal people in <i>eriss</i> research programs where possible <i>Project leader:</i> J Rovis-Hermann <i>Project File:</i> JS-04-047	Staff:	 Commenced: September 2000 Coordinate employment and contract arrangements for staff as required: Ongoing Investigate funding opportunities for employment and training support through EA Indigenous Employment Program and with other agencies: Ongoing Assess training needs for staff who will be working with Bininj and implement training where necessary: Ongoing Liaise with other employment providers in Kakadu to develop coordinated training strategies for Bininj: Ongoing 			

Project and aims	Staff commitment (p/w)	Targets	Outputs
Coordinate consultation with Traditional Owners, representative bodies and other stakeholders for monitoring and research programs			
<i>Aim:</i> To ensure that consultation for existing and new projects is undertaken prior to work commencing <i>Project leader:</i> J Rovis-Hermann <i>Project File:</i> SG 2002/0098	Staff:	 Commenced: June 2002 Liaise with Supervising Scientist Staff on project development and implementation: Ogoing Ensure each new project has consultation and communication strategy: Ongoing Advise on correct consultation process: Ongoing Conduct consultation with Traditional Owners and representative bodies in accordance with protocols: Ongoing Keep file notes on all consultation: Ongoing Ensure staff have correct permits are inplace for access: Ongoing 	
Coordinate the communication of eriss resea	arch and monitor	ing to stakeholders	
Aim: To ensure that erriss disseminates information on research work and results to stakeholders in an appropriate and timely manner Project leader: J Rovis-Hermann Project file: JS-04-047	Staff:	 <i>Commenced:</i> September 2000 All new projects to have a communications strategy included as part of the project plan and to be approved by the program leader before the project can commence: Ongoing Offer relevant Traditional Owners and representative bodies briefing sessions and site visits for each project and produce plain English summary at the completion of each project: Ongoing Coordinate the production of <i>eriss</i> notes, newsletters and other brochures, where appropriate, for communication of research outcomes and key issues to stakeholders and the general public: Ongoing Actively seek out opportunities for Supervising Scientist Division to coordinate activities such as seminars, workshops, briefings on key issues of importance to different stakeholder groups: Ongoing 	

Project and aims	Staff commitment (p/w)	Targets	Outputs
Produce bimonthly newsletter for Aboriginal associations and other key stakeholders on key issues			
Aim: Keep Aboriginal associations, Parks Australia, Energy Resources Australia, Jabiru Town Council and others regularly informed about monitoring, research and other Supervising Scientist Division activities Project leader: J Rovis-Hermann	Staff:	<i>Commenced</i>: May 2000Six newsletters produced a year	
Liaise with Aboriginal associations and other	stakeholders		
Liaise with Aboriginal associations and other Aim: To maintain a high level of contact with key stakeholders Project leader: J Rovis-Hermann Project Files:: File: SG2000/0169	stakeholders Staff:5	 <i>Commenced:</i> May 2000 Maintain regular contact, with Aboriginal Associations: Ongoing Maintain regular contact with other stakeholder groups such as Parks Australia, Northern Land Council, Energy Resources of Australia: Ongoing Strengthen links with scientific, environmental and academic stakeholders in Darwin: Ongoing Attend meetings of the Kakadu Employment, Training and Education Committee, Gunbang Action Group, Bininj Working Committee: Ongoing Provide in-kind and other support to community and cultural events such as the Gunbalanya Open Day, NAIDOC Week: Ongoing Represent Supervising Scientist Division at all community events: Ongoing Update protocol on access to Aboriginal land to ensure Supervising Scientist Division staff are aware of access requirements: Ongoing Ensure relevant Aboriginal 	
		groups and Parks Australia are notified of intended access to areas within Kakadu National Park in advance: Ongoing	

Project and aims	Staff commitment (p/w)	Targets	Outputs
Ensure all staff are aware of the cross cultura	I aspects of livin	g and working in Kakadu	
<i>Aim:</i> Ensure all Supervising Scientist Division staff are aware of the cultural issues that they may encounter living and working in the Alligators Rivers Region	Staff: 2	Commenced: May 2000	
		All staff and students undertake cross cultural training: Ongoing	
Project leader: J Rovis-Hermann		Refresher course offered appually for existing staff:	
Project Files: SG2000/0169		Ongoing	
		All new staff undergo an Aboriginal Communications component as part of the induction: Ongoing	
		Update the information pack on Aboriginal Associations of the Alligator Rivers Region: October 2002	

Table 6.2 Research support

Project and aims	Staff commitment	Targets	Outputs	
(p/w) Coordinate, administer and promote the activities of the National Centre for Tropical Wetland Researc				
Aim: Administer the secretariat of the National Centre for Tropical Wetland Research coordinate research and training projects and initiatives, and promote capabilities and activities Project leader: M Finlayson (Secretariat: vacant), Coordinator: Jacqui Rovis-Hermann Project file: SG2000/0199	Staff: 20	 Commenced: June 2000 Organise six-monthly meetings of the Board of Management and Advisory Committee: Ongoing Prepare and distribute meeting minutes and related documentation: Ongoing Maintain and update web site: Ongoing Distribute publications to stakeholders and general public: Ongoing Maintain and improve contacts database, website, and other administrative and communication tools: Ongoing Coordinate and promote wetland related publicity activities, such as seminars, open days: Ongoing Implement communications strateov: Pending approval 		

Project and aims	Staff commitment	Targets	Outputs
	(p/w)		
Coordinate the development and implementat	ion of corporate	strategic development processes	
<i>Aim:</i> To ensure the Supervising Scientist Division has developed and put in place corporate planning process to allow for the proper planning and implementation research and monitoring programs <i>Project files:</i> New File	Res staff: 4	 Commenced: January 2000 Coordinate Supervising Scientist workplan: August 2002 Coordinate Supervising Scientist Strategic Plan: November 2002 Coordinate the Environmental Research Institute of the Supervising Scientist annual research permit with Parks Australia 	
Responding to EA and Ministerial enquiries a	nd submissions		1
Aim: To provide comment on draft framework and/or policy documents being prepared or reviewed by Environment Australia Strategic Policy and Coordination Section (Canberra) eriss contact: M Finlayson Project files: JD–011–062 (Ecosystem services project)	Res staff: 4 Tech staff:1	 <i>Commenced:</i> January 2000 Ecosystems services project: Ongoing On as needs basis 	
Providing information to International Conver	ntions		
Aim: Provide guidance to international Conventions on guidelines for wetland inventory, assessment and monitoring, environmental allocation of water, and climate change	Res staff: 2	Commenced: July 1999 Inputs to Ramsar Convention Scientific & Technical Review Panel: June 2002	
Project files: .IH-02-234 (IPCC)			
JG-10-007 (Ramsar)			
Representation on environmental committees and panels			
Aim: To provide technical advice to local, national and international panels and committees Project leader: M Finlayson Project files: JK-02-039 (PEAK) JD-07-110 (MCRMC) JD-07-037 (MRLCG) JD-04-021 (KRAC) JH-10-025 (WI-AP) JD-07-089 (ASL)	Res staff: 5	 Commenced: March 1996 Attendance at meetings of Porgera Environmental Assessment Komiti; Macquarie- Cudgegong River Management Committee; Mary River Landcare Group; Wetlands International –Asia/Pacific Council; Australian Society for Limnology; Kakadu Research Advisory Committee 	

7 Organisational structure



Appendices

Appendix 1

Introductory remarks by Max Finlayson — notes and points for discussion — *eriss* workplan review 2 August 2002

Purpose: There are a few reasons for being here and undertaking this exercise

- To critically review each program and produce a workplan for 02–03 with a focus on necessary and realistic outputs and targets.
- To provide a basis for our individual workplans and performance agreements with an increased personal emphasis on individual accountability within a team effort, noting that our budget allocations are not independent of our outcomes/targets.
- To provide a basis for continual team assessment of progress with the workplan outcomes/targets across the year.
- To provide Parks Australia North with sufficient information to enable them to satisfy Environment Australia's legal requirements under the EPBC Act 1999 and ourselves to carry out our functions under the Alligator Rivers Region Act 1978.

Comments: The above could benefit with some explanation and latter discussion

- 1. The first step above is not new, but it has not necessarily been done sufficiently well across all parts of *eriss*. It needs to be an encompassing process that is, not one confined to program leaders in isolation. All program staff need to be involved and support their program leader and their colleagues. All EA6 and EL level staff in particular should be sufficiently aware of the directions and progress of their own programs to represent the program fully when required. I'd like to thank those who have made an effort and responded to past requests and fully supported their program and colleagues.
- 2. In preparing the draft workplan this year program leaders were asked to look at the big issues, especially those associated with mining rehabilitation and monitoring, at the minesites, and ensure your project proposals covered the research priorities. And could present adequate advice to the Supervising Scientist in a timely manner. This meant that the existence of a project in 01–02 was not in itself justification for continuation in 02–03. I do not see any point in continuing with unproductive projects. We all need to realise that we need to be more responsive to public and political expectations and demonstrate that we are productive and addressing the critical issues. It is not business as usual our role has changed and the public scrutiny seems to have intensified. That is, our world has changed and to be part of this we need to respond accordingly.
- 3. In looking at our workplan and outcomes we also need to be very aware of reporting and accountability requirements. This could include some of us recognising that society as a whole does not recognise the same prerogatives that we as scientist may recognise. That

is, we may need to spend more effort and justify our very existence. Again, let me express appreciation to those who have already demonstrated their realisation and support for our efforts to work within a changing and transparent and critical environment.

