Analytical case study of a large scale riparian rehabilitation project from an IWRM perspective —

Boorowa River Recovery

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Masters thesis
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The aims of this report are to provide information for natural resource management practitioners, and feedback to the project participants and other stakeholders. It is intended to submit this report for publishing in a relevant restoration journal. As such, any feedback to the author would be gratefully received.

Front cover main photo: Pudman Creek.

Pudman Creek.

Executive summary

Integrated water resource management (IWRM) promotes coordinated management of water resources to maximise economic and social welfare without compromising the sustainability of ecosystems and the environment. Water management in Australia is of a high standard for drinking water supply, but management of catchment health and water resources has generally been poor, particularly riparian zones in agricultural areas.

Riparian rehabilitation in agricultural landscapes (such as fencing these areas from stock and undertaking revegetation), has focused on reversing degrading processes, and there is a good body of evidence to underpin 'best practice'. On-ground works are undertaken with the assumption these actions will automatically improve ecological function (and related ecosystem services such as clean water), although this has not been well field tested.

Evaluations of riparian rehabilitation projects from an IWRM perspective, encompassing the full range of ecological, socio-political and economic outcomes, are difficult to find. It is for these reasons this report evaluates a large scale riparian rehabilitation project—Boorowa River Recovery (BRR), from an IWRM perspective—as one model of riparian rehabilitation. Although a significant amount of data has been collected from BRR over the past eight years, no evaluation has been undertaken. Available information was supplemented with targeted stakeholder interviews and related research.

BRR was a partnership project, managed by Greening Australia Capital Region in collaboration with the Lachlan Catchment Management Authority and Boorowa Community Landcare Group. The project was implemented via a co-investment model, encompassing a range of sub-projects and funding sources. BRR aimed to improve biodiversity and water quality in the Boorowa Catchment, by improving native riparian vegetation management on farms, and promoting sustainable land management practices more broadly. Landholders were provided with incentives to undertake on-ground works on their farms, in addition to significant community engagement activities.

This report follows a case study format with 1) situation analysis of Boorowa Catchment; 2) overview of project implementation; 3) evaluation of outputs; 4) evaluation of environmental, socio-political and economic outcomes using a MERI (monitoring, evaluation, reporting, improvement) framework specifically developed for this report, and 5) summary of lessons learnt.

Outputs for BRR exceeded all targets. Sixty landholders (target: 50), undertook riparian rehabilitation along 80 km of waterways (target: 50 km) encompassing 640 ha of riparian lands (target 250 ha). The average project size was 11.6 ha, and considered large when compared with similar projects (average 2.3 ha). No specific targets were set for community engagement although BRR involved hundreds of stakeholders and members of the broader community, in events such as river and farm walks, school activities, tours, workshops, presentations, fish surveys, revegetation, seed collection activities and a major science forum.

Environmental outcomes were evaluated using a number of approaches. The main source of information was analysis of data collected from 20 BRR project sites matched with 20 control sites over the past six years. Other information was sourced from research into water savings relating to willow control, anecdotal evidence from landholders, fish surveys and aerial photographic surveys undertaken in 2005 and 2008. Overall the picture forming is a positive one, with on-ground works being completed and maintained, positive trends emerging in terms of ecological response for a number of variables, improvements in water availability in relation to willow removal, and positive responses for native fish in a major Boorowa River tributary.

However, it was also found there is significant variability both within, and between sites, and results often did not follow clear patterns. Many were related to the quality of sites before projects began, and/or the types of works that took place. They were also influenced by drought, floods, and pest animals. The results highlight the complex and long-term nature of ecological improvement (and associated monitoring), and the importance of ongoing long-term maintenance of sites.

Socio-political—governance and human resources—and economic evaluations were undertaken using targeted stakeholders interviews, landholder surveys and broader research.

Recovering riparian zone.

Governance for BRR was found to be strong overall, especially the non-government organisation–government–community partnership. Of particular note was the strength of the BRR Steering Committee with representation from all key stakeholders. It was recognised there was a need for more active engagement by some members, and better recognition of the contribution from others. There was found to be influence from external factors such as the development of catchment management authorities in New South Wales, that played a role in governance of the BRR project. Successful governance is a balancing act that depends on the people involved and the context within which a project is implemented.

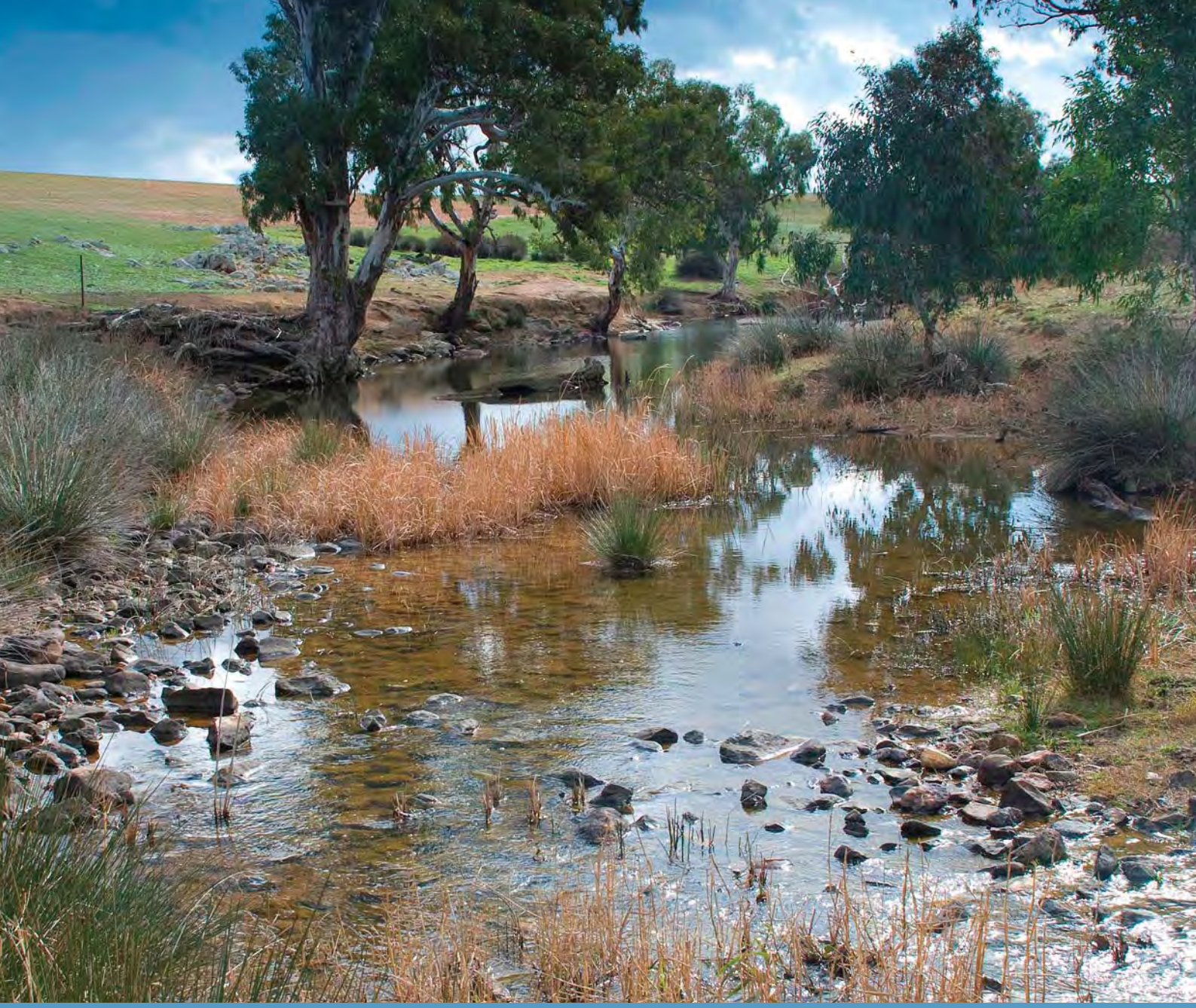
Human resources and engagement for BRR primarily centred on landholders, who had a range of views, and different levels of knowledge. Behavioural change depended on the knowledge platform people were starting from, and took time. Success of BRR community engagement was strongly facilitated by the long history of natural resource management projects previously undertaken in the Boorowa Catchment through Landcare. Areas for improvement included reaching out to the broader community more effectively (especially those outside the catchment), better understanding the reasons for non-participation, consideration of having a local presence, and greater opportunities for training and formal knowledge acquisition.

Economic evaluation was difficult to undertake, and outcomes varied depending on the nature of on-ground works and farming systems. Economic gains relating to biodiversity and water quality improvements (specifically due to BRR), were impossible to quantify because of external influences, significant complexity and a lack of information. The majority of farmers did not notice a negative impact on productivity, but did not recognise a significant gain either. Projects were implemented for reasons other than economic gain, such as peace of mind, aesthetics and stock management. Incentives were found to be critical, and BRR (through purchase of materials and services) provided a boost to local businesses during long-term drought.

Overall, BRR was considered successful in terms of implementation, most likely because of its ‘people-centric’ focus. More time is needed to realise the full extent of ecological change, and economic outcomes may never be fully recognised. Projects of this nature need to embrace complexity and variability, and need to be flexible enough to continually adapt to new people, new ideas and new knowledge.

Abbreviations

ACT	Australian Capital Territory
BCLG	Boorowa Community Landcare Group
BRCC	Boorowa Regional Catchment Committee
BRR	Boorowa River Recovery
BRR SC	Boorowa River Recovery Steering Committee
CFR	creek fenced and revegetated [type of work undertaken]
CMA	catchment management authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
ESR	environmental services ratio
GA	Greening Australia
GACR	Greening Australia Capital Region
GEW	gully earthworks [type of work undertaken]
GFR	gully fenced and revegetated [type of work undertaken]
GIS	geographic information system
ha	hectare
IWRM	integrated water resource management
KASA	knowledge attitudes skills aspirations
km	kilometre
KPI	key performance indicator
KRA	key result area
LCMA	Lachlan Catchment Management Authority
LCMB	Lachlan Catchment Management Board
m	metre
M&E	monitoring and evaluation
MERI	monitoring, evaluation, reporting, improvement
ML	megalitre
NGO	non-government organisation
NRM	natural resource management
NRR	National River Recovery
NSW	New South Wales
NSW DPI	New South Wales Department of Primary Industries
NWC	National Water Commission
NWI	National Water Initiative
P	protection [type of work undertaken]
SC	Steering Committee
SIGNAL	Stream Invertebrate Grade Number – Average Level
W	willow control [type of work undertaken]



Pudman Creek.

Water is the most critical resource issue of our lifetime and our children's lifetime. The health of our waters is the principal measure of how we live on the land.

Luna B. Leopold, former United States Geological Survey Chief Hydrologist, 1915–2006.

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SECTION 1

Introduction

1.1 Context

Integrated water resources management (IWRM) is defined as 'a process which promotes the coordinated development and management of water, land and related resources to maximise economic and social welfare in an equitable manner without compromising sustainability of vital ecosystems and the environment' (GWP 2012).

IWRM is beginning to be accepted as an alternative to disconnected, top down approaches to water management that have occurred in the past. It takes a cross sector approach by promoting the coordinated development of land and water catchments as well as coastal and marine environments (GWP 2012).

In 1992, the Dublin Principles of IWRM were announced at the United Nations Conference on Environment and Development in Rio de Janeiro. These principles propose a balance between resource availability and impacts associated with direct and indirect water use (Snellen & Schreval 2004), and bring together the often segregated approach to water management.

More specifically, the Dublin Principles recognise the importance of managing and developing water in an integrated and participatory manner, with women playing a central role. Water is recognised as an economic good, and basic human rights should enable access to clean water and sanitation. Water should be managed sustainably (Snellen & Schreval 2004).

It is within this biophysical, social and economic context that the Dublin Principles of IWRM provide important guidance for the sound management of water in relation to the efficient production of food and fibre. Sound water management is critical for agricultural productivity, not only with respect to water availability, but also the management of water pollution associated with agriculture.

Photo Thomas Bresson (Wikimedia Commons).

1.2 Water management and IWRM in Australia

Management of water supply in Australia is of a high standard in comparison to many countries (Productivity Commission 2000). However, Australian waterways are suffering from land degradation issues that impact water quality and availability. The management of water resources over the past 150 years has generally been poor, focusing on infrastructure development rather than sustainable land management practices (NSW EPA 2003).

In 1994, in response to these issues, the Council of Australian Governments agreed to develop and implement a strategic framework to achieve an efficient and sustainable water industry recognising environmental, social and economic objectives (Australian Government 2004). This stimulated a move towards community driven 'bottom up' catchment management, with the formation of catchment management authorities (CMAs) and regional management of resources for natural resource management (NRM).

By 2004, the National Water Initiative (NWI) was developed as a shared commitment by state and territory governments to increase the efficiency of Australia's water use, including greater certainty for investment and productivity for rural and urban communities, and to better address environmental degradation (DSEWPC 2012). The main elements of the NWI include water planning and trading, socio-economic and environmental needs, integrated catchment management, wide consultation and research.

The NWI is implemented by states and territories, assisted by the National Water Commission (NWC), and overseen by the Natural Resource Management Ministerial Council (Australian Government 2004).

Under the NWI, national legislation for water management has tended towards 'enabling'; where legislation is enacted along with a process that allows the broader community to contribute to planning and decision making (ComLaw 2012). A notable example of this is in catchment management and protection of water quality, where many programs have been community driven, or at least have had strong community input over the past 20 years (Bellamy et al. 2002).

