
Lake Eyre Basin Rivers Assessment Implementation Plan Project

**Milestone 1 Report:
Review of achievements**

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RESEARCH WITHOUT BOUNDS



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EYRE
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MINISTERIAL FORUM

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Kiri-ganai Research Pty Ltd is a Canberra based company that undertakes consultancy and analytical studies concerned with environmental policy, industry performance, natural resource management and sustainable agriculture. Our strength is in turning knowledge gained from public policy, markets, business operations, science, and research into ideas, options, strategies and response plans for industries, governments, communities and businesses.

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Project team

The LEB River Assessment Implementation Plan Project is managed by Kiri-ganai Research Pty Ltd. The project team comprises Dr Richard Price, Professor Martin Thoms and Dr Samantha Capon.

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Disclaimer

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Overview

This is the first of four reports specified as outputs for the initiative: Lake Eyre Basin Rivers Assessment Implementation Plan Project (see a summary of the Terms-of-Reference under Appendix A). The report reviews progress made in the name of the LEB Rivers Assessment process since protocols for such assessments were agreed to in 2005. Future reports will cover:

- a revised LEB assessment process (if a revision is deemed necessary);
- a business plan for LEB assessments; and
- an implementation plan for future LEB assessments.

The project was commissioned following completion of the LEB Action Plan 2009-2014. That Plan identified the need to consider the governance arrangements appropriate to ensure effective implementation of future LEB assessments and condition reports.

In essence, this Implementation Plan Project deals with the governance arrangements by first coming to grips with the assessment requirements necessary to meet LEB ministerial agreement obligations. This is to ensure that structure follows function, tailoring the governance arrangements to meet specific outcomes. The function and efficacy of the agreed Rivers Assessment process is dealt with in this report.

What we did

The project team commenced examination of the current LEB Rivers Assessment (LEBRA) process by initially grounding stakeholder expectations for the project through an inception meeting on 23rd March 2009, then reviewing background materials provided by sources associated with LEB management, coordination and research interests. In all, around 40 documents were assessed, including the formal LEB Agreement, Ministerial Forum papers and minutes, the agreed Assessment Methods report, workshop and associated reports leading up to Methods report, and finally the first Rivers Assessment report completed in 2008. A list of these documents appears in Appendix B.

To clarify expectations about the LEBRA, seek comment on the first assessment process / outcomes and gain initial perspectives about future governance arrangements, team members consulted with a range of stakeholders in Canberra, Brisbane, Longreach, Adelaide and Alice Springs between 7th April and 8th May 2009. Those consulted (see Appendix C) varied from local LEB producers, administrators, catchment

managers and researchers through to State and Federal government officials and ministerial advisers and national and university researchers. Consultation is expected to continue throughout the project, culminating with a stakeholder workshop in August 2009.

Interviews with stakeholders provided valuable feedback on the implementation of the current LEBRA process; its achievements, strengths, limitations and weaknesses. The analysis in this report is informed by both the literature and the consultations.

Initial observations

The project team makes two sets of observations: one relating specifically to this report: the Rivers Assessment process; the other relating to the higher order issue concerning governance.

At the Assessment level, our three most striking observations were:

- i. the assessment indicators and protocols agreed to in 2005 do not appear to bear directly on the Ministerial Agreement's focus of assessing the condition of the LEB as a whole;
- ii. irrespective of this, or possibly because of it, the first assessment completed in 2008 does not follow the agreed assessment protocols nor argues why a different method was adopted; and
- iii. neither does the method adopted fulfil the Ministerial Agreement's focus on assessing the condition of the LEB as a whole.

While there may be good argument for having changed the assessment method, the way the initial methods were developed and agreed to and the manner in which they were changed raises issues about the governance arrangements in place below the Ministerial Forum level. Our observations here were also articulated by many we consulted.

A fourth observation stands out. A number of State and Territory officials indicated that the LEB is not a particularly high priority for their organisation in terms of financial and staff allocation vis-à-vis the other regions or NRM issues. To some extent it is surprising that a Ministerial Forum is in place. This is no doubt due to recent historical factors, strong personalities and advocacy, and a general desire not to see the LEB become another Murray Darling Basin. However, it raises interesting questions about higher order visions, expectations and issues that need to be taken into account in the consideration of appropriate governance and implementation arrangements at the Assessment level.

1. Background

The Australian Department of the Environment, Water, Heritage and the Arts (DEWHA) requires the development of a Lake Eyre Basin Rivers Assessment Implementation Plan to identify how regular on-going monitoring of key indicators will be implemented within the Lake Eyre Basin Agreement Area. To meet this aim DEWHA has engaged the services of Kiri-ganai Research Pty. Ltd to undertake a consultancy for this purpose.

The main objectives of this consultancy are to undertake:

- a review of achievements to-date under the Lake Eyre Basin Rivers Assessment;
- a review of the Lake Eyre Basin Rivers Assessment methodology and recommend an approach and key indicators to be monitored, their scale and frequency (including rationale for decisions);
- support development and documentation of governance arrangements; development of a business model (including the cost of monitoring, managing data and report; funding for future monitoring and possible funding arrangements).

This report is submitted in accordance with the terms of reference for this consultancy and addresses Step 1: A brief review of achievement to date under the Lake Eyre Basin River Assessment, in the agreed terms of reference. Specifically, all documents pertaining to the Lake Eyre Basin Rivers Assessment are reviewed in terms of their stated successes and failures; and assessed in terms of meeting their original aims and objectives.

2. Introduction to the Lake Eyre Basin

The biophysical environment

The Lake Eyre Basin covers an area of 1,140,000 km² (15 percent of the Australian landmass) and is similar in size to the Murray-Darling Basin (MDB). There are a number of large iconic river systems within the Lake Eyre Basin, notably Cooper Creek (catchment area 306,000 km², river length 1500 km) and the Diamantina River (catchment area 160,000 km², river length 1000 km), that are important international and national ecosystems. These ecosystems are amongst a handful of large river systems that remain relatively untouched by human development,

especially water resource development, and they are Australian folklore icons – especially the Cooper and Diamantina.

The Lake Eyre Basin contains areas of high economic value. These include activities such as pastoralism, tourism, oil and gas extraction and mining, as well as areas of social, cultural and heritage value. Sustainability of the environmental and economic significance of the Lake Eyre Basin depends, in part, upon the continued health of its riverine landscape; its sub catchments, main river channels, flood plains, lakes, wetlands and overflow channels.

The rivers of the Lake Eyre Basin are dryland rivers being characterized by extremely variable and unpredictable flows, low gradients and complex flow paths. Lake Eyre Basin rivers; namely the Thompson, Barcoo, Cooper Creek, Georgina, Diamantina, Neales and the Warburton; and their tributaries, change from a series of waterholes in dry times to slow moving ‘inland seas’ that are often kilometres wide during large flood events. Although the rivers of the Lake Eyre Basin are largely unmodified by large-scale water resource developments there are a range of activities in the broader catchment that could potentially impact on the ‘health’ of these river systems.