- 4. When undertaking our workplan we need to also consider and support the performance agreement and personal development programs espoused across Environment Australia. Our institute-wide workplan is a starting point for developing and supporting each other. We need to get this right. Again, some of you have demonstrated your support. But it's pretty obvious that some have not. This is a problem for all of us as we all need to demonstrate our commitment to the working processes as well as the outcomes.
- 5. To meet our targets and adapt to changing circumstances and new immediate challenges, we need to keep the institute and our individual workplans under continual assessment. It's pleasing to report some success in doing this over past years, but again the effort is not even or consistent. We need to bring all elements up to speed. By doing this we can also more regularly meet our reporting obligations within Environment Australia and to our stakeholders. These include regular written reports as well as our normal scientific papers. It also includes more verbal interaction with stakeholders and an open attitude towards critique from external sources. We cannot hide, but we can fend off the ridiculous an effective documentation and reporting mechanism coupled with consultation is a major part of this.
- 6. We also need to take due notice of changed circumstances and reporting arrangements such as those associated with our monitoring role. This should drive more efficient processes. We need to get the results out as soon as practicable some stakeholders may not readily see reasons for delays.
- 7. The EPBC Act also imposes some further requirements on our time. In particular we need to work with Parks Australia North and ensure they receive sufficient information to satisfy Environment Australia's legal requirements within Kakadu. This includes consultation and adherence to agreed protocols, including those for duty of care. Some of our initial efforts to supply newly requested information have not been adequate. We should ensure we demonstrate our support for their role we are all part of Environment Australia and have joint responsibilities in the Alligator Rivers Region.
- 8. To achieve all of the above may require a change in attitude by some, or even a change in the work 'culture' of the institute. I think the latter is an extreme as many of us have already shown responsiveness and adaptability. But we will be judged by the errant or erratic something akin to the rotten apple in the barrel.
- 9. I will stress that meeting our goals and expectations from stakeholders is not negotiable — we have goals and targets to meet and processes to follow. To ensure that we can achieve our scientific goals and support the Supervising Scientist we need to be proficient and open in the manner in which we work. Again, thanks to those who have demonstrated commitment to required processes and meeting outputs or targets. I ask you to continue and to assist others.
- 10. It's been pretty obvious that 2001–02 has not been the simplest of years. We have contended with the building program and relocation and this has been disruptive. But we will soon have a new opportunity an opportunity to work to our strengths in new premises and to shed the constraints of the past and develop new partnerships and change our 'business' model. *It's not business as usual*. Our world has changed and the physical relocation is the least of it the wider world is paying a lot of attention to the Alligator

Rivers Region. Our role is to undertake *quality science* (research and monitoring) and to *report* our data and information in the best possible manner. We are called upon to become even more *transparent* than we have been; even more transparent than others? And doubters will challenge our science. And our flexibility will be challenged. Having a well-considered workplan is one way in which we can respond and account. Conducting ourselves professionally is another. Developing partnerships and trust is another. To do this, and I will be candid, we need to make these activities part of our culture and not treat them as annoying extras. By doing this we will not break with the past — a past characterised by some great scientific achievement and endeavour — we will instead develop and be better equipped to take advantage of new opportunities.

- 11. Occupying this new building in a location much closer to the intellectual and bureaucratic centre of the NT is one opportunity. This planning exercise is another. I am asking you to not only join in and work as a team to present our workplan for 2002–03 but afterwards to strive to achieve our targets and communicate our results to the outside world. We will need to look at how we do this, but first, lets get down to the business of outlining our business, recognising that our business is everyone's business.
- 12. With this I'd like to welcome the first of our program leaders to the front. And to remind you that we are here to critique and review our own workplans. We need to consider the big issues and we need to respond. Your advice and guidance is as critical as your further involvement.

Thankyou

Max Finlayson 2 August 2002 Appendix 2

Minutes and notes taken from research planning day

(by program)

Environmental Radioactivity

The EnRad program is divided into non-research and research projects.

Non research projects (and project leaders):

Commercial lab (Shelly)

The NATA accreditation is put down and we rather try to establish a Quality Management System and get that certified. This can then be used as our data Quality Assurance for the clients.

Building (Bruce)

This project will take at least until the end of September and it kept Bruce busy for the last 12 months. This was appreciated publicly by Max at the beginning of the res review meeting.

Radioanalytical lab (Andreas)

This will take to probably the end of November as instruments have to be set up, calibrated, and the backgrounds have to be estimated etc. A new sample prep technique will be established. This new technique was developed at AIMS and involves grinding and pressing the samples for gamma spectrometry to known geometries, rather than casting into epoxy resin.

Quality Management System (Bruce)

This will be a system to reassure our clients the quality of our data and will mainly involve interlaboratory comparisons, traceable calibrations etc.

Questions that came up re non research projects:

Will there be problems arising with intercomparisons with other labs due to the very low levels (especially in regard to Ra-226) we work with?

Possibly there will be problems with Ra-226 intercomparisons but there are labs in Australia (ARParks Australia NorthSA, ANSTO) or New Zealand (NRL) for intercomparison. Everybody agreed that it would also be good if we go overseas with intercomparison exercises.

NATA accreditation

EnRad came back from trying to achieve NATA accreditation, as it is too much work and trouble and staff resources do not allow to further try to achieve it. One full time staff member would be needed to achieve NATA accreditation as similar exercises at ARParks Australia NorthSA and other labs showed. The idea however is, that clients will get a certificate with their results, and the system in use at the Chemistry lab of NTU was used as an example. Our QMS as such will be certified.

Research Projects

Monitoring Ranger and Jabiluka

This includes Ra-226 in surface water, radionuclides in sediments of Swift Creek (Ngarradj), long lived alpha activity on dust and radon and radon progeny measurements in Jabiru, Jabiru East and Mudginberri.

Arthur argued why it was necessary to take years and years of baseline samples (especially at Swift Creek) rather than going out once and collecting one baseline at a time. He suggested to do it once rather than spending too much time on it, whereas *EnRad* suggested that it was necessary to see the variation in the natural background in order to assess if any changes are significant within those variations.

Remote sensing

CASI

Nabarlek:

Arthur question was if the CASI work can be applied and used to assess the success of revegetation work at Nabarlek, and if it is applicable to the work of David Tongway.

Ranger:

Alex's question re its applications and if it can be used to assess the success of the rehabilitation of Ranger was positively answered as CASI can be applied for exactly these sort of problems.

Rum Jungle: No questions there.

Radiation anomalies

This is more or less a project that will start with collecting data and information about radiation anomalies in the Alligator Rivers Region. Dave Walden will be involved in this project.

Arthur commented that one of the presenters at an Energy Resources Australia meeting showed the minister exactly those radiation anomalies in the Alligator Rivers Region and basically implied that radiation anomalies are present throughout Alligator Rivers Region naturally and not only at Ranger therefore it cannot be 'that bad'. He (Arthur) emphasised that it is important to assess what's there naturally, and it is even more important how to present it to the public.

Mangrove response to climate change

Collaborative Project with UNSW. Max commented that it could be seen as a monitoring project for climate change. This project is important to distinguish between mining and non-mining pressured to Kakadu.

Arthur commented that a *more holistic* approach should be presented, especially to Alligator Rivers RegionTC, to make people understand what we do and why and present the overall aim more precisely.
Ikonos data

The different bands of the Ikonos data can be used to assess the success of revegetation, for the Mangrove project and various other things (distinguish vegetation etc.)

Don asked about the accessibility of those data. Basically the data can be viewed in form of posters, which are currently being prepared by Kirrilly Pfitzner. Data sets are approximately 3 GB big, so they cannot be downloaded etc.

Site assessments

Nabarlek:

All pathways have been studies in terms of radiological issues (radon, gamma dose, soil activities etc.)

Arthur made the comment that he wants to see a more holistic approach for this project as well, he wants to have it written up and assess a dose to the public, once it is re-occupied. My impression was that he wanted to have something similar to what EnRad did at the South Alligator Valley. He emphasised that it is very important to assess and present that holistic approach in the near future.

South Alligator Valley:

Complete assessment provided to Parks and Traditional Owners.

Air Quality projects

Mainly the radon work.

Alex asked where the radon stations would go when Jabiluka starts mining. PaulM answered that the monitors and weather stations will eventually be put close to Jabiluka (Jabiluka Hill), if possible on top of the escarpment to get information about the meteorological conditions as well, which somewhat differ to elsewhere in the Alligator Rivers Region.

Arthur insisted on having a *clear title* on all those projects (especially the radon exhalation one) so that the general public actually understands what and why we are doing things.

The dust projects are either in write up mode (Bruce) or there is not a lot of contribution from *eriss* needed at this stage (Pb-isotopes project is in the data acquisition stage at Curtin University).

Monitoring

Swift Creek

Don asked if there will be anything required from JFS staff: There won't as AFB will go out there in October and collect the samples as sample collection is very difficult and can be subject to contamination very easily. Again a discussion evolved about the frequency of baseline sampling with Arthur, who reckons once is enough.

