internal report **344**

Environmental Research Institute of the Supervising Scientist Workplan 2000–2001

Environmental Research Institute
of the Supervising Scientist

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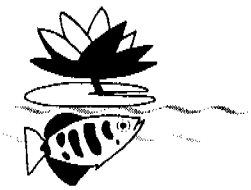
supervising scientist

ENVIRONMENTAL RESEARCH INSTITUTE OF THE SUPERVISING SCIENTIST

2000–2001 WORKPLAN

(October 2000)



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1 Introduction to *eriss*

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 Jabiru and Darwin in the Northern Territory. It was established to carry out 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 (ARR) both during and following mining in the region. Following a decision by the Australian Federal Government in 1993 we commenced a program of research 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.

In response to community concerns about environmental protection we made consultation and communication tasks an integral component of our research activities. We also recognise that our research programs need to be developed in cooperation with the communities potentially affected, as well as regulators, mining companies and wetland managers. And the outcomes of our research programs need to be communicated in forms that are suitable for a diverse audience. In particular we have taken increased steps to ensure that Aboriginal people in the region are included in these processes and where possible, are able to participate in research projects.

To fulfil these expectations we carry out the following programs:

- research on the impact of mining, particularly uranium mining, on people and ecosystems.
- research on the ecology and conservation of tropical wetlands.
- other environmental research as requested by Government.

Research activities have been divided into two branches – Environmental Impact of Mining (EIM) and Wetland Ecology and Conservation (WEC). These are supported by a communications program and corporate services. The activities of the research branches and the communications program for 2000–2001 are described in this workplan. In addition to the tasks and indicators shown below we also spend considerable time attending to formal governmental processes that both assist the implementation of our research programs and contribute to program, structural and personnel development within Environment Australia. Such activities include compliance with and promotion of Occupational Safety and Health (OH&S) procedures, redevelopment of buildings and facilities, personnel development schemes and career training, and responding to requests for departmental briefs and information needs.

2 Environmental Impact Of Mining Branch

The objective of the Environmental Impact of Mining research branch is to:

> ***provide advice, based on research and monitoring, to the Supervising Scientist and other stakeholders on standards, practices and procedures to protect the environment from the effects of mining, particularly uranium mining in the Alligator Rivers Region.***

The 2000–2001 program is built on two decades of research in the ARR with a renewed emphasis on the Jabiluka mining lease to complement the work being done at the Ranger and Nabarlek lease. The former is in response to recent significant effort expended on reporting to UNESCO and the United Nations World Heritage Committee in 1998–99 and again in 2000. The World Heritage Committee became involved in greater scrutiny of Jabiluka after concerns were raised by members of the public regarding the expansion of uranium mining in the region. This culminated in formal discussions with an Independent Scientific Panel that visited Jabiru early in July 2000 and subsequently submitted a report that we will consider formally. It is anticipated that this report and any formal governmental responses will influence our report to the December 2000 meeting of the Alligator Rivers Region Technical Committee (ARRTC).

Given high community expectations for rehabilitation, including revegetation, research will continue at Nabarlek as agreed with other interested parties. As rehabilitation at the Ranger mine site is expected to increase in prominence over the next decade further consideration needs to be given towards priority research projects. This will be addressed in concert with the mine operators and regulators.

The major research projects planned for 2000–2001 for each of the three research programs within this Branch are described below with all individual projects being listed in the tables that follow.

2.1 Environmental Radioactivity Program

Work undertaken 1999–2000

During 1999–2000 staff in this program undertook a number of projects near the Nabarlek, Ranger and Jabiluka uranium mining sites in the region with some work also undertaken at the site of the former (1957–1964) South Alligator mill in the upper South Alligator valley. These projects generally involved radioactivity measurements, either in the field or on samples collected in the field for analysis in the laboratory. It is important to realise that some of these analyses are time consuming and a great deal of time and effort is spent ensuring that all analyses are undertaken with the utmost care and accuracy.

Radiological studies at Nabarlek have been a focus of the program since rehabilitation works were completed in 1995. Radon emanation rates were measured during 1999–2000 and will enable comparison of concentrations of radon in air to be made with the results of radon dispersion modelling.

Measurements of radionuclide concentrations in water and aquatic biota of Magela Creek, as well as in Ranger process water, continued and received a major impetus following the evidence of a leak of process water from Ranger early in 2000. This included analysis of radionuclides in fish from Mudginberri billabong for comparison with results from similar analyses carried out by ***eriss*** in the 1980s. The results obtained so far show no significant change in radium and polonium concentrations, enabling the Supervising Scientist to assure Aboriginal people that the process water leak has not resulted in fish from the creek system

being unsafe to eat. Collection of baseline radionuclide data for the Jabiluka area also continued with a focus on radionuclide concentrations in groundwater and water of Swift Creek.

An investigation of radiological conditions in the vicinity of Rockhole Mine Creek in the South Alligator valley was undertaken following the discovery of exposed mill tailings. The program carried out a survey in collaboration with the Office of the Supervising Scientist to help delineate the extent of the contaminated area and to provide advice regarding radiological risk. This information was used to provide advice to Parks North who are presently preparing a plan for rehabilitation of old uranium mine and mill sites in the area.

The regional radon measurement network was advanced with the commissioning of a fourth combined radon/meteorological station near Mudginberri billabong. Data from these stations are being used to determine the effect of particular uranium mining operations on regional radon levels. In particular, the project will provide a baseline dataset to assess the impact of the Jabiluka mine.

As the capacity for radionuclide analysis in Australia is limited, and following a request for assistance from the NT Department of Mines and Energy, we established a commercial radioanalytical facility to ensure that analyses required under legislation can be carried out and that analytical capacity is available in situations where rapid analyses are required. During 1999–2000 this laboratory focussed on analysis of radium and commenced procedures for NATA registration to ensure high quality results were produced through recognised and standardised procedures.

Work proposed 2000–2001

The tasks and performance indicators for 2000–2001 are listed in table 2.1.

Work at Nabarlek will mainly involve the completion of radionuclide analysis of surface soil samples, and analysis of data collected so far on radon emanation rate and radon concentrations in air at the former minesite. The measurements of radionuclide concentration in surface soils is being carried out in collaboration with the Erosion and Hydrology program, and will enable estimation of the flux of radionuclides leaving the site via this pathway. The radon data analysis will include comparison of measured concentrations with predictions obtained from radon dispersion models to help identify the most critical parameters used in such models.

Radionuclide concentrations in water and aquatic biota of Magela Creek will also continue and mainly involve the completion of analysis of samples collected as a result of the Ranger process water leak incident, and on the publication of results obtained. In particular, existing ***eriss*** data on radionuclide uptake by freshwater mussels will be analysed and the implications for dose estimation to people assessed. The results from these projects will be reported to local communities, who have an obvious interest in the safety of aquatic foods obtained from the creek, as well as to involved organisations such as the Office of the Supervising Scientist, Northern Land Council and Parks Australia North.

Collection of baseline radionuclide data for the Jabiluka area will focus on radionuclide concentrations in aquatic biota and sediments of Swift Creek, although measurements of radionuclides in groundwater and creek water will continue. This will provide a baseline dataset with which to compare any future changes which could be attributed to the Jabiluka mine. The importance of baseline data collections of this nature is underlined by the example of the Ranger process water leak discussed above.

An airborne gamma spectrometric survey of the upper South Alligator River valley will be flown in October 2000. This will provide data on the location of soils of above-background radionuclide concentration with a spatial resolution of approximately 50 metres. Hyperspectral and Internal Report surveys have also been commissioned to provide data useful in interpreting the gamma survey. The survey is being funded jointly with Parks North, to provide background information of benefit to the planning of the rehabilitation of old mine workings in the area, as well as of the exposed tailings in the vicinity of Rockhole Mine Creek.

The regional radon network will be used over the next years to gain an understanding of radon levels in the region and the influence of particular sources such as Nabarlek, Ranger and Jabiluka. It is intended that each year three detectors will be relocated, with the detector near Mudginberri being kept as a control station. During 2000–2001 work will concentrate on the influence of Ranger on radon levels in its vicinity, and on the influence of distance of measurement locations from major floodplain areas.

Further work will be undertaken to obtain NATA accreditation for our radioanalytical laboratory as this is needed to ensure that analyses carried out will be acceptable for regulatory purposes and hence provide greater public confidence in the results and our competency. Effort will concentrate initially on accreditation for analysis of uranium and radium isotopes by alpha spectrometry.

Noting that local stakeholders in particular are keen to be informed about our analyses and their meaning, we have placed increased emphasis in recent years on communication and consultation, particularly in regard to Aboriginal foods for radiological assessment. This will continue; one example is the planned production of a video in which questions which have been identified by Aboriginal people as being of greatest interest to them will be addressed.

Table 2.1 Projects for 2000–2001 in the Environmental Radioactivity research program

Project and aims	Staff commitment (pw)	Targets
Identification of traditional Aboriginal foods for radiological assessment		
Aims 1 Identification and cataloguing of traditional Aboriginal foods collected in the Alligator Rivers Region 2 Recognition of the preparation techniques used with traditional foods 3 Measurement of radionuclide content of traditional foods for estimation of radiological significance *Project leader:* B Ryan *Project file:* JR-05-281	*Res staff:* 6	*Commence:* 1997 • Internal Report: July 2001 • FAQ video for Aboriginal people: Jul 2001
Radiological impact arising from uptake by freshwater mussels of Magela Creek		
Aim: Analyse and publish the data currently available on uptake of radionuclides by freshwater mussels in the Alligator Rivers Region *Project leader:* M Iles *Project file:* JR-04-013	*Res staff:* 12 *Tech staff:* 3	*Commence:* 1997 • Journal paper: Apr 2001

Radionuclide and metal concentrations in aquatic biota of Magela floodplain billabongs		
Aim: Collate existing data on radionuclide and metal concentrations in aquatic biota of Magela floodplain billabongs and re-sample to add data to this baseline *Project leader* M Iles *Project file:* SG2000/0082	*Res staff:* 10 *Tech staff:* 4	*Commence:* 1997 • Complete radionuclide analysis of fish samples collected from Magela billabongs: Jan 2001
Radiological impact arising from dispersion of dust		
Aim: Determine dust dry and wet deposition factors to enable prediction of the transport of radionuclides on dust from uranium minesites *Project leader:* B Ryan *Project file:* SG2000/0171	*Res staff:* 10	*Commenced:* 1998 • Journal paper: Dec 2000
Radon concentrations within the Alligator Rivers Region		
Aims: 1 Establish a network of radon and meteorological stations in the Alligator Rivers Region 2 Collect time-series data; establish background radon levels and determine the effect of uranium mining on regional radon concentrations *Project leader:* B Ryan *Project file:* JR-05-302	*Res staff:* 18 *Tech staff:* 10	*Commenced:* 1997 • Internal Report: Oct 2000 • Relocate three detectors: Oct 2000 • Complete background and calibration checks on all detectors, check and summarise data collected so far: Jan 2001
Uranium in groundwater seepage at ERA – Ranger		
Aim: Determine uranium retardation factors in the groundwater aquifer at Ranger *Project leader:* M Iles *Project file:* JR-05-214	*Res staff:* 3 *Tech staff:* 2	*Commenced:* 1996 • Continue collection of samples on a 12-monthly basis
Radiological impact assessment of the rehabilitated Nabarlek site		
Aims: 1 To validate presently-used models for radionuclide transport in the environment 2 To obtain information to assist in planning for the rehabilitation of uranium minesites 3 To enable a prediction of radiological dose in the vicinity of the Nabarlek site *Project leader:* P Martin *Project file:* JR-05-219	*Res staff:* 12 *Tech staff:* 4	*Commenced:* 1996 • Internal Report: Feb 2001 • Journal paper: Apr 2001
Radionuclides in creek waters of the Jabiluka area		
Aim: To obtain pre-mining data on concentrations of radium, thorium, polonium, lead and uranium isotopes in surface waters of the Jabiluka area *Project leader:* B Ryan *Project file:* JR-05-265	*Res staff:* 4 *Tech staff:* 2	*Commenced:* 1997 • Internal Report: April 2001