“Dryland” rivers typically occur where annual rainfall is less than 500 mm and the annual evaporation rate exceeds rainfall. Australian dryland rivers have some of the most variable flow patterns in the world. Large floods, which cover large areas of the riverine landscape, and extensive droughts, when water availability is restricted to a few permanent waterholes, are features of Australian dryland rivers. Despite the variable and unpredictable nature of flow in dryland rivers, the animals and plants inhabiting the rivers and associated floodplains are well adapted to the nature of this flood-drought variability. Indeed, the integrity of dryland river ecosystems, especially in their lowland areas, depend upon the irregular inundation of the floodplain (period of flooding) and the drying out of the majority of the riverine landscape during periods of drought.

Pressures of development

In 1995 a consortium of cotton growers put forward a proposal for irrigated cotton farming at Currareva, on the headwaters of Cooper Creek in the Queensland section of the Lake Eyre Basin. The development proposed to withdraw 42 000ML of water from the Cooper each summer to irrigate 3 600 ha of cotton, and to construct two off-stream storages (total capacity 15 000ML) as reservoirs for low-flow years. While this diversion represents only 2.5% of the median annual

flow (1.7 million ML) it potentially would have significant impact on the river ecosystem especially during low or no flow periods. The Currareva proposal provoked dismay among river scientists and conservationists because the development would be in sharp contrast to the boom-and-bust character of the regional dryland environment. On 29 October 1996 the Queensland Minister for Natural Resources announced that the Currareva proposal would be rejected by a special Act of Parliament citing the 'overwhelming weight' of ecological evidence predicting environmental damage from the development.

Catchment management in the Lake Eyre Basin: a brief history.

The Lake Eyre Basin Intergovernmental Agreement grew from a process that began in the mid 1990s. People from various Lake Eyre Basin community groups and from government began discussing how to ensure the long-term sustainability of the Basin's natural resources. The Lake Eyre Basin Steering Group, formed in 1995, brought together stakeholders and interest groups from the pastoral industry, the Queensland and South Australian governments, conservation groups, the mining and petroleum industries, Landcare groups, Indigenous organisations and local government. The task of this group was to find out from people interested in the Basin whether they would like to set up a mechanism for community input into, and coordination of, natural resource management decision-making. Several years later it was decided to adopt a catchment management approach for the Basin and the Lake Eyre Basin Coordinating Group was established with the support of Natural Heritage Trust funds. This was followed by the establishment of the Cooper's Creek Catchment Committee and the Georgina Diamantina Catchment Committee in 1998. Collectively, the Lake Eyre Basin Coordinating Group and the two catchment committees developed a series of catchment management strategies that were based on issues identified through wide public consultation.

At the same time, the Commonwealth, Queensland and South Australian Governments began negotiating an intergovernmental agreement for the Lake Eyre Basin. The Lake Eyre Basin Heads of Agreement was signed in 1997 as the basis to negotiate a formal inter-governmental cooperative agreement for integrated catchment management and water resources management of the Lake Eyre Basin. The Lake Eyre Basin Intergovernmental Agreement was signed by Ministers of the Commonwealth, Queensland and South Australian governments in October 2000, and ratified by Acts of Parliament in all three jurisdictions

in 2001. The Agreement applied to the Cooper Creek and Georgina Diamantina River systems in South Australia and Queensland, and established the Lake Eyre Basin Ministerial Forum, with responsibility for achieving the objectives of the Agreement. Part of the Agreement required the Ministerial Forum to appoint a Community Advisory Committee, a role previously performed by the Lake Eyre Basin Coordinating Group until late 2002. The Ministerial Forum also appointed a Scientific Advisory Panel to provide scientific and technical advice, in particular to advise on monitoring the condition of rivers and catchments within the Lake Eyre Basin Agreement Area.

Values of the Lake Eyre Basin

The following environmental and social values in the Lake Eyre Basin have been identified by various community groups and government agencies.

VALUES IDENTIFIED IN THE LAKE EYRE BASIN INTERGOVERNMENTAL AGREEMENT

- Continued health of the Thomson/Barcoo/Cooper, Georgina and Diamantina river systems (to maintain nationally and internationally significant areas and other values dependent on the health of the river systems);
- Conservation and promotion of important social, environmental, economic and cultural values;
- Landscapes and watercourses that are valuable for aesthetic, wilderness, cultural and tourism purposes;
- Aquatic ecosystem health which is maintained by naturally variable flow regimes and water quality;
- Flow variability and seasonality to maintain ecological processes and biodiversity;
- Maintenance of beneficial flooding for pastoralism and floodplain ecosystem processes;
- Integrated management;
- Precautionary management to protect environmental attributes;
- Management to be undertaken within a framework of ESD principles and national and international obligations;
- Local knowledge and experience;
- Best available scientific and technical information.

VALUES IDENTIFIED BY THE MINISTERIAL FORUM AND INCLUDED IN THE AGREED POLICIES ADOPTED ON 25 OCTOBER 2002

- Maintenance of ecological integrity and natural functioning of in-stream and floodplain ecosystems;
- Viable economic, social, cultural and other activities which do not threaten the above environmental values.

VALUES IDENTIFIED BY THE LEB COMMUNITY IN ITS STRATEGIC PLANS FOR THE LAKE EYRE BASIN BASIN-WIDE

- Sustainable and wise use of natural resources;
- Conserving biodiversity;
- Economic prosperity;
- Respect for and use of local knowledge;
- Outback lifestyle;
- Healthy systems with high ecological integrity;
- Forward looking, vibrant communities;
- Sustainable and diverse regional economy.

3. A River Assessment Program for the Lake Eyre Basin

The Lake Eyre Basin Rivers Assessment (LEBRA)

The Lake Eyre Basin Intergovernmental Agreement provides for the sustainable management of the water and related natural resources associated with the major river systems of the Lake Eyre Basin. In terms of natural resource management and conservation the Agreement is important for two reasons. First it allows for the protection of economic, social and environmental values that depend on the natural resources of the basin, especially its river systems. Second, it serves to avoid potential cross-border impacts. The literature contains numerous examples of cross border jurisdictional conflicts both here in Australia and elsewhere and in the majority of circumstances this has been associated with a decline in the condition or functioning and the overall integrity of natural resources. Part of the Lake Eyre Basin Agreement requires an assessment of the condition of the major river systems and catchments within the Agreement Area and for the assessment to be repeated every 10 years.