Big issues for EnRad in 2002–2003

- Nabarlek: use holistic approach for Nabarlek site assessment
- Ranger: rehabilitation and radon exhalation data.
- Jabiluka: establish baseline dataset for sediments and radon.

• SAV: get info across to Parks.

Arthur again commented that EnRad needs a more strategic approach, a more holistic view. Especially for presentations at Alligator Rivers RegionTC to make general public aware and understand what we are doing.

In addition, Arthur wants to include more research in the Land Application Area, assess soil capacities etc. Some of that, however, is included in Cameron's project and the project work with QUT.

Ecosystem Protection

Monitoring of community structure

• The workshop audience had trouble interpreting the graphic presentation of ordination analysis (fish communities in billabongs). This is common for those not familiar with the technique. It was suggested that the presentation of these analyses to non-specialist audiences needs to be simpler and clearer to get across the correct message.

Ecological effects of Magnesium sulphate

• The possibility that edge effects from the mesocosm chambers could affect results should be considered in any interpretation of the experiment (WE).

Jabiluka fauna survey

• How extensive is the range of fauna to be examined? If conservation assessments need to be conducted at a landscape scale, access restrictions (from traditional owners) are likely to limit the range of fauna that can be studied.

Jabiluka water chemistry

• Exact location of monitoring sites needs to be clarified for the coming wet season, especially Ngarradj tributary-downstream sites. This should take into account the strategic location in relation to possible mining impact, accessibility and other management issues such as lease boundaries.

Creekside monitoring

• It was pointed out that the one week gap between measurements could easily miss short pulse contamination events in alternate weeks. This issue needs to be addressed.

Magela Water chemistry

- The problems with measuring solute load from the present weekly spot measurements were discussed. Data on solute concentrations in different stream braids and at different stages of flow events was required for each monitoring site to evaluate their influence on load estimates (WE).
- The introduction of continuous conductivity monitoring may help compensate for the temporal limitation of weekly water samples in indicating contamination events. The correlation between EC and uranium levels needs to be examined for interpretation of these data.

ACMER water quality guideline handbook

• The completion of this handbook provides an opportunity to approach NCTWR partners about training courses in the guidelines.

Hydrological and Ecological Processes

Mud transport relationship slide

Arthur Johnston: Were 'first flush' event data excluded in the derivation of the relationship?

Ken Evans: Yes.

Arthur Johnston: Do we have enough data now to assess future impact?

Ken Evans: Yes, and as a result we are cutting back the workload at Ngarradj this year.

Stream bed cross section slide

Arthur Johnston: How does the sand extracted by Parks Australia North at Ngarradj effect the sand flux work?

Ken Evans: It was significant. Although the confidence intervals are very large, it was estimated that the amount removed was equal to ~ 60% (KE unsure of this figure – a later check of notes revealed the figure is ~ 7%) of annual sand load. Further investigations are being conducted.

Melaleuca distribution on Magela floodplain slide

General discussion on method and reason why melaleuca density has decreased.

Landform evolution modelling at Nabarlek slide

Arthur Johnston: As a general comment, perhaps we need to look at other issues concerning the success of rehabilitation at Nabarlek besides just erosion modelling/assessment. Such as, for example, dispersion of contaminants in groundwater etc.

Sensitivity/error analysis of SIBERIA model slide

Arthur Johnston: Will this sensitivity analysis work be complete by the time we have the final Ranger landform?

Ken Evans: We plan to have it completed but have been doing some simpler in-house studies.

Ngarradj backwater plain slide

Arthur Johnston: There needs to be a change of focus. Resources have to be transferred from Jabiluka, an area where there is currently no mining, to Ranger, where its about to be rehabilitated.

Ken Evans: We plan to now scale down this project and make it an Honours project.

Gulungul map

Arthur Johnston: On the issue of the location of the d/s gauging station, at the road is fine.

John's slides

Max Finlayson: Liase with Traditional Owners and Parks Australia North staff to understand their views on vegetation mapping and areas of interest. We will not need to construct the map on this aspect alone, but it should be incorporated within our own mappings.

Point Farewell slide

Arthur Johnston: What is the point of this project?

Max Finlayson: Part of a study on climate change and saltwater intrusion effects.

General comments

- Arthur Johnston: Timescales what are the issues and strategic directions that need to be addressed by HEP? Although these were discussed within the presentation, they should be more clearly stated in the write-up, ie.
 - 1. Final landform assessment at Ranger
 - 2. Ability to assess rehabilitation in terms of erosion
 - 3. Where does the sediment get transported to?

Max Finlayson: This has been addressed in the introduction.

Arthur Johnston: Also, are the billabongs at Ranger going to be studied?

Ken Evans: Yes, in Kate's project.

Ecological Risk Assessment

EcoToxicology Program

Cammo spoke briefly about outcomes of the research in the EcoToxicology program.

Determination of a Trigger Value (TV) for Uranium in Magela Creek

Trigger Value is derived from NOEC results obtained from 5 native species representative of the food web. The Burrlioz program is then used to calculate TV.

Some confusion arose as to what the current TV was, and which test data was used to calculate this data. There is a need to clarify this quickly for political reasons and our own reporting.

The further development of standards for testing is a critical R&D issue. For example, some doubt remains over the statistical validity of using only 1 *valid* range-finder test followed by 2 further *valid* definitive tests for each species in the suite used for calculating TV in the Burrlioz program. Currently this number of tests is seen to be the absolute minimum requirement for calculating TV.

Toxicology of U on *Chlorella* was further investigated, and these data were incorporated into calculation of new TV. Publication on the speciation of U and its effects on Chlorella toxicity in process (Scott Markich, Rick Van Dam and Alicia Hogan).

CC noted the need to add to the suite of local species used for Tox testing. The further development of the snail reproduction and survival test (*Amerianna cumingii*) test, initially developed for creekside monitoring is seen as a priority. This is also an important species as it would help bridge the gap between laboratory based testing and field based tests.

Toxicity of MgSO₄ to local Tropical aquatic species: derivation of a site specific TV

Interim TV value calculated for Mg (0.8mg/L) using same method as above.

Mg:Ca ratio strongly influences the Mg toxicity. The higher the level of Calcium relative to Mg, the more Mg toxicity is ameliorated. This is particularly significant for the Magela Ck where the major source of Mg contamination from the Ranger mine occurs in union with a relatively high Ca ratio. Therefore, based on this evidence, Mg toxicity is thought to be very low in the Magela Ck and to cause little or no ecological impact.

Silica reduces toxicity of aluminium to embryo development and survival of *Mogurnda mogurnda*

Aim: To investigate the effect of Si on AL toxicity by introduction of differing ratios of Si to Al. A secondary aim was to investigate whether the observed effects of Si could be explained by chemical speciation modelling of Si and Al. This project grew from the impact study for Gadjarigamundah Ck at Nabarlek mine.

Results: Si reduced (or eliminated) acute toxicity of Al to developing Purple Spotted Gudgeon embryos at pH of 5. However, speciation modelling of Si:Al complexes did not explain the observed pattern of reduced toxicity of Al from Si. Therefore the possible mechanism(s) by which Si reduces Al toxicity remains a mystery. This issue has been identified as a suitable *eriss* -affiliated masters/PhD project.

Arthur Johnston asked as to whether or not the issue of Al toxicity is a significant issue more generally. It is noted that there is a need to further investigate the ecological context/relevance

of such toxicants in the broader wetland environment, and that further information is required to identify the incidence/spatial prevalence of observable episodes (eg fish kills).

Risk Assessment

Cane Toads and Mimosa

Dave Walden outlined Risk assessment studies on Cane Toads and Mimosa.

The 'wetland risk assessment model' developed by Van Dam and Finlayson was applied to both the assessment of Cane Toads and Mimosa:

- problem
- potential extent & effects
- risk & species at risk
- uncertainty & information gaps
- recommendations for monitoring *Outcomes*:
- van Dam RA, Walden DJ & Begg GW 2002. A preliminary risk assessment of cane toads in Kakadu National Park. Supervising Scientist Report 164, Supervising Scientist, Darwin.

Walden D et al 2002. A risk assessment of the tropical wetland weed *Mimosa pigra* in Northern Australia.

Results of the Mimosa risk assessment suggest that there is still a need to further describe habitat preferences and/or processes of seed dispersal in order to refine models that predict distribution patterns and rates of dispersal. Other related R&D issues that were raised included the need to develop better monitoring/mapping techniques. It was highlighted that liaison with land managers involved in weed control will be important part to developing 'cost of control' models.

Climate change — presented by PB and MF

Large spatio-temporal scales. Processes such as the CO2 and Methane cycles are feedback loops that influence climate changes. Aims are to predict physical changes and to determine how humans/animals/plants can adapt to such change.

Summing up

Priority activities for ecotoxicologyare:

- Continue deriving site specific Water Quality guidelines
- Refine protocols and broaden suite of local species' used for testing
- Maintain quality control management systems for the laboratory
- Assess mimosa herbicide (new)
- Derive TVs for salt (Chris Humphrey)

Landscape projects

• A number of major bids for funding over the longer term (Cooperative Research Centre Earth Observations). Many associated projects are unlikely to get off the ground this year, where most time will go into admin and development.