Radium and uranium isotopes in groundwater of the Jabiluka area		
Aim: To obtain pre-mining data on concentrations of radium and uranium isotopes in groundwaters of the Jabiluka area *Project leader:* B Ryan *Project file:* SG2000/0170	*Res staff:* 2 *Tech staff:* 2	*Commenced:* 1997 • Continued regular sampling and analysis of groundwater samples
Radionuclides in freshwater fish of Swift Creek		
Aim: To obtain pre-mining data on concentrations of radium and uranium isotopes in freshwater fish of Swift Creek *Project leader:* B Ryan *Project file:*	*Res staff:* 6 *Tech staff:* 2	*Commenced:* 1997 • Sample: Oct 2000
Radionuclides in aquatic organisms of the South Alligator River		
Aim: To obtain data on concentrations of radium and uranium isotopes in freshwater fish of the upper South Alligator River *Project leader:* B Ryan *Project file:* SG2000/0192	*Res staff:* 4 *Tech staff:* 2	*Commenced:* 2000 • Sample: Oct 2000 • Analyses: mid-2001
Airborne gamma survey of the upper South Alligator River valley		
Aim: To provide remotely sensed data and images giving information on the state of abandoned uranium minesites in the upper South Alligator River valley *Project leader:* P Martin *Project file:* SG2000/0144	*Res staff:* 22 *Tech staff:* 3	*Commenced:* 2000 • Survey completed: Oct 2000 • Reports on results supplied to Parks North on a frequent basis up to mid-2001
Obtaining NATA accreditation for the *eriss* radioanalytical laboratory **Operation of the commercial radioanalytical laboratory**		
Aim: To NATA accreditation for the ***eriss*** radioanalytical laboratory *Project leader:* M Iles *Project file:* SG2000/0187	*Res staff:* 30 *Tech staff:* 4	*Commenced:* 2000 • Quality control and procedures manuals: Feb 2001

2.2 Ecosystem Protection Program

Work undertaken 1999–2000

A second year of data collection was completed on the streams around the Jabiluka project area in order to accrue data on the biota and water of the streams near the mine site. These will serve as a baseline for any possible impacts arising in future from the Jabiluka mine. This included a collaborative project with EWLS to collect macro-invertebrate samples to assess community structure at sites in Swift Creek and in three control creeks. The results of this sampling and that conducted in the previous year were used to demonstrate to the visiting Independent Scientific Panel that disturbance of the Jabiluka mine site and associated elevation in suspended solids in Swift Creek downstream of the mine site, has not adversely affected aquatic communities. A number of taxonomic consultants were engaged to identify aquatic macro-invertebrates from creeks around Jabiluka and including Magela floodplain to confirm that waterbodies downstream of the mine site are not refugial sites for any endemic invertebrates.

Other biological sampling included visual observations of fish communities in Swift Creek and control creeks during the Wet season. Samples of fish were also taken in October (1999) from sites in Swift Creek and Catfish Creek (control) for processing of chemical concentrations in livers. These data will serve as baseline for any possible bioaccumulation arising in future from the Jabiluka mine. Water samples were also collected and analysed regularly from sites in Swift Creek and control creeks during the Wet season to typify temporal and spatial variations in water chemistry.

Biological monitoring continued in the vicinity of the Ranger mine with sampling in Magela Creek and control creeks during the Wet season and wet-dry transition season. This included creekside monitoring of larval fishes and snail egg production (in collaboration with ERA); sampling of macroinvertebrate communities in Magela Creek and three control creeks; and counts of fish communities in lowland channel and shallow billabongs. The latter trialled new safety procedures for sampling in shallow billabongs and engaged local Aboriginal assistance in the data collection. The results of biological monitoring conducted in Magela Creek during the 1999–2000 Wet season showed no adverse responses of the biota downstream of the Ranger mine. This enabled the Supervising Scientist to assure Aboriginal people that the process water leak did not harm Magela Creek ecosystems.

Local Aboriginal groups were involved in training and field tasks. Sampling of macro-invertebrate communities, together with visiting taxonomists, occurred in the Cadell River in Arnhem Land with Djelk rangers from the Bawinanga Aboriginal Corporation. Other landowners in Arnhem Land were contacted about baseline sampling needs for imminent developments and potential threatening processes occurring on their land. An information brochure about biological baseline data collection at Jabiluka was prepared and the Gundjehmi Association was contacted to explain proposed research to be conducted on the ecological effects of magnesium sulphate in Magela Creek.

Work Proposed 2000–2001

The tasks and performance indicators for 2000–2001 are listed in table 2.2.

A third year of data collection will be conducted on streams around the Jabiluka project area. These baseline studies will include macro-invertebrate, fish and water quality. Sampling of macroinvertebrate communities in Swift Creek and in three control creeks will be done to further assess changes within season and across the wet-dry transition. Visual observations of fish communities in Swift Creek and control creeks will continue and fish from sites in Swift Creek and Catfish Creek (control) will be collected to determine chemical concentrations in livers (bioaccumulation).

Biological monitoring will continue in Magela Creek and control creeks during the Wet season and wet-dry transition season, using established methods for: creekside monitoring of larval fishes and snail egg production; counts of fish communities in lowland channel and shallow billabongs; and sampling of macroinvertebrate communities in Magela Creek and three control creeks. Formal protocols will be completed for these monitoring studies.

A three-year PhD project has commenced to assess the ecological effects of magnesium sulphate on aquatic ecosystems downstream of Magela Creek. This assessment will include a field mesocosm approach as well as laboratory toxicity testing. The first year will comprise baseline field sampling and laboratory toxicity assessment, while subsequent years will involve dosage of creek pools with various concentrations of magnesium sulphate.

A new project has been initiated to investigate the elevated concentrations of uranium in sediments from RP1 at Ranger. This will determine the proportion of uranium that can be

mobilised under moderately forcing conditions. Specifically, the sediments will be exposed to acid at a concentration that approximates the maximum concentration that could plausibly be generated under natural conditions. The results of this project will be used to assess the risk of unacceptable concentrations of uranium persisting in water released to Magela Creek from RP1.

In response to requests to assist in acquiring baseline information from mining exploration sites at an early stage we will develop approaches to acquire baseline information in stream and wetland areas in western Arnhem Land. Proposed components include raising awareness of water quality issues and conservation values of aquatic ecosystems within Aboriginal communities, opportunistic sampling of biota and waters of aquatic ecosystems adjacent to mine exploration sites, training of Aboriginal people in sampling methods, and development of training and education aids.

We are also planning to review the status of and future directions of this research program to take into account recent developments in monitoring of ecosystems and information supplied through interaction with the World Heritage Committee assessment of the Jabiluka mining proposal. The review will look at research directions and provide a base for a self-contained mine monitoring program and outline further research and staffing requirements. In this respect it will build on past projects and formalise past approaches to monitoring.

Table 2.2 Projects for 2000–2001 in the Ecosystem Protection research program

Project and aims	Staff commitment (pw)	Targets
Early detection of mine-related effects using creekside testing procedures		
Aim: Conduct creekside tests, and transfer knowledge and expertise to ERA *Project leader:* C Humphrey *Project file:* JR-05-116	*Res staff:* 4 *Tech staff:* 16	*Commenced:* 1985 • Conduct creekside tests: Jan–Apr 2001 • Report results for 2000–01: May 2001 • Finalise protocolsand publish in a Supervising Scientist Report: May 2001
Community structure of macroinvertebrates in streams: Ranger		
Aim: Conduct a biological monitoring program based on the community structure of benthic macroinvertebrates in streams associated with the Ranger mine *Project leader:* C Humphrey *Project file:* SG2000/0179	*Res staff:* 28 *Tech staff:* 16	*Commenced:* 1988 • Sampling of Magela Creek and control streams: April 2000 • Report results up to 2000: May 2001 • Complete protocols and publish in a Supervising Scientist Report: Mar 2001
Community structure of fishes in lowland billabongs: Ranger		
Aim: Conduct a monitoring program to detect effects of mining on Magela Creek ecosystems using fish in lowland billabongs *Project leader:* R Pidgeon & J Boyden *Project file:* JR-05-170	*Res staff:* 5 *Tech staff:* 15	*Commenced:* 1984 • Conduct sampling and refine methods: Apr–Jun 2000 • Report on safety procedures: Sept 2000 • Report results up to 2000: May 2001 • Complete protocols protocols and publish in a Supervising Scientist Report: Mar 2001
Sulphate flux in catchment of Ranger RP1		
Aim: Test a predictive model for sulphate flux in the RP1 catchment *Project Leader:* C leGras *Project file*: JR-05-235	*Res staff:* 2	*Commenced:* 1998 • Internal Report: Apr 2001
Uranium flux in the catchment of Ranger RP1		

Aim: Assess the capacity of RP1 sediments to desorb uranium under forcing conditions *Project Leader*: Chris leGras *Project file*: SG2000/0060	*Res staff:* 6 *Tech staff:* 4	*Commenced:* 2000 • Internal Report: Dec 2000