The Lake Eyre Basin Rivers Assessment (LEBRA) required the development of an appropriate assessment methodology, a number of conceptual models of the river systems and how they function, the identification of suitable indicators of condition and the development of monitoring and reporting protocols (including identification of

representative monitoring sites). Further, the methodology used to undertake the LEBRA was required to be scientifically rigorous and credible, and deal effectively with the challenges of remoteness, vast distances, lack of existing monitoring infrastructure and baseline data, and the complexity and variability of the Lake Eyre Basin system. In addition, it was proposed that a Rivers Assessment Steering Committee develop an implementation plan which would set out the various components of the Rivers Assessment project, and the timetable for its implementation. Part of this also required community involvement and consultation.

In accordance with the Agreement the project objectives for the initial assessment of river condition within the Agreement Area were as follows:

OVERALL PROJECT AIM

To develop a method, data management framework and supporting conceptual models and indicators for the assessment of, and reporting on, the ecological condition of watercourses and catchments within the Lake Eyre Basin Agreement Area. Specific objectives of the project were to:

- develop a method for the assessment of, and reporting on, the ecological condition of watercourses and catchments within the Lake Eyre Basin Agreement Area;
- develop supporting conceptual models of river processes and functions that provide a scientific basis and rationale to the assessment, that clearly articulate current understandings of key processes as a basis for supporting management activities;
- recommend a discrete set of indicators from attributes that, when collated and interpreted, provide measures of ecological condition;
- outline a data management framework that summarises existing data;
- recommend a geographically based classification system and data standard for the assessment that supports monitoring and reporting at regular intervals;
- link to Australia's Collaborative Rangelands Information System with its parallel monitoring activities concentrating on the condition of terrestrial environments.

The outcomes, outputs and recommendations of the LEBRA Methods Development Project: Methods for Assessing the Health of Lake Eyre

Basin Rivers, are contained in the various milestone and final reports supplied to Kiri-ganai Research.

The Australian federal government and the various state and territory governments have a history of investment in developing methods for and assessing the health or condition of the nation's streams, rivers and watercourses. At the time of commencing the LEBRA Methodology project there were several other national programs on river health that were either in the final throes of completion, being developed or just about to be implemented. A short summary of each of these is provided in the following section in order to place the work done in a broader context of river health assessment within Australia. Three particular programs are of direct relevance to the LEBRA Methodology project; the first National Assessment of River Health and its precursors undertaken within the intensive land zone of Australia, the Sustainable Rivers Audit of river systems within the Murray Darling Basin and the development of the First Assessment of Wetlands and River Health, Australia.

THE FIRST NATIONAL ASSESSMENT OF RIVER HEALTH.

The first major investment in a river health program on Australia began with the development and implementation of the First National Assessment of River Health. This river health program focused on the in-channel environment and relied upon the routine collection of water and biological (macro invertebrates) samples and essentially provides a rapid assessment of the 'health' of rivers. While aquatic biota have been widely recognised as good indicators of river health and were a major focus of this assessment program, it is recognised that catchment and habitat conditions are important drivers of river health and these factors were not considered strongly in this program. Since its inception this has been followed by a number of other programs, most notably the National Land and Water Audit conducted in 2000.

NATIONAL LAND AND WATER AUDIT STUDY

In 2000 the National Land and Water Audit was commissioned to assess the condition of rivers within the intensive land zone of Australia. It provided an assessment of river condition (ARC) in terms of the environmental and biological condition for more than 14 000 river reaches (average length 14 km) within 193 catchments (average area 13 500 km²) that covered most of the Australian Capital Territory, New South Wales, Queensland, Victoria and significant areas of South Australia, Western Australia and Northern Territory (ASRIS, 2001). The Assessment of River Condition (ARC) assumes that a series of environment indices (ARCE) measure important environmental drivers to which biota respond (ARCB), with the biota themselves being important

measures of condition. Essentially the Biota Index (ARCB) represents the response of biota to environmental changes and in this audit it was calculated only using aquatic invertebrate data because there was a widespread and consistently collected data set. Invertebrate data collected at a site had been previously used extensively to assess the biological health of Australian rivers. The Environmental Index (ARCE) was composed of four sub indices, these being a Hydrological Disturbance Index; Suspended Sediment and Nutrient Load Index, Habitat Index and a Catchment Disturbance Index. The Environmental Index (ARCE) was used for general assessment and the sub-indices for more specific interpretation of the physical condition. All indices were calculated at the scale of river 'reach', defined on geomorphological principles. Details of the approach taken, development of methods, their application, analysis, and the preliminary interpretation of results are provided in Norris et al. (2007).

THE SUSTAINABLE RIVERS AUDIT OF THE MURRAY DARLING BASIN

The Sustainable Rivers Audit (SRA) is a program designed to measure the health of the rivers at this large Basin scale. It aims to:

- determine the ecological condition and health of river valleys in the Murray-Darling Basin;
- provide a better insight into the variability of river health indicators across the Basin and over time;
- eventually help us detect trends in river health over time; and
- trigger changes to natural resource management by providing a more comprehensive picture of river health than is currently available.

The SRA is an initiative of the former Murray-Darling Basin Commission involving partner agencies in each state and territory within the Basin.

The SRA uses scientific indicators of health to determine the current status of the Basin's rivers and any potential trends. Groups of indicators or "themes" for immediate implementation include fish, macroinvertebrates and hydrology. Indicator themes to be further developed over the forthcoming years include floodplains; riparian vegetation and the physical form of river channels. Fish communities and populations are sampled during normal flow conditions, across entire river valleys in the one season, and once every three years at all 23 valleys in the Basin. Macroinvertebrate populations are also to be sampled during normal flow conditions, across entire river valleys in the one season, but once every two years across the Basin. Hydrology information is also collected every six years and evaluated using long

term river flow sequences, developed by the States. When there are major changes to river flows through new structures being built or environmental flow allocations, additional computer modelling will be needed. The assessment and interpretation of the SRA's results are done by an Independent Sustainable Rivers Audit Group (ISRAG) which reviews data from each valley in detail by looking at results related to each indicator theme (fish, macroinvertebrates, hydrology); across indicator themes; across valleys; and over time.

FRAMEWORK FOR THE ASSESSMENT OF RIVER AND WETLAND HEALTH

The National Water Commission has developed a national framework that hopes to form the basis of future national river and wetland health assessments, and to provide the capacity to bring together results of existing broad-scale assessments conducted at state, territory and basin scales.

Understanding the environmental condition of Australia's aquatic ecosystems is central to their management. The Framework for the Assessment of River and Wetland Health (FARWH) was developed when scoping undertaken for the Australian Water Resources 2005 baseline assessment identified difficulties in reporting on river and wetland health in a comparable manner within and across jurisdictions, and deficiencies in the level of information available for current NWI reporting requirements.

The FARWH aims to:

- develop an approach that can be used by the Australian Government and all states and territories to provide nationally comparable assessments of river and wetland health;
- incorporate a critical suite of river and wetland attributes that indicate key ecological processes and are conceptually appropriate for comprehensive assessments of river and wetland health; and
- interpret and prioritise the causes of observed environmental degradation using the measured attributes.