Boorowa River landscape.

LORI GOULD

Monitoring macroinvertebrates.

1.3 Riparian rehabilitation in Australia

There is well established research into the degrading processes affecting stream health. Some issues causing ecosystem dysfunction include erosion, sedimentation, nitrification, loss of shade and alteration of flow regimes, causing the collapse of aquatic ecosystems, leading to poor water quality and loss of species (Lovett & Price 2007; Rutherfurd, Jerie & Marsh 2000; Lovett & Price 1999). Best practice tends to rely on a 'provide it and they will come' riparian management theory (Wilson et al. 2007) in the hope the reversal of degrading processes will result in improved ecological function.

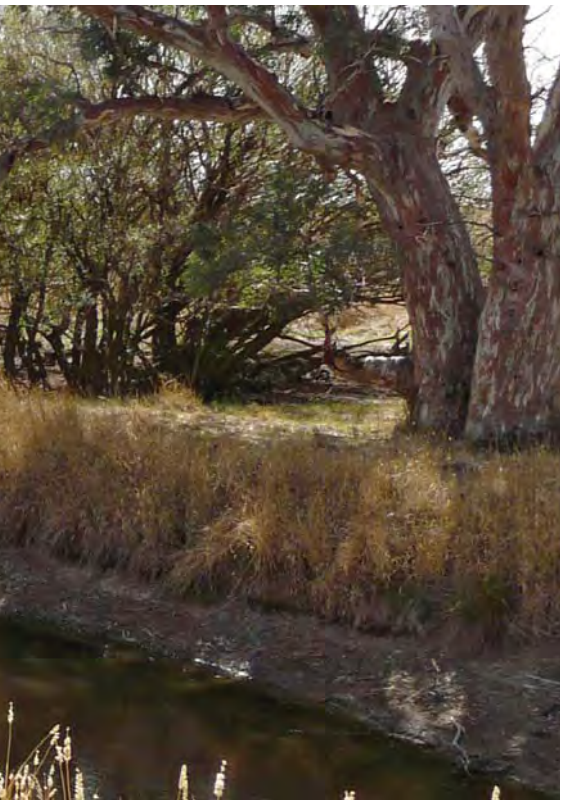
As such, investment in riparian rehabilitation projects over the past 20 years has been significant, by both government and community (Wilson et al. 2007). The most common form of rehabilitation is fencing from livestock and revegetation (Cummins & Watson 2012, Stewardson et al. 2002). Other intervention includes structural erosion control works, control of invasive species such as willows, and installation of in-stream habitat structures.

Well managed riparian areas provide a buffer to agricultural activities (Burger, Reich & Cavagnaro 2010), provide shade and shelter for stock, clean water, habitat for wildlife, aesthetics, recreational and cultural values (Cummins & Watson 2012, Lovett & Price 2007, Rutherfurd, Jerie & Marsh 2000).

Although riparian lands management has been incorporated into environmental policy (Rutherfurd, Jerie & Marsh 2000; Lake, Bond & Reich 2007), it is recognised that remediation of catchment water quality more generally is still not well managed and water *quality* and *quantity* are often managed in isolation of each other (DSEWPC 2011).

1.3.1 Monitoring and evaluation of riparian rehabilitation projects

Monitoring and evaluation (M&E), is a requirement of many environmental funding grants. One methodology, recently adopted by government is the monitoring, evaluation, reporting and improvement (MERI) framework (Beeton et al. cited by Pearson et al. 2010; Reich et al. 2011), which provides a generic framework to help improve Australia's approach to managing key assets. In the NRM context this includes human, social, natural, physical and financial assets (Australian Government 2009).



However, few published evaluations of Australian NRM research exist (Christiansen; Price & Hacker both cited by Pearson et al. 2010). Bellamy et al. (2002) reviewed NRM evaluation challenges and found it to be difficult because of differing evaluation perspectives, rich socio-economic, policy/institutional and environmental contexts, lack of agreed assessable goals or outcome measures, and sporadic and/or delayed feedback. Other constraints include the need for extensive historical data, cost, ability to demonstrate robustness and the long-term nature of change (Pearson et al. 2010; Wilson et al. 2007).

Monitoring of riparian rehabilitation projects in Australia tends to focus on outputs or implementation of restoration activities, rather than if the intended ecological outcomes have been achieved (Gollan 2008, Reich et al. 2011).

Outputs (cost, community contribution, trees planted, fencing erected, etc) are easy to monitor. Monitoring outcomes (water quality, changes to biodiversity and habitat, soil loss and ecosystem services) pose a much greater challenge, due to the long time frames required for environmental improvement, and short-term funding and reporting cycles (Wilson et al. 2007). The general assumption is that by engaging in riparian rehabilitation activities, ecological function will also improve, although this has not been well field tested (Lake, Bond & Reich 2007). For example, the Australian Riparian Restoration Experiment (Reich et al. 2011)—as one of the only long-term programs investigating ecological response of riparian areas to rehabilitation—has been running for over 10 years, and positive ecological change is only just beginning to show.

Similarly, evaluation of riparian project outcomes from an IWRM perspective encompassing the full range of economic, social, political and environmental outcomes is also lacking for most projects. This is generally because of insufficient funding, complexity and lack of prior planning for monitoring (Palmer et al. 2005 & Dudgeon et al. 2006 cited by Lake, Bond & Reich 2007).

It is for these reasons this report evaluates a riparian rehabilitation project —Boorowa River Recovery—from an IWRM perspective.

1.4 Aim of this report

This report analyses and evaluates the BRR project as one model of riparian rehabilitation. Although a significant amount of data has been collected by the author and others over eight years—and outputs reported on to justify grant funding—no full evaluation of BRR has yet been undertaken.

It is within this context, that this report aims to evaluate the outcomes of the BRR project from an IWRM perspective, with reference to a specifically developed MERI framework. This report also summarises the lessons learnt to inform future direction, and other projects operating within a similar context.

River Red Gum archway.

SECTION 2

Boorowa River landscape.
Photo Col Ellis.

Research approach

The research approach for evaluation of the BRR project follows the logic that in project planning and implementation, inputs lead to process development resulting in a variety of outputs which then lead to outcomes and overall goals. Monitoring occurs at all steps along the transition and results from a range of sources are brought together and used to evaluate project outcomes in line with IWRM theory. Figure 1 illustrates this concept.

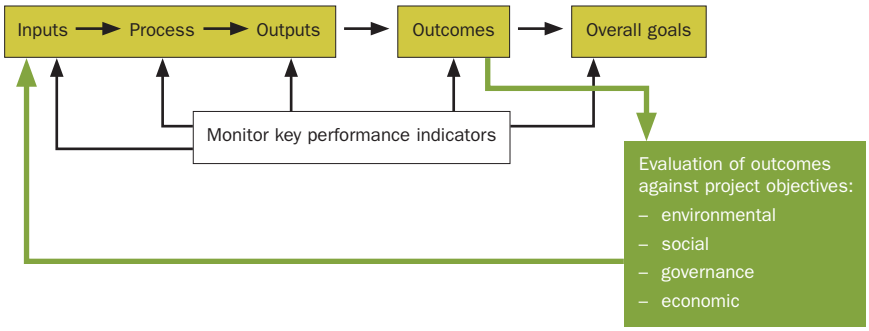


FIGURE 1. Conceptual diagram showing monitoring of key performance indicators at each step along a project continuum. This enables evaluation of a project from an IWRM perspective using a range of data.

A desktop review of information relevant to BRR was undertaken, and gaps were identified. Most of the information was originally collected or commissioned by the author as project manager, with some additional stakeholder surveys carried out specifically for this report.

As no overall evaluation has been taken for BRR previously, a MERI framework was developed to bring together the ad hoc variety of monitoring data. As mentioned in section 1.3.1, there are few examples of IWRM evaluation of riparian rehabilitation projects that focus on outcomes.

This report follows a case study format with 1) situation analysis of the Boorowa Catchment, 2) overview of project implementation, 3) evaluation of outputs, 4) evaluation of environmental, socio-political and economic outcomes, and 5) lessons learnt.

The methodology for each evaluation is provided in the relevant section, and analyses a mixture of qualitative and quantitative data. A summary of findings in relation to MERI framework is at the end of each section.

Table 1 outlines the structure of this report and identifies the research approach for each component along with relevant data sources.

It should be noted the author has managed BRR since 2005, and can provide insight into the project from a management perspective. Strong measures have been taken to reduce bias by ensuring all information reported on has been substantiated by available literature, research, project data and/or third parties.

TABLE 1. EVALUATIONS UNDERTAKEN AND RELEVANT DATA SOURCES

Report component	Data source	Section
Situation analysis	Literature review (various sources) Project records (Greening Australia Capital Region (GACR)) Social surveys (GACR)	3
Overview of project implementation	Literature review (various sources) Project records (GACR)	4
Evaluation of outputs	Project records (GACR)	6.1
Environmental evaluation	Literature review (various sources) On-ground monitoring data (collected by author as project manager, unpublished) Data analysis and interpretation (author assisted by Melbourne University and Department of Sustainability and Environment Victoria Fish surveys Boorowa River (NSW DPI Fisheries commissioned by author as project manager) Fish surveys Pudman Creek (NSW DPI Fisheries)	6.2
Socio-political evaluation: – governance – human resources and engagement	Social surveys (GACR) Targeted interviews with key stakeholders (author)	6.3
Economic evaluation	Targeted interviews with key stakeholders (author)	6.4
Lessons learnt	Major findings (author)	7

SECTION 3

Boorowa River landscape.
Photo Col Ellis.

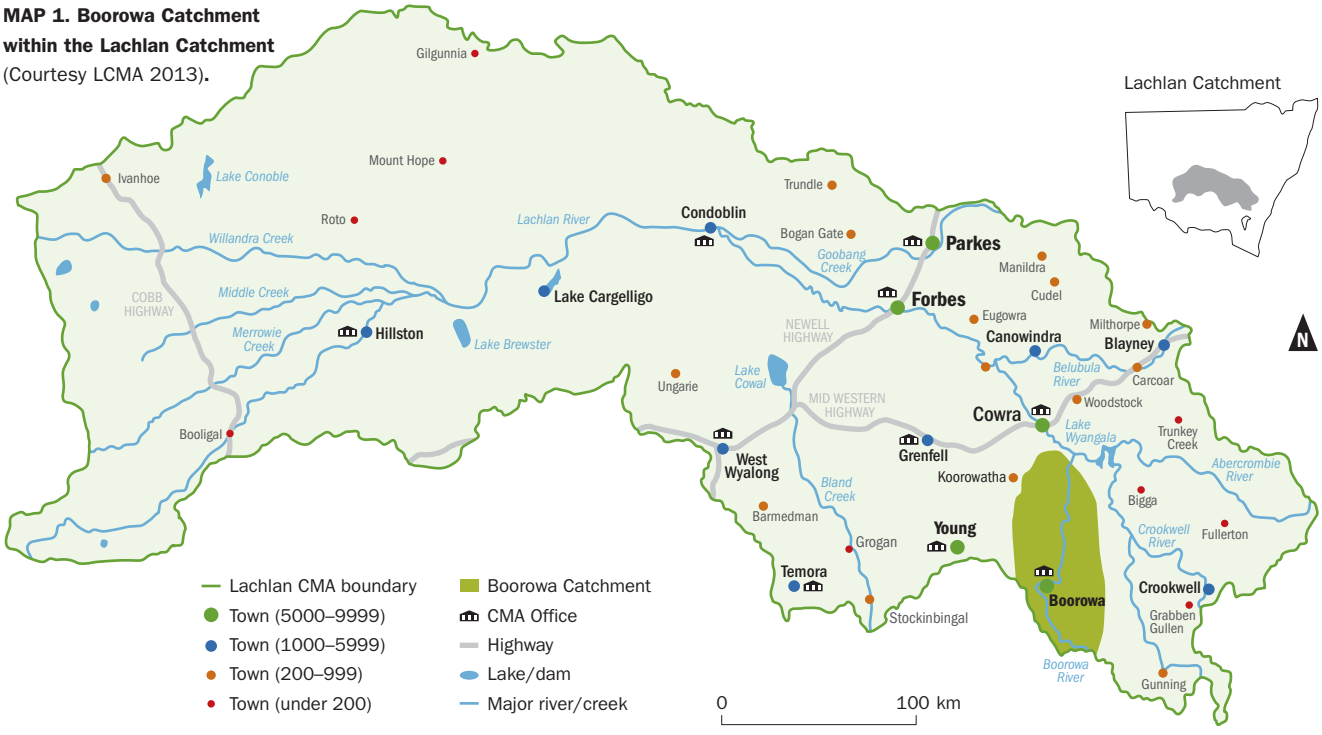
Situation analysis of Boorowa River Catchment

3.1 Overview and history

Boorowa River Catchment is 2200 km² (220,000 ha) and is the headwaters for the Lachlan River, one of the major tributaries in the Murray–Darling Basin.

The Boorowa Catchment (see Map 1) is characterised by farms of various sizes (from 100 ha up to 5000 ha) including rural residential holdings and small regional centres. The main town in the catchment is Boorowa with a population of 2390 (ABS 2010).

MAP 1. Boorowa Catchment within the Lachlan Catchment (Courtesy LCMA 2013).



Boorowa township. Photo Col Ellis.