Ecological effects of magnesium sulphate in Magela Creek		
Aim: Assess toxicity of enhanced residual levels of Mg_2SO_4 in pools of Magela Creek on macroinvertebrate communities *Project Leaders:* C Humphrey Project file: SG2000/0036	*Student:* 40 *Res staff:* 2 *Tech staff:* 2	*Commenced:* 2000 • Progress report: Jan 2001
Baseline studies on aquatic macroinvertebrate communities for the proposed Jabiluka mine		
Aim: Determine temporal and spatial characteristics of macroinvertebrate communities at stream sites potentially affected by the Jabiluka mine *Project Leader:* C Humphrey *Project files:* JR-05-294	*Res staff:* 21 *Tech staff:* 16	*Commenced:* 1998 • Internal Report: Dec 2000 • Further sampling: Jan–May 2001
Effects of suspended solids on macroinvertebrate communities of Swift Creek		
Aim: Determine whether increased suspended solids concentrations in Swift Creek downstream of the Jabiluka mine lease result in any changes to aquatic macroinvertebrate community structure *Project Leader:* C Humphrey *Project files:* JR-05-309	*Res staff:* 5	*Commenced:* 1998 • Honours thesis: Nov 2000 • Supervising Scientist Report or external publication: Apr 2001 • Supervising Scientist Note: April 2001
Taxonomic studies in water bodies around Jabiluka for conservation assessment		
Aim: Collect taxonomic information on species richness, biodiversity and endemism of macroinvertebrate taxa in water bodies around Jabiluka *Project Leaders:* C Humphrey *Project file:* SG2000/0138	*Res staff:* 2	*Commenced:* 1998 • Internal Report: Jan 2001
Baseline studies on fish communities for the proposed Jabiluka mine		
Aim: Determine temporal and spatial characteristics of fish communities at stream sites potentially affected by the Jabiluka mine *Project Leader:* C Humphrey & R Pidgeon *Project files:* JR-05-308	*Res staff:* 4 *Tech staff:* 4	*Commenced:* 1998 • Internal Report: Dec 2000 • Further sampling: Jan–May 2001
Bioaccumulation of metals in fish from Swift Creek		
Aim: Determine baseline concentration of metals in livers of fishes from Swift Creek and Catfish Creek *Project Leader:* C leGras *Project file:* JR-05-313	*Res staff:* 6 *Tech staff:* 3	*Commenced:* 1998 • Sampling and dissections: Oct 2000 • Internal Report: Mar 2001
Physico-chemical characteristics of Swift Creek		
Aim: Determine temporal and spatial water chemical characteristics in the Swift Creek catchment (1998/99 Wet season) *Project Leader:* C leGras *Project file:* JR-05-279	*Res staff:* 10 *Tech. Staff:* 4	*Commenced:* 1997 • Internal Report: Dec 2000 • Supervising Scientist Report: June 2001
Physico-chemical characteristics of Jabiluka and Nankeen billabongs		
Aim: Provide a physico-chemical baseline for Jabiluka and Nankeen billabongs from early and new data *Project Leader:* D Klessa	*Res staff:* 3	*Commenced:* 1998 • Internal Report: Mar 2001

Metal concentrations of mussels in the upper South Alligator River		
Aim: Measure and report metal concentrations of mussels and relate these to biological and environmental variables *Project Leader:* C leGras *Project file:* JR-04-075	*Res staff:* 7	*Commenced*: 1999 • Internal Report: Jun 2001
Baseline sampling needs for Arnhem Land streams		
Aim: Advise & train Aboriginal communities about baseline requirements associated with mining exploration *Project Leader:* C Humphrey *Project file:* SG2000/0175	*Res staff*: 10	*Commenced*: 1999 • Attend field and training programs with NLC, Jawoyn and NT PWC: Sept 2000 • Collaborative report with NT Museum on Mann and Katherine river aquatic fauna: Dec 2000 • Internal Report: Jun 2001

2.3 Erosion and Hydrology Program

Work Undertaken 1999–2000

A major project assessing the effect of vegetation on erosion from the Ranger mine waste rock dump was completed. Field methods were developed for deriving input parameter values for the landform evolution model SIBERIA and the project results now allow quantification of depth of cover required to cap contaminant repositories. A second project associated with refinement of SIBERIA was the determination of temporal changes in model input parameters. Significant results were achieved where, using data from sites of various ages and rehabilitated conditions, temporal changes in erosion rates were quantified and a sensitivity analysis showed that the incorporation of temporal changes in modelling was reliable. The third major project associated with this modelling research was the validation of SIBERIA. Using data for a natural analogue site and an abandoned mine site it has been shown that SIBERIA simulates erosion processes that are similar to those observed in nature. A number of reports were produced from this and the results reported in scientific forums.

We also undertook an assessment of the status of rehabilitation of the Nabarlek mine. We completed an initial survey of erosion at the site and presented the results at an in-house workshop and at an external workshop conducted by the Office of the Supervising Scientist. As a result, we then undertook a detailed assessment of erosion at the site. The field and laboratory work for this project were completed and analysis and reporting are being finalised.

We continued monitoring in the Jabiluka catchment and now have two years of hydrology, sediment load and channel stability data. Background suspended sediment loads in Swift Creek were derived and used in an impact assessment of waste rock dump erosion on Swift Creek. This impact assessment was presented to the Independent Scientific Panel and showed that there would be no observable impact in Swift Creek due to waste rock erosion from Jabiluka if progressive rehabilitation strategies were implemented.

A major review of the need to assess offsite impacts of uranium mining on Magela Creek was completed and will be finalised in August 2000. A paper was prepared and a presentation made to an industry group on combining modelling techniques to link the Ranger mine site to receiving waterways and methods to assess landform design with respect to water quality impact.

Work Proposed 2000–2001

The tasks and performance indicators for 2000–2001 are listed in table 2.3.

Jabiluka catchment monitoring and GIS development will continue and for ease of operation will be split into five sub-projects. The monitoring infrastructure (installed in 1998) will be serviced and upgraded and hydrology, sediment loads and channel stability data will be collected during the Wet season. The briefing paper on this topic submitted to the Independent Scientific Panel will be reviewed and published.

A new project will use rainfall simulation to derive erosion rates from disturbed areas at the Jabiluka mine. The need for site specific erosion rates was an issue raised by the Independent Scientific Panel. The erosion rates will be used to derive sediment delivery to Swift Creek and test rehabilitation design for catchment impact using SIBERIA linked with the GIS. The GIS project will also incorporate an error analysis of modelling predictions. This will result in deferral of the project investigating the hydrology of the Nabarlek airstrip.

It is anticipated that the Nabarlek erosion assessment project will be finalised and refinement of the landform evolution model SIBERIA should be completed. It is also anticipated that the model will now be used to assess proposed rehabilitated landforms at the Ranger and Jabiluka mine sites.

The need for further hydrological monitoring near mine sites in the region will be considered further. This may include assessment of existing data resources held by other agencies and a feasability study to assess establishing an extended stream monitoring network.

A project to evaluate multispectral remote sensing for monitoring mine site rehabilitation in the South Alligator valley has also commenced. This will involve external consultants who will provide training in ecological evaluation of mine-sites which should enable us to undertake similar work on other mine sites in the region.

Table 2.3 Projects for 2000–2001 in the Erosion and Hydrology research program

Project and aims	Staff commitment (pw)	Targets
Impact of mining operations on sediment movement in catchments in the Jabiluka mining lease		
This project has now been split into the following five sub-projects. Details are given in these projects *Project leaders:* K Evans & M Saynor *Registry file:* JR-05-298	*Res staff:* 15 *Tech staff:* 2.6	*Commenced:* 1998 • Internal Report: Sept 2000 • Supervising Scientist Report: Oct 2000 • Supervising Scientist Report: April 2001

Hydrology of the Swift Creek Catchment NT		
Aims: 1 To obtain baseline data on hydrology of catchments in the Jabiluka mining lease (JML) 2 To calibrate a hydrology model which can be used for long-term 'total catchment' management of the JML *Project leader:* D Moliere, M Saynor, K Evans *Registry file:* SG2000/0145	*Res staff:* 8 *Tech staff:* 4	*Commenced:* 1998 • Complete annual Wet season monitoring program: April 2001
Suspended sediment loads in the Swift Creek Catchment		
Aims: 1 To obtain baseline data on stream suspended sediment loads in catchments in the Jabiluka mining lease (JML) 2 To derive sediment transport equations for Swift Creek which can be used for long-term 'total catchment' management of the JML *Project leader:* K Evans, D Moliere & M Saynor *Registry file:* SG2000/0146	*Res staff:* 11.4 *Tech staff:* 33	*Commenced:* 1998 • Complete annual Wet season monitoring program: April 2001 • Journal paper: Sept 2000
Stream bedload characterisation in the Swift Creek Catchment		
Aims: 1 To obtain baseline data on stream bedloads in catchments in the Jabiluka mining lease (JML) 2 To determine bedload size distributions and derive bedload fluxes in Swift Creek which can be used for long-term 'total catchment' management of the JML *Project leader:* M Saynor *Registry file:* SG2000/0149	*Res staff:* 9 *Tech staff:* 16	*Commenced:* 1998 • Complete annual Wet season monitoring program: April 2001
Assessment of stream channel stability in the Swift Creek Catchment		
Aims: 1 To determine historical evolution of channels within the Swift Creek catchment 2 To assess the present stream channel stability of streams in catchments in the Jabiluka mining lease (JML) 3 To determine rates of change in stream channel characteristics in Swift Creek to predict the evolution of channels within the catchment and impact on tailings storage *Project leader:* M Saynor *Registry file:* SG2000/0150	*Res staff:* 6.8 *Tech staff:* 5	*Commenced:* 1998 • Complete annual Dry season survey of cross sections. Locate and measure erosion pins and scour chains. Collect bulk bed material samples: Dec 2000

Application of GIS to assessment and management of mining impact		
Aims: 1 *Develop a GIS to manage and store data and information.* To establish a temporal and spatial database (GIS) on sediment movement and hydrology of the JML catchments 2 Develop a GIS for the management and storage of data obtained for the erosion and hydrology Jabiluka project *Project leader:* K Evans & D Moliere *Registry file:* JR-05-327	*Res staff:* 6.4	*Commenced:* 1999 • Conference and journal paper: Sept 2000 • Journal paper: Aug 2000 • Supervising Scientist Report: Nov 2000 • Internal Report 2: Aug 2000 • Internal Report 3: Dec 2000 • Internal Report 4: June 2001
Erosion rates from disturbed areas within the Jabiluka mine site		
Aims: Use rainfall simulation to derive erosion rate from disturbed areas of the Jabiluka mine and derive sediment delivery to Swift Creek Jabiluka project *Project leader:* K Evans New project	*Res staff:* 5 *Tech staff:* 0.4	*Commenced:* September 2000 • Establish a consultancy and complete field program: June 2001
Validation of the SIBERIA landform evolution model		
Aims: 1 To test the predictions of the long-term landform evolution model, SIBERIA 2 Implement changes where necessary to improve model predictions *Project Leaders:* K Evans *Registry file:* JR-05-238	*Res staff:* 6.6	*Commenced:* April 1996 • Supervising Scientist Report: Oct 2000 • Journal paper: Oct 2000 • Journal paper: April 2001
Temporal changes in the hydrology and erosion of rehabilitated landforms		
Aim: To determine and compare the erosion rates and hydrology of waste rock dumps at Ranger, Scinto 6 and undisturbed schist terrains at an analogue site and identify and interpret temporal trends in model parameters *Project Leader:* D Moliere *Registry file:* JR-05-071; SG2000/0134	*Res staff:* 9.4	*Commenced:* 1992 • Supervising Scientist Report: Feb 2001 • Journal paper: April 2001
Current and future offsite geomorphic impacts of uranium mining on Magela Creek, northern Australia (Quantification of solute and particulate loads discharged from rehabilitated landforms at Ranger uranium mine)		
Aim: To develop methodologies for assessing off-site impacts due to erosion products from mining which can be used in the rehabilitation planning process and management of mine sites *Project Leader:* M Saynor & K Evans *Registry file:* JH-03-305; JH-03-305	*Res staff:* 2.4	Commenced: June 1997 • Supervising Scientist Report: Aug 2000 • Invited paper at AMEEF conference: Aug 2000