The FARWH does not generate data itself or replace existing monitoring and assessment programs. Rather, it provides a methodology to integrate and aggregate the data collected by the states and territories to be reported at a water management area scale. This provides an important link between aquatic ecosystem health and water management planning.

It has also been designed to ensure that the outputs from previously conducted and future monitoring and assessment activities in the states and territories are nationally comparable.

The FARWH uses a conceptual model of river and wetland function, based on six ecologically significant components that should be represented in all future river and wetland health assessments. These key ecological components are:

- catchment disturbance
- hydrological change
- water quality and soils
- physical form
- fringing zone
- aquatic biota.

Important considerations for monitoring river health in the Lake Eyre Basin

Monitoring programs need to be specifically developed or modified for use in arid zone rivers, like those within the Lake Eyre Basin because of their naturally high levels of hydrological variability and associated high degree of spatial heterogeneity in biophysical character. Any monitoring program is dependent on the researcher having first articulated the desired state to which the system should conform. Within arid zone river systems 'state' will in necessity be a dynamic state with a range of characters, populations or communities over space and time. Thus any monitoring of arid zone river systems will require knowledge of the system's attributes and behaviour (structure, composition, function and dynamics), either gained through intensive prior study (baseline surveys) or through modelling (which itself must be based on a combination of sound theory and intensive study of comparable systems elsewhere).

It is evident that at the time of development there was no program or method available to assess the condition of rivers within the Lake Eyre Basin. Indeed, as further demonstrated by the results of two significant aquatic research programs (Aridflow and the CRC for Freshwater Ecology's Dryland Refugia Program) conducted on the river systems of the Lake Eyre Basin important components of a sound adaptive management cycle must include theory-driven hypothesis articulation (conceptual models of river function, health and predicted responses); focussed study (gap identification, data acquisition, information gain); indicator selection; target setting (incorporating ecosystem modelling) and monitoring of selective indicators. In this way the twin objectives of

(i) increasing understanding of how and why ecosystems function, and
(ii) refinement of indicators and their expected response to drivers of change, can be met through time with each repetition of the management cycle.

Particular issues pertinent to monitoring the condition or health of river systems within the Lake Eyre Basin include:

- Scale. Any assessment of the Lake Eyre Basin must be undertaken at an appropriate spatial and temporal scale or resolution. The range of scales over which indicators are likely to be reliable needs to be explicitly considered.
- Context. Given the highly variable and unpredictable nature of flows in the rivers of the Lake Eyre Basin, important questions include: what the stage(s) of the flood cycle is the system in?; and what season should be monitored? This determines the magnitude or direction of expected response of those indicators sensitive to hydrological and seasonal variation. The 'when to monitor' may be driven by events, e.g. floods or periods of no flow, rather than according to a fixed calendar schedule.
- Reference state. How can this be defined for a large and highly variable system? Recognition and description of relative pristine systems is particularly difficult for highly variable ecosystems.
- Indicator choice. What indicators should be chosen and how can they be calibrated and validated? Do biotic components need to be monitored or are there more efficient surrogates? Some indicators should be chosen for which a change in variance, rather than in mean or median, may be important.
- Sensitivity. The power of any test of an environmental impact is constrained by data variability, the magnitude of the putative effect and the number of independent sampling events.
- Cost effectiveness. Budgetary trade-offs need to be considered when deciding upon the scale and limitations of potential monitoring programs.
- Values. Scientific and community values are both important and are not the same. Key sites within any monitoring program for Lake Eyre Basin rivers could include a variety of sites – reaches – zones and landscapes. Each would require a different approach and methods for assessment.

These issues will be taken into account in the preparation of the second project report.

4. Activities undertaken to-date under the Lake Eyre Basin Rivers Assessment

Twelve documents were listed to Kiri-ganai Research as being relevant to the major activities undertaken to-date under the Lake Eyre Basin Rivers Assessment. Each document is reviewed in Table 1 in terms of its relevance to implementing the Lake Eyre Basin River Assessment and the recommendations provided. Of the 12 documents listed in Attachment B of the Terms of Reference for the project, only nine were able to be accessed and eight provided further recommendations for the Rivers Assessment.

The nine reports that were reviewed address activities in hydrology, fish monitoring, the viability of using waterbirds as an indicator of river health and the state of the basin Table 1. A brief discussion of each is provided below.

Hydrology. The sole focus of the hydrological activities undertaken to-date has been on making recommendations for the location and installation of data loggers for recording water levels. The installation of water level recorders which can be used to construct reliable rating tables of water level and discharge is a priority for any river assessment program.

Fish. Activities for this biological component of the river assessment program appear to be relatively advanced. Major achievements include a workshop to determine how to assess the condition of fish communities within the Lake Eyre Basin. It is pertinent to note that because of the limited data available on fish communities in the basin a new approach of determining the condition of fish communities has been developed. The natural trajectory of fish within the basin has been developed and is being tested in both the Queensland and South Australian sections of the basin and a series of joint recommendations on the method provided.

Waterbirds. The validity of using waterbirds as an indicator of river condition has been provided.

Table 1. Lake Eyre Basin Rivers Assessment Achievements: Reports cited

Report addressed	Relevance to Implementation Recommendations	Further Recommendations
<p><u>Data loggers</u> <i>Lake Eyre Basin Data Logging Review</i>, December 2006</p>	<ul style="list-style-type: none"> Makes recommendations concerning appropriate indicators and measurements for Flow & Flood theme. 	<ul style="list-style-type: none"> Priorities for monitoring locations are provided but should be confirmed in consultation with scientists involved in LEB projects, governments and stakeholders. Stakeholder workshop suggested to consider report findings and ‘Methods’. Sites to be prioritised on basis of information needs of LEB assessment and budget scenarios. Way to move beyond ‘wish list’ of monitoring sites is to apply discipline in prioritising sites and information needs (p.27). Suggested that 2 types of sites are considered: 1. Long-term sites: with ‘sensor to web’ technology, to develop rating curves and 2. Large number of stage recording sites (without telemetered data), similar to existing AridFlow sites (p.27). Selection of new instrumentation and measurement techniques require expert advice to be drawn from within LEB jurisdiction. Recommendations for a committee (people listed in Table 6).
<p><i>Maintenance of ARIODFLO logger network, Final Report</i>, September 2007</p>	<p>REPORT NOT PROVIDED.</p>	
<p><i>Updating and analysis of the ARIDFLO water level data in the Lake Eyre Basin</i>, July 2008</p>	<p>REPORT NOT PROVIDED.</p>	
<p><u>Fish</u> <i>Report on the LEBRA Workshop: Determining the natural trajectory of fish within the Lake Eyre Basin</i>, November 2006</p>	<ul style="list-style-type: none"> Reports on 2006 workshop to develop fish indicator component of LEBRA. 	<ul style="list-style-type: none"> Fish monitoring must be linked with hydrological and water quality monitoring (p. 7). Fish sampling should occur biannually; once after wet season recedes in March/April and again near end of dry season in November (p. 7). Recommended spatial arrangement for sampling and reporting is at 1. catchment level, 2. biogeographic/climatic/hydrological regions within each catchment and 3. representative reaches and critical sites. Minimum of 2

