

# Quantifying Health in Ephemeral Rivers



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Land & Water Australia

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## Project Summary

Ephemeral rivers and streams are widespread throughout the inland regions of Australia and there is increasing interest by governments, industry and communities in monitoring changes to their health. However, assessment methods currently used in Australia have largely been developed and evaluated on coastal or permanent rivers and streams that carry year round flows. These methods may not be appropriate for measuring changes in the health of ephemeral rivers and streams.

Therefore a new project, funded by Land and Water Australia (LWA) in collaboration with the South Australian Catchment Water Management Boards (CWMB's), is being undertaken by members of the CRC for Freshwater Ecology and the CRC for Catchment Hydrology.

The project will evaluate and compare a range of existing ecosystem health methods. The project will undertake direct measures of ecosystem health plus geomorphic and hydrologic "pressure" indicators. Field trials of indicators and assessment techniques will be undertaken on ephemeral rivers within South Australia. Many of South Australia's rivers and streams are ephemeral, carrying significant flow only during the wet season (winter) or during infrequent but intense rainfall events in other seasons. This project will identify the most appropriate methods for quantifying the health of ephemeral rivers, prepare and publish protocols for their use, and provide practical training to river managers in how to use them.

Our focus is on ephemeral streams and small rivers. Assessment methodology for large ephemeral rivers (such as those in the Lake Eyre Basin) is being considered in a complementary project (see Page 4).

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## What are Ephemeral Rivers?

For this project we are defining ephemeral rivers as those which sustain a loss of surface water connection along part of their river length for a period of time in most years. This encompasses two types of rivers (a) "episodic" (or ephemeral) which occur in areas where rainfall has no well-defined seasonal patterns and (b) "intermittent" where rainfall shows seasonal periodicity.



Photo by AWQC Staff

Light River

## For further information:

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This is a Land and Water Australia Project being undertaken by the Cooperative Research Centre for Freshwater Ecology and the Cooperative Research Centre for Catchment Hydrology

# Project Objectives

1. Identify river health assessment methods that may be applicable to evaluating and quantifying changes in the health of ephemeral rivers.
2. Evaluate and trial these assessment techniques, using a selected group of ephemeral streams and rivers in South Australia that provide a range of past disturbance patterns, flow regimes, catchment and channel characteristics, and completed restoration works.
3. Identify which river health assessment tools are most appropriate for use in ephemeral streams and rivers in Australia, and develop, test and demonstrate modifications to those methods that will improve their accuracy, repeatability, and cost-effectiveness.
4. Develop written protocols for the use of the identified river health assessment tools and for the interpretation of data collected. These protocols will be in a form that can be readily used by managers and others with responsibilities and interests in assessing the health of ephemeral stream and river systems. Involve staff from the SA CWMBs in the field work component of the project to foster ownership and confidence in the use of the assessment tools.
5. Design and deliver a workshop to present the results of the project to a wide range of people involved in the management of ephemeral streams and rivers. Provide a field day to demonstrate the assessment techniques and seek and record their feedback to project outputs. Present a written report of the project, outlining results against each objective, to the National Rivers Consortium. This will be in a form suitable for publication in electronic and hardcopy formats.

## Stage 1 Study Design

Our initial field trials are to be conducted across a range of ephemeral streams and rivers within the Mount Lofty Ranges region of South Australia. However, the written protocols for indicators of ephemeral river health will apply to a wide range of ephemeral systems both within South Australia and in other regions.