Spatial changes in SIBERIA input parameter values and sediment transport in streams		
Aims: 1 To identify spatial effects of processes such as weathering, soil formation, ecosystem development and varying rehabilitation strategies that can be incorporated in SIBERIA modelling 2 To investigate how stream transport and flushing can be in incorporated in SIBERIA modelling *Project Leader:* K Evans *Registry file:* JR-05-310	*Res staff:* 1	*Commenced:* September 1998 • Review honours thesis to asses suitablility for publication: Oct 2000
Weathering of waste rock at RUM, NT – consultancy CRCLEME ANU		
Aim: 1 To understand controls, processes and product governing weathering of waste rock at RUM 2 To understand distribution of distribution, trace and U- and Th- decay series to determine their distribution through the regolith in weathered and non-weathered phases *Project Leader:* K Evans *Registry file:* SG2000/0069	*Res staff:* 0.4	*Commenced:* January 2000 • Supervise consultancy contract with ANU
Calibration of the SIBERIA weathering module – ERA Ranger mine waste rock dump natural weathering processes		
Aim: To gain an understanding of the rates that selected waste rocks from Ranger mine weather under natural conditions to aid in the calibration of the SIBERIA weathering module *Project Leader:* K Evans & B Smith *Registry file:* JR-05-291; JR-05-238	*Tech staff:* 1	*Commenced:* July 1998 • Establish experimental program October 1998 – completed
Assessment of erosion at Nabarlek mine site NT and environs		
Aim: 1 Compile an inventory of erosion features on the mine site and the surrounding natural environment 2 Develop a model of site stability and assess future impact on downstream water quality *Project leaders:* K Evans *Registry file:* SG2000/0136	*Res staff:* 4 *Tech staff:* 6	*Commenced:* January 2000 • Completion of field work: Aug 2000 • Honours project University of Newcastle Thesis: Dec 2000
Use of airborne and field gamma spectrometry in assessing erosion and sediment transport		
Aims: 1 Carry out ground geological mapping for interpretation of aerial survey data from Nabarlek minesite, focussing on Buffalo Creek 2 Assess the usefulness of the technique for assessing erosion and sediment transport *Project leaders:* P Martin & K Evans *Registry file:* JR-05-306	*Res staff:* 1	*Commenced:* January 1999 • Honours project NTU Thesis: Dec 2000 This project is not active as the student has deferred.

Collection of multispectral video data from South Alligator Valley Mines		
Aim: Evaluate the potential for multispectral video data to provide a useful baseline for environmental monitoring with particular reference to vegetation density, weeds and seeped chemical pollutants. The project aims to develop EFA targets for monitoring minesite rehabilitation status with respect to ecosystem health. *Project Leader:* J Boyden *Project file:* SG2000/0026	*Staff:* 3	*Commenced: May* 2000 • Graduate Diploma: Mar 2001 • Master Science: Dec 2001 • Reports provided: Mar & Dec 2001

3 Wetland Ecology and Conservation

The objective of the Wetlands Ecology & Conservation Branch is to:

> ***provide advice, based on research and monitoring, to key stakeholders on the ecology and conservation of tropical wetlands.***

The major research projects completed in 1999–2000, ongoing and/or planned for 2000–2001 for each of the two research programs within the Branch are described below with individual projects being listed in the tables that follow. It is important to note that the programs are increasingly working collaboratively, developing projects that incorporate both inventory and assessment. In addition a number of tasks span both programs, including the identification of funding opportunities, the provision of advice to International Conventions, representation on environmental committees, and importantly, the development of the **National Centre for Tropical Wetland Research**.

The development of the ***nctwr*** saw progress during 1999–2000 with signing of the HoA, the drafting the of research strategy and mission statement, and the inaugural meeting of the Board of Management. Following this meeting the terms of reference for the ***nctwr*** Advisory Committee together with a capability statement and business plan were drafted.

During the course of the year our endeavour to provide guidance to international conventions on wetland inventory, assessment and monitoring, environmental allocation of water and climate change continued. Highlights included input to the Ramsar Convention Scientific and Technical Review Panel (STRP) program and to the Intergovernmental Panel on Climate Change third assessment report, and comment on the World Commission on Dams reports. External collaboration and communication was also advanced through participation in the Wetlands International Wetland Inventory and Monitoring Specialist Group, Wetlands International-Asia Pacific Council, Porgera Environmental Advisory Committee, the Macquarie Cudgegong River Management Committee, and the Kakadu Research Advisory Committee.

A number of externally funded projects were secured in 1999–2000. This year will see increased effort and resources allocated to seeking and securing external funding opportunities particularly in relation to the development of the ***nctwr*** with some of these contributing to the over-arching Coastal Monitoring Program that has been maintained for a number of years. The tasks and performance indicators for 2000–2001 aimed specifically at development of the ***nctwr*** are listed in table 3.1.

Table 3.1 Tasks for 2000–2001 in the Wetland Ecology and Conservation Branch specifically aimed at or related to development of the ***nctwr***

Projects and aims	Staffing commitment (p/w)	Targets
National Centre for Tropical Wetland Research		
Aims: 1. Through research and training, to provide information and expertise that will enable managers and users of tropical wetlands to use them in a sustainable manner 2. Develop and participate in ***nctwr*** activities and initiatives and meet ***nctwr*** targets *Project leader:* M Finlayson *Project files:* SG2000/0054	*Res staff:* 24 *Tech staff:* 8	*Commenced:* August 1998 • Organisation of ASL 2000 conference: Jul 2000 • Inaugural meeting of Advisory Committee: Sept 2000 • Director's report and BoM meeting – Perth: Sept 2000 • Completion of capability statement (Nov. 2000) • Development of ***nctwr*** website: Feb 2001
Providing information to International Conventions		
Aim: Provide guidance to international Conventions on guidelines for wetland inventory, assessment and monitoring, environmental allocation of water, and climate change *Project leader:* M Finlayson *Project files:* JH-02-234 (IPCC) JG-10-007 (Ramsar)	*Res staff:* 4	*Commenced:* July 1999 • Review of IPCC Third Assessment Report: July 2000 and another occasion to be advised • IPCC meeting – Portugal: Aug 2000 • Links to other conventions
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) JG-10-014 (IUCN Comm) JD-04-021 (KRAC) JG-10-013 (Wetland IMSG) JH-03-239 (Dakar Workshop) JH-10-025 (WI-AP) JD-07-089 (ASL)	*Res staff:* 18 *Tech staff:* 6	*Commenced:* March 1996 • Continued attendance at meetings of PEAK; MCRMC; MRLCG; WI-AP Council; WIMSG; IUCN Commission on Ecosystem M'mt; ASL; Kakadu Research Advisory Committee • Publication of Wetland Inventory Workshop – held in Dakar, Senegal in 1998

3.1 Wetland Ecology and Inventory Program

Work Undertaken 1999–2000

We undertook a number of wetland ecology-related projects that were felt at both local, regional and international scales and included consultation and collaboration with many groups.

Consultation at the local community level continued with active participation in the Mary River Land Care Group and collaboration with Aboriginal land owners and representative agencies. The latter included the compilation of an inventory of information on the Blyth/Liverpool wetlands being produced. Involvement in community-based wetland monitoring projects took the form of a vegetation and bird study at Yellow Waters; a similar study on the Carmor Plains; a study of birds, general ecology and nutrient budget of Lake

Jabiru and a re-vegetation study on the Mary River (following the clearance of *Mimosa pigra*). All helped to establish good relationships with local community groups, to increase local knowledge of wetlands and provide information on selected wetland habitats. A commitment was also made to supervise a NHT-funded fish project on the Arafura swamp and to complete the fish survey work on the Blyth/Cadell floodplain.

With view to promoting data and information management our GIS facility was further developed and the ArcInfo–ArcView facility is available to all users of the Jabiru/Darwin network and a listing of all the dataset titles and abstracts for the GIS was entered into a metadatabase. The transfer of the ARR Herbarium at ***eriss*** to the PWCNT Herbarium (in Palmerston) and the entering of all the data (electronic and hardcopy) into a metadatabase was also completed, as was an identification key on the basis of scale description for fish of the ARR.

In collaboration with the Northern Territory and Griffith Universities who were funded by the Environment Australia Wetland R&D Program we participated in a project to assess the impact of paragrass (*Brachiaria mutica*) on faunal biodiversity and ecosystem processes of wetlands. The field work was completed and a workshop detailing the results of the study was held in July 2000. During the year a NTU honours student was supported to investigate the spectral properties of *Mimosa pigra* on the Adelaide and Mary River floodplains, with the aim of determining the suitability of using satellite imagery to map the current and potential extent of mimosa.

Also during the course of the year a WWF-funded review of environmental impacts, management practices and potential threats to wetlands of 11 major mines operating in tropical Oceania was undertaken. The final report was distributed to stakeholders in December 1999. A Department of Land, Planning and the Environment funded study aimed at providing a mapping base and hazard assessment framework for determination of the environmental flow requirements of aquatic habitats in the Daly River basin was initiated and a 'milestone report' produced in May 2000.

The group's resolve to continue being actively involved in the transfer of information and to assist wetland managers and/or policy makers to develop skills and understanding about wetland processes, surveys and threats was shown through support for the NTU Tropical Wetland Management Course at ***eriss*** in July 1999. Collaboration with wetland managers from the Mekong Delta was greatly advanced by the visit of several wetland managers from the Mekong Delta and a visit to Viet Nam by a consultant engaged on our behalf to produce a weed management strategy and provide training in weed control. Funding for these two projects was provided by the NTU Wetland Managers Training Program.

One of the largest jobs undertaken was a review of the global extent of wetland inventory information (a project initiated the previous year to assess the extent of wetland inventory and identify major gaps) and a major milestone was reached in August 1999 when a revised version of the CD-ROM (containing databases, reports and bibliographies) was produced and, in a report and journal article published. This project was funded by the UK Government in cooperation with the Ramsar Bureau.

Work Proposed 2000–2001

The tasks and performance indicators for 2000–2001 are listed in table 3.2. Although several of the projects are ongoing from1999–2000, most are generally in the final stages of completion or awaiting publication of the results.

Our program continues to build on extensive community consultation conducted locally, nationally and internationally and on several scene-setting investigations. The latter is focussed on conservation assessments and surveys; international initiatives to develop standard approaches to wetland inventory, assessment and monitoring and risk analyses directed. This will include a review of past work on wetlands on Aboriginal lands to identify gaps in our data and opportunities for collaboration with other agencies and representative groups. Our community-based monitoring tasks will continue, but with a greater focus on data analysis and communication with local groups and individuals. These efforts will be greatly assisted by the production of a report on natural fish kills that can occur regularly and can result in great public alarm.