- Parks Australia North affiliated projects in Kakadu region related to weed and feral animal management. These need to also be placed in the context of mine-related management.
- Arthur mentioned that it will be important for Peter Bayliss to prepare a detailed brief for the Alligator Rivers Region Technical Committee (September) outlining the rationale behind each landscape ecology project, and placing it in the context of mining in the Alligator Rivers Region.

Arthur Johnston asked the question; does the existing biological monitoring framework used by *eriss* cater also for monitoring cane toads?

Chris Humphrey replied that a more dedicated experimental approach is considered better than just relying on the existing monitoring regime. Nevertheless, James Boyden mentioned, baseline-monitoring data may be useful. Therefore it is necessary to remain vigilant at current monitoring locations for Cane Toad invasions, taking particular care to identify the time in which invasions occur at various locations.

Appendix 3

eriss project approval, recording and review processes

- This document replaces previous instructions and procedures for reviewing and approving
 research and monitoring projects undertaken by *eriss*. The key steps are outlined below.
 Responsibility for ensuring all projects are approved and reviewed rests with *eriss*program leaders in consultation with the Director. Unless formally approved a project
 should not proceed and a cost centre should not be allocated. Under extraordinary
 circumstances the Director or the Supervising Scientist may temporarily waive this
 requirement.
- 2. This document should be read in conjunction with the following corporate documents:
- annual *eriss* workplan (July–June)
- annual SSD strategic plan (July–June)
- SSD corporate plan (1998–2003)
- 3. Project approval encompasses the following steps:
- a. Project proposed and discussed with program leader and other relevant *eriss* staff. Where applicable a formal external contract may form the basis for discussion. All documents should be immediately placed on a relevant registry file.
- b. Each project will be included in a draft workplan (July–June) and discussed at the internal annual workplan review day held generally in July or early August. Documentation for the workplan follows an agreed template that may be changed from year to year. A copy of the template used for 2002–03 is included in this appendix.
- c. The workplan is completed after internal discussion. An IR is also prepared and encompasses the PowerPoint slides used by program leaders as well as notes taken by nominated program scribes during the review. The IR should be drawn to the attention of all staff and handed to new staff recruited during the year. New staff should be given a copy of the workplan during formal induction. If a project is developed after the workplan is agreed it must be confirmed by the Director and all other steps below followed.
- d. Projects that will be undertaken in Kakadu National Park will be submitted to Parks Australia North before the end of August by the *eriss* Research Support and Communication section. A standard template will be used for this purpose. Parks Australia North will issue a generic approval by 31 September and assist with consultation as necessary with local people. Projects submitted at other times of the year will require separate approval. Consultation should commence with local people as early as possible and be coordinated through the Research Support and Communication section.
- e. All projects require formal approval via an approval form. This form will be available on the new information management system, SSD Explorer. All sections on the form must be approved and all signatures obtained before the project can commence. A copy of this approval must be placed on the project registry file.

- f. All projects require a registry file which can be requested from the registry using the Word template, 'file-request.dot' [File/New/select 'file-request.dot']. All documents and correspondence relating to the project should be immediately placed on this file and given a discrete page number. When transferring files a transfer slip should be lodged with the registry and all details on the file cover completed. Records of consultation and notification of access to Kakadu and other localities should also be filed.
- g. Where a formal contract exists for the project a copy of the signed document should be filed and another given to the OSS administration staff, noting any reporting and financial requirements. Project staff are responsible for meeting all reporting requirements and must supply Administration staff with all details for issuing invoices and for financial acquittals. All contracts should be signed by the Director or the Supervising Scientist. All expenditure against contract projects should have a separate cost centre.
- h. The annual workplan provides a basis for individual workplans with all targets and expected outcomes being formally agreed in individual Performance Agreements. The workplan should be reassessed every 6 weeks in a meeting of all program staff and a representative of the Research Support and Communication section. A rolling document can be used to record progress and changes to the workplan. Missed deadlines or changes to outcomes should be recorded on a program meeting registry file and immediately forwarded to the Director with accompanying records. A formal mid-term review may be held.
- i. At the end of each financial year all program staff are required to provide a report on progress against major activities listed in the annual SSD strategic plan. All members of staff should have a copy of the strategic plan, which will be available on the new information management system, SSD Explorer.
- j. Throughout the year selected staff will be required to present occasional internal seminars to report on progress and achievements. Seminars to external meetings are also expected from all EA6 and EL1/2 staff. Abstracts and PowerPoint slides and accompanying notes should be included in an Internal Report. Others are encouraged to make presentations where possible.
- k. Program leaders should formally notify the program leader of Research Support and Communication before any external presentations or publications. The project approval form contains a requirement to discuss steps for effective distribution of all publications and other communication productions.
- 1. The program leader should also ensure that the SSD editor receives a record of all external presentations and publications (and a completed non-exclusive licence form) in order to compile an annual list of such activities. A copy of external publications should be lodged with the SSD library (including a copy of all posters).

July 2002

Template for projects in *eriss* workplan

Here is the template used for the projects in the *eriss* workplan.

Table x.x Title of table

Project and aims	Staff commitment (pw)	Targets	Outputs
Natural soil movement and soil loss at Tin	Camp Creek, Arr	hem Land	
Aim: Determine soil erosion rates at Tin	Res staff: 1	Commence: May 2002	1.4
Camp Creek using caesium 137	Tech staff: 2	Completion of field work and data	
Project leaders: K Evans		collation: August 2002	
Registry file: SG2002/0112		• Journal paper: 2003	
Clients: Supervising Scientist			
Location: Tin Camp Creek			
Type of sampling: Surface soil samples usin	ig small cores 10ci	m deep	
Dates: 19–23 August 2002			
Consultation: Northern Land Council permits	s obtained by G Ha	ancock	
Collaborating Partners: The University of No.	ewcastle, NSW		

Below is a blank template.

- Type your text into the form. Type in over the top of example text such as 'Project name' and 'Target: date'
- Style are set up within the form use them, don't change them
- Don't put full stops or any other punctuation at the end of any items unless they form a complete sentence list items have no commas or semi-colons at the end please
- Spell out all abbreviations in full save on typing, many of them will be in the autotext list (insert/autotext/browse list)
- The same table can be produced from the autotext entry: 'wpe' there is also a multi-project autotext entry 'wpe4' which has 4 projects add more as needed

Project name			
Aim:	Res staff:	Commence:	1.4
Project leaders:	Tech staff:	Target: date	
Registry file:		Target: date	
Clients:			
Location:			
Type of sampling:			
Dates:			
Consultation:			
Collaborating Partners:			

Appendix 4

Slide presentations



Supervising Scientist

Environmental Radioactivity Program

Main workload & achievements for 2001/02

- Darwin laboratory
- Commercial laboratory
- Establishment of remote sensing facility
- SAR Valley: radiological impact assessment
- Rum Jungle assessment
- PhD project: Rn exhalation and Pb-210 deposition fluxes

Main workload & achievements for 2001/02

- Establishment of monitoring regime
- Completion of radiochemical analysis of samples from a number of projects
- Ranger leak projects
- Jabiluka baseline
- Aboriginal foods: fruits & yams
- Dust project

Main workload for 2002/03

Commercial laboratory	22		
Darwin laboratory setup	17		
Darwin building	16		
Regional Rn project		11	mainly write-up
Rn & Pb-210 fluxes		10	PhD
QM System		10	
Monitoring		10	
CRC AEO preparation	∞		
Nabarlek		6	mainly write-up
SAR Valley		9	write-up
OSS support		9	

"Non-research" projects

Commercial laboratory

Why

 Provide radioanalytical service to clients on a commercial basis

2002/2003

- Major clients expected to be ERA, NTDME. Several other potential clients are interested.
 - Emphasis on high-quality analyses provided within reasonable time-frame.

Project leader

Michelle Iles 20/22

Darwin building establishment

Why

Bruce Ryan placed on project Sept 2001

2002/2003

- Move from Jabiru continuing
- Other issues will continue at least into September.

Project leader

• Bruce Ryan 10/16

Darwin radioananalytical laboratory

Why

• Establishment of new laboratory

2002/2003

- New gamma spectrometry sample prep method
- Calibration of detectors
- Installation of beta counter for Pb-210

Project leader

Andreas Bollhoefer 8/17

Quality Management System

Why

especially given that we carry out analyses for ERA, NTDME and Proving the integrity of our analytical system is a priority, SSD monitoring

2002/2003

- Urgent need for system of intercomparisons, independent checks with other labs, etc
- Sample/analysis database needs development
- System needs to be compatible with NATA, ISO

Project leader

• Bruce Ryan 5/10

Monitoring of Ranger & Jabiluka

Why

Required ongoing project

2002/2003

Major workload: alpha spectrometry analyses

Project leader

Paul Martin 2/10

CRC for Application of Earth Observations

Why

eriss has agreed to be a partner in the proposed CRC

2002/2003

• Bid will require liaising with other partners, preparing project proposals, etc

Project leader

• Peter Bayliss /8

OSS Health Physics Support

Why

 Andreas Bollhoefer provides Health Physics support to OSS (20%)

Project leader

Andreas Bollhoefer 6/6

Remote sensing projects

Nabarlek CASI

Why

revegetation assessment. 1 m resolution, 16 band dataset, Trial whether CASI can reduce field sampling time for Vis-NIR.