Report addressed	Relevance to Implementation Recommendations	Further Recommendations
		<p>representative reaches required for each region with 3 being best (p. 8).</p> <ul style="list-style-type: none"> • Research into LEB fish taxonomy, conservation status, genetics etc. required (p. 8).
<p><i>Fish Survey Lake Eyre Basin, Western Queensland, November 2007</i></p>	<ul style="list-style-type: none"> • 9 sites surveyed in November 2007. Fish assemblage composition, abundance & size structure assessed & water quality parameters. 	<ul style="list-style-type: none"> • None given.
<p><i>Preliminary Fish Surveys for the Lake Eyre Basin Rivers Assessment: Testing the Fish Trajectory Model in South Australia, August 2008</i></p>	<ul style="list-style-type: none"> • Reports on pilot monitoring program to test Fish Trajectory Model in South Australian catchments. 	<ul style="list-style-type: none"> • Final monitoring framework needs a survey protocol that maximises species detection and provides comparable abundance data with realistic degree of effort. Need appropriate timeframe for surveying larger habitats to ensure even levels of survey effort (p.83). • Fyke nets required in most sites, particularly large waterbodies (p.83). • Collation and analyses of data from AridFlow, Dryland Refugia and Wet/Dry projects needed to guide future surveys (p.83). • Need information about genetics and distribution of key taxa, taxonomy and conservation status of fish in basin, tolerances of taxa to physicochemical parameters, implications of alien taxa, impacts of livestock and terrestrial alien taxa and impacts of tourism, fishing and mining as well as how fish community structure changes with respect to flow (p. 83). • Future monitoring should consider strong local support, particularly at populated centres, e.g. Innamincka, and from landholders (p.84). • Arid catchments and reaches of LEB likely to be particularly important indicators of declines in river health and monitoring outputs from these sites will provide comparative targets (p. 86). • Need to link fish monitoring to biological, ecological and hydrological research projects in order to maximise value of monitoring outputs (p.86).
<p><i>Preliminary fish sampling for the Lake Eyre Basin Rivers Assessment: testing the Fish Trajectory Model in Queensland, undated</i></p>	<ul style="list-style-type: none"> • Reports on pilot monitoring program to test Fish Trajectory Model in Queensland LEB catchments building on results of above. 	<ul style="list-style-type: none"> • The effectiveness of the FTM may be improved by including waterhole level or similar descriptive term in the ‘Antecedent condition’ headings so that responses of communities or species to concentration effect be predicted and explained (p. 35). • FTM needs to reflect that expected flooding benefits are likely to persist beyond 12 months (p. 35).

Report addressed	Relevance to Implementation Recommendations	Further Recommendations
		<ul style="list-style-type: none"> • Need for further targeted research to understand life-history aspects of LEB fish assemblages (p. 36). • Need to retain alien fish species as indicator despite lack of relevance at present due to low numbers (p. 36). • Need to adjust trophic groups if these are to be monitored. Herbivorous species are absent in LEB and <i>Nebatolosa erebi</i> is only truly non-carnivorous species. • Prevalence of fish disease not thought to be a useful indicator except during periods of low fish abundance (p. 37).
<p><i>Joint recommendations for fish monitoring in Lake Eyre Basin Rivers: testing the Fish Trajectory Model in Queensland and South Australia, undated</i></p>	<ul style="list-style-type: none"> • Combines results of above to make further recommendations for fish monitoring. 	<ul style="list-style-type: none"> • Analysis of fish species richness, abundance in arid systems needs to be more than site specific and consider broader spatial patterns (p. 1). • Length/weight curves need to be developed for species and catchments so biomass can be estimated from length (p. 1). • Alterations needed to recruitment indicator with allowances made for variability in responses between species, climates and hydrological conditions (p. 2) • Research required into spawning and biology of LEB fish species (p. 2). • Population size structure response curves needed for different species (p. 2) • Abundance of herbivores indicator to be replaced by Abundance of detritivores (p. 2). • Abundance of macro-carnivores and microcarnivores not as useful as species-specific data and ontogenetic classes within species (p. 2).
<p><u>Waterbirds</u> <i>Scientific validity of using waterbird measures to assess river condition in the Lake Eyre Basin, September 2008</i></p>	<ul style="list-style-type: none"> • Reports on availability & suitability of information for using waterbirds as indicators & provides recommendations for future monitoring. 	<ul style="list-style-type: none"> • Inclusion of waterbirds as key biological indicator in LEBRA • Identification of thresholds for waterbird abundance, diversity and composition for important wetland sites in LEB • Development of a program focusing on surveys of iconic and important sites at least annually using repeatable methodology. More frequent surveys required during significant flow events. • Identify all major colonial waterbird breeding sites in LEB and monitor key breeding events. • Integration of river flow data and waterbird data.

Report addressed	Relevance to Implementation Recommendations	Further Recommendations
		<ul style="list-style-type: none"> • Analysis of long-term waterbird data sets to determine current status of waterbirds in LEB. • Use of aerial survey data to identify wetlands of importance in LEB.
<p><i>Remote Sensing</i> <i>A report on using remote sensing to monitor river health in the Lake Eyre Basin is due to be completed in early 2009</i></p>	<p><i>REPORT NOT PROVIDED.</i></p>	
<p><i>State of the Basin Report</i> <i>State of the Basin 2008: Rivers Assessment</i></p>	<ul style="list-style-type: none"> • Reports on broad measures of Hydrological Condition, Landscape Stress, Water Quality, Fish & Waterbirds. 	<ul style="list-style-type: none"> • Aim of LEB monitoring program must be to directly link ecosystem thresholds with management actions and thus identify actions protecting natural values of LEB (p. 6)
<p><i>State of the Basin 2008: Rivers Assessment - Background and Reference, April 2009</i></p>	<ul style="list-style-type: none"> • Provides background rationale, data sources & methods for above. 	<ul style="list-style-type: none"> • Need to define what moderate and poor condition classes constitute (p. 10) • Future LEB assessments should align with nationally agreed resource condition indicators from NRM MERI Framework and with FARWH for national reporting (p. 10) • FARWH recommends use of hydrology indicators developed for MDB SRA by SKM plus NWC groundwater assessment. Since no model for natural flows in LEB, SRA methods cannot be directly applied to LEB and time series approach is required (p. 12) • Need for development of local or regional water quality guidelines (p. 16)

State of the Basin Report. Two documents outlining the State of the Basin 2008 have been produced. The first is essentially a score card of condition for various regions across the basin while the second provides technical information underpinning the score card. The State of the Basin reports on broad measures of hydrology, landscape stress, water quality, fish and waterbirds. The methods supporting the report card are based on the FARWH approach of condition assessment.