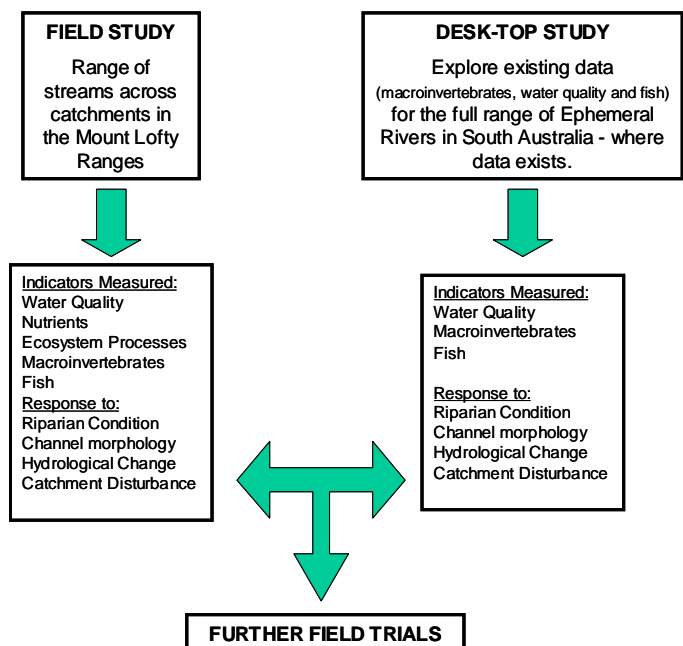
In the first phase of the project, a range of indicators will be tested on a range of ephemeral streams and rivers draining the Mt Lofty Ranges (see Figure). Given the inherent variability of ephemeral systems we believe it is critically important to test the temporal variability of the proposed indicators in order to better determine their robustness and scientific validity. Within the limitations of our budget, this is best achieved by limiting the geographic spread of sampling sites and concentrating resources on collecting data for the indicators on multiple occasions.

To explore the links between stream health and indicators across a more broad range of ephemeral streams, existing data (such as the South Australian Monitoring River Health macroinvertebrate database and the water quality database) will also be examined and analysed.

The indicators of river health that we are testing in the field in a number of sites across the Mt Lofty Ranges measure physical and biological processes and characteristics that are shared by all ephemeral streams and rivers. Therefore the indicators will be applicable to other ephemeral systems outside of the Mt Lofty Ranges region. Although various processes and characteristics may differ between systems in different regions we believe that we are addressing the fundamentals of river health and so the indicators will have wide applicability.



Map showing some of the streams to be sampled. Background image from [http://www.dwlbc.sa.gov.au/water/technical/surface\\_water\\_archive](http://www.dwlbc.sa.gov.au/water/technical/surface_water_archive)



## Choice of Study Catchments for Initial Field Trials

The project team has chosen streams and rivers from a number of catchments draining the Mt Lofty Ranges, some draining west into Gulf St Vincent and others east into the River Murray system. Sites within the Mt Lofty Ranges have been selected based on their distribution across a range of ephemeral stream and river types and disturbance gradients. The selected streams provide a range of past disturbance patterns, flow regimes, catchment and channel characteristics, and completed restoration works. Where possible, locations have been chosen to coincide with long-term monitoring sites so that existing data can be used to understand temporal changes in a subset of indicators (macroinvertebrates; water quality; and, at some sites, fish assemblages). These sites will be used for evaluating a broader suite of indicators of ecosystem health suitable for ephemeral rivers.

### UPLAND SITES

<b>Upper Marne</b>	Marne River	3 Sites
	Somme Ck	3 Sites
<b>Upper Onkaparinga</b>	Aldgate Creek	1 Site
	Biggs Flat Creek	1 Site
	Onkaparinga River	1 Site
	Spoehr Creek	1 Site
	Inverbrachie Creek	1 Site
	Lenswood Creek	1 Site
<b>Upper Torrens</b>	Kersbrook Creek	1 Site
	Torrens River	1 Site
<b>Upper Gawler</b>	North Para River	1 Site
	South Para River	1 Site
<b>Upper Finnis</b>	Finniss River	1 Site
<b>Upper Bremer</b>	Davidson Creek,	1 Site
<b>Upper Light</b>	Light River	1 Site

### LOWLAND SITES

<b>Lower Marne</b>	Marne River	6 Sites
<b>Lower Angas</b>	Angas River	2 Sites
<b>Lower Inman</b>	Inman River	1 Site
<b>Lower Myponga</b>	Myponga River	1 Site
<b>Lower Bremer</b>	Bremer River	1 Site
<b>Lower Wakefield</b>	Wakefield River	1 Site



Photo by AWQC Staff

Field River - an ephemeral river in South Australia.