The area has a long heritage of fine wool production but this has been declining due to changing terms of trade since the 1970s and long periods of drought (Race et al. 2007). Poor water quality and unsustainable land management have affected productivity and eroded the resource base for future income and livelihoods both on and off farm. This is a major issue identified by NRM agencies (Race et al. 2007). Despite the challenges, agriculture dominates land use, and generated an income of $37.4 million in 2006 (ABS 2010) at the height of the drought.

Historically the area was inhabited by the Wiradjuri people. Aboriginal populations were decimated by disease or moved to nearby missions at Yass and Rye Park around the time of European settlement in 1821. By 1851, the population of several thousand was reduced to only 300 (Argyle Country 2008). Currently, the Aboriginal community is represented by Wiradjuri elders who form only 1.8% of the Boorowa Catchment population (ABS 2010).

3.2 Natural resources

Before European settlement, native vegetation was characterised by a variety of eucalypt woodlands, swamplands and grasslands. Clearing began in the 1820s in association with grazing and dryland cropping. Almost all native vegetation communities have since been cleared or modified (Yates & Hobbs cited by Langford et al. 2005).

Aboriginal canoe tree.

Severe gully erosion.

The 2004 State of the Environment (SoE) report for Boorowa (ACT Government 2004) identified pressure on water supply, extreme and severe gully erosion, low vegetation vigour (85% of the catchment cleared) especially in riparian vegetation communities, high environmental stress on waterways, and severe dryland salinity (recorded at double the acceptable level). Most of the land under crops was classed as 'unsuitable' for that purpose, with acidic soils considered a problem. Lack of monitoring or base data was seen as an issue and a subsequent regional SoE report (ACT Government 2009) showed little had changed and recommendations for data collection had not been fulfilled.

The lack of base data meant no assessment could be made regarding activities undertaken to improve natural resources at the catchment scale. However, project monitoring has shown improvements at the local scale (ACT Government 2009) in association with a large number of NRM projects implemented over the past 15 years.

Water supply is a mixture of surface water (rivers, creeks and dams) and rainwater tanks for domestic and stock water supply (Greening Australia 2012, Langford et al. 2005). The Boorowa River and its tributaries provide water for the Boorowa township.

A 'full' water treatment ensures clean water for half the Catchment's population, although unrestricted cattle access to the Boorowa water supply weir remains a problem. On occasion, water is rendered undrinkable because of high levels of *E.coli*, and colouration (turbidity) of water after high rainfall events can make water difficult to treat for several days (Minchin 2013 pers. comm.).

Small images (L–R): Dryland salinity near Pudman Creek. Willow infestation. Nutrification of the Boorowa River. Bottom: Boorowa town water supply. Photo Col Ellis.

3.3 Catchment governance and natural resource management

Since 2004, natural resource management across New South Wales (NSW) has been governed by 21 regional CMAs, formed as part of the NWI to improve catchment health. They are statutory authorities with accountable Boards who make decisions on NRM issues and coordinate action (NSW Government 2013).

The Lachlan Catchment Management Authority (LCMA) is the authority governing catchment management in the Boorowa Catchment (LCMA 2013a). The LCMA was preceded by the Lachlan Catchment Management Board (LCMB) who were responsible for putting together the 'Lachlan Blueprint' in 2003 (Hassall and Associates 2005). This Blueprint provided the basis for a 10 year Catchment Action Plan (Lachlan CAP) which aimed to provide a coordinated approach to NRM for all government and community stakeholders (LCMA 2013b).

The LCMA, although having input into the development of water sharing plans, has little jurisdiction over water supply and sanitation (which is the responsibility of Boorowa Council), or water use (which is governed by the NSW Office of Water) (LCMA 2013a).

Local government (Boorowa Council) although responsible for water supply, tends to focus on municipal issues. They view catchment management as the role of the LCMA and Landcare (Southwell 2013 pers. comm.).

In essence, there are a number of players involved in water management in the Boorowa Catchment, each with different roles and responsibilities. There does not appear to be one shared vision for water and catchment management in terms of overall governance, with segregation of different functions depending on the organisation. There is some level of cross-communication but governance could not be considered truly collaborative.

Boorowa has a long history of fine Merino wool production. Photo Col Ellis.

BRR launch.

3.4 Community engagement in natural resource management

In 2006, community consultation workshops run by the NSW Department of Environment, Climate Change and Water (DECCW 2006) on water management in the Lachlan Catchment provided an insight into views on NRM within the community.

Participants were concerned about:

- river health and better water quality,
- carp, salinity, effluent, erosion, access to stock water, sedimentation, willows and loss of riparian vegetation,
- having local input into water management and equitable access to water,
- how the costs of water supply should be spread across the community,
- community education on environmental issues including complexities between causes and symptoms,
- having a clean, healthy river and recognising their dependence on it.

Aboriginal participants were concerned about:

- weirs, inadequate fish passage, regulators and levee banks affecting billabongs and producing unnatural flows,
- salinity,
- greater difficulty accessing food and medicinal plants,
- water pollution contributing to a high level of ear infections,
- ensuring they had more involvement in consultation.

Consultation tended to focus on a particular topic (i.e. water management), and probably could not be extrapolated to represent the views of the whole community. However, it does provide a useful snapshot of NRM issues as perceived by participants.

In a broader survey, Race et al. (2007), revealed the community were not as concerned about NRM issues as agencies expected them to be. Race et al. (2007) recommended the need for agencies to put more effort into understanding the community in line with socio-economic, political and environmental factors. They suggested using participatory research (bottom up approach), local support staff, technical expertise, various communication strategies, and long-term commitment of resources for on-ground works.

Race et al. (2007) found the community did not see land degradation as a major contributor to poor returns on production. They were aware of the problems but cited external factors as having a greater influence on their viability. This represents a dichotomy of viewpoints between agencies and landholders regarding sustainable production. Many landholders, however, were undertaking on-ground works such as revegetation to address salinity, poor water quality and lack of stock shelter on their farms for reasons other than direct economic returns.

Social research such as this, is important when looking at the Boorowa Catchment (and BRR), as it provides knowledge about community views, a critical platform for the implementation or evaluation of any project or initiative.

3.4.1 Landcare in the Boorowa Catchment

Landcare deserves special mention as they have historically been the predominant group addressing catchment management in the Boorowa region since 1989. The group expanded in 1992 to the Boorowa Regional Catchment Committee (BRCC) (Langford et al. 2005) and brought together landholders, state and local governments, and community organisations (Langford et al. 2005). The BRCC implemented an array of projects and community engagement activities addressing dryland salinity, water quality, loss of biodiversity, sustainable agriculture, weeds and erosion (Langford et al. 2005).

The Boorowa Catchment Action Plan—with reference to the 2003 Lachlan Catchment Blueprint—was launched in 2005 by the BRCC, who represented the seven Landcare groups (approximately 270 members) in the Boorowa Catchment from 75% of the catchment area (Langford et al. 2005).

This history is important in the context of this report, as community action provided a strong platform for the development and implementation of the BRR project in 2005.

SECTION

4

...and Boorowa River Recovery was born!

Boorowa River Recovery project

4.1 Background—National River Recovery

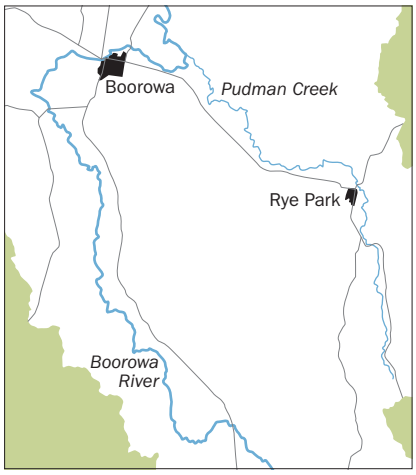
Boorowa River Recovery was a sub-project of National River Recovery (NRR), implemented by Greening Australia Ltd in partnership with the Nature Conservancy and other sponsors including Macquarie Bank and Alcoa Aluminium. NRR began in 2004 with seed funding for a demonstration project in each state and territory using a co-investment model targeting businesses and other funding sources. It was envisaged that success in co-opting support from the private sector would help to reduce reliance on short-term 'boom and bust' government funding cycles.

Although NRR is no longer funded, state based river recovery projects continue to operate (e.g. Hawkesbury Nepean, Derwent and Boorowa) and have become self sustaining with their own funding streams.

4.2 Boorowa River Recovery project overview

The Boorowa Catchment was chosen as an NRR demonstration site because it was one of the Lachlan Catchment priority areas for water quality and salinity management. It included the Boorowa River, and key tributaries with significant habitat values such as Pudman Creek, one of the only creeks west of the Great Divide with no feral fish, and home to a translocated population of the threatened Southern Pygmy Perch (NSW DPI 2007). Map 2 shows the area of operation.

Seed funding of $50,000 from NRR began the development of BRR which became a $2.2 million flagship riparian rehabilitation project.



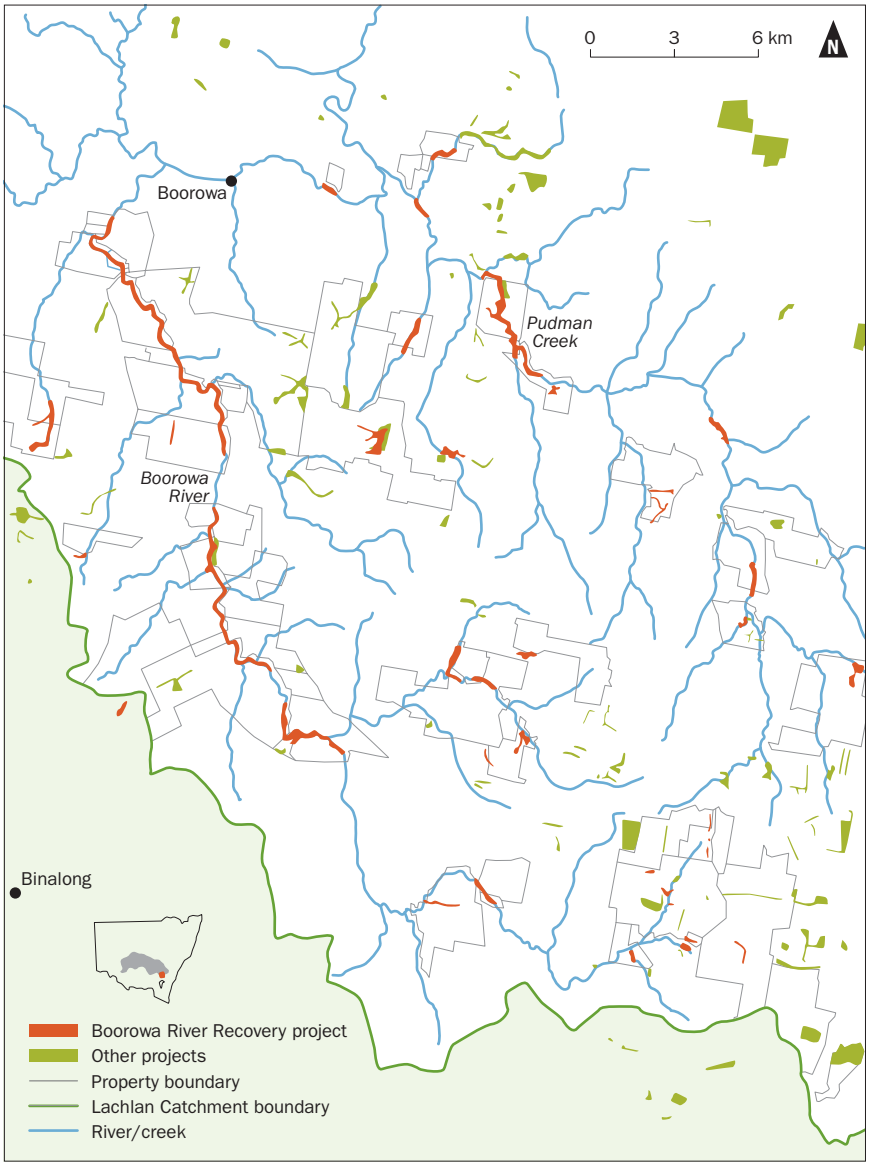
MAP 2. Boorowa River Recovery project area.

BRR aimed to (BRR SC 2005):

- recover the health of the upper Boorowa River and its tributaries to improve water quality for the Boorowa township and downstream users along the Lachlan River,
- conserve, connect and enhance biodiversity by increasing the native vegetation cover on farms,
- increase rural and urban community understanding of NRM to improve farm practices and sustainable livelihoods.

Original key performance indicators included (BRR SC 2005):

- protect and rehabilitate 50 km of the Boorowa River and its tributaries,
- protect, enhance and link 250 ha of high conservation value vegetation,
- protect and enhance habitat for threatened species such as the Southern Pygmy Perch, Superb Parrot and others,
- provide shelter and clean water for domestic stock on 50 properties,
- seek and secure corporate investment,
- engage schools, community groups and volunteers,
- raise awareness of the general community about river health.



MAP 3. Boorowa River Recovery project.

LCMA Regional NRM Award 2009.

BRR was a partnership project managed by Greening Australia Capital Region (GACR) in collaboration with the LCMA and Boorowa Community Landcare Group (BCLG) (formerly BRCC). The project was supported by TransGrid, Alcoa, the Australian Government, NSW Environmental Trust and the community.