2002/2003

- Field spectrometry
- Weed identification
- Data processing

Project leader

• Kirrilly Pfitzner 6/6

Rum Jungle CASI

Why

acid rock drainage assessment. 1 m resolution, 16 band Trial whether CASI can reduce field sampling time for dataset, Vis-NIR.

2002/2003

- Field spectrometry
- Mineral identification/XRD
- Data processing

Project leader

• Kirrilly Pfitzner 4/4

Radiation anomalies

Why

• Landscape-wide assessment project

2002/2003

- Literature review/discussions with relevant parties
- Collate NTDME airborne gamma data and MODAT database
- Map & relate datasets

Project leader

• Kirrilly Pfitzner 2/5

Mangrove response

Why

 Use remotely sensed data to determine mangrove species & biomass for indicators of climate change

2002/2003

- 1 m DEM coverage of all mangroves in Kakadu
- Other datasets used: CASI, MASTER, AirSAR
- Field verification & spectroscopy

Project leader

• Kirrilly Pfitzner 3/3

SAR and Magela datasets IKONOS data fusion:

Why

 Provide spatially correct high-resolution datasets for users

2002/2003

- Geometric & radiometric preparation
- Fusion of 1 m & 4 m data
- Preparation of poster displays

Project leader

• Kirrilly Pfitzner 3/3





Remotely sensed data management

Why

• Need to store & organise datasets on network in datums & formats ready for users

2002/2003

Organisation of network area, uploading of data

Project leader

• Kirrilly Pfitzner 2/2

Site assessment projects

Radiological assessment of Nabarlek

site

Why

- Provide radiological assessment of Nabarlek site
- Apply lessons learned to planning for Ranger rehabilitation

2002/2003

- Primarily write-up:
- Erosion assessment
- Airborne gamma survey
- Radon exhalation flux

Project leader

• Paul Martin 3/6

Airborne gamma survey of upper SAR valley

Why

 Provide information to Parks and TO's for rehabilitation planning

2002/2003

- Analysis of MASTER data
- Production of poster
- Write-up of radiological impact assessment

Project leader

• Kirrilly Pfitzner 3/6


RGB Master data with eU counts > 300 counts/sec



Data fusion: K,eTh, eU (RGB) Spatially used with 12m MASTER

Air quality projects

Regional radon project

Why

Provide data on Rn-222 concentrations regionally prior to cessation of operations at Ranger and beginning of operations at Jabiluka

2002/2003

- Four detectors set up in SE/NW line through Ranger to Mudginberri
 - Data analysis and write-up

Project leader

Andreas Bollhoefer 4/11

Rn exhalation & Pb-210 deposition
fluxes
Why
 Provide source term for Rn, in particular for Ranger site materials, including seasonal variations
Provide Pb-210 flux regionally
2002/2003
• PhD student project to run over the 2002/03 seasonal
Eriss staff to provide support esp in field, plus gamma spectrometry analyses
Project leader
• Paul Martin 3/10

Radionuclides on dust

Why

• Determination of source term at Ranger and dry & wet deposition fluxes downwind

2002/2003

• Data analysis & write-up

Project leader

• Bruce Ryan 3/4

Pb isotopes on deposited dust

Why

• Trial of the use of Pb isotopes as a tool for tracing of contamination from U mining activities

2002/2003

• Pb isotope analyses being carried out at Curtin University as an honours project

Project leader

Andreas Bollhoefer 1/1

Bioaccumulation projects

Radionuclides in Aboriginal foods

Why

Uptake of radionuclides by terrestrial plants & animals for prediction of radiological risk post-rehabilitation

2002/2003

• Data analysis & write-up

Project leader

• Bruce Ryan 3/4

Radionuclides in freshwater mussels

Why

publishing & incorporation into radiological impact Knowledge & data on radionuclide uptake needs assessment models for Range & Jabiluka

2002/2003

• Data analysis & write-up

Project leader

• Paul Martin 4/4

Water quality projects

Radionuclides in creek sediments of

Jabiluka area

Why

ratio data for sediments of Ngarradj – sensitive measures Baseline radionuclide and Pb isotope concentration & of mining-related sediment deposition

2002/2003

Collect, sieve and analyse by gamma spectrometry

Project leader

Andreas Bollhoefer 3/3

Western Arnhem Land rivers baseline

dataset

Why

NLC request to take part in baseline dataset collection

2002/2003

- Mainly data analysis & reporting
- Further sample collection may occur

Project leader

• Bruce Ryan 1/1



Department of the Environment and Heritage

Ecosystem protection program

Staffing changes and acknowledgements:-

Pre-Darwin move:-Chris Humphrey Bob Pidgeon Chris leGras Frederick Bouckaert James Boyden

Post-Darwin move:-

Chris Humphrey Bob Pidgeon

New Chemist?

Dedicated Jabiru monitoring team:

Alistair Cameron

Duncan Buckle

Wayne Barbour

David Norton

Robert Luxom

Ecosystem Protection program Achievements in 2001-02

Overall

- Implementation of routine environmental monitoring program for Ranger and Jabiluka
- Recruitment and training, including knowledge transfer from departing staff, of a new dedicated stream monitoring team
- Continued steps towards finalising draft sampling protocols and reporting and communications strategies
- Contribution to NCTWR activities
- Advice to Department

7	labiluka
٠	Water chemistry: Targeted weekly sampling in Narradj and tributaries (North and Central) in period of stream flow
•	Macroinvertebrate communities: After three years of intensive monthly sampling in Narradj and three control streams in period of stream flow:-
	- continued monthly sampling in Narradj but only one control stream (Catfish)
	- end-of-season sampling in Narradj and all three control streams
٠	Fish communities: Fourth year of sampling:-
	- Winmurra Billabong (included in pop-netting program)
	- Narradj and three control streams, March and April
•	Fish bioaccumulation: With ER group, late wet and late dry season sampling

Ranger - monitoring

- Ck, Georgetown B'bong, RP1 spillway, Gulungul Ck in period from creek flow to Water chemistry (including radionuclide): Targeted weekly sampling in Magela cessation of overflow from RP1
- Creekside monitoring: Every other week over Wet season (improved infrastructure)
- Mussel bioaccumulation: Late dry season sampling in Mudginberri
- Macroinvertebrate communities: End-of-season sampling in Magela and three control streams
- Fish communities: End-of-season sampling (with refined safety procedures):-
- Channel billabongs (Mudginberri & Sandy, visual observations) I
- Shallow lowland billabongs (Magela & Nourlangie sites, pop-netting) I



Dissimilarity value

Consolidation of macroinvertebrate data for Ranger

- Additional control streams introduced in 1994
- Three different sampling methods since 1994
- Within the sampling periods:
- Similar, constant patterns in paired site dissimilarity amongst streams
- Magnitude of dissimilarity values similar amongst streams (probably proportional to stream size)

	at little change has ion) in Gulungul	94-present: dissimilarity low	in ordination space, id 'unexposed' sites,			 Control site - Nourlangie Ck ■ Exposed sites - Magela Ck 	
ata for Range	eriod (1978-2001): Wh habitat (aquatic vegetati ty	control) billabongs, 19 ty structure, paired-site	eriod (1978-present): i 1e Magela 'exposed' an	During mining, pit two (1998 to 2002)		1.0	
tion of fish d	mmunities, 22-year pe ed more by changes to h changes to water quality	d Sandy (Nourlangie, c rdance in fish communi time.	billabongs, 24-year p e relative positions of th ites.	During mining, pit one (1993 -1996)		-10	Vector 1
Consolidat	Gulungul fish co occurred, explaine Billabong than by	Mudginberri and reasonable concor and constant over	Shallow lowland little change in the and Nourlangie si	One year prior to mining (1978)			
	•	•	•				
					Vector 2		

Ranger & Jabiluka – protocol development

- Protocols drafted apart from bioaccumulation (requires ER input)
- Consultancy seeking advise on technical matters relevant to design and analysis arising in the (re-)drafting of monitoring protocols:
- Conduct power analyses for complex MBACIP design (near-completed)
- Assist with the writing of worked examples for the protocols T
- Review the drafted and final draft protocols and reporting pro forma I
- Relevant training in statistical procedures

Ranger - investigations

- Ecological effects of MgSO₄:
- Substantial ecotoxicity work to:
- Derive new Mg Trigger Value
- Determine relative toxicity of Mg vs SO_4
- located in creek channel: macroinvertebrates, zooplankton, attached diatoms, Mesocosm study conducted July-October 2002 using large plastic tubs phytoplankton, water chemistry 1
- Gulungul Creek fish communities (landscape studies)
- EWLS/eriss nutrient attenuation in the Ranger Constructed Wetland Filter. Study abandoned due to technical difficulties.