The four key points of the State of the Basin Assessment are:

- The rivers and catchments of the Lake Eyre Basin are in generally good condition. A low degree of hydrological modification was stressed as being particularly important.
- Intact aquatic ecosystems within the basin: the Lake Eyre Basin rivers are unique compared to other arid rivers in Australia and globally.
- Cooper Creek is the most studied river in the basin but knowledge of the structure and function of this system is considered to be below that of other Australian river systems.
- Potential threats to the condition of rivers within the basin include water resource development, invasive pests and land use intensification.

Conclusions of the State of the Basin Report were based on the following:

- Five indicators were used in this assessment; hydrological condition, landscape stress, water quality, fish and waterbirds.
- The actual approach to assessing the condition of rivers within the basin appears to follow the FAWRH framework rather than that proposed by the Lake Eyre Basin River Assessment Methodology.
- Apart from the Hydrological Condition, which was reported at a catchment scale, the other indicators were reported at the sub catchment scale of Headwaters, Channels and Waterholes and Terminal Wetlands, as recommended by the Lake Eyre Basin River Assessment Methodology.
- Some of the data used in the river assessment were accessed from regional data sets that were compiled before 2000.
- The assessment was based on a variety of sources of information, these being; existing reports, scientific data (but these were not stipulated) and expert opinion and once again the experts and their views are not noted.
- Most indicators were reported to be in 'good' condition across the basin but a clear definition of 'good' was not provided.

- In addition, it was noted that defining what constituted 'moderate' and 'poor' condition must be developed.

In addition to the State of the Basin Report, other required achievements to-date, which address the various themes and indicators in the proposed Rivers Assessment Methodology are outlined in Table 2. A total of 39 cited actions were noted as part of the implementation recommendations from the Rivers Assessment Methodology and these address the four main themes of Flow and Flood, Riparian and Floodplain, Waterholes and Wetlands and Physical Form. These listed actions can be grouped as addressing 11 different attributes like hydrological variability, fish assemblage diversity and ecosystem processes as examples.

35 of the 39 listed actions have either not been addressed or reported. Completed achievements that have been listed include those on the broad scale assessment of hydrological condition, a review of data logging, the hydrology of the Lake Eyre Basin and a vegetation condition report for the basin.

Table 2: Lake Eyre Basin Rivers Assessment: Achievements to date.

THEME/ <i>Attribute/</i> <u>Indicator/ Measurement</u>	Implementation Recommendations (January 2005)	Progress (2009, based on reports provided)	Actions required (based on reports provided)
FLOW & FLOOD			
<i>Hydrological condition reported in SOB 2008. Broad assessment of level of impact on flows & floods in different habitats & regions.</i>			
<i>Water Use</i>			
<u>Volume of water held in storage</u>			
<ul style="list-style-type: none"> Upstream water licensing information 	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting Full report to be completed and submitted
<ul style="list-style-type: none"> Upstream area (volume) of water stored calculated from satellite imagery 	Pilot study required	<i>Remote sensing report not provided.</i>	
<u>Percent of flow diverted</u>			
<ul style="list-style-type: none"> Water licensing information 	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting Full report to be completed and submitted
<ul style="list-style-type: none"> Area (volume) of water diverted calculated from satellite imagery 	Pilot study required	<i>Remote sensing report not provided.</i>	
<i>Hydrological Variability</i>			
<u>Flow variability at gauging stations</u>			
<ul style="list-style-type: none"> Long-term variability in amplitude, frequency & duration of floods 	Pilot study required	<i>Lake Eyre Basin Data Logging Review</i> , completed December 2006.	
<ul style="list-style-type: none"> Predictability analyses 	Pilot study required	McMahon et al. (2005) <i>Hydrology of the Lake Eyre Basin</i> report completed: considers flow variability	
<i>Flood Extent</i>			
<u>Flood extent (current compared with modelled past events)</u>			
Changes in discharge vs. flood extent relationship	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting

THEME/ Attribute/ Indicator/ Measurement	Implementation Recommendations (January 2005)	Progress (2009, based on reports provided)	Actions required (based on reports provided)
RIPARIAN & FLOODPLAIN			
<i>Vegetation condition reported on as part of 'Landscape Stress' in SOB 2008: combination of grazing pressure, proportion of conserved native vegetation, density of weeds & feral animals & numbers of threatened species.</i>			
<i>Riparian & Floodplain Biodiversity</i>			
<u>Riparian & Floodplain Biodiversity</u>			
• Riparian & floodplain vegetation taxa richness	Pilot study required	This has not been undertaken based on reports provided.	Pilot study required
• Riparian & floodplain vegetation functional diversity	Pilot study required	This has not been undertaken based on reports provided.	Pilot study required
• Riparian & floodplain waterbird assemblage composition & diversity	Immediate implementation	Expected species presence & abundance reported in SOB 2008.	R & D, further analysis of existing data
<i>Riparian Vegetation Condition</i>			
<u>Riparian composition & extent</u>			
• Riparian cover index	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting
• Riparian SLATS – using TM & ETM+ imagery	Pilot study required	This has not been undertaken based on reports provided.	Pilot study required
<u>Riparian recruitment & regeneration</u>			
• Riparian regeneration index	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting
<u>Riparian percent exotics</u>			
• Riparian NATIVES index	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting
<i>Floodplain Vegetation Condition</i>			
<u>Floodplain composition & extent</u>			
• Floodplain cover index	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting

THEME/ Attribute/ Indicator/ Measurement	Implementation Recommendations (January 2005)	Progress (2009, based on reports provided)	Actions required (based on reports provided)
<ul style="list-style-type: none"> Floodplain SLATS – using TM & ETM+ imagery <u>Floodplain recruitment & regeneration</u>	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting
<ul style="list-style-type: none"> Floodplain regeneration index 	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting
<u>Floodplain percent exotics</u> Floodplain NATIVES index	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting
WATERHOLES & WETLANDS		<i>Some broad fish & water quality information reported on in SOB 2008.</i>	
<i>Waterhole & Wetland Biodiversity</i>			
<u>Aquatic macroinvertebrate assemblage composition</u>			
<ul style="list-style-type: none"> Taxa richness 	Pilot study required	This has not been undertaken based on reports provided.	Pilot study required
<ul style="list-style-type: none"> Modified SIGNAL score 	Pilot study required	This has not been undertaken based on reports provided.	Pilot study required
<ul style="list-style-type: none"> AUSRIVAS score 	Pilot study required	This has not been undertaken based on reports provided.	Pilot study required
<u>Fish assemblage diversity</u>			
<ul style="list-style-type: none"> Fish assemblage O/E 50 	Immediate implementation	Not directly reported in SOB 2008.	Modifications to ‘Methods’ as per recommendations.
<ul style="list-style-type: none"> % Exotic individuals (abundance) 	Immediate implementation	Not directly reported in SOB 2008.	Modifications to ‘Methods’ as per recommendations.
<ul style="list-style-type: none"> Recruitment 	Immediate implementation	Not reported in SOB 2008.	Modifications to ‘Methods’ as per recommendations.
<i>Waterhole & Wetland Water Quality</i>			
<u>Water quality</u>			
<ul style="list-style-type: none"> Conductivity (salinity) 	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting
<ul style="list-style-type: none"> pH 	Immediate implementation	Not reported in SOB 2008.	Data collection, collation, analysis & reporting