BRR rehabilitated and/or protected 640 ha of riparian area along 80 km of river, involved more than 60 land managers through tailor made work programs outlined in individual 10 year management contracts, and included a continuous 29 km stretch of the Boorowa River above the town water supply dam. BRR involved four corporate partners, eight community groups, two local schools, two councils and the broader community. A priority for the project was to engage community support with events such as river science forums, plantings and various educational activities with local schools and groups. These are listed in Appendix A.

BRR has been recognised for its achievements through multiple awards:

- Winner, ACT Project Management Achievement Awards, 2010.
- Finalist, United Nations Association of Australia, World Environment Day Awards, 2010.
- Winner, Tidy Towns—Wildlife Corridors and Habitats Conservation Award 2009.
- Winner, LCMA Regional NRM Awards, 2009.
- Finalist, Banksia Foundation Water Award, 2009.
- Finalist, NSW Landcare Awards, 2008.
- Winner, LCMA Rivercare Award, 2006.

4.3 Project planning and stakeholders

Planning documents guiding BRR included the Lachlan Catchment Action Plan (2006), the Boorowa Catchment Action Plan (2005) and through NRR, a Catchment Action Planning process undertaken in partnership with the Nature Conservancy and project stakeholders (BRR CAP 2008).

These documents consistently identified the Boorowa Catchment as a high priority for water quality and salinity, and the importance of protecting, enhancing and linking highly significant Yellow Box/Red Gum woodland and riparian remnant communities. Community engagement and partnerships were identified as a priority to ensure ongoing stewardship and maintenance of projects.

The $50,000 seed funding from NRR was used to co-invest resources from the contributors. These are shown in Table 3 and include a mixture of cash and in-kind contributions (GACR database 2013). Landholders contributed an average of 40% of their project expenses, partner agencies contributed staff time, and volunteers participated in on-ground activities.

TABLE 2. BRR SUB-PROJECTS AND SOURCES OF FUNDING (GACR DATABASE RECORDS 2013)

Sub-project	Focus	Cash	Funding sources	In-kind (landholders)
Core project	Original BRR aims: Fifty km riparian area, number of farmers, included M&E program	$1,036,000	LCMA ($600,000); NRR ($310,000) from Natural Heritage Trust, Alcoa and Macquarie Bank; TransGrid ($100,000); GACR ($25,000); Adapt2eco ($1,000)	$277,603
Better Water to Boorowa 1	Boorowa River extension of willow control and riparian rehabilitation	$100,000	LCMA	$40,000
Better Water to Boorowa 2	Boorowa River extension of willow control and riparian rehabilitation	$100,000	NSW Environmental Trust	$28,000
Pygmy Perch in the Pudman	Rehabilitation of Pudman Creek Catchment and habitat reconstruction for Southern Pygmy Perch	$97,500	NSW Environmental Trust	$29,200
Weir to Weir	Boorowa River rehabilitation between the two weirs in Boorowa township	$50,000	Community Water Grants	$4,000
TransGrid Pudman Project	Linking two BRR sites on Pudman Creek	$38,000	TransGrid	$15,200
Fish Habitat Project	Construction of fish ladders to facilitate movement of native fish	$27,500	Recreational Fishing Grants, Department of Agriculture, Fisheries and Forestry	$0
Café Brindabella Rock Flume	Construction of rock flume in erosion hotspot linked to BRR works	$10,000	Café Brindabella	$5,000
Other in-kind contributions	n/a	n/a	Stakeholders (BRR SC) GACR staff LCMA staff Greening Australia Green Team Other volunteers (on-ground)	$40,200 $93,600 $117,000 $22,750 $42,000
Total cash contributions		$1,459,000	Total in-kind contributions *	$714,553
TOTAL PROJECT INVESTMENT				$2,173,553

*** In-kind contributions do not include event participation (on-ground works and project implementation only).**

The reasons for involvement by partners varied, for example, TransGrid's main objective was to become known in local farming communities to easily access land for powerline maintenance, and to improve their corporate social capital. Motivation for investment by Macquarie Bank and Alcoa was to increase their 'green' portfolio and demonstrate their commitment to the environment.

National and state governments were interested in achieving outcomes that addressed the degradation of biodiversity and water quality, and were listed as priorities in several strategies.

BCLG's involvement was motivated by the opportunity for their members to contribute to improving the health of their catchment. Actions outlined in the Boorowa CAP—which members developed and had strong ownership of—could be implemented.

Right: Initial tour of the BRR Steering Committee. Below: Tour by TransGrid Environmental Executive Committee.

To ensure key stakeholders had a voice, the BRR Steering Committee was formed with representatives from major project partners (LCMA, GACR, TransGrid, Boorowa Council, and BCLG) and three landholders representing the community. They had a strategic focus, and provided guidance on the project's direction.

4.4 Project works and prioritisation

An incentives program was developed to encourage landholders to engage in riparian rehabilitation works. Planning was undertaken on an individual basis, within the project's strategic direction. A 'tool box' of options—fencing, direct seeding, tubestock, soil works, structural engineering works, willow control and the installation of alternative stock water—was tailored to each site.

Face to face site visits were a feature of BRR.

Projects were assessed using an environmental services ratio (ESR) developed by LCMA, to prioritise each site in line with BRR objectives and cost–benefit outcomes. The ESR assessed environmental issues, project size, upstream and downstream linkages, remnant vegetation, previous projects, landholder capacity, habitat value and potential outcomes. GIS satellite imagery, on-ground appraisal and interviews with landholders were also used. Appendix B shows an ESR assessment.

The ESR scored the percentage of the total cost of each project eligible for incentives (generally between 60–80%). It ruled out low priority projects, taking some of the subjectivity out of how funding was invested across the project area. It also provided a negotiation tool where applicants could increase their project size, or protect more intact areas to receive greater funding.

Incentives were tailored to individual sites.

Participating landholders committed to 10 year management agreements (not linked to land title), which outlined works to be undertaken, and ongoing responsibilities for maintenance. Long-term management of projects relied on the premise of good will, along with increased knowledge and behavioural change, rather than legislative requirements.

4.5 Monitoring and evaluation of BRR

A monitoring and evaluation (M&E) program was specifically designed for BRR during its planning phase with data collected for project outputs as well as ecological and social outcomes, although no analysis or evaluation has yet been carried out. There was less focus on governance and economic outcomes but there is a growing body of anecdotal evidence to enable evaluation of these aspects. M&E methodology will be discussed further in this report.

Negotiating a project plan with landholders.

LORI GOULD

SECTION 5

Stock on Boorowa River.
Photo Col Ellis.

Boorowa River Recovery evaluation

The evaluation framework (based on the MERI framework), was chosen for this report to provide a logical structure to allow evaluation of BRR in relation to key result areas (KRAs) and key performance indicators (KPIs) derived from sources relating to the BRR project plan. MERI is useful because it allows project evaluation from a broad IWRM perspective and can incorporate the full suite of environmental, socio-political and economic evaluation.

5.1 MERI framework for Boorowa River Recovery

The MERI framework (Table 3) has been developed to analyse BRR. MERI (Australian Government 2009), documents a link between the overall project goal (impact) and the purpose of the project (outcome) with KRAs, and KPIs that inform the KRAs. It also documents the evidence (M&E methodology) used to underpin development of KPIs.

The BRR project goal and purpose were derived from the BRR Project Plan (BRR SC 2005). KRAs, KPIs and associated methodologies were combined for this evaluation and obtained from a range of sources (literature review, project plan, project database, stakeholder interviews and other related documents).

TABLE 3. MERI FRAMEWORK DEVELOPED FOR EVALUATION OF BRR

EVALUATION LEVEL	PROGRAM LOGIC	PERFORMANCE INDICATORS (Focus questions)	M&E METHODS
Goal (Impact)	Improve economic and socio-political environment in Boorowa Catchment as it relates to water quality and riparian biodiversity (adapted from BRR Project Plan, BRR Steering Committee 2005)		
Purpose (Outcome)	Improve riparian ecosystem services for agricultural production water supply and environment (adapted from BRR Project Plan, BRR Steering Committee 2005)		
Key result areas (KRA) *Target groups* – Primary producers *Key stakeholders* – LCMA – BCLG – TransGrid – Rural community – Greening Australia Ltd – Australian Government – State government – Corporate investors *Broad stakeholders* – Urban community – Research institutions (Land & Water Australia, CSIRO) – Educational institutions (Canberra University) – Rural residential landholders	KRAs KRA 1: (Reactions) – Stakeholders aware of and inspired to improve riparian condition in target areas in association with, or via, BRR.	KPIs KPI 1 – Level of enquiries – Types of enquiries – Resulting site visits – Attendance at events	Apply across all KRAs Database / GIS / monitoring records: – riparian zone sustainably managed or rehabilitated (km and ha) – number of new enquiries – number of site visits – number of people accessing incentives – project planning document analysis (works, costs, contributions etc) – improvements in water quality (long term) – ecological improvements (long term) Case studies of individual projects: – productivity increases – project details – people engaged – range of examples – practise change Surveys, interviews: – willingness to be involved – landholder views about project implementation and outcomes on their land – confidence in project and outcomes – non-participants — why they are not involved
	KRA 2: (Capacity) – Stakeholders understand issues of poor riparian management and have knowledge and skills to take action and make decisions.	KPI 2 – Knowledge attitudes skills aspirations (KASA) change – Improvements in understanding about riparian management – Greater numbers of landholders undertaking on-ground works – Changes in attitudes towards riparian zone management	
	KRA 3: (Practice change) – Fifty primary producers take up incentives to rehabilitate 50 km of riparian zone.	KPI 3 – Landholders undertaking on-ground works – Evidence of stakeholder contribution – Level of uptake of on-ground incentives – Types of on-ground works – On-ground works undertaken	

EVALUATION LEVEL	PROGRAM LOGIC	PERFORMANCE INDICATORS (Focus questions)	M&E METHODS
	KRA 4: (Short and long term stakeholder engagement and governance) – Stakeholder confidence in aims, objectives and processes of the project is high, and feel an important part of the process.	KPI 4 – Stakeholders feel valued – Stakeholder views incorporated into project planning – Confidence that actions will result in outcome – Satisfaction with advice and information – Evidence new ideas considered and utilised – Stakeholders influence others	Apply across all KRAs (continued) Written materials: – number of fact sheets, reports, brochures produced and distributed – feedback on information provided Workshop and event records: – attendance – observation – topics discussed – process – evaluation forms and comments – generation of ideas – number of stakeholder enquiries – number of handouts taken Personal interviews, meetings and site visits: – documented concerns and opinions – appropriateness of project in line with needs – number of meetings and written minutes – feedback after meetings
	KRA 5: (Short and long term on-ground outcomes) – Fifty km of riparian zone is rehabilitated resulting in improved water quality, biodiversity and sustainable farm and catchment management benefits including increased productivity.	KPI 5 – Types of riparian rehabilitation undertaken – Quality of works – Impacts of works on water quality, biodiversity, sustainable farming and ecological systems – Increased economic benefits on farm and to local community	

BOOROWA RIVER RECOVERY

TABLE 3. (CONTINUED)

EVALUATION LEVEL	PROGRAM LOGIC	PERFORMANCE INDICATORS (Focus questions)	M&E METHODS
Engagement strategies	*Communication* – fact sheets on best available science relevant to different audiences – media (mostly local papers) – email distribution via existing networks *Papers/publications* – case studies – meeting minutes and outcomes – reports *Two way communication* – workshops – training events – demonstration field days and tours – stakeholder forums – planting events – individual site visits – meetings with agencies to ensure alignment with priorities – meetings with community leaders	Fact sheets – number distributed – target audience reached – quality and relevance of information Media articles – topics, key messages, positive or negative Email/web based networks – number of enquiries – number of hits – number and types of people receiving information Attendance at, and contribution to, group events, workshops and field days/tours – number of people – types of people (demographics) – new enquiries generated – new ideas generated – satisfaction with events – interaction between participants – level of awareness of issues Landholder understanding and uptake of incentives resulting in on-ground outcomes – number uptaking incentives – number not uptaking incentives – speed of uptake – works undertaken – number of km rehabilitated – quality of works – satisfaction with project processes Partner agencies/governing bodies willingness to be involved with project – topics discussed – types of meetings – agreed outcomes – contribution of staff time (in-kind) from agencies	Records of fact sheets distributed Follow up surveys Media monitoring including letters to editor Event feedback: – attendance list – evaluation forms on event management, quality of information, usefulness of information, follow up (planned action), knowledge gained – observation – targeted interviews – records of follow up enquiries and resulting site visits – information distributed – evaluation surveys Database and program records: – records of feedback – landholder enquiries – incentives and in-kind contribution Satellite imagery/GIS mapping: – extent and types of works Surveys: – written surveys – telephone surveys – interviews – transcripts – demographics – statistical information – qualitative information—comments Meeting minutes Direct discussion, feedback transcripts Website analysis was deliberately omitted as it was not a primary monitoring tool. Information about BRR was on LCMA and GA websites but there was not a specific BRR website

SECTION 6

Green Team replanting.

Boorowa River Recovery evaluation findings

6.1 Project outputs assessment

6.1.1 Methodology

Details of individual on-ground works projects were recorded in a database developed by GACR. Information collected included landholder personal details, works undertaken (length of fencing, watering options, tubestock planted, direct seeding, willow control, erosion control and structural works), project incentives, landholder contribution and other details such as property size and site description. These records, along with landholder interviews, were used to assess outputs.