It is intended to also reassess and develop further wetland inventory projects such as those looking at the inundation of floodplains using remotely sensed data. This will continue past collaboration on wetland inventory and lead towards cost-effective techniques for monitoring change in wetlands including that caused by climate change and sea level rise. An Asian Wetland Inventory project is being developed with Wetlands International and will provide a base for further estimates of wetland area in particular countries and also contribute information towards climate change analyses. Connected projects will investigate data requirements for wetland inventory, the accuracy of various data sources for estimating wetland area, and an overview of the ecological information available for the Magela floodplain.

The above mentioned initiatives are expected to result in an enhanced profile for our wetland research potential in local, national and international circles where it is evident that we have an opportunity not only to contribute to the research base for wetland management but also to provide scientific leadership. The latter is already recognised through the Ramsar Wetlands Convention and should be enhanced by further collaborative projects on environmental flows and inventory.

Table 3.2 Projects for 2000–2001 in the Wetland Ecology and Inventory program

Project and aims	Staffing commitment (p w)	Targets
Survey and management planning for wetlands on Aboriginal lands in the NT		
Aim: Undertake ecological surveys and management planning for wetlands on Aboriginal lands *Project leaders:* M Finlayson & R Pidgeon Project files: JR–05–216 / 231/ 258/ 267/ 278 / 280/ 287/288/ JS-06-139 (Intecol paper)	*Res staff:* 4 *Tech staff:* 5	*Commenced:* July 1996 • Paper prepared for presentation at Intecol conference, Canada: Aug 2000 • Djelk wetlands/lower Cadell fish survey: before Nov 2000 • Formalising supervision arrangement for Arafura project: Nov 2000 • Supervising Scientist note: Dec 2000 • Report on fish inventory: Feb 2001 • Lodgement of reference fish collection with NT Museum and Djelk Rangers: Mar 2001
Identifying and monitoring change in wetland inundation and vegetation patterns, ARR		

Aims 1 To use radarsat and videography to monitor changes in wetland inundation to delineate freshwater from tidal wetland areas. 2 Develop routine procedures for mapping wetland change over northern Australia. *Project leader:* AK Milne UNSW ***eriss** contacts:* M Finlayson/G Begg *Project file:* JR–03–087 (Radarsat monitoring) JR–05–234 (coastal monitoring)	*Res staff:* 10 *Tech staff:* 6	*Commenced:* October 1997 • ASL paper: July 2000 • Mapping of saltflat/mangrove expansion on coast: Oct 2000 • Acquisition of further AIRSAR data (on next pass 8th Sept 2000) • Completion: March 2000
Comparison of estimates of wetland area in the wet-dry tropics		
Aims: Compare different estimates of wetland area from existing data *Project leaders:* M Finlayson, John Lowry *Project files:* JR-05-199 (GAIM) 296 (IGBP – DIS) JR-03-023 (CIESIN) SG2000/0151	*Res staff:* 4	*Commenced:* September 2000 • Consultation with IGBP and CIESIN (USA) and STRP meetings • Analysis of maps and remotely sensed data from NASA • Completion of Internal Report and Supervising Scientist Report: February 2001

Natural fish kills in the ARR		
Aim: To compile a record of the occurrence of fish kills in the ARR and the limnological conditions associated with them *Project leader:* R Pidgeon *Project file:* SG 2000/0151 ab JR:06 /32	*Res staff:* 1 *Tech staff:* 1	*Commenced:* 2000 • Internal Report: February 2000 • ASL paper: July 2000 • DPIF Fisheries permit & Animal Ethics approval: November 2000 • Supervising Scientist Report: June 2001 • Presentation to amateur fishing organisation: May 2001 • Draft protocol on approach to investigation of fish kills: June 2001
Review of global extent of wetland inventory information — Phase 2		
Aim: To update global inventory project (GroW1) and construct web-based metadatabase *Project coordinator:* M Finlayson *Project files:* JK–02–036 JH–03–306 & 336 JG–10–007 & 013	*Res staff:* 12 *Tech staff:* 2	*Commenced:* to be advised • Project submission: July 2000 • Securing of Ramsar funding: Sept 2000 • Supervising Scientist Report and report to Ramsar: Aug 2000
Description and literature review of the flora and vertebrate fauna of Magela Creek		
Aim: To provide an updated review of literature for further ecological assessments *Project leader:* M Finlayson *Project file:* SG2000/0207	*Res staff:* 4 *Tech staff:* 12	*Commenced:* June 2000 • Draft report October 2000 • Supervising Scientist Report December 2000
Identification of culturally significant butterfly and dragonfly species in the Alligator Rivers Region		
Aim: To record the common / ecologically or culturally significant species of butterflies found in the Alligator Rivers Region, and to collate them in the form of a field manual *Project leader:* C Camilleri Project file: SG 2000/0191 *Aim:* To record the common / ecologically or culturally significant species of dragonflies found in the ARR, and to collate them in the form of a field manual *Project leader:* J Davis *Project file:* SG 2000/0193	*Res Staff: 1* *Tech staff:* 6	*Commenced:* May 1998 • Final Report: October 2000 • Supervising Scientist note: Dec 2000 *Commenced:* March 1998 • Final Report: Jun 2001 • Supervising Scientist note: Dec 00 • Book
Inventory and Risk Assessment of wetlands in the Daly Basin		
Aim: To provide a mapping base and risk assessment framework for determination of the environmental flow requirements of aquatic habitats in the Daly basin *Project leader:* G Begg *Project file:* SG 2000/0091	*Res staff:* 10 *Tech staff:* 24	*Commenced:* March 2000 • Milestone report No 2: Aug 2000 • Final Report/Internal Report: March 2001 • Supervising Scientist Report: July 2001
Distribution and conservation ecology of waterbirds		

Aim: Investigate habitat requirements and behaviour of selected waterbirds whose populations are declining in eastern Australia *Project leader:* E Dorfman (Univ. Sydney) *Project file*: JR-05-319	*Res staff:* 2 *Tech staff:* 4	*Commenced:* May 2000 (planning) July/Aug 2000 – (field work) • ASL talk: July 2000 • Aerial census :Sept 2000 • Transformation of non-spatial data into spatial coverage using GIS: Dec 2000 • Supervising Scientist note: June 2001

Community based wetland monitoring		
Aim: (1) To develop awareness of wetland values and processes in local community groups (2) To provide basic information on wetland ecology and threats. *Project leader:* M Finlayson *Project files*: JR–05–284 (Yellow Waters) 285 (Carmor Plains) 286/194/324 (Lake Jabiru) 245/355 (Mary River) SG2000/0203 (Intecol paper)	*Res staff:* 5 *Tech staff:*3	*Commenced*: July 2000 • Input to INTECOL wetland symposium • Initiation of tree phenology project at Yellow Waters: Sept 2000 • Supervising Scientist Report on Mary River Land Care Group: Dec 2000 • Internal Report on ecology of Lake Jabiru: May 2001 • Supervising Scientist note on community based monitoring: May 2001 • Meetings with and talks to local community groups and NGOs • New project outlines: June 2001
Asian Wetland Inventory		
Aim: Adoption and application of ***eriss***/Ramsar approved approaches to wetland classification and inventory. (Stage 1 – Lower Mekong Basin) *Project leader:* M Finlayson *Project file*: SG 2000/0055 SG 2000/0184 (MRC)	*Res staff:* 8 *Tech staff:* 6	*Commenced*: to be advised • Participation in wetland inventory and classification workshops in Laos: Sept 2000 • Refocusing of Mekong River Commission classification scheme: Nov 2000 • Training course and pilot study in NE Asia (WI – Japan): April 2001 • Supervising Scientist note: April 2001
Responding to EA and Ministerial enquiries and submissions		
Aim: To provide comment on draft framework and/or policy documents being prepared or reviewed by EA Strategic Policy and Coordination Section (Canberra) ***eriss*** *contact*:: M Finlayson *Project files*: JD–011–062 (Ecosystem services project)	*Res staff:* 4 *Tech staff:*1	*Commenced:* January 2000 • Ecosystems services project: Aug 2000 • On as needs basis

3.2 Wetland Risk Identification and Assessment

Work Undertaken 1999–2000

Our ecotoxicological work continued with a Masters project, investigating the influence of true water hardness and alkalinity on the toxicity of U and Cu to two aquatic species, being completed and the results presented at a conference and a paper published. A collaborative

project between ***eriss*** and the University of Tasmania, investigating copper speciation and toxicity in estuarine water was also completed. The results of research by two Honours students from RMIT were also finalised and published. The first, developed a rapid toxicity bioassay based on the feeding rate of the cladoceran, *Moinodaphnia macleayi*, while the second assessed variability in response of three populations of *M. macleayi* to U and Cd. The development and application of the rapid toxicity bioassay continued in 2000, with another Honours project currently underway, and due for completion in November 2000.

The toxicity assessment of Gadji Creek water from 1997 was compiled as an Internal Report in November 1999. The results of this research, and the 1998 toxicity results, are being combined with a related study assessing the influence of silica on the aquatic toxicity of aluminium, due for publication in 2001.

A quantitative ecological risk assessment of the herbicide tebuthiuron was completed, although publication of the final report was delayed. Related to the herbicide risk assessment, a wetland risk assessment of the tropical weed, *Mimosa pigra* was commenced in collaboration with the Northern Land Council. A comprehensive literature review was compiled for publication in a journal. The information was used to provide wetland managers from Tram Chim National Park in the Mekong River Delta, VietNam, with guidance for mimosa control and management.

In collaboration with Parks North a preliminary risk assessment of cane toads in Kakadu National Park was commenced, aimed at identifying key cane toad habitats and species most at risk. A field trip to the Katherine and Borroloola regions was undertaken to discuss the cane toad issue with traditional land owners. The assessment will be completed in early September 2000. The vulnerability assessment (VA) of Olango Island and the Yellow River Delta to climate change and sea level rise was published in January 2000. The assessments utilised the VA process developed by the IPCC and modified following a series of Australian case studies. The project, a collaborative effort with Wetlands International, was funded by the Asia Pacific Network for Global Change Research.

The second phase of a short, two phase consultancy to the NSW Department of Land and Water Conservation, to evaluate a risk assessment for a proposed extension to an irrigated cotton farming practice adjacent to the Ramsar-listed Macquarie Marshes Nature Reserve was undertaken and a report was provided.

Work Proposed 2000–2001

The tasks and performance indicators for 2000–2001 are listed in table 3.2. A number of projects are awaiting final publication and should require little in the way of staff resources.

Planning of the 2000–2001 workplan should allow successful completion of a number of ongoing projects, all of which constitute important outputs for the program's future directions. For example, the completion of several risk assessment reports is essential for demonstrating and promoting the wetland risk assessment model to the Ramsar convention and other funding bodies. Attendance at the Global Invasive Species Program Phase 1 Synthesis Conference in Capetown, September 2000 will involve major promotion of the use of the wetland risk assessment model.

New projects include short-term internal projects and consultancies, and the development of long term projects for which external funding will be sought. The current suite of ecotoxicological protocols is being compiled and will be published. This will be a valuable reference source for tropical freshwater ecotoxicology, complementing the National Water Quality Guidelines, as well as being available as a training material. A short-term

ecotoxicology consultancy has already been secured through CSIRO and is due to be completed by October. An Honours/Masters project, based at ANSTO's laboratory at Lucas Heights, will commence in early 2001, attempting to determine the mechanism by which silica prevents aquatic aluminium toxicity. This project will be a collaboration between ***eriss***, ANSTO and the National Research Centre for Environmental Toxicology (NRCET).