Jabiluka landscape/ISP studies

- Gulungul Creek fish communities
- Use methodology as template for possible future approach to sampling fish communities in Ngarradj and control stream I
- Jabiluka/Ngarradj where similar mine contaminants will be encountered) Use results as an indication of the intensity of human-related change required to alter fish community structure (ie risk assessment for I
- Changes to important and significant habitats and native species in Kakadu National Park
- Not as advanced as anticipated last year but consultation within eriss and with stakeholders underway to develop project I

Communication

- Continued involvement/employment of local aboriginal people in EP program wherever possible
- Contribution to local newsletters
- Preparation of monitoring information for loading onto Website

Advice to the Department

- Heritage values reporting, SSD's role in Kakadu and more general aspects of Parks Australia and Australian & World Heritage Division (World monitoring and wetland management for Australian properties)
- membership, advice on QA/QC for AUSRIVAS), implementation of the A & NZ WQ Guidelines responding to public and departmental enquiries) Marine and Water Division (National River Health Program (TAC
- Standards and Targets, assessment of Heritage Protection Act applications, ie Natural Heritage Division (EA Working Group on NRM Biodiversity mine dewatering at Lake Miranda, WA goldfields)

NCTWR activities

- Consultancy with CSIRO and for ACMER preparing a handbook for the mining industry on implementation of the new Australian Water Quality Guidelines – draft report submitted
- Savage River Rehabilitation Project, Independent Panel Review (water quality issues)
- Porgera mine: identification of stream invertebrates
- Wetlands International, Malaysia program: development of wetland inventory, assessment and monitoring scheme (WIAMS)

Ecosystem Protection Proposed program in 2002-03

Scope of monitoring program for 2002-03: Jabiluka

Monitoring to assess whether ERs have been met

- Weekly water chemistry sampling in Ngarradj and tributaries
- Monthly macroinvertebrate community sampling in Ngarradj and Catfish creeks
- Monthly estimates of suspended solids loads in Ngarradj Ck
- Measurement of radionuclides in Ngarradj Ck waters and sediment

Monitoring/baseline sampling (in addition to above-listed approaches)

- Late and/or end-of-wet water chemistry, fish and macroinvertebrate community sampling in four streams
- End-of-dry and end-of-wet fish bioaccumulation study (metals and radionuclides)

Water chemistry sampling sites for Ngarradj and tributaries



Scope of monitoring program for 2002-03: Ranger

Ecosystem protection

- Creekside monitoring (two species, several tests per wet season)
- Water chemistry (weekly in Magela, Gulungul, Georgetown, RP1)
- Wet-dry transition macroinvertebrate and fish community sampling in Magela and control streams

Human health/Ecosystem protection

- Dry season mussel and fish bioaccumulation study (metals and radionuclides)
- Radionuclides in Magela Ck waters and sediment

Additional Jabiluka and Ranger initiatives and issues

- Jabiluka and Ranger monitoring support:
- clear all backlogs
- summarise all data and results, streamline data reporting procedures and communication
- finalise and publish protocols (creekside monitoring, macroinvertebrate and fish community studies, water chemistry, bioaccumulation studies) I
- improve monitoring procedures (more reliable creekside pump system and improved field security and safety, water quality for animal husbandry)
- New trigger values
- derive new TV for Mg on basis of lab ecotoxicity and field mesocosm study
- Derive new TVs for Gulungul Ck
- **Recruitment to fill duties of environmental chemistry and** macroinvertebrate sample processing

Specific issues relating to monitoring of Magela **Creek water chemistry**

- Continue to monitor west and central braids at GS8210009 and attempt to correlate indicator values with hydrological variables, such as discharge
- Monitor the braid of Magela Creek that drains Georgetown Billabong (incorrect MCUS) during early flow period to measure contaminant discharge possibly attributable to prior years spill events
- For 2002-2003 Wet, compare solute loads from RP1 with those at GS8210009, estimated from Central and Western braids
- If desktop study reveals solute load from sources other than RP1 are significant, implement investigation sites immediately downstream from the Georgetown confluence, and upstream from Coonjimba confluence

Specific issues relating to monitoring of Gulungu Creek water chemistry	• Use 2001-02 and 2002-03 monitoring data to derive site-specific focus and action levels	• Relocation of upstream site approximately 200 m downstream to align with proposed gauging station	• Monitor the tributary that flows north-west from the southern wall of the tailings dam, near confluence with Gulungul Creek. Effort should be concentrated at or shortly after the first flush.	 Collect and analyse riparian soil samples for sulfide and metal contents. Soils will be chosen with advice from HEP or OSS staff. This will help to determine whether natural soils make a significant contribution to indicator loads at the downstream site
--	---	---	---	---
Specific issues relating to monitoring of Ngarradj **Creek water chemistry**

- Locate and adopt downstream monitoring sites for North & Central Tributaries closer to the confluence with Ngarradj Creek
- Recalculate trigger levels for Ngarradj Creek using 2001-02 monitoring data, which provides the first relatively dry, abnormal discharge pattern year in the data set
- Locate and implement a telemetric EC datalogger, near the current downstream gauging station

Jabiluka landscape/I	$\mathbf{\Omega}$	SP studies
Title: Changes to important and significant habi Kakadu National Park	ita	ats and native species in
Objective: Map, catalogue/describe and monitor habitats and native species in KNP/ARR	im	nportant and significant
Priority: Survey stone country seeps where enden particular risk from cane toads	mic	c aquatic fauna may be at
Includes. Taxonomy and distribution	F	Eophreatoicus:
of species of <i>Eophreatoicus</i>	•	 Probably only species with potential as Ngarradj Ck endemic
	•	 Australian Museum consultancy
		<pre>(~\$14,000 over two years); ~15 ARR species to be described</pre>
いたいので、「「「「「「「「」」」」	•	 Requires collection of adult
		specimens in headwater sections of Jabiluka streams (November)
	•	 Requires collection of new type material in King R catchment

Contribution to NCTWR

- Seek funding and collaborative opportunities
- Contribute to national and international wetland fora, including Wetlands International
- Complete ACMER Handbook on the Guidelines (CSIRO & eriss)
- Contribute to workshops or provide advice on implementing the Water **Quality Guidelines**
- Acquire basic information about the environment from mining exploration sites in Arnhem Land at an early stage

Studies in Arnhem Land

Mining exploration proposal (western Arnhem Land)

- Need to acquire basic information about the environment from mining exploration sites at an early stage
- Proposal with NLC for provision for acquiring baseline data in new license agreements
- Small commitment of *eriss* staff resources (mainly sampling)
- Companies to fund any helicopter access, sample processing and aboriginal field assistance/cultural information
- eriss and NLC to better define the program scope and develop strategic approach to sampling

Summary of major initiatives for 2002-03 in **EP Program**

- Biological and chemical monitoring and/or baseline program for Ranger and Jabiluka
- Support data, results and protocols for monitoring program, including additional investigative studies (water chemistry, deriving new TVs, improved infrastructure)
- ISP/Landscape study: Changes to important and significant habitats and native species in Kakadu National Park
- Seek funding/ collaborative opportunities for NCTWR
- WQ Guidelines implementation study for ACMER
- Studies in Arnhem Land: baseline investigations for mining exploration and write up of past inventory work

Hydrological & Ecological

Processes

Supervising Scientist



Research Themes

- (i) Develop technology to assess mine site impact;
- (ii) Landscape characterisation and monitoring for environmental impact and risk assessment;
- (iii) Support the NCTWR in inventory and survey of tropical wetlands; and
- (iv) eriss-wide support for collection and management of spatial data.



		RL 0 RL 14	2007 2008	2010 2013-14
ning timeframes	Ranger	Tailing disposal	Mining cease	chabilitation complete
Min	Jabiluka	10 years care and maintenance		Re

2001-2002



Landform evolution modelling

- Incorporation of landform evolution modelling in GIS
- Application of modelling on a catchment-wide basis for impact assessment
- Application of geomorphic statistics to impact assessment

Landform Evolution Modelling



Geomorphic Statistics

Width function

Hypsometric curve





Other work

Hydrology modelling

- Compared HEC with DistFW now using HEC
- Modelling pre- & post-mining hydrology of Nabarlek

Soil erosion data for Jabiluka

Rainfall simulation to collect data to derive erosion rates for different surfaces at Jabiluka

Landscape characterisation and monitoring

Catchment characterisation - Jabiluka (Ngarradj)

- Catchment hydrology
- Stream suspended sediment loads in Ngarradj
- Stream bedload characterisation in Ngarradj
- Assessment of Ngarradj stream channel stability and change



Gauging network established in 1998



Average discharge (mm)

design of	give						
o be considered in the o	npling programs would	Weekly grab sample	Mean C (mg/L) [Mean time of collection (h)]	35 [12:30]	41 [10:30]	35 [11:00]	
ogical responses need to regime within the Ngarra	C data from various san lifferent results.	Stage-activated pump sampler	Mean C (mg/L)	47	63	85	
These hydrol a monitoring	For example, significantly c		Site	SC	NM	ET	

Implications

Downstream

Upstream



Downstream

Upstream



Total event load (g)



Landscape characterisation and monitoring

Geomorphic landscapes of Kakadu region

- 1st phase of ISP LWA program
- Hierarchical approach implemented
- 1000 copies of A1-sized poster produced depicting 6 key geomorphic

landscape types in region









Inventory and survey of tropical wetlands

Daly basin EFI

SSR162 completed; presentations to NARGIS01, NT Government; presentation at Riversymposium in Brisbane (September 2002)

Ramsar contract

Framework for metadatabase completed for Ramsar Bureau

Inventory and survey of tropical wetlands

AW

- Cambodia
 - Database developed to complement Manual







eating wetlands at broad scale in ith UNSW hin KNP from global landcover datasets LC, AARS G4MLC, L&G G4MLC) Conference Brisbane
--

Topo data

'land subject to inundation

Melaleuca mapping

•Determining changes in distribution and density of Melaleucas between 1975

and 1996 on section of the Magela floodplain







Application of LEM to Nabarlek minesite

Aim

- Practical application, by eriss staff, of GIS technology developed for Jabiluka.
- Develop a GIS to manage and store data and information on sediment

movement and hydrology of Nabarlek minesite

Assess minesite landform stability of the Nabarlek mine site using

landform evolution modelling

Application of LEM to Nabarlek minesite

Issues

Staff development opportunity and ensures technology

transfer to eriss so that the method can be applied to

other sites by eriss staff.