6.1.2 Results and discussion

Project outputs met or exceeded original targets, with 60 landholders (17% above target) undertaking rehabilitation works along 80 km of riparian areas (38% above target), comprising 640 ha (61% above target) (GACR 2013). The uptake of incentives over and above targeted levels indicates high landholder interest resulting in significant on-ground action. For example, a continuous 29 km stretch of the Boorowa River was rehabilitated with only two from 19 farmers deciding against taking part in the project (GACR database 2013). The average project area was 11.6 ha which is sizable compared with similar projects. Ede (2011) found that 2.3 ha was the average size of riparian rehabilitation projects in Victoria.

Ongoing monitoring has shown works have been maintained and landholders interviewed were happy with their projects five to seven years later (Gould 2013). Landholders contributed an average of 40% in cash and in-kind contributions and agreed to 10 year management agreements (GACR database 2013), demonstrating a strong commitment to the project.

Landholders interviewed all felt their contribution was important as it meant they had control over works undertaken. One Rye Park farmer reflected others' views:

> "I am happy to contribute because I knew what needed to be done and could ensure things went to plan."

Appendix C contains four case studies.

Originally, no targets were set for broad community engagement but more than 1000 people became involved, taking part in over 100 events (Gould 2007). Appendix A contains more details.

EVALUATION SUMMARY OF PROJECT OUTPUTS AGAINST KRAs AND KPIs

KRA	**KPI**	**Result** (in relation to outputs)
KRA 1: Stakeholders aware of and inspired to improve riparian condition in target areas in association with or via BRR.	– Level of enquiries. – Types of enquiries. – Resulting site visits. – Attendance at events.	– Exceeded targets. – Diverse. – Exceeded targets. – Very high.
KRA 3: Fifty primary producers take up incentives to rehabilitate 50 km of riparian zone.	– Landholders undertaking on-ground works. – Evidence of stakeholder contribution. – Level of uptake of on-ground incentives. – Types of on-ground works. – On-ground works undertaken.	– KRA exceeded by 17%. – Very high. – KRA exceeded by 17%. – Diverse. – KRA exceeded by 38%.
KRA 5: (Short and long term on-ground outcomes) Fifty km of riparian zone is rehabilitated resulting in improved water quality, biodiversity and sustainable farm and catchment management benefits including increased productivity.	– Types of riparian rehabilitation undertaken. – Quality of works. – Impacts of works on water quality, biodiversity, sustainable farming and ecological systems.	– Diverse. – High. – Targets exceeded by 38%.

6.2 Environmental outcomes assessment

The BRR monitoring program involved several approaches:

– on-ground data collection,
– investigation of water savings associated with willow control,
– fish surveys,
– photo monitoring and aerial surveys.

6.2.1 On-ground data collection

METHODOLOGY

Environmental monitoring designs were developed by GACR in 2007 with assistance from CSIRO, and 20 from 47 potential river recovery sites were chosen for this purpose. Four sites were monitored within each of the five 'work type' categories:

1. Fencing and revegetation of erosion gullies (GFR).
2. Structural works, fencing and revegetation of erosion gullies (GEW).
3. Fencing and revegetation of streams (CFR).
4. Willow control, fencing and revegetation of streams (W).
5. Fencing for protection (P).

Right: Fencing and revegetation of erosion gullies (GFR). Below: Structural works, fencing and revegetation of erosion gullies (GEW). Below right: Fencing and revegetation of streams (CFR). Below centre: Willow control, fencing and revegetation of streams (W). Bottom: Fencing for protection (P).

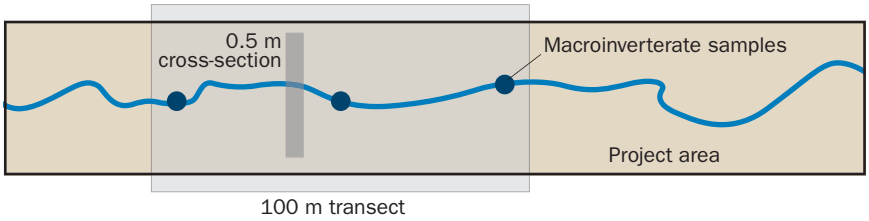
Each project (or treated) site was paired with a control (or untreated) site so they could be compared (total of 40 sites monitored). Initially, sites were randomly chosen—within each work type—but this was refined due to suitable control sites, access, land manager support and long-term tenancy. Data was collected by GACR staff not working on BRR to reduce any pre-conceived expectations.

Limited resources meant monitoring indicators focused on vegetation, macroinvertebrates and erosion instead of water quality because it is resource intensive and difficult to link on-ground interventions directly to results. Indicators were chosen to demonstrate ecological improvement with the likely effects on water quality extrapolated from existing research.

Each monitoring site comprised a 100 m transect including the riparian zone on both sides. Assessments covered:

– description of site, vegetation community and structure, regeneration of woody species, willow invasion and land use,
– measurement of gully and streambank erosion using CSIRO's ephemeral streams assessment (Machiori, Tongway & Loch 2003) which estimates bank stability as an indicator of erosion activity.

FIGURE 2. Design of M&E data collection.



Each transect contained a 0.5 m cross-section for specific vegetation assessment including groundcover. This assessment aimed to examine changes in percentage of plant cover.

Macroinvertebrate sampling was carried out at three sites evenly spaced along the transect where habitat was available. Presence of, and sensitivity to, water quality was noted for each genus using SIGNAL 2 (Chessman 2003) which is a common methodology for monitoring macroinvertebrates as an indicator of water quality. Figure 2 shows data collection design.

Dr Rob Hale (Melbourne University) and Dr Paul Reich (Department of Sustainability and Environment, Victoria) were commissioned to statistically analyse the data for this report, as both have recognised experience in researching ecological responses to riparian restoration. Of the 20 control sites, four were rehabilitated (because of landholder enthusiasm) while two of the project sites had works delayed. Instead of excluding this data, the sites were recoded to match their actual, rather than intended, status. The four 'treated' control sites were recoded as project sites and the two delayed project sites became controls.

Linear mixed effects models (Hale & Reich 2013) were used to examine if a range of response variables relating to vegetation, macroinvertebrates and stream geomorphology had responded to riparian treatments.

Protocols outlined in Logan (2010, cited by Hale & Reich 2013) were used to assess the potential influence of three factors: 1) riparian treatment method (type), 2) site treatment (control and project) and 3) year of treatment. Many of the variables were scored in categories (i.e. <10%, 10–50%, 51–80%, >80%) and for analysis, these were converted to single number scores before analysis (i.e. 1 = <10%, 2 = 10–50%, 3 = 51–80%, 4 = >80%).

ON-GROUND DATA RESULTS

Analysis of data collected from the 0.5 m vegetation cross-sections did not reveal consistent statistical responses to riparian works over time, or when compared with control sites. Appendix D shows statistical analysis for the cross-section data, which included three factors:

1. Riparian treatment types (five work categories).
2. Control and project sites (for comparative purposes).
3. Year of data collection (three samples over six years).

For the 100 m transects, differences were observed between control and project sites (refer to Figures 3–8) over six years of sampling. Only the more distinct statistical results are presented in this report. Appendix E contains full analysis and additional graphs.

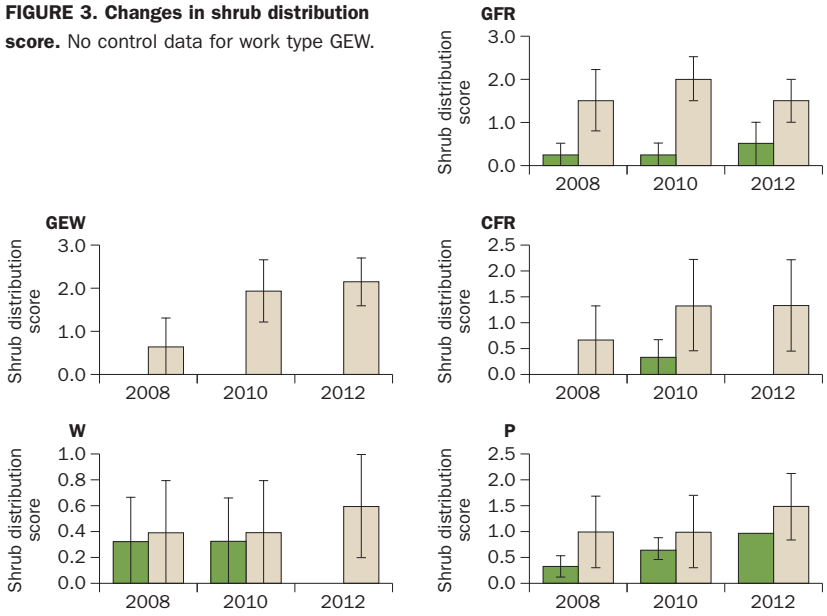
KEY TO FIGURES 3–8
Data shows changes at control and project sites over six years of sampling for each work type.

Work (or treatment) type

GFR Fencing and revegetation of erosion gullies
GEW Structural works, fencing and revegetation of erosion gullies
CFR Fencing and revegetation of streams
W Willow control, fencing and revegetation of streams
P Fencing for protection

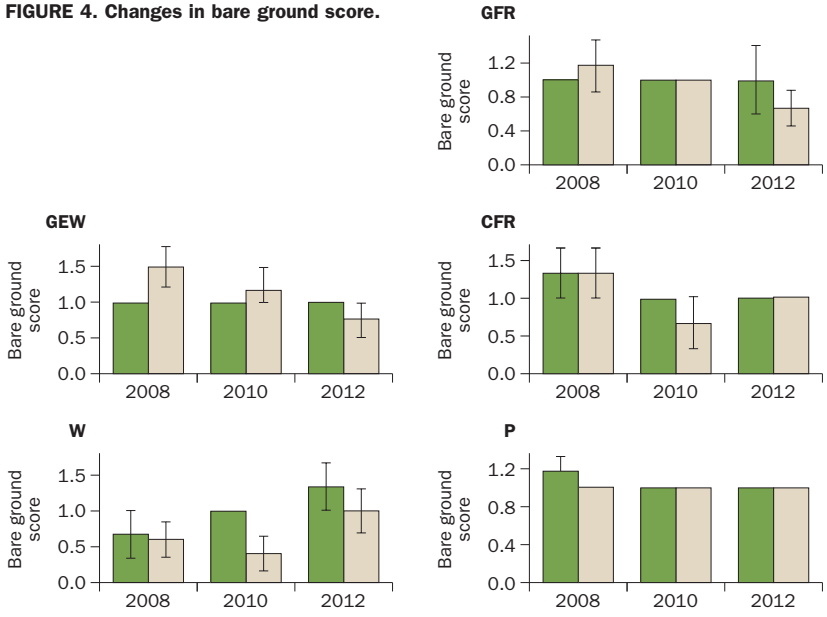
Green = control sites
Beige = project sites

FIGURE 3. Changes in shrub distribution score. No control data for work type GEW.



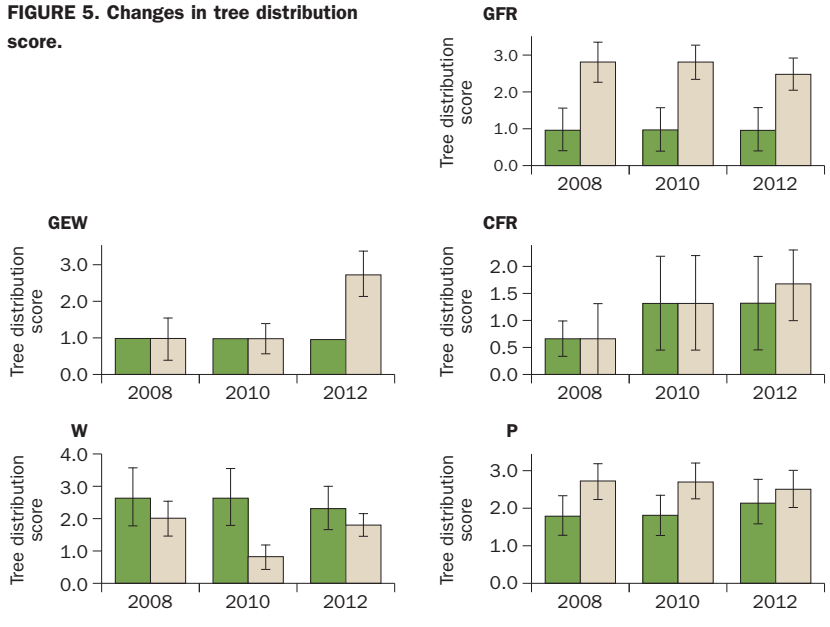
Shrubs increased over time at all project sites, whereas available control sites remained relatively stable, or increased slightly.

FIGURE 4. Changes in bare ground score.



Bare ground was strongly related to the types of intervention works. For CFR and GEW projects, bare ground decreased over time while control sites remained constant. Bare ground decreased in GFR sites and increased in later years (possibly responding to high rainfall). For willow project (W) sites, bare ground increased (although willow control sites also increased), and protection (P) sites remained static.

FIGURE 5. Changes in tree distribution score.



KEY TO FIGURES 3–8
Data shows changes at control and project sites over six years of sampling for each work type.

Work (or treatment) type

GFR Fencing and revegetation of erosion gullies
GEW Structural works, fencing and revegetation of erosion gullies
CFR Fencing and revegetation of streams
W Willow control, fencing and revegetation of streams
P Fencing for protection

Green = control sites
Beige = project sites

Tree distribution score increased slightly or remained stable over time in project sites, except at willow control sites where tree cover decreased. As with bare ground, this indicator was strongly linked to the work types undertaken.

FIGURE 6. Changes in litter score.