A major new project being initiated is a risk assessment of the major herbicides used to control *Mimosa pigra*. The project will build on the methodology used to assess the ecological risks of one of the herbicides, tebuthiuron. The initial step is to identify potential collaborators and it is expected that the project would run for at least two years.

Another major new project is the initial development of a formal training course in ecotoxicology. We have identified an opportunity for ecotoxicological training for the assessment of herbicides and pesticides in South-East Asia and plan to develop a training course that can be attended by a range of technicians and professionals. The course would include specialist speakers with whom ***eriss*** has had substantial collaboration over recent years.

In summary, over this year we plan to complete major and important reports, and provide a base for consolidation of the program for the next three years.

Table 3.3 Projects for 2000–2001 in the Wetland Risk Identification & Assessment research program

Project and aims	Staffing commitment (pw)	Targets
Effects of speciation on water quality guidelines for uranium and copper		
Aim: Investigate the influence of key physico-chemical parameters on the toxicological responses of hydra and gudgeon to uranium and copper *Project leader:* R van Dam & S Markich *Project file:* JK-02-034	*Res staff:*0.25 *Tech staff:* 0	*Commenced:* July 1997 • Supervising Scientist Report: Dec 2000
Copper speciation and toxicity in estuarine water		
Aim: To relate copper toxicity to copper speciation in estuarine water *Project leader:* R van Dam *Project file:* JR-05-237	*Res staff:*0.25 *Tech staff:* 0	*Commenced:* May 1997 • Supervising Scientist Report: ~~Dec 2000~~ Feb 2001
Development of rapid waterflea toxicity test using feeding inhibition as an endpoint		
Aim: Develop a rapid waterflea toxicity test to meet regulatory needs *Project leader:* R van Dam *Project file:* JR-05-295	*Res staff:*0.25 *Tech staff:* 0	*Commenced:* July 1998 • Journal paper (in press): Mar 2001
Aim: To assess inter-population variability of *Moinodaphnia macleayi* in response to various toxicants *Project leader:* R van Dam *Project file:* JR-05-295	*Res staff:* 0.25 *Tech staff:* 0	*Commenced:* April 1999 • Journal paper (in press): May 2001
Aquatic toxicity of aluminium and the effect of silica		

Aim: To assess the toxicity of aluminium to *M. mogumda* and determine the influence of silica on Al toxicity *Project leader:* C Camilleri & R van Dam *Project file:* JR-05-311	*Res staff:* 7 *Tech staff:* 1	*Commenced:* September 1999 • Internal Report: Jan 2001 • Journal paper submitted: March 2001 • Supervising Scientist note: March 2001
Toxicity of uranium to the green alga, *Chlorella* sp.		
Aim: To assess the toxicity of uranium to the green alga, *Chlorella* sp. in Magela Creek water *Project leader:* C Camilleri *Project file:* SG2000/0093	*Res staff:* 7 *Tech staff:* 3	*Commenced:* April 2000 • Internal Report: Dec 2000 • Journal paper submitted: Feb 2001

Application of the *Moinodaphnia macleayi* feeding rate bioassay as a rapid screening test for complex mixtures		
Aim: to compare the sensitivity of the feeding rate bioassay and the standard 48-h survival and 3 brood reproduction bioassays to a range of complex mixtures *Project leader:* R van Dam *Project file:* JR-05-357	*Res staff:* 5 *Tech staff:* 5	*Commenced:* April 2000 • Thesis: Nov 2000 • Internal Report: Feb 2001 • Presentation at ASE Conference, Feb 2001 • Journal paper submitted: May 2001
Risk assessment of herbicide impacts on tropical Australian wetlands (2)		
Aim: To assess the toxicity of the herbicide, tebuthiuron, to two native, non-target aquatic phytotrophs and to undertake a quantitative risk assessment based on all available relevant data *Project leader:* R van Dam & C Camilleri *Project file:* JR-05-263	*Res staff:* 3 *Tech staff:* 1	*Commenced:* July 1997 • Journal paper submitted: ~~Dec~~ 2000 Feb 2001. • Supervising Scientist note: March 2001
Application of wetland risk assessment model to *Mimosa* in northern Australia and South East Asia*		
Aim: To undertake a wetland risk assessment of the problem of the wetland weed, *Mimosa* *Project leader:* R van Dam *Project file:* JR-05-325	*Res staff:* 6 *Tech staff:* 6 postponed	*Commenced:* December 1998 • Internal Report: Sept 2000 • GISP Conference, Capetown: Sept 2000 • Trip report – GISP outcomes: Oct 2000 — (IR) & attachments • Journal ~~paper~~ submitted, Dec 2000 • WRA case study report to Ramsar: ~~Feb~~ Mar 2001 • Supervising Scientist Report: ~~Mar~~ Apr 2001 • Supervising Scientist note: May 2001
Ecological risk assessment of cane toads in Kakadu National Park and surrounding regions		
Aim: To undertake a risk assessment of the likely impacts of cane toads to Kakadu National Park and the surrounding region *Project leader:* R van Dam *Project file:* JR-05-307	*Res staff:* 6 *Tech staff:* 10	*Commenced:* January 2000 • Final report to PN: Sept 2000 • Supervising Scientist Report: submitted Jan 2001 • Supervising Scientist note: April 2001
Further studies on aluminium toxicity and the influence of silica		
Aim: to determine the mechanism by which silica prevents aluminium toxicity *Project leader:* R van Dam & C Camilleri *Project file:* SG2000/0211	*Res staff:* 3 *Tech staff:* 0	*Commenced:* April 2000 • Thesis: Dec 2001 • Internal Report: Feb 2002 • Journal paper submitted: May 2002
Compilation of ecotoxicology test protocols developed and/or used at *eriss*		
Aim: to document and publish the existing, modified and new toxicity test protocols used at ***eriss*** *Project leader:* C Camilleri *Project file:* SG2000/0194	*Res staff:* 6 *Tech staff:* 2	*Commenced:* April 2000 • Internal Report: Nov 2000 • Supervising Scientist Report: Feb 2001

add: communication prgm indicators.

• CBD poster March 01

• CBD poster? Mar-01

Toxicity of nickel tailings liquor to two tropical aquatic species: *Mogunda mogurnda* and *Moinodaphnia macleayi*		
Aim: to determine the NOEC, LOEC and LC50 of a simulated nickel tailings liquor *Project leader:* C Camilleri *Project file:* SG2000/0121	*Res staff:* 3 *Tech staff:* 3	*Commenced:* September 2000 • Report to CSIRO: Oct 2000
Risk assessment of herbicides in tropical Australian wetlands (3)		
Aim: To assess the risks to Top End wetlands of the other major herbicides used to control Mimosa *Project leader:* R van Dam *Project file:* To be advised	*Res staff:* 4 *Tech staff:* 4	*Commenced:* December 2001 • Grant/Funding proposal/application: Feb 2001 • Progress report and literature review: June 2001
Development of an ecotoxicology training program targeting SE Asia		
Aim: to develop and initiate a program providing important background and training in ecotoxicological approaches *Project leader:* C Camilleri *Project file:* To be advised	*Res staff:* 5 *Tech staff:* 1	*Commenced:* February 2001 • Scoping report: April 2001 • Action Plan and draft program structure: June 2001

payment pending.

4 Communications

4.1 Aboriginal Communications Unit

The unit was established in February 2000 and consists of two staff based in Jabiru. The objective of the Aboriginal Communications unit is to:

> ***develop and implement communication programs to ensure that all local Aboriginal communities and associations are kept informed, and involved where possible, about research work*** **eriss** ***and*** **oss** ***undertake.***

The unit is also responsible for coordinating the employment and training of local Aboriginal people in ***eriss*** programs.

The unit's first priority is to establish effective liaison and communication links with the Aboriginal communities after which it will also become involved in communication programs for the wider community. Creation of the unit in the later half of the reporting year has meant that specific programs are in the early stages of development, however progress has been made towards a number of internal and external initiatives and activities.

Work Undertaken 1999–2000

As communication is considered an integral part of our research the unit assisted in the dissemination of information to appropriate stakeholders. This included, for example coordinating information about the survey work ***eriss*** is conducting in the Gunlom area of the South Alligator valley in preparation for the rehabilitation of old tailings. This involved working with Parks Australia, the Northern Land Council and the Jawoyn and Bambartluk Associations to ensure people knew what work we are doing and if there were issues, such as cultural sensitivities, what we should be aware of.

As part of the cane toad impact study, the unit coordinated a collaborative research and liaison survey on the impact that cane toads have had on Aboriginal people in some parts of the Northern Territory. The survey was conducted at Aboriginal communities in the Katherine to Borroloola region to hear first hand what impact, if any, the cane toad is having on their lives with the decline of certain bushfoods. The survey was conducted by Parks Australia North, ***eriss*** and some traditional owners of Kakadu National Park. The information gathered on the survey was to develop a communication program for the traditional owners of Kakadu about the possible impacts that the cane toad could have on bush tucker in their region.

The unit also participated in a number of committees, including the Bininj Working Committee, Gunbang Action Group, Kakadu Aboriginal Employment, Education and Training Committee. Other community based committees include the Territorians Against Litter Committee (TALC). It also maintained regular contact with Djabulukgu, Gagudju, Bumbartluk and Jawoyn Associations, Gundjehmi and Minitja Corporations, the Northern Land Council, Parks Australia North and ERA. Other liaison work such as arranging the appropriate permits. In kind and other support to groups and events was also coordinated through the Aboriginal Communications Unit. A bimonthly newsletter wass produced summarising research that has been undertaken and that which is proposed for the near future. These newsletters are written in plain English and outline the reason for the research and not the scientific methodology behind it. It is distributed to all Aboriginal stakeholder groups, as well as local and Commonwealth government agencies and the Ranger mine. An invitation for full briefings on the topics summarised in the newsletter is extended with each edition.

Other liaison work includes arranging appropriate permits and access permission. In kind and other support to groups and events is also coordinated through the Unit. It is also a contact point for non-Aboriginal groups such as students, environmental groups and the general public who are seeking information about ***eriss*** and ***oss***.

eriss and ***oss*** take an active role in community festivals and events providing information displays and interactive educational activities. These events provide ***eriss*** with an opportunity to demonstrate some techniques used in scientific research, such as the use of microscopes and the sorting of macroinvertebrates. Displays and information sessions were also conducted for associations and communities on issues as they arose. Other information briefings are arranged on an issue basis.

Internal initiatives have included the implementation of a communications protocol to ensure the approach taken and the methods used to communicate with traditional landowners and associated groups are appropriate and consistent. Cross cultural training was made available to all staff along with training on working with Aboriginal people for staff who would be involved in the employment and training program. A cross cultural and protocol briefing has been included in the induction program for new staff.

Work Proposed 2000–2001

The tasks and performance indicators for 2000–2001 are listed in table 4.1. The communciation and liaison tasks outlined above will continue in conjucntion with internal steps to identify major communication tasks for each research program.

We will take part in further education based projects with Aboriginal groups. As an example the unit is working in conjunction with the Ecosystems Protection Research Program on a *Caring for Country* project coordinated by the NLC. This involves training traditional owners of the Mann River region in Arnhem Land on baseline sampling techniques to allow them to make decisions about future developments on their land. The project involves a field survey, after which a teaching kit and survey guide will be produced in local language to help the traditional owners conduct their own biological survey and sampling work. This kit will be produced in conjunction with the community and the NLC.

The first employment project being developed involves coordinating landowners to participate in the collection and identification of fish and recording of data for annual fish counting undertaken in billabongs in the region. The traditional owners of the mineral leases, the Mirrar People, will be asked to work at billabongs on their country, and the Murrumburr landowners collaborated with ***eriss*** at the control sites upstream of any possible mining impact. Aboriginal people from Arnhem Land will also be invited to work on billabongs in Arnhem land

Table 4.1 Projects 2000–2001 for the Aboriginal Communications Unit — Interacting with the community

Project and aims	Staff commitment (pw)	Targets
Coordinate the employment and training of local Aboriginal people in *eriss* research		
Aim: In conjunction with project leaders, identify and coordinate the involvement and employment of local and other Aboriginal people in ***eriss*** research programs where possible *Project leader:* J Rovis-Hermann *Project File:* JS-04-047	*Staff:* 20	*Commence:* September 2000 • All project plans to address employment options and indicate where opportunities lie and to include costings • Investigate funding opportunities for employment and training support through EA Indigenous Employment Program • Produce inventory of what short term and long term employment opportunities exist, at what time of the year and the skills required • Assess training needs for staff who will be working with bininj
Coordinate the effective communication of *eriss* research activities and findings to stakeholders		
Aim: To ensure that eriss disseminates information on research work and results to stakeholders in an appropriate and timely manner *Project leader:* J Rovis-Hermann *Project file:* File being created	*Staff:* 20	*Commenced:* September 2000 • All new projects to have a communications strategy included as part of the project plan and to be approved by the Branch Head before the project can commence • Review existing projects for inclusion of communications strategies for key projects • On the completion of each project, an Internal Report on the effectiveness of communications strategy is prepared, including stakeholder feedback
Produce bimonthly newsletter for Aboriginal associations on key issues		
Aim: To keep Aboriginal associations informed of the scientific and other work being conducted at ***eriss*** *Project leader:* J Rovis-Hermann *Project file:* SG2000/0103	*Staff:* 2	*Commenced:* May 2000 • Six newsletters produced a year

Liaise with Aboriginal associations and other groups and represent *eriss* on appropriate committees		
Aim: To maintain a high level of contact with relevant groups *Project leader:* J Rovis-Hermann *Project Files:* *TALC File:* SG2000/0169	*Staff:* 15	*Commenced:* May 2000 • Maintain regular contact (at least fortnightly), with all six Aboriginal Associations • Attend meetings of the Kakadu Employment, Training and Education Committee, Gunbang Action Group, KRSIS Committee, Bininj Working Committee, and TALC Committee • Provide inkind and other support to community and cultural events such as the Gunbalanya Open Day, NAIDOC Week • Represent ***eriss*** at all community events • Maintain regular contact with other stakeholder groups such as PAN, NLC, ERA
Ensure that *eriss* and *oss* provide timely and accurate information to traditional owners on relevant environmental issues as they arise		
Aim: To identify when information is required on environmental issues affecting the traditional owners of the Alligators Rivers Region and to devise appropriate communications strategies in consultation with staff and stakeholders *Project leader:* J Rovis-Hermann *Project Files:* File being created	*Staff:* 5	*Commenced:* June 2000 • Assess what information is required to inform landowners and devise methodology in consultation with association and NLC • Produce Supervising Scientist note outlining the issue and ***eriss*** involvement and actions • Prepare filenote for on consultation with traditional owners outlining methodologies used and outcomes
Ensure all staff are aware of the cross cultural aspects of living and working in Kakadu		
Aim: To ensure all eriss staff are aware of the cultural issues that they may encounter living and working in the Alligators Rivers Region *Project leader:* J Rovis-Hermann *Project Files:* File being created	*Staff:* 2	*Commenced:* May 2000 • All staff and students undertake cross cultural training • Refresher course offered annually for existing staff • All new staff undergo an Aboriginal Communications component as part of the induction

Identify internal communications needs and make recommendations for strategies to ensure effective communication flow		
Aim: To ensure that internal information on projects and issues is provided to the relevant staff as it becomes available *Project leader:* J Rovis-Hermann *Project Files:* SG2000/0092 (held in Darwin)	*Staff:* 6	*Commenced:* September 2000 • Attend all branch meetings and provide briefing on what tasks the Aboriginal Communications Unit is undertaking across the organisation • Identify areas where the internal dissemination of information is required or could be enhanced and develop a strategy and proposal to enhance in consultation with relevant staff • Develop new strategy to encourage the participation of the associations and traditional owners in the ARRAC structure • Produce Internal Reports on communication options for a new format ARRAC

5 GENERAL ENVIRONMENTAL RESEARCH

During 1999–2000 the review of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* continued. This included a period of public consultations, revision and further review by ANZECC/ARMCANZ agencies before being forwarded to the Standing Committee for Environmental Protection in May 2000. These will be submitted to ANZECC for Ministerial approval in July and prepared for publication in October 2000. This will be the culmination of a major effort involving ***eriss*** and many contributors from around Australia and New Zealand.

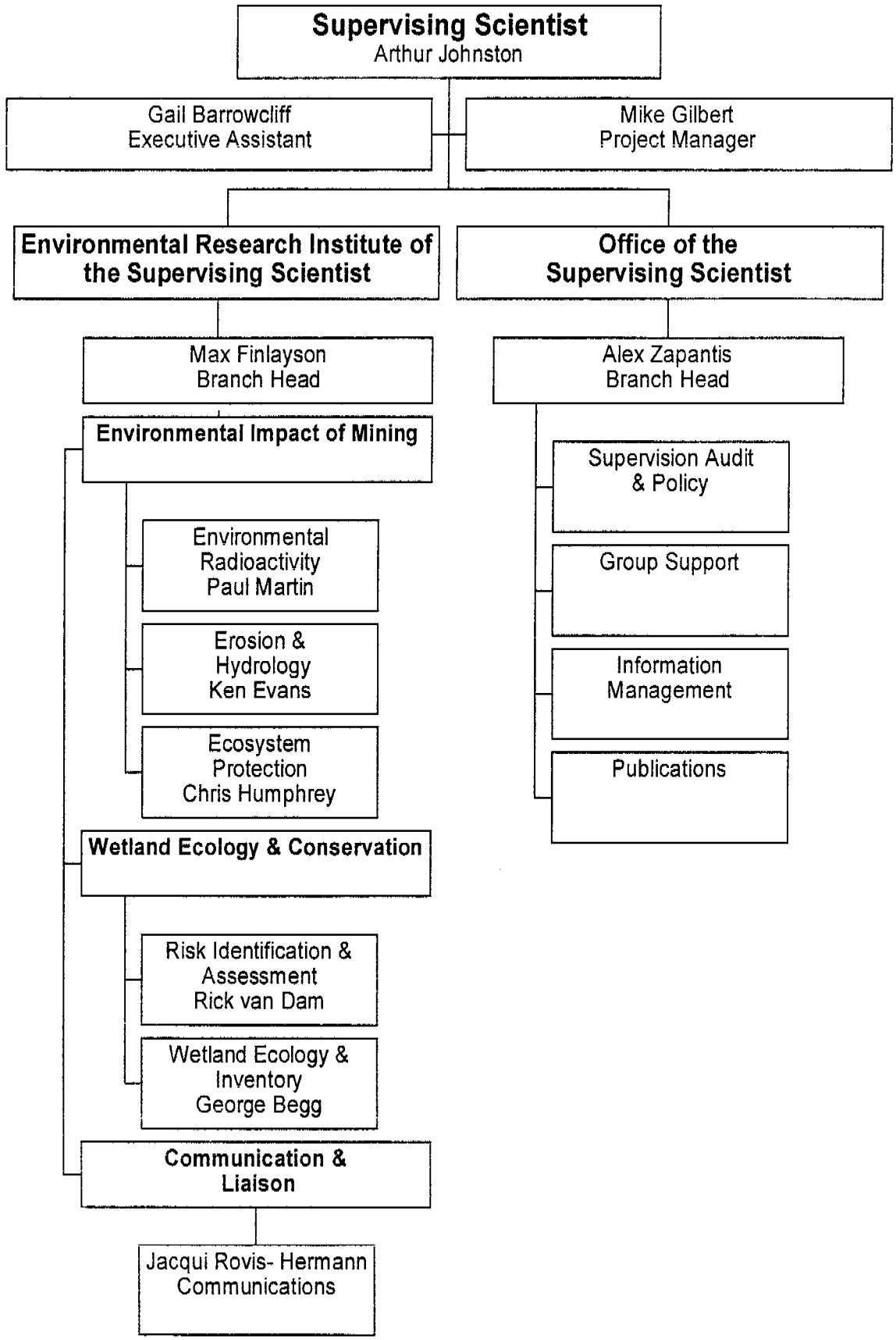
Table 5 Projects for 2000–2001 in the General Environmental research program

Project and aims	Staffing commitment (pw)	Indicator
Review of the Australian & New Zealand Water Quality Guidelines		
Aim: Manage the technical revision of the Australian & New Zealand Water Quality Guidelines *Project Leader:* C Humphrey	*Res staff:* 12	*Commenced:* 1996 • Submit Guidelines to ANZECC: Jul 2000 • Publication of Guidelines: Jul–Oct 2000

Supervising Scientist Division

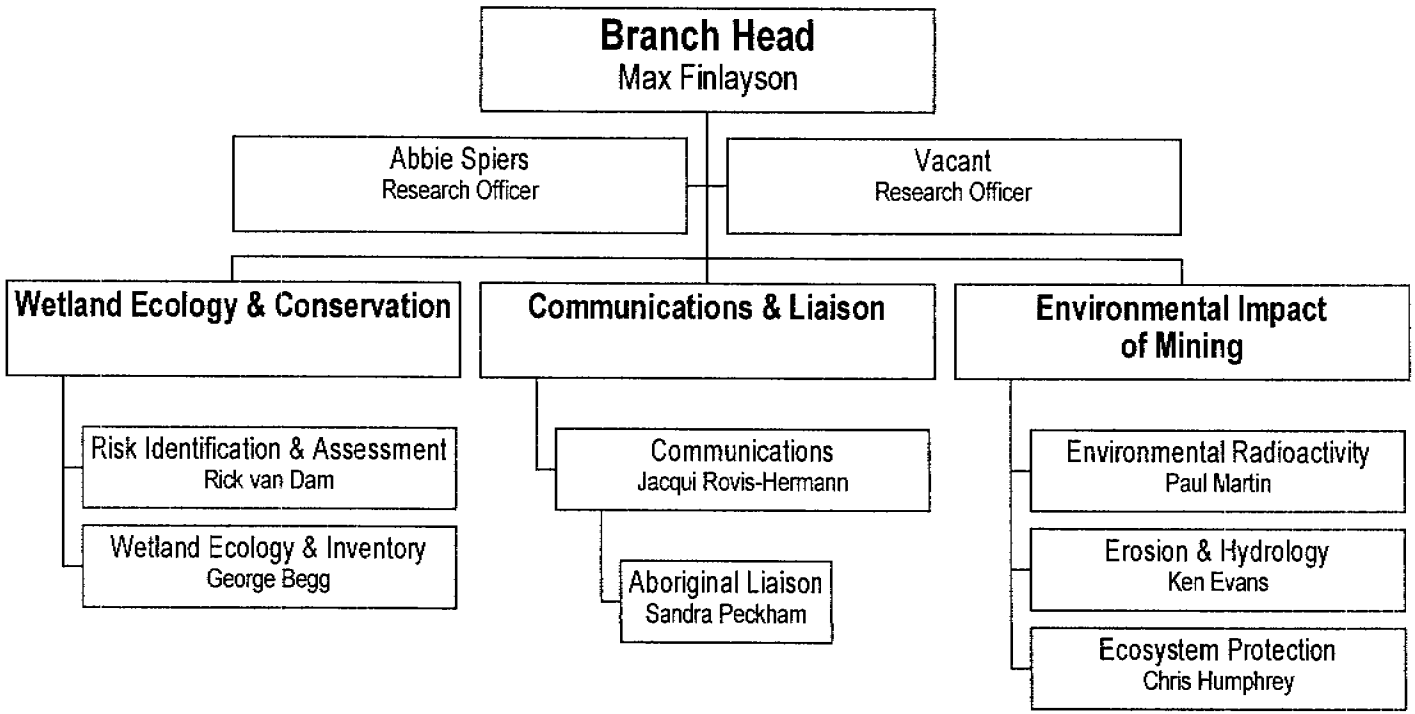
Organisational Structures

Supervising Scientist Division



October 2000

Environmental Research Institute of the Supervising Scientist



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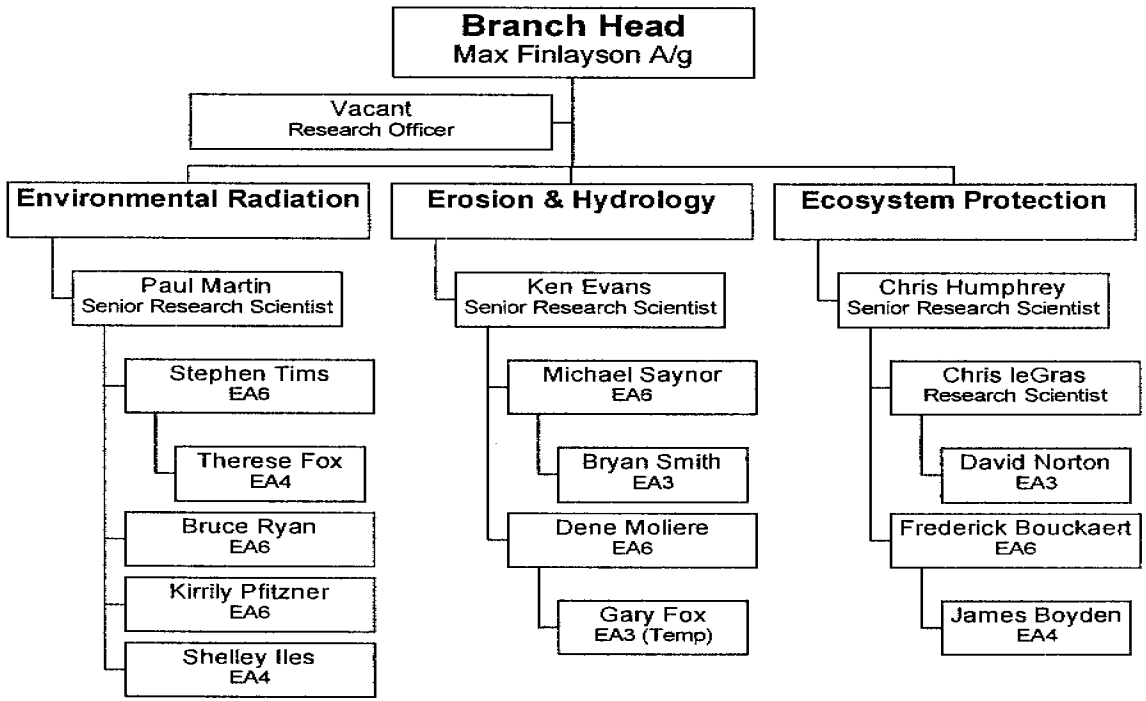
Environmental Impact of Mining



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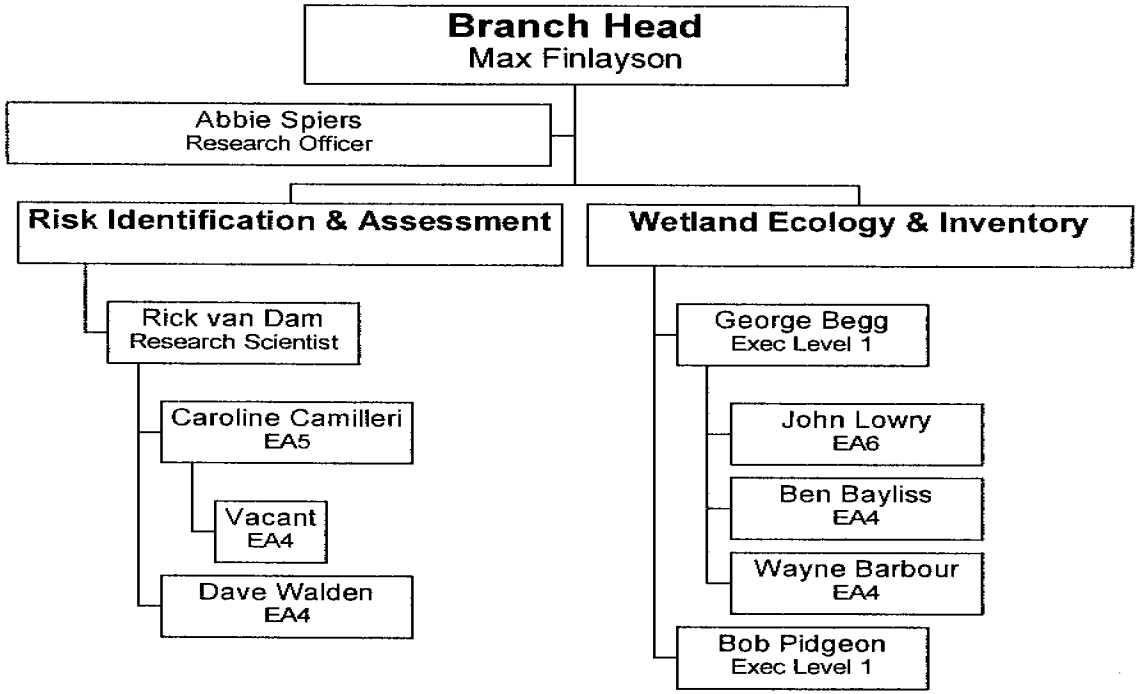

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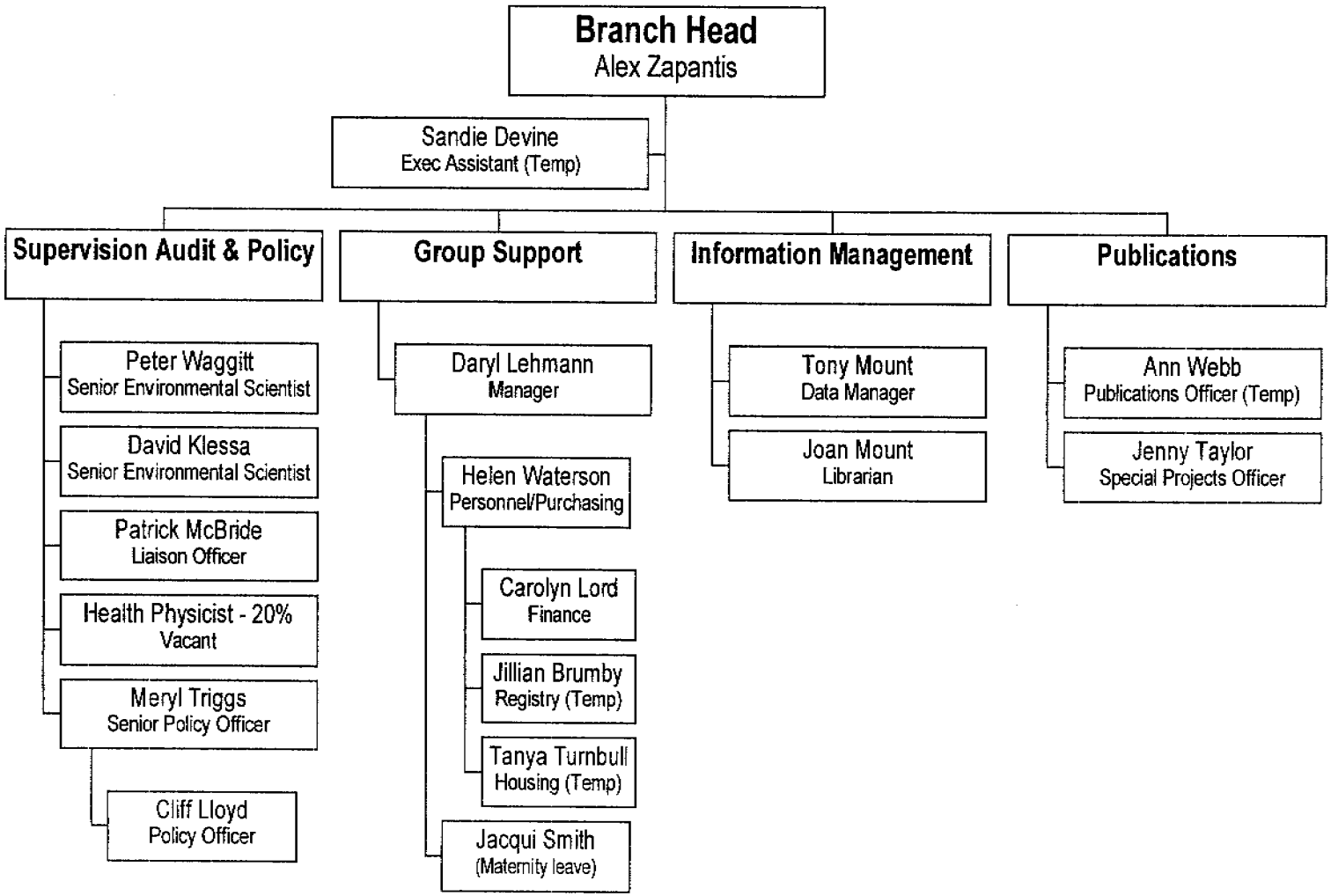

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