THEME/ <i>Attribute/</i> <u>Indicator/</u> Measurement	Implementation Recommendations (January 2005)	Progress (2009, based on reports provided)	Actions required (based on reports provided)
<ul style="list-style-type: none"> • pH • Turbidity • Diel range in DO • Diel range in water temperature • Nutrients (Total N & Total P) 	<p>Immediate implementation</p> <p>Immediate implementation</p> <p>Immediate implementation</p> <p>Immediate implementation</p> <p>Immediate implementation</p>	<p>Not reported in SOB 2008.</p> <p>Not reported in SOB 2008.</p> <p>Not reported in SOB 2008.</p> <p>Not reported in SOB 2008.</p> <p>Not reported in SOB 2008.</p>	<p>Data collection, collation, analysis & reporting</p> <p>Data collection, collation, analysis & reporting</p> <p>Data collection, collation, analysis & reporting</p> <p>Data collection, collation, analysis & reporting</p> <p>Data collection, collation, analysis & reporting</p>
<i>Waterhole Process & Function</i>			
<u>Ecosystem processes</u>			
<ul style="list-style-type: none"> • Benthic metabolism • Algal biomass & composition 	<p>Pilot study required</p> <p>Pilot study required</p>	<p>This has not been undertaken based on reports provided.</p> <p>This has not been undertaken based on reports provided.</p>	<p>Pilot study required</p> <p>Pilot study required</p>
Carbon & nitrogen stable isotope analysis	Pilot study required	This has not been undertaken based on reports provided.	Pilot study required
PHYSICAL FORM		<i>Not reported in SOB 2008.</i>	
<i>Channel System Integrity</i>			
<u>Channel system integrity</u>			
<ul style="list-style-type: none"> • Floodplain geomorphic complexity • Channel complexity • Within waterhole complexity 	<p>R & D required</p> <p>Pilot study required</p> <p>Pilot study required</p>	<p>This has not been undertaken based on reports provided.</p> <p>This has not been undertaken based on reports provided.</p> <p>This has not been undertaken based on reports provided.</p>	<p>R & D required</p> <p>Pilot study required</p> <p>Pilot study required</p>
<i>Erosion Potential</i>			
<u>Erosion potential</u>			
<ul style="list-style-type: none"> • Landscape function analysis 	R & D required	This has not been undertaken based on reports provided.	R & D required

5. Initial Observations of the process

The project team has identified a broad range of issues arising from our review of the LEB Assessment process. Each of these has implications for both our next report, dealing with recommendations for a future assessment process, and our overall project objective of preparing an implementation plan with appropriate governance arrangements in place to ensure effective ongoing assessments in the LEB.

Scale

The LEB is an enormously large area, and it is understandable that the LEBRA has focussed on specific indicators. These indicators are largely associated with in-stream water condition, which in itself does not address the wider issue of Basin condition as required by the terms of the Intergovernmental Agreement. Moreover, in-stream condition indicators focus around select water-holes, a limitation in determining overall LEB river let alone overall basin condition.

Various monitoring efforts in the LEB do provide some relevant data in respect to overall Basin condition, and some of these, including broad-scale rangeland and vegetation monitoring were expected to be incorporated into the LEBRA. This did not occur. For reasons such as this, the Kiri-ganai Research team found that the results of the 2008 Assessment, which indicated that much of the LEB was in excellent condition, were questioned by many of the local stakeholders, many of whom were unaware of the LEBRA process and considered that conditions were not as rosy as portrayed in the Assessment.

The issue of scale must be addressed if future Assessment processes are to be consistent with the terms of the Intergovernmental Agreement. This issue will be dealt with more extensively in our next report.

Changing expectations

The 2008 LEB Rivers Assessment essentially followed the FARWH river assessment protocols developed since the time the LEBRA Methodology were agreed to. As a consequence, 35 of 39 actions outlined in the Methodology were not pursued. In many cases there is good reason for the change process, including the need to get a better handle on the stress drivers in the LEB and, if nothing else, to be seen to follow and or test more recent assessment protocols agreed to within the context of other, more recent initiatives. In essence, the expectations of those

involved in the LEBRA process evolved over time, and as a consequence, the protocols were subject to adaptation.

Adaptive management is a critically important element of monitoring and evaluation, however when multiple stakeholders are involved it is important that consensus be sought about the adaptations carried out. This was not the case in the 2008 Assessment. Indeed while some research and management stakeholders interviewed understood the need for some form of adaptation, many were not aware that a major adaptation had taken place, and many were concerned that the adaptation may not have been an improvement.

It is unlikely that the Kiri-ganai Research team will be advocating highly bureaucratic structures within the context of future governance. That said, a process does need to be put in place that ensures the key stakeholders in the Assessment processes are aware of, and endorse, significant variations to agreed protocols.

Governance issues

Throughout our consultations, LEB stakeholders raised issues about governance, particularly in respect to ensuring that procedures, more-so than structures, are in place to undertake future assessments in a timely fashion and are fit-for-purpose in respect to the key threats to resource condition across the basin. While some stakeholder comments about the current Assessment process reflecting compromises between researchers with vested interests were unconstructive, it did highlight ongoing contestation around what is deemed an appropriate Assessment process for the LEB. Much of this contestation has taken place around indicators that, to the consultants' minds, do not address the critical issues of scale, high order expectations or fit-for-purpose utility, and suggests a missing link between the Intergovernmental Agreement and implementation of key actions.

High level drivers of interstate NRM arrangements such as the LEB Intergovernmental Agreement usually involve complex factors that cross borders, including water, people, fish, birds, dust or feral animals. In no case has an alarm rung in the LEB over any of these factors, although some bells have sounded in respect to key pressures, including grazing and mining. The current Assessment process is not in tune with this situation, which begs for a different approach to monitoring the condition of the LEB and ascertaining when and how responses are justified.

6. Recommendations

In progressing to the next stage of this project, which deals with developing an agreed assessment methodology (Milestone 2), Kiri-ganai Research makes the following recommendations:

- i. A revised LEB assessment methodology should be developed based around whole-of-Basin condition, in line with the terms of the LEB Intergovernmental Agreement. An outline of such a methodology will be included in the second Milestone report of this project.
- ii. Consideration should be given to the nature of future Assessments and their timing. It may be appropriate for less intense monitoring (at whole-of-Basin scale) to take place in an ongoing process, with intensive studies undertaken only in response to specific warnings requiring such investment.
- iii. Governance arrangements in respect to future Assessments should be adopted that support a more whole-of-Basin approach. Such arrangements should, from an accountability perspective, separate the conduct of assessments from their initiation, engagement, oversight, review and acceptance. Protocols for handling and agreeing to variations in methodology need to be included.
- iv. Governance arrangements should be kept relatively simple and should certainly not entail the establishment of complex structures (i.e. a statutory authority) that would potentially lead to perverse outcomes as well as high and unnecessary cost burdens. Revised arrangements need, however, to adopt universally recognised principles of good governance to ensure that the terms of the Intergovernmental Agreement are met in practice. These principles and specific recommendations for governance will be outlined in the third Milestone report of this project.

Appendix A: Terms of Reference

LEB Rivers Assessment Implementation Plan

The Department of Environment, Water, Heritage and the Arts requires the development of a Lake Eyre Basin Rivers Assessment Implementation Plan (Implementation Plan) to identify how regular on-going monitoring of key indicators of the condition of river ecosystems and catchments will be implemented within the Lake Eyre Basin Intergovernmental Agreement Area. The process of developing the Plan will involve:

1) Review of achievements to date under the Lake Eyre Basin (LEB) Rivers Assessment (Milestone 1)

- a. A number of activities have been undertaken as part of the LEB Rivers Assessment to date. As part of developing the Implementation Plan, reports from these activities are to be reviewed and recommendations incorporated into the Plan for future on-going monitoring.
- b. The Service Provider is to provide a draft report to the Department, for review and comment, indicating how the recommendations have been considered. The Service Provider will be required to address all comments received and provide a final document to the Department. The report should include, but is not limited to:
 - the title of the report addressed;
 - how the recommendations have been considered in developing the Methodology/Implementation Plan;
 - any further action required.

2) An agreed LEB Rivers Assessment Methodology (Milestone 2)

As part of developing the Implementation Plan, the Service Provider is to finalise a methodology for monitoring that can be undertaken immediately, recognising that there will be a need for continued research and development of some indicators for future use.

This task will require the Service Provider to perform services including but not limited to:

- a) identify the monitoring already being undertaken within the Lake Eyre Basin which will be included in the Implementation Plan;
- b) identify the recommendations from previous LEBRA work that will be included in the Implementation Plan;
- c) identify the indicators that were suggested in Method for Assessing the Health of Lake Eyre Basin Rivers that will be included in the Implementation Plan;
- d) identify linkages with national monitoring, evaluation and reporting frameworks;

- e) identify monitoring actions that can be undertaken immediately – summarise their methods and costs;
- f) identify monitoring actions that require further research and development; and
- g) advise on the appropriateness of reporting on a ten year basis or other timeframe.

3) Support development and documentation of governance arrangements (Milestone 3)

The Implementation Plan should briefly review the current responsibilities of the jurisdictions with the Agreement area and make recommendations on the options for governance associated with ongoing monitoring. The Service Provider is to provide a draft written report to the Department indicating suggested governance arrangements which includes but is not limited to:

- a) reporting requirements;
- b) the role of the Lake Eyre Basin Scientific Advisory Panel;
- c) the role of Government officers;
- d) the role of Regional Natural Resource Management groups;
- e) links with Bureau of Meteorology;
- f) scientific review of the program;
- g) Quality assurance/quality control;
- h) research and development issues independent of the assessment.

4) Development of a business model (Milestone 4)

The LEBRA Implementation Plan is to include an outline of how the monitoring activities will be funded or supported.

The Service Provider is to provide a draft report to the Department, for review and comment, indicating suggested governance arrangements. The Service Provider will be required to address all comments received and provide a final document to the Department. The report should include, but is not limited to:

- a) the organisation committed to providing funding or support;
- b) the funding or support to be provided;
- c) the source of the funding or support; and
- d) duration of commitment

5) LEB Rivers Assessment Implementation Plan (Milestone 5)

Using information from Milestone Reports 2, 3 and 4 the Service Provider will prepare a draft LEB Rivers Assessment Implementation Plan. The Service Provider will be required to address all comments received and provide a final document to the Department. Detail on what is to be included in the Implementation Plan is to be discussed with the Steering Committee.

6) Workshop (Milestone 6)

After completion of Milestone 5 the Service Provider is required to organise and participate at a workshop with relevant stakeholders. The location and duration of the workshop will be determined by the Steering Committee and the Service Provider together, and may include participation of some stakeholders by telephone. The services that will be required include, but are not limited to:

- a) Organisation of the workshop (location to be agreed with the Steering Committee, will be a capital city).
- b) Attendance and presentation at the workshop which will include:
 - outlining the approach undertaken to develop the Implementation Plan;
 - feedback received from stakeholders;
 - commitment to regular on-going monitoring of key indicators of the condition of river ecosystems and catchments.

Appendix B: References

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Appendix C: Stakeholders consulted to date

Place	Name	Organisation
Canberra	Derek White	Dept of Environment, Water, Heritage & Arts
	Don Blackmore	World Bank
	Craig James	Desert Knowledge CRC
	Tim Fisher	Minister Wong's Office
	Mark Sjolander	Parliamentary Sec. Kelly's Office
	Doug Watkins	Wetlands International
	Mark Stafford Smith	CSIRO Sustainable Ecosystems
Brisbane	Stuart Bunn	Griffith University
	Fran Sheldon*	
	Satish Choy	Dept of Environment & Resource Management
Longreach	Vol Norris	LEB Facilitator
	Angus Emmott	LEB Community Advisory C'tee
	David Phelps	Dept of Employment, Economic Development & Innovation (formerly DPIF)
	Luw Markey	
	Mike Chuk	Desert Channels Qld Inc
	Vanessa Bailey	
Adelaide	Alun Hoggett	
	Ben Fee	Dept of Water, Lands & Biodiversity Conservation
	Dale Lewis	
	Henry Manchini	
	Glynn Schulze	
Alice Springs	Jenny Cleary	South Australian Arid Lands (SAAL) NRM Board
	Kirrilie Rowe	
	Ian Fox	Dept of Natural Resources, Environment, the Arts and Sport
	John Wischusen	Geoscience Australia
	Richard Walsh	Centralian Land Management Assoc
Darwin	Hugh Pringle	Bush Heritage Australia
	Kate Andrews*	NT NRM Board

* Teleconference