Litter score decreased at all treatment types, mainly because of flooding in 2010 and 2012, washing litter away in all but treatment GEW which is probably due to earthworks controlling water flow (e.g. dams, contour banks etc).

KEY TO FIGURES 3–8
Data shows changes at control and project sites over six years of sampling for each work type.

Work (or treatment) type

GFR Fencing and revegetation of erosion gullies
GEW Structural works, fencing and revegetation of erosion gullies
CFR Fencing and revegetation of streams
W Willow control, fencing and revegetation of streams
P Fencing for protection

Green = control sites
Beige = project sites

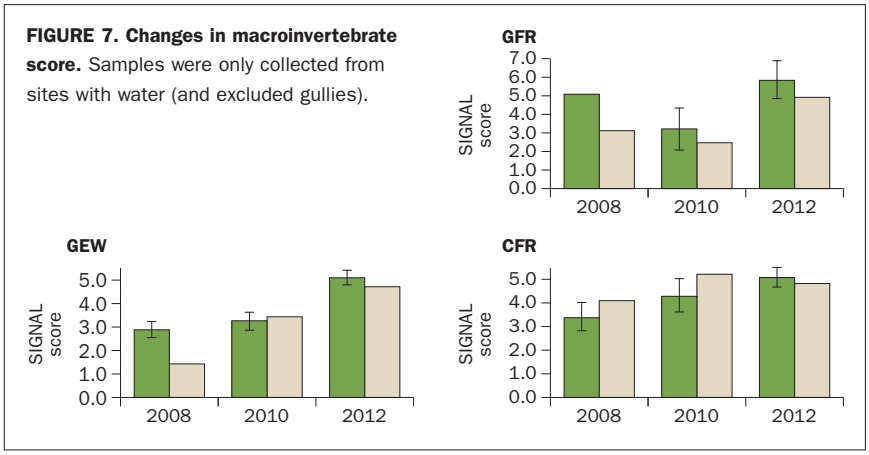


FIGURE 7. Changes in macroinvertebrate score. Samples were only collected from sites with water (and excluded gullies).

Macroinvertebrates showed little differences between project and control sites, or over time, and all sites followed similar patterns from year to year.

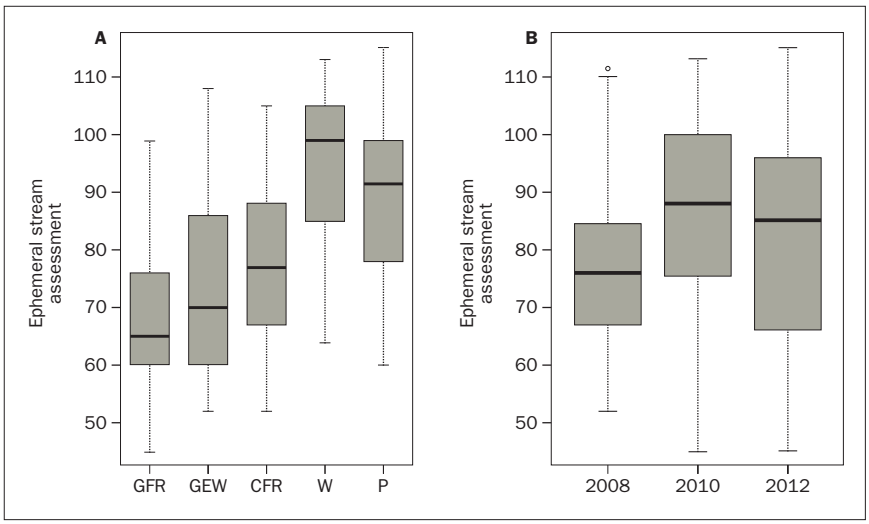


FIGURE 8. Differences in ephemeral stream assessment across A) riparian work types and B) over the six years of sampling. Greater scores represent higher soil stability.

Soil stability did not statistically differ between project and control sites (and is not presented here), but it did differ between **A**) treatment methods and **B**) across the six years of monitoring. Soil stability was higher at willow (W) and protection (P) sites. Fenced and revegetated creeks (CFR) were more stable than both gully sites (GFR and GEW). GFR sites were more unstable overall than sites where earthworks took place (GEW).

Soil stability improved over time. It was notable in 2008–10 and decreased slightly in 2010–12.

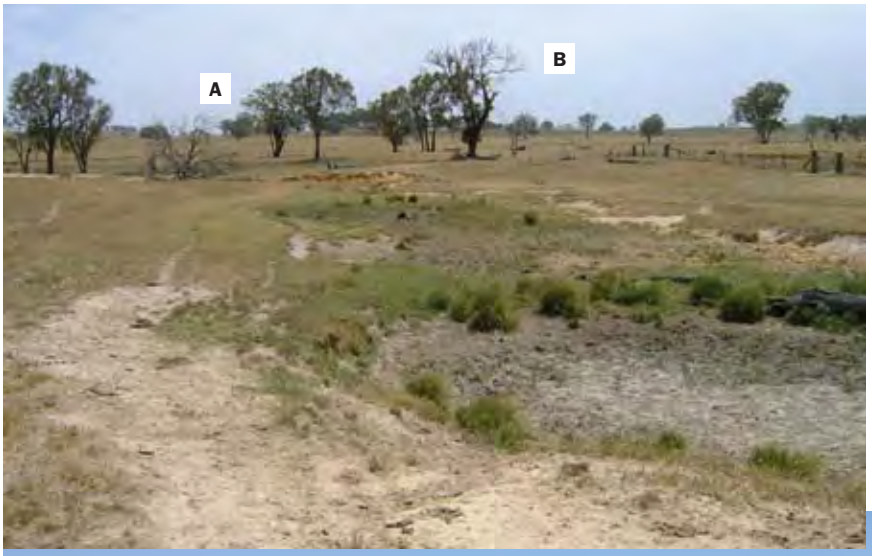
ON-GROUND DATA COLLECTION DISCUSSION

The results presented in this report provide a snapshot of some ecological responses to riparian rehabilitation works. More detailed results are in Appendices D and E.

The most likely explanation for the lack of responses detected in cross-section sampling is high-within-site variability for vegetation indicators. This is consistent with other work, such as the Riparian Restoration Experiment (Reich, unpublished data). It was concluded that significantly increased replication (i.e. more transects per site) would be required for BRR, or transect data collection dropped altogether (Hale & Reich 2013).

Results for transect data show ecological responses are strongly linked to the work types undertaken and the site's condition before intervention. For example, willow control works produced a different response for bare ground compared to other treatment methods. Similarly, protection works (where existing riparian remnant vegetation was protected) showed a response for both regeneration and shading, whereas other sites were not mature enough to illicit a shading response.

The statistically significant increase in shrub cover at all project sites (except those where 'protection' works took place) is probably due to revegetation where understory plants were planted to enhance remnant vegetation, rather than natural regeneration. Most sites, based on initial site assessments (GACR 2013) did not have remnant understory plants for this to have occurred naturally.



Boorowa River headwaters in 2006 (left) and 2013 illustrating a decrease in bare ground and increase in shrubs. Note comparison points.

LORI GOULD

Rock armouring, fencing and revegetation. Soil is stabilising and planted trees and shrubs are increasing. Top photo: 2007, above: 2010, and right 2012.

Soil stability results differed between work types. This is likely related to the site's characteristics before works rather than from intervention activities. That is, some sites were more stable than others before works took place (e.g. gully versus protection site) and although there were differences between work types, there was little difference between control and project sites.

Interestingly, willow control sites scored the highest for stability. This is a significant finding as erosion is often a reason cited for not removing willows (Gould 2013 pers. obs.).

Rapid regeneration of groundcover after willow control could explain high soil stability scores and little difference for bare ground between control and project sites.

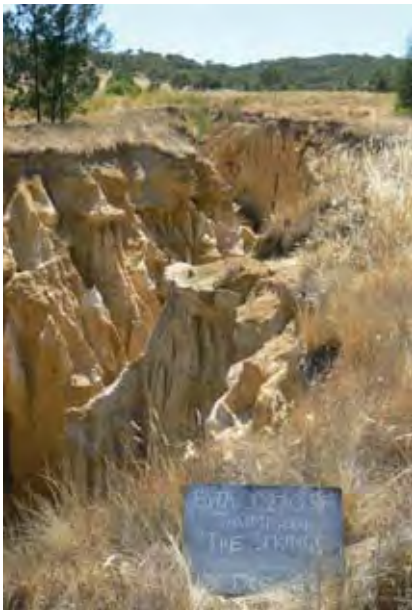
Protection of refugia along Pudman Creek in 2010 (left) and 2012.

Macroinvertebrate SIGNAL 2 scores increased over time, and similar patterns were followed between control and project sites. This suggests a relationship between macroinvertebrates and flooding associated with increased rainfall in latter years (following drought), as more surface water and increased dispersal of aquatic invertebrates is related.

Results of BRR data are consistent with the limited amount of research available on ecological outcomes of riparian rehabilitation. Lake, Bond and Reich (2007) highlighted the importance of refugia and longitudinal connectivity for wildlife movement and ecological stream function. Increased shrub cover at project sites and the high level of project connectivity, should continue to improve outcomes over time.

Burger, Reich and Cavagnaro (2010) found that changes in soil and vegetation properties after riparian restoration showed an ecological improvement. In the case of BRR, bare ground was decreasing at all sites except for willow control where it was increasing.

Once fenced, grass cover increased by 2010, followed by growth of planted trees and shrubs. Changes to ecology take time. Note person circled in photo on left.



Ecological improvement takes time.
Photo Col Ellis.

Projects of a large spatial scale, like BRR, are critical to ecological response and need to be managed over a long time frame with continued intervention (Lake, Bond & Reich 2007). In essence, it is likely BRR will result in ecological improvement because of trends in this direction if it continues to be managed appropriately. Results of monitoring and landholder interviews indicate this is occurring.

Ecological analysis becomes more complex with external factors (drought, floods, kangaroos, fire) presenting a challenge to achieving ecological outcomes. In the case of BRR, 2008 was a severe drought, 2010 experienced above average rainfall and two major floods, which was the likely reason for decreased litter and snags in 2012 monitoring data.

The main message to come from the BRR monitoring program is that although outcomes are trending in a positive ecological direction, there is significant variability, both within and between sites. There is a long time frame for ecological response to intervention, and the difficulty in monitoring of this kind needs to be recognised. It also highlights that the quality of sites before intervention plays an important role in determining long-term environmental outcomes.

Further analysis is planned for late 2013 to take into account drought, floods and different treatment types, and to compare findings with other research such as the Riparian Restoration Experiment. It has been determined the BRR data collected is sufficient for this to occur (Hale 2013 pers. comm.).

6.2.2 Water savings and willow control

Water savings in relation to BRR willow removal along a continuous 29 km stretch along the Boorowa River above the town water supply was investigated. The target area was a mix of willows and remnant vegetation, with significant willow infestations in many areas.

An observed increase in water flow by several landholders was noted after willow removal, particularly in areas where they were the dominant species. Comments from two interviewed landholders who removed willows include:

> "Water quality is better … no brackish smell and oily water anymore [from leaf drop] … waters a lot clearer and can now hear more frogs … been looking at that river a long time, lived here all my life and waterholes dried up during drought with the willows there and didn't before the willows took over." and
> "Water is cleaner and purer and there is more of it."

These observations are supported by research undertaken by CSIRO (Doody & Benyon 2011) who estimated that savings of up to 5.5 ML/ha of crown canopy can be made removing in-stream willows and replacing them with River Red Gums. Using this research and by calculating willow crown canopy (using GIS technology), water savings for the 29 km stretch along the Boorowa River was calculated at 3–5.5 ML/ha of crown canopy. This equates to estimated water savings of 39–57.2 ML per annum above the Boorowa town water supply.

Additional discussions with CSIRO (Doody 2009 pers. comm.) confirmed this as a realistic estimation. Additional water became available for the Boorowa town water supply and for landholders relying on the river for stock and domestic use.

Willow control along Boorowa River in 2005 (top) and 2008. Photos Col Ellis.

6.2.3 Fish surveys

Fish surveys took place in 2008 at nine sites along an 18 km stretch of the Boorowa River to obtain baseline data on fish populations, and at four sites along Pudman Creek from 2005 to present, to monitor the survival of a translocated population of Southern Pygmy Perch. Both surveys were undertaken in partnership with NSW DPI Fisheries, who were commissioned to complete the surveys along the Boorowa River. Pudman surveys were part of a wider NSW DPI Fisheries monitoring program.

Results for the Boorowa River showed high numbers of introduced fish (four species and 83% of fish sampled) and a low diversity of native fish (three species and 17% of fish sampled). One native fish, the Flathead Gudgeon, had particularly high numbers and constituted 16% of the native fish sampled (Knight 2008).

This information is baseline data and further surveys have not yet occurred. Fish populations can take many years to change and it is feasible to wait until there is a greater change in ecological conditions at project sites (as indicated by the M&E program). An unexpected finding of the surveys revealed that 7000 fingerlings introduced by the Boorowa Fishing Club over a seven year period had not survived, and more work is needed to improve conditions for native fish before any future releases.

Southern Pygmy Perch found in Pudman Creek. Photo Luke Pearce.

Main photo: Spectators at a NSW DPI Fisheries electrofishing survey. Inset: Flathead Gudgeon.