Limited field data available

Sensitivity/error analysis of 3-D LEM applied to mine sites

Aim

Conduct sensitivity analysis of landform evolution modelling.

Sensitivity/error analysis of 3-D LEM applied to mine sites

Issues

- Developed from ISP review.
- First proposed in 2000. Little work completed due to illness of G

Willgoose.

G Willgoose now in position to complete work from Leeds

University (and has done much of the preliminary work).

Other work

- Jabiluka erosion rates reporting
- Spatial interpolation of soil measurement Tin Camp Creek
- Soil movement and loss rates at Tin Camp Creek

Landscape characterisation and monitoring Catchment characterisation - Jabiluka (Ngarradj)

- Data collected from 1998 to 2002 therefore program to be reduced
- Continuous hydrology to be collected
- Fortnightly collection of stream suspended sediment data to assess

upstream and downstream differences

- > Investigate turbidity/concentration relationships
- > Plot event data on baseline curves to assess impacts
- Dry season channel surveys to assess inter-season changes
Morphology of the Ngarradj backwater plain and alluvial fan

Aims

- Map the form of the plain and fan
- Determine spatial distribution of sediment and main depositional areas.

Issues

- Reduced program as PhD project shifted to Ranger
- Proposed 1 year honours program to describe sediment distribution.

Sediment routing and hydrogeomorphic processes in

Gulungul Creek and Ranger minesite billabongs

Aims

- Derive sediment transport conditions for Gulungul Creek.
- Derive sediment transport rates through small minesite

catchments/billabongs to Magela Creek

Develop monitoring strategy to assess rehabilitation integrity



Gulungul and Magela Creeks





Total event discharge

Sediment routing and hydrogeomorphic processes in Gulungul

Creek and Ranger minesite billabongs

Issues

Data collection should start now to have monitoring

protocols in place at cease of mining in 2007.

Gulungul, Corridor and Magela Creek catchments will be

affected by the post-mining landform.

Location of gauging stations on Gulungul Creek





Monitoring suspended sediment movement in

Magela Creek

Aim

Determine mud transport conditions in Magela Creek for

impact assessment of Ranger mine

Monitoring suspended sediment movement in Magela Creek

Issues

- Limited data on mud transport
- Difficulty obtaining continuous data due to stream size
- Investigate turbidity relationships
- Large hydrology data set available and existing gauging

stations could be used

Mapping biophysical features of Magela Creek and

floodplain

Aim

Produce a 1:50 000 base map of the Magela Creek and

floodplain downstream of the Ranger uranium mine

Continued application of hierarchical model



Issues

Data :

- Raster / Vector :
- ➢ Availability
- > Extent / scale
- » Temporal range
- Validation of desktop mapping :
- > Ground access
- Communications / liaison

Other work

- Stratigraphy of a Chenier Plain- Point Farewell
- Saltwater intrusion Point Farewell
- ARR Soils database.
- GPS marking of mangrove transects KNP
- Melaleuca distribution reporting
- Landscape mapping (poster) reporting
- Comparison of Wetland datasets reporting

Support to the NCTWR in the inventory and survey of tropical wetlands Aim

> To develop new projects to support research strategy and

objectives of NCTWR.

> To provide advice / support to existing NCTWR partners

and projects as required.

Issues -

- with NCTWR partners and AC where possible. Possible ideas Need to identify and develop new projects, in collaboration floated at last AC/ BoM meetings include :
- Potential to develop projects in Queensland Gulf Rivers – provide input to Water Allocation Plans underway
- Ecological character of Ramsar sites
 possible further input / development
- Multi-scalar wetland inventory and assessment across northern Australia

- Integrated coast/ catchment management, focussing on coastal wetlands
- Develop 'Information Centre for Tropical Wetland Knowledge'
- > Opportunities to link wetland health human health through epidemiological studies

Asian Wetland Inventory

Aim

- > Implement protocols / guidelines developed by the Asian Wetland
- Inventory in previous phase.

Issues

- > On-ground support for implementation of current phase.
- > Major focus will be the delivery of training to agencies / organisations
- inventory, GIS and database
- Funding being sought for next phase



eriss-wide support for collection and management of spatial data dGPS implementation

- Maintain an eriss-wide global positioning system and ensure staff have the skills to use the technology
- Move toward staff independence in use.



Thank you to the group for their enthusiasm, and

hard work during the year.



Ecological Risk Assessment Team Work Plan 2002 –03

Risk assessment is estimating the probability of an adverse event

Team Objective

To provide advice on the significance of functioning of tropical wetlands in the Alligator Rivers Region & elsewhere threats to the biological diversity &

Team

<u>Years wit</u>	21	15	10	3	Ċ
l eriss					C







Highlights for 2001 - 2002

- Ecotoxicological impacts
- uranium
- $MgSO_4$
- Aluminium

Landscape impacts

- cane toads
- mimosa
- climate change

Uranium toxicity to alga Chlorella sp. Derivation of a site-specific TV Magela Creek

Aim

Determine a Trigger Value (TV) for U in Magela Creek

Method

Use toxicity testing results from 5 species of local aquatic organisms in receiving water – site-specific approach using Burrlioz program

Result

TV for U is 5.0 µg/L

Further work

Results published in journal



Toxicity of MgSO₄ to local tropical aquatic species: derivation of a site-specific TV

Aim

Determine Trigger Value (TV) for Mg in Magela Creek

Method

receiving water – site specific approach using Burrlioz Use toxicity test results from 5 local aquatic species in program

Result

Interim TV for Mg is 0.8 mg/L

Further work

cladocerans, & results from mesocosm experiments More toxicity tests for fish, snails &



Silica reduces toxicity of aluminium to a tropical freshwater fish

Aims



- Assess effect of Si on Al toxicity
- Undertake speciation modelling explain changes in Al toxicity

Method

Toxicty tests with fish & speciation modelling using FIAM

Results

- Si reduced (or eliminated) acute toxicity of Al to PSG at pH 5.0.
- No evidence to suggest that the formation of Al- Si complexes reduces acute toxicity of Al to M. mogurnda at pH 5.0

Further work

AH - Si competes with Al for binding sites at fish gill surface

Landscape – cane toads



- Report by van Dam, Walden & Begg (2000). Preliminary Risk **Assessment of Cane Toads in Kakadu National Park**
- Used a "wetlands risk assessment approach". Identification 0f:
- problem
- potential extent & effects
- risk & species at risk
- uncertainty & information gaps
- recommendations for monitoring



Landscape – mimosa

Dave Walden et al. (2002): A Risk Assessment of the Tropical Wetland Weed Mimosa pigra in Northern Australia



1:250K topographical wetland data ('land subject to inundation' and 'swamp land') and Wetlands across northern Australia potentially at risk of mimosa infestation, based on potential distribution using CLIMEX

Landscape – climate change







- van Dam R, Gitay H & Finlayson CM, Orlando B & Davidson NC (2002). Climate change & wetlands: Impacts, adaptation and mitigation. Ramsar STRP10 Working paper 2.
- Continue to advise Ramsar on the impacts of climate change to wetlands & methods of assessing their vulnerability.
- For example assess impacts of saltwater intrusion on World Heritage values of ARR, particularly Magela floodplains & Boggy Plain (see new projects).

Priority Activities (Outcome areas) 2002

- 2003

Ecotoxicology

- derive site-specific water quality guidelines
- refine procedures using local aquatic species
- maintain quality control & assurance system at eriss lab
- assess risks from mimosa herbicides
- derive TVs for salt

Landscape

- assess impacts climate change
- assess World Heritage waterbird values ARR
- assess threats to marine & coastal wetlands
- develop decision support tools incorporating
- ecosystem models
- indigenous perspectives
- socio-economic frameworks

Ecotox Projects

- **Toxicity of U to green algae (AH)**
- 2. Toxicity of MgSO₄ (CC)
- Annual pre-release testing of Djalkmara billabong & RP1 using local aquatic biota (AH)
- Compile ecotox protocols used at eriss (CC/AH) 4
- AusAid project establish ecotox labs in Asia-Pacific (AH) 5

Ecotox Projects (cont.)