Photo by AWQC Staff

Skillogallee Creek - an ephemeral stream in South Australia

## Relationship with the Lake Eyre Basin Rivers Assessment Methodology Development Project

The "Quantifying Health in Ephemeral Rivers" (QHER) Project is also being run in parallel with the Land and Water Australia funded project "Lake Eyre Basin Rivers Assessment Methodology Development". This latter project deals specifically with the large ephemeral rivers of the Lake Eyre Basin, as compared with the stream focus in the QHER project and will provide indicators that can be utilised at larger scales, possibly using remote techniques. The outcomes of both projects will be complimentary.

The specific aims of this project are to:

- develop conceptual models to illustrate how healthy dryland rivers, such as those of the Lake Eyre Basin, function and how they respond to threats
- classify the rivers of the Lake Eyre Basin using a hierarchical approach
- undertake spatial and temporal analyses of existing data
- review the available indicators for river health across the appropriate spatial and temporal scales applicable to the rivers of the Lake Eyre Basin
- identify appropriate indicators of the ecological health of the rivers of the Lake Eyre Basin
- suggest a data management framework for the assessment

## Catchment Board Perspective

Given that the CWMBs (and the NRM Boards/Group that will likely soon follow) will be required to implement the rapid health assessment method on a larger scale, we suggest that the following be considered when selecting indicators.

1. The assessment of indicators needs to be simple enough for a junior professional to undertake with limited training and supervision.
2. Indicators should provide a broad indication of ephemeral river health at a catchment level.
3. Indicators should be able to provide an indication of ephemeral river health at a reach level so that the Boards can assess the impact of their on-ground works

Ultimately, the CWM Boards will use the QHER method to undertake the following

1. determine the success of watercourse rehabilitation works at a reach scale;
2. determine the health of watercourses at a reach scale;
3. determine the impact of whole of catchment management (changed land use, planning, on-ground work, etc) on watercourse health at a sub-catchment level; and
4. determine the impact of whole of catchment management (changed land use, planning, on-ground work, etc) on watercourse health at a catchment level.

The Boards and Department of Water Land and Biodiversity Conservation variously collect data that provides only half the picture on watercourse health. This can include:

- Physico-chemical water quality data;
- Macroinvertebrate surveys;
- Geomorphology (River Styles © available complete for Mount Lofty Ranges);
- Fish;
- Riparian vegetation; and
- Hydrology (measured and modelled flows available)

There may be more. What's missing is the method to pull all this together, with other data as required, in order to help us measure health as indicated in the 4 points above.

Steve Gatti  
Onkaparinga Catchment Board



Photo by AWQC Staff

Hill River

## Project Team

This project is a collaborative project between the CRC for Freshwater Ecology and the CRC for Catchment Hydrology. Project team members come from the University of Adelaide, Griffith University, Melbourne University, Monash University and University of Canberra. The base for the project is the School of Earth and Environmental Sciences at the University of Adelaide, South Australia.

Members of the team include:

**Dr Fran Sheldon (Project Leader):** CRC for Freshwater Ecology, Griffith University - Arid and ephemeral river ecology, macroinvertebrate ecology, multidisciplinary projects

**Justin Costelloe (Project Leader):** CRC for Catchment Hydrology, University of Melbourne - Hydrology of ephemeral rivers, integration of hydrological and ecological behaviour.

**Ben Taylor (Research Assistant):** CRC for Freshwater Ecology, University of Adelaide.

### Project Advisory Team

Prof. Stuart Bunn: CRC Freshwater Ecology, Griffith University.

A/Prof. Rodger Grayson: CRC Catchment Hydrology, University of Melbourne.

A/Prof. Richard Norris: CRC Freshwater Ecology, University of Canberra.

A/Prof. George Ganf: CRC Freshwater Ecology, University of Adelaide.

A/Prof. Keith Walker: CRC Freshwater Ecology, University of Adelaide.

Dr Tony Ladson: CRC Catchment Hydrology, Monash University.

A/Prof. Ian Rutherford: CRC Catchment Hydrology, University of Melbourne.

Dr Mike Stewardson: CRC Catchment Hydrology, University of Melbourne.



Photo by AWQC Staff

Marne River south of Cambrai