By contrast, Pudman Creek was shown to support diverse native fish populations and contained no introduced species. The population of Southern Pygmy Perch was surviving well, and surveys in 2013 recorded juveniles, indicating that fish are breeding (Pearce 2013 pers. comm.). This is significant because the natural population they were translocated from—in an adjacent catchment—were found to be struggling because of increased numbers of introduced Redfin Perch.

Fish surveys helped inform project planning. For example, survival of Southern Pygmy Perch has been attributed to the diversity of macroinvertebrates linked to diverse riparian vegetation and the lack of introduced species (Pearce 2013 pers. comm.). This is despite the fact the creek is affected by salinity and significant erosion (Langford et al. 2005). One BRR sub-project 'Pygmy Perch in the Pudman' was developed and implemented to protect and extend riparian remnant vegetation along the Pudman to help survival of this species.

Before takeoff.

6.2.4 Photo monitoring and aerial surveys

Visual monitoring along the Boorowa River and Pudman Creek was taken by professional video and still photography by helicopter in 2005 and 2008. On-ground photo monitoring has been extensive. This has shown the extent of works, changes in groundcover, growth of revegetation, and changes relating to willow control. Almost all sites showed some visual improvement, and although this does not measure ecological function, it is useful to show project progress, and changes to landform and vegetation that could complement the ecological monitoring program over time.

Revegetation of gully in 2005 (far left) and 2008 (left). Photos Col Ellis.
Below: On-ground close up of same gully.

The BRR environmental M&E program is multi-dimensional. Overall, the picture forming is positive with on-ground works being completed and maintained, positive trends emerging in ecosystem response for a number of variables, improvements to water availability from willow removal, and positive responses for native fish in the Pudman Creek.

BRR is large scale and project sites are well connected in terms of longitudinal habitat which is consistent with research advice. A critical factor of long-term success will be ongoing maintenance and monitoring, and further projects / programs that build on work completed will be informed by monitoring results. Broader adjacent land use activities will need to be incorporated into future analysis of BRR sites.

EVALUATION SUMMARY OF ENVIRONMENTAL OUTCOMES AGAINST KRAs AND KPIs

KRA	**KPI**	**Result** (in relation to environmental outcomes)
KRA 5: (Short and long term on-ground outcomes) Fifty km of riparian zone is rehabilitated resulting in improved water quality, biodiversity and sustainable farm and catchment management benefits including increased productivity.	KPI 5 – Types of riparian rehabilitation undertaken. – Quality of works. – Impacts of works on: = water quality = biodiversity = sustainable farming = ecological systems – Increased economic benefits on farm and to local community.	– Diverse, five types. – High and maintained. = Difficult to ascertain at catchment level. On-site anecdotal improvements. = Positive trends for some variables. Complex. Longer time frame required. Good site linkages. = Water savings from willow control. Better stock management. = Positive trends for vegetation, soil stability and fish. Longer time frame required. Southern Pygmy Perch breeding. – Difficult to determine. Not enough information.

Remnant protection works.
Photo Col Ellis.

6.3 Socio-political analysis

Information on stakeholder views was gathered from two main sources:

1. Large scale social survey carried out by GACR (Andrew 2011) across the south-east region of NSW.
2. Interviews conducted by the author, with 12 individuals representing key BRR stakeholder groups.

Database records, meeting minutes and other correspondence, underpins this information as outlined in the MERI framework.

6.3.1 Methodology

LANDHOLDER SURVEYS

Surveys were conducted by GACR in conjunction with the ACT NRM Council in 2011, and ACTewAGL in 2012 (Andrew 2012). Surveys were sent to 2700 landholders across 33 postcodes in south-east NSW and the ACT, with 430 (representing 466 landholders) being returned. The purpose was to gain an idea of their understanding and behaviour of NRM with a focus on water.

Since surveys covered a broad region and a variety of demographics, only information relating to the project area is used in this report. BRR covers four postcodes and information was obtained from 102 landholders who collectively manage 65,131 ha.

STAKEHOLDER INTERVIEWS

Further to the broader survey, 12 participants in the BRR project were interviewed by telephone or in person. They included:

- five landholders (including one non-participant),
- two LCMA staff members,
- one LCMA Board member,
- one councillor (Boorowa Council),
- two BCLG representatives,
- one TransGrid staff member.

Questions were sent to participants before they were interviewed. Individual responses were summarised and returned for confirmation and consent before any information was used. Participants have not been identified.

The stakeholder interviews complied with the University of Queensland's ethics procedures and policies and the School of Chemical Engineering Ethics Sub-Committee reviewed and approved this work.

The purpose of these interviews was to provide qualitative insight for this report from a representative group of stakeholders closely involved with BRR. The sample size is too small to be statistically analysed but provides valuable data.

A summary of interview questions and responses is in Appendix F.

6.3.2 Socio-political evaluation results and discussion

Socio-political analysis has been divided into an evaluation of project governance, human resources and engagement. Results and discussion for these sub-sections are presented together.

PROJECT GOVERNANCE

BRR was governed by a Steering Committee (see section 4.3) with representatives of major stakeholders, to ensure a diversity of views were considered. The most significant role of the BRR Steering Committee was during the project's development phase.

One committee member commented:

> "All parties were able to reach agreement on project direction and believed in what they were doing, there was a high degree of trust which was a great strength of the project."

An LCMA Board member sums up other interview responses concerning project governance:

> "It was a good approach; brought together people with differing points of view to work towards a common goal."

Although the Steering Committee worked well bringing people together, some felt there could have been more 'hands on' engagement by other members.

> "Some parties that sat on the Steering Committee such as Council, were there in support, but did not have an active role in the project."

Further, three interviewees thought it would have been beneficial if they had been more involved. An example was the willow control component of BRR.

> "It would have made sense to engage Council's expertise and machinery in willow control works rather than getting external contractors."

It was suggested that more could have been invested early in the project by engaging a broader range of Council staff.

> "Some field days with Council staff (especially those that manage water treatment) linking catchment management to water quality in the town water supply would have been of benefit."

Barriers to fish passage.

An example is when Council were engaged to construct fish ladders on three weirs along the Boorowa River. Insufficient planning and poor communication, meant the sub-project did not eventuate and significant funds were returned to the funding body. Senior Council staff were responsible for the planning (agreeing to the sub-project and signing the grant application). However those due to carry out construction were not aware of the sub-project until it was to start. Construction of fish ladders was outside the experience of Council staff and despite designs being provided by an expert, it was too challenging. If on-ground staff had greater understanding and input into the sub-project there may have been a better outcome.

Conversely, this observation comes from a BRR SC member who has since become a Councillor:

> "Council want environmental outcomes and the support of the community but Council should only provide a support role. They view Landcare and the LCMA as being responsible for the environment as Council are more focused on municipal services. They are happy to support specific activities but there are no resources to undertake more. However, things are likely to have been different now with a subsequent change in engineering staff and general management."

This example shows what 'active' engagement really means, giving insight into some of the challenges faced when implementing projects with multiple players. Project planning and sound communication is especially important early in project development, along with a clear understanding of the capacity, conditions, conflicts and constraints (Patterson, Smith & Bellamy 2012). Idealism has to balance reality to make a project work, and must consider an array of conflicting viewpoints of which no particular one is necessarily correct, or better than another.

BRR SC initial tour July 2005.

Another issue identified by one LCMA interviewee was that equal weighting was given to all members on the Steering Committee, regardless of their contribution or involvement in the project.

> "LCMA invested heavily but were recognised for their contribution at the same level as those not contributing as much."

This is a valid point, and is difficult to address with a 'bottom up' community driven project, especially where government agencies usually have more resources to contribute. There is a fine balance between true community ownership of a project when relying on government and corporate support. Although not impacting LCMA support of the project, it was identified as an issue at staff and Board level, and more effort could have been made to address it, given the LCMA contribution to BRR was significant and critical to project success.

A Steering Committee member representing corporate support for BRR had a different view on governance, observing that the project was largely based on trust. This refers to the fact there was no formalised governance structure (although there was a 'Memorandum of Understanding' between GACR and LCMA), and landholder agreements were not linked to their property title (to minimise bureaucracy). He wondered:

> "Whether there were enough processes in place that if things went wrong, the trust model would stand up to scrutiny if applied in a different setting, over a larger geographic area, or in the case where there was more conflict."

Another perspective from an LCMA Board member:

> "Governance has to be careful not to become too risk averse so that people don't get put off by bureaucratic processes, but at the same time needs to remain accountable. The project balanced this well."

Both perspectives highlight that any governance structure (and associated processes) needs to be appropriate to the context in which a project is being implemented. Patterson, Smith and Bellamy (2012) reported similar findings when analysing comparable case studies in south-east Queensland. They found context-specific dynamic, social and institutional factors have a strong bearing on project success.

Many landholders were unable to comment specifically on governance, as they were not engaged at that level. Perspective on governance appears to depend on an individual's specific role in BRR, and is against the backdrop of the values and viewpoints of the stakeholder groups they represent.

The history of NRM governance in the Lachlan Catchment is relevant to BRR as it influenced project direction and resourcing. Since 1998, NRM in the Boorowa Catchment was largely community driven, until 2004 when the LCMA was set up and coordinated the majority of on-ground works. Many Landcare groups disbanded or amalgamated at this time with reduced funding available for projects. Several landholders, Landcare and LCMA representatives commented:

> "Some people within Landcare viewed the establishment of the LCMA as government taking over and the first public meeting with the Boorowa community was bitter. The LCMA were hammered by the community. It was a very toxic environment."

Project managers noted some negativity towards the LCMA during site visits early in the project. The level of negativity has significantly reduced since the community has become more engaged with the LCMA through various projects and programs including BRR (Gould 2013 pers. obs.).

BRR began in 2005, coinciding with the afore-mentioned changes to catchment management. Through the NGO–government–community partnership, Landcare could access resources during trying times. LCMA, through BRR, were able to demonstrate their support for a community governed project (and show they were not 'taking over'). This situation—although not planned this way—was fortunate, and it likely contributed to the high level of landholder involvement, and strong commitment of partners.

BRR effectively finished in terms of new works in 2010, but continued with project monitoring and maintenance. Steering Committee meetings were less often and ultimately members were updated via email. One member summarised the viewpoint of several participants:

> "The project petered out with no formal wrap up —just kept ticking along. It would be good to see a formal transition to the new project 'Rivers of Carbon' and get some feedback on lessons learnt—happens with a lot of projects in that they are never written up to inform others."

It is intended this report may form the basis of communicating BRR outcomes back to stakeholders.

Governance for BRR was strong overall and the partnership model appears to have been successful, although there was a need for more active engagement by some members and better recognition for others. Community ownership is important, providing risk is minimised without becoming too bureaucratic. Successful governance is a balance between a range of factors, and applicability depends on the players involved and the context within which a project is being implemented. Often a project is replicated without consideration of all the factors that made it successful and subsequent projects then fail. It is important to consider all the success factors in this regard.

EVALUATION SUMMARY OF PROJECT GOVERNANCE OUTCOMES AGAINST KRAs AND KPIs

KRA	**KPI**	**Result** (in relation to governance)
KRA 4: (Short and long term—stakeholder engagement and governance) Stakeholder confidence in aims, objectives and processes of the project is high, and feel an important part of the process.	KPI 4 – Stakeholders feel valued. – Stakeholder views incorporated into project planning. – Confidence that actions will result in outcome. – Satisfaction with advice and information. – Evidence new ideas considered and utilised. – Stakeholders influence others.	 – Mostly. More recognition needed for some contributors. – Mostly. A need identified for more active involvement of some stakeholders. – Yes. – Yes. High collaboration. – Yes. Equal weighting for members on SC, adaptive flexible governance approach. – Yes. High level of influence and collaboration.

HUMAN RESOURCES AND ENGAGEMENT

Environmental improvement relies on the capacity of people, who believe strongly in the actions they take. Bennett (1979) highlighted that for long-term behavioural change, the acquisition of knowledge is important to influence attitude, resulting in learning new skills and developing aspirations. Bennett describes this as 'KASA (knowledge, attitudes, skills, aspirations) change'. Human resources were valued as one of the most important components of BRR by all people interviewed, and a reason why on-ground works continue to be maintained and extended.

> "Human resources were the most important part of the BRR project especially with regard to lasting value." BRR SC member

Landholder engagement was a primary focus of BRR and occurred in various ways (as listed in the MERI framework). It included advertising through local media, 'door-knocking' and via existing networks such as Landcare. Appendix A provides examples of media coverage.

Word of mouth became the main means of communication once the project started. Sixty land managers agreed to undertake riparian rehabilitation on their properties over a relatively short time frame, and subsequent monitoring has shown these works are continuing to be managed for conservation at almost all monitored sites (GACR 2012).

The importance placed on human resources is also evidenced by the high number and diversity of people engaged with the project (Appendix A). Despite this, two Steering Committee members felt that broader community engagement could have been stronger, especially with those outside the catchment such as other NRM practitioners:

> "Communications were fairly good at the basic level—not sure how well it was known to the wider community. Be good to take it further especially since it was part of a national project to begin with."

Pudman Creek field day.

Inspecting revegetation success.

Canberra-based Aboriginal Green Team field tour.

Greening Australia's broader landholder surveys (Andrew 2011) found most respondents had undertaken some form of NRM activity such as revegetation (86%), fencing riparian areas (25%), and fencing remnant vegetation (39%). Less than 10% had done no NRM work at all. These findings indicate BRR did not operate in isolation. A range of NRM initiatives implemented over the past 20 years provided BRR with a strong platform to build on and partly explains the high level of landholder interest (over and above targets) in a relatively short project time frame of three years. This observation was reiterated by several interviewees:

> "The project built on the works of Landcare over the past 20–30 years. All these past projects have been important for BRR."

The following quote is from a landholder who completed two BRR projects:

> "Native vegetation on the property has multiplied since starting projects in 1997. Native animal life has increased — at least 57 bird varieties regularly seen at … [our farm]. Water and soil erosion areas have been rectified over most of the property as have salinity areas."

One person observed BRR was a single focus project and could incorporate more aspects of farm management under a similar model. Alternatively, another landholder commented:

> "Having an identified problem to focus on is a good thing. [It] enables people to understand what they are doing without it being too complex."

The dichotomy of viewpoints recognises the need for different BRR participation entry points. For example, as knowledge increases, people are able to take a broader view on NRM and deal with more complexity, but for people where these ideas are new, or represent a change in land management it was beneficial to start with a simple focused project and let their knowledge, attitudes and behaviour develop over time with experience. This is consistent with Bennett (1979) in relation to KASA change.

One landholder summarised this transition:

> "A major change in land management (from set stocking to holistic land management) involved a major change in mindset. This was a real barrier until the penny dropped one day. Even though the benefits are now obvious to me it is still hard to convince others. They have to come to the decision themselves in their own way."

Ironically, this landholder did not see value in fencing his creek from stock as he could manage groundcover and regeneration through changed grazing practices. He did, however, see the value of fencing riparian areas in traditional farming situations.

Another interviewee who chose not to be involved in willow control (despite both neighbours participating) said:

> "My partner really likes the willows and sees them as beneficial to the river. He is very strong on this point."

These landholders manage their block specifically for conservation (no stock). Their knowledge of NRM is considered good, but they have different views on the value of willows.

These examples show the various views on riparian lands management. All like to see the river improved but have different ideas on the best way to go about it.

The variation in the level of knowledge among landholders was also revealed in the surveys. Some comments indicated a straight forward point of view:

> "Removed stock from creeks, river." and
> "Erosion and wet spots managed better."

others were more complex:

> "Constantly seek to advance our knowledge and efforts to integrate primary production with the natural resource base outcomes." (Andrew 2011)

The variety of knowledge and perspectives reveal the need to offer a range of opportunities for people to become involved in projects such as BRR. The BRR model of individually tailored works agreements was a useful tool to facilitate this. An effort has been made to continue to engage landholders who chose not to undertake a BRR project, as they have been important in providing control sites for the environmental monitoring program, along with valid input into adaptive management.

Recent research into why landholders become involved in riverine restoration has found that private benefits—such as aesthetic improvements and a sense of land stewardship in the eyes of the broader community—tend to influence landholders (Januchowski-Hartley 2012). Disincentives included impracticality, a bias towards ecological outcomes rather than production outcomes and government distrust (Januchowski-Hartley 2012). BRR, intentionally or otherwise, overcame such barriers by making it easy to become involved (minimal bureaucracy), by addressing production outcomes (e.g. alternative water for stock which improved management outcomes) and by implementing the project through an NGO in partnership with government (rather than directly through government).

Local schools became involved.

Community engagement can depend on individual personalities.

Successful community engagement relies on a strong knowledge of the community where a project is planned. This can be difficult, as this knowledge often does not fully develop until a project is implemented. Individual personalities and level of collaboration with influential community leaders can also play a role. One landholder commented they appreciated BRR was implemented by an independent person (not from the community):

> "Outside person is better to negotiate works along the river rather than a local person—too many politics."

Another respondent appreciated having an outside project manager but felt:

> "Having them for a day a week or so in Boorowa [LCMA] office would have been of value."

Over time, with investment in social engagement, there is the potential to engage more people, but a deeper understanding of reasons why people do not become involved still needs to be investigated. This is complex, as it forms part of a deeper social fabric, and in many cases falling outside the capacity of a program to deliver on.

Training is another important component that fosters behavioural (KASA) change in relation to riparian rehabilitation. Incentives and advice alone cannot guarantee action, especially if people do not have the opportunity to properly expand their knowledge base.

Surveys (Andrew 2011) showed 22% of landholders in the Boorowa project area had undertaken some form of training regarding 'whole of farm' or 'property management planning' and a further 24% expressed an interest in doing it. Those not interested believed they already had the skills, did not have time, or felt it was not appropriate for them (Andrew 2011).

Formal training for landholders through BRR was minimal, and focused on provision of face to face advice and through written materials. Semi-formal training was provided via field days, workshops, meetings and forums.

Boorowa Environmental Education Program.

Formal training may be an area for improvement, through subsidised and easily accessible programs delivered by appropriate organisations. These could be tailored to suit a range of participants and offered on a voluntary basis, or even as a condition of receiving incentives. This may improve knowledge and understanding, and perhaps enhance a project long term.

Overall, BRR engaged the community to a high degree, and this allowed the involvement of people with a range of views and knowledge. Areas for improvement include: reaching out to the broader community more effectively (extending to those outside the catchment), better understanding the reasons for non-participation, consideration of local presence, and providing greater opportunities for training and formal knowledge acquisition.

EVALUATION SUMMARY OF HUMAN RESOURCES AND ENGAGEMENT OUTCOMES AGAINST KRAs AND KPIs

KRA	**KPI**	**Result** (in relation to human resources)
KRA 1: (Reactions) Stakeholders aware of and inspired to improve riparian condition in target areas in association with or via BRR.	KPI 1 – Level of enquiries. – Types of enquiries. – Resulting site visits. – Attendance at events.	 – Very high. Target exceeded. – Diverse. – Very high. Target exceeded. – Very high.
KRA 2: (Capacity) Stakeholders understand issues of poor riparian management and have knowledge and skills to take action and make decisions.	KPI 2 – KASA change. – Improvements in understanding about riparian management. – Greater numbers of landholders undertaking on-ground works. – Changes in attitudes towards riparian zone management.	 – Varied. Depended on their knowledge platform and beliefs to begin with. Some landholders did not change practices due to differing views on best way forward. Understanding improved for those involved. – Yes. External project managers (NGOs) was viewed as positive for some and less so for others. – Yes for most. Again, depended on beliefs and knowledge to begin with.
KRA 4: (Short and long term—stakeholder engagement and governance) Stakeholder confidence in aims, objectives and processes of the project is high, and feel an important part of the process.	KPI 4 – Stakeholders feel valued. – Stakeholder views incorporated into project planning. – Confidence that actions will result in outcome. – Satisfaction with advice and information. – Evidence new ideas considered and utilised . – Stakeholders influence others.	 – Yes. Long-term relationship with project. – Yes mostly relevant to landholders. Individually tailored works programs. Broader community less so. – Yes. Demonstrated by monitoring. – Yes overall. – Mostly but within confines of individual agreements. – Yes but not all landholders participated that were approached even when neighbours undertaking works.

Community surveying native plants.

6.4 Economic assessment

Economic outcomes are difficult to analyse specifically for BRR because it was implemented on a platform of past projects and evolving farming practices. There are also different ways of viewing economic outcomes, including direct financial benefits to landholders (e.g. incentives), stock management (shelter and off point stock water) and increased time availability (e.g. not having to muster stock from the river). Benefits may be felt downstream with improved water quality and biodiversity, and by the broader community because of purchasing materials from local suppliers.

To properly assess these outcomes, a link would have to be established between actions through BRR (producing outcomes shown to take several years to realise) and increased productivity. Confounding this, is that environmental benefits, although highly valued for other reasons, remain unpriced in the market (Cummins & Watson 2012).

In pure economic terms, Silar and Associates (2001, cited by Schofield, Chudleigh & Simpson 2007) looked at the private costs and benefits of riparian lands management through case studies and found only 19% of sites had a cost benefit ratio greater than one when landholders funded their own projects. Research into the dairy and sugar industry relating to riparian lands management (Agtrans Research 1998, cited by Schofield, Chudleigh & Simpson 2007) showed the public needed to contribute a minimum of 20% to the costs associated with changed land management for an individual farmer to gain a positive return, indicated by net present value of investment (Schofield, Chudleigh & Simpson 2007).

In BRR, landholders interviewed could not put a dollar figure on the economic outcomes of their projects, however, all stated (without exception) they would not have been able to undertake their projects to the degree they did (if at all), without financial help. BRR contributed an average of 70% of total project costs, and it is likely any increases in production could be considered a 'gain' in terms of the cost–benefit of an individual project.

One landholder commented:

> "Wouldn't have done it if there were no incentives—job way too big and expensive for individual landholders. Also not profitable."

From another:

> "Incentives meant that the cost of the project worked out even [didn't cost anything]."

One landholder revealed his family had been looking at a particular erosion gully (see photo pair below) for generations, he remembered his grandfather talking about fixing it with tyres and filling it with dirt.

> "We would have done something about it eventually but due to the cost it would have been done over a much longer time frame. Through the project we could fix it in one year."

2007.

2012.

Boorowa sheep. Photo Col Ellis.

Most landholders felt they had forgone land by fencing their riparian areas though many stated their stocking rates had not changed. This is confirmed by Cummins & Watson (2012) who found a reduction in land availability was offset by improvements in stock management and water supply. Similar findings were revealed by landholder surveys by Ede (2011) in Victoria where 76% of landholders reported no lost production from fencing riparian areas.

Landholder investment tended to be labour and machinery, with no or very little cash outlay and landholders interviewed agreed there needed to be this in-kind commitment:

> "Happy to do the work, [it is] important landholders are involved in their projects so they look after it long term."

Anecdotally, it appears the reasons for engaging in projects were not related directly to economic gain but were for reasons such as aesthetics, better stock management along waterways, river health and peace of mind. A landholder said:

> "I used to lose stock in the river—steep banks —much better now for management of the place."

Similarly, Ede (2011) found the main reasons landholders had undertaken riparian rehabilitation works were improved waterway health, improved overall environment on their properties and aesthetics consistent with BRR. Alternative water and grazing management were also stated as benefits.

In terms of broader catchment economics in association with long-term productivity and sustainability of water quality, a high number of landholders (and/or those in key areas) would need to take action. Additionally a link between improved ecosystem services and productivity gains would need to be made against a backdrop of regional economics. A cost benefit analysis has not yet been undertaken for the Boorowa region or BRR, and remains an area for further investigation.

A tangible economic gain identified for the broader community, was the purchase of materials from local suppliers. The was valued at approximately $300,000 for fencing materials and $160,000 for alternative water. Other items, such as tubestock, direct seeding, earthworks and willow control totalled around $460,000 (GACR 2013). This investment was significant as the project took place during long-term drought which resulted in a downturn in agricultural enterprise. This was emphasised in two landholder interviews (Gould 2013).

In summary, economic returns for BRR projects vary at the property level depending on the nature of works and each landholder's farming system. Most farmers did not notice a negative impact on their productivity, but did not recognise a significant economic gain. Projects were generally implemented for other reasons. Incentives were critical, and large scale projects such as BRR can have a positive effect on local suppliers. One isolated project such as BRR is not likely to have a large economic impact, but forms part of the cumulative effect of sustainable land management activities at the catchment level.

EVALUATION SUMMARY OF ECONOMIC OUTCOMES AGAINST KRAs AND KPIs

KRA	**KPI**	**Result** (in relation to economics)
KRA 5: (Short and long term on-ground outcomes) Fifty km of riparian zone is rehabilitated resulting in improved water quality, biodiversity and sustainable farm and catchment management benefits including increased productivity.	KPI 5 – Types of riparian rehabilitation undertaken. – Quality of works. – Impacts of works on water quality, biodiversity, sustainable farming and ecological systems. – Increased economic benefits on farm and to local community.	– Incentives critical. Would not have had uptake otherwise. – Incentives critical. Larger projects able to be achieved. – On-site anecdotal improvements in water quality and availability and thus, a move towards sustainable production. – Not quantified. Needs further research. Improvements to landholder time and effort in managing stock around waterways. – On farm—anecdotally little economic gain in pure financial terms but no net loss. Quantitative analysis required. – Improved aesthetic benefits as biodiversity improves. – Local community—investment of about $1 million into local businesses.

SECTION 7

Planting after willow control.

Summary of lessons learnt

This summary of lessons learnt has been grouped into IWRM-related themes in the order of their evaluation in this report.

These lessons may be useful to guide similar projects, but should be used cautiously because they are inter-related and context-specific to BRR. That is, some lessons are widely applicable but, as found when evaluating BRR, others were related to the historical, demographic and political context of the project.

Environmental

- Long time for ecological change (more than six years). Needs to be planned for *during* project development (not *after* implementation).
- Significant variability between, and within, sites.
- Different types of on-ground works produce different responses.
- Site quality influences response to on-ground works. Longer time needed to recover the more degraded sites.
- Site maintenance over a longer period is critical to reaching desired ecological outcomes.
- External factors (drought, floods, native and pest animals) influence ecological outcomes and should be planned for.
- Finding control sites to match project sites to monitor ecological change is difficult. Site variability requires many monitoring points, and detailed analysis.
- Range of monitoring methods needed (photography, on-ground data collection).
- Research is required for assessing cumulative environmental outcomes of many projects/sub-projects undertaken in a small catchment especially noting concentrations of linked sites.

Governance

- Partnership model with key stakeholders (NGO–government–community) is important.
- Steering Committee arrangement proved a good way for stakeholders to have input through all stages of project, and was most important during the planning phase.
- Representatives need to be actively engaged (e.g. self-determined defined role) and involved in aspects of project. That is, do more than just attend meetings.
- Good communication needed and recognition that no one