- All projects continued from 2001-2002 for completion
- Post-doc postion in ecotoxicology will be advertised (EA6)
- sought (e.g. LWA applications for risk assessment New projects will be developed & external funds mimosa herbicides & TVs salt)
- In interim further protocol work with new species to strengthen WQGs

ISP Landscape Projects	1. Assess weed impacts Magela & Boggy Plain SA (DW)	2. Feral animal management Kakadu NP:	I. with TOs determine pest values & cost of damage (PB) II. develop bioeconomic pest control framework (PB)	3. Assess World Heritage waterbird values of Magela & f context ARR (PB/MGB/DW)	 Assess multiple landscape impacts at Boggy Plain, Sout Alligator River (fire, weeds, ferals, saltwater intrusion) (PB/JB/DW) 	5. Develop ecosystem model approach for ARR (PB/DW/

ISP Landscape Projects (cont.)

- Assess threats to marine & coastal ecosystems in ARR (PB/CC) 1. \bigtriangleup
- ENRAD: Radiological anomalies (KP with JB/DW) 8
- **ENRAD: Landscape mapping Magela using IKONIS (KP with** JB/DW) 6

Other Landscape Projects

- Help develop catchment management plans for Aboriginal communties in Arnhem Land (PB/CC) - \bigtriangleup
- **CRC** Applications of Earth Observations bid (MF/PB) તં

Work Plan 2002 - 2003

PROJECTS	РВ			MUL	Total	% Total	_
							1
Ecotox Projects	4	Ι	4				
1. U toxicity to Chlorella			8		∞	5.0	-
2. Compilation of toxicity protocols into SSR			5		5	3.1	
3. Toxicity of MgSO ₄ to local organisms		8	0		10	6.2	
4. Consultancy DBRD		7			7	1.2	
5. Annual pre-release testing Djalkmara billabong & RP1			9	7	8	5.0	-
6. Aus Aid project - Establish ecotox labs in Asia-Pacific			2		2	1.2	
7. Laboratory maintenance		5	10	0	25	15.5	1
8. Application for funds		2	2	+	5	3.1	
			F				
Sub-total	0	17	35	3	0 65	40.4	
ISP Landscape Projects							7
1. CRC Application of Earth Observations - bid process	e			2	5	3.1	
2. Management feral animals KNP: Part I. Contract with NTU KCTWM, consults with TOs					10	6.2	
Office - modelling	4			2	9	3.7	
Field - consultations	3	1			4	2.5	
3. Management feral animals KNP: Part II. PAN-eriss project, control framework					4	2.5	
Distribution & abundance of pigs & bufflo KNP	7				7	1.2	
Damage-density relationships	2				2	1.2	
4. Radiological anomolies - ENRAD Program					5	3.1	
Airborne & ground truthing				з	3	1.9	-
Commission survey					2 2	1.2	
5. Landscape mapping Magela (IKONIS)				5	2 4	2.5	
6. Assess weed invasion Magela wetlands & ARR in general	2	5		e	4 14	8.7	
7. Assess World Heritage waterbird values of Magela wetlands & ARR in general	e			n	6	2.6	
8. Multiple landscape impacts at Boggy Plain, South Alligator, KNP	З	3		2	2 10	6.2	
9. Ecosystem modelling ARR					22	13.7	
Geomorphology, hydrology, mass & nutrients	2				2 4	2.5	
Vegetation	2	2			4	2.5	
Fish	2		_	5	2	3.7	
Waterbirds	2	2		N	2 8	5.0	-
10. Catchment management planning with Indigenous communities in Amhem Land	2	2			4	2.5	
11. Assess threats to marine & coastal ecosystems in the ARR & north Australia generally	2	2			4	2.5	
12. Application for funds	-	٢		-	2 2	F C	_
Sub-total	35	18	0	2	1 96	59.6	
)						١.
TOTAL (Ecotox + Landscape weeks)	35	35	35	35 2	1 161	100.0	-
	_						

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	3
i de la compañía de la	1

Observations CRC bid Application of Earth



- Eriss is a participating partner
- Sub-program: "Healthy Tropical Wetlands" in the **Environment Program**
- produce information products for wetlands & waterway inventory, assessment & monitoring, using integrated data sets from remote sensing & GIS
- Collaborators: JCU/ACTFRW, NTU, UWA all NCTWR partners I

Potential projects

- downstream impacts of mining operations
- broad-scale coastal wetland inventory
- assessment & monitoring of northern rivers & wetlands
- coastal assessment & monitoring
- extension of applications to other Australian regions & Asia-Pacific I






Managing invasive species impacts (weeds & ferals)

- Involves making choices
- how much management intervention at what cost (\$) ?
 - what benefit is delivered ?
- Challenge is to make choices that are
- sensible
- pragmatic
- defensible
- **Requires benefits & costs to be balanced**
- past focus on population biology of pest species but need also bioeconomic models/frameworks

 \bigtriangledown



BENEFITS: DENSITY - DAMAGE RELATIONSHIP

Pig damage = extent of ground rooting, disease incidence



IMPACT OR DAMAGE (D)



Need information on pest distribution & abundance – over small & large areas by aerial survey methods



Assess threats to marine & coastal environment in tropics

Iconic wildlife – dugongs, dolphins, crocodiles & sea turtles







MANYDJARRARRNGA - NANYDJAKA A Report for the Australian Heritage Commission HERITAGE VALUES ASSESSMEN

> offshore islands, tourism, MPAs & IPAs, indigenous coastal debris, aquaculture, (marine communities, pollution mangroves, fisheries, Coastal habitats mining impacts)

MARINE & COASTAL

- Emerging issue, great opportunities needs strategic positioning
- Dr Ilse Kiessling adjunct fellow with NTU KCTWM & CINCRM (now with National Oceans Office & NTU; linked to nctwr)
- Australia: an overview of planning, management, research & policy **Report: State of play in marine & coastal management in northern** initiatives (2002)
- jurisdiction & management
- values & uses: economic (fisheries, aquaculture, tourism), environmental & cultural I
- threats to values
- strategic opportunities key planning initiatives I
 - existing capacities & stakeholders
- partnership approach: NCTWR, ATRF, NLC CFSC/NAILSMA, NOO, NTG, Comm. Govt I











Survey blocks & transects



Dugongs Bayliss & Freeland (1989)

Dugong & Seagrass Distribution in NT Gulf

Distribution of seagrass via boat surveys (Poiner *et al.* 1987)







Note

Similar spatial pattern found between Irrawaddy River dolphin & abundance of commercial fish (catch/effort)

Freeland & Bayliss (1989)







Waterbird monitoring program "Top End" of the NT





Bayliss & Yeomans (1989)



Alligator Rivers Region



Visual cover ranks – replace with remote sensing data

Calibrated counts



Magpie Geese & habitat in the "Top End"

National waterbird monitoring program **Project stages**

- Comprehensive spatial analysis, using advanced modelling & GIS analytical tools, of all monitoring survey data of waterbirds in NT (1983 – 2002).
- Relate temporal & spatial waterbird variations to environmental variation on catchment scale, & local & global impacts.
- Do Lake Eyre Basin & MDB/South-east Aust waterbird survey region.
- Collaborate with Qld EPA, NTU KCTWM, P&WC NT, Vic DNRE, SA DEH, NSW NPWS, DoC WA, Wetlands Unit EA, Wetlands International, Birds Australia.
- Links to ISP Landcsape, Northern Rivers Assessment & CRC AEO projects.



Incorporate Indigenous perspectives in wetland management in northern Australia









Indigenous Perspectives

1. Cultural values of water

- largely ignored in govt policy & management
- NWQM Strategy & revised Guidelines CVW now has large role (e.g. scared sites, spiritual, customary use & commercial access)
 - but needs consultation process at local & regional levels (e.g. Darwin Harbour)

Catchment management planning ~i

- no management plan for 11 major catchments in NT outside KNP
- within existing community capacity building programs, help initiate & complete management plans for selected catchments Arnhem Land
 - partners NLC, EA-Indigenous Programs, NTU (CINCRM, KCTWM)

Sustainable use of living natural resources 3

- remote indigenous communities minimal economic development, low income & welfare dependence – land unsuitable for conventional economies
- new "sunrise" sustainable community-based economies using living resources may address socio-economic & environmental needs





(Chief Ranger Djelk) **Dean Yibarbuk**





Djinkarr Ranger Station & Field Laboratory











Catchment Management Planning with

Indigenous Communities in central

Arnhem Land







Corporation - Maningrida

Sustainable use of living natural resources: wildlife & plants

Commercial use of wildlife – crocodile eggs to hatchlings







Other species: aquarium fish & turtles, plants (e.g. Kakadu plum, cheese fruit)







- **Ecosystem models are abstractions of reality used to:**
- understand the system (show interactions & links between ecological processes & attributes, ID knowledge gaps)
- predict management outcomes (via scenario simulation)
- **Essentially a powerful Decision Support Tool**
- But need to integrate biophysical & socio-economic frameworks









		Modelling Coastal Ecosystems
•	Model ARR.	coastal processes, links & interactions between catchments in the
	At lea:	st 4 basic submodels:
	,	Hydrodynamic - space-time variation in water flow
	5	Hydrochemistry – transport & transformation of key chemical variables (nutrients & sediments)
	'n	Lower trophic level – primary, invertebrate & small forage fish production
	4.	Population dynamics of key animal indicator species (fish, waterbirds) – biomass or abundance
●	A key riparia	constraint for implementing adaptive management policy for an & coastal ecosystems (Walters 1997):
	is i hyu	the failure of modeling to overcome cross-scalar effects, varying from rapid drologic change to long-term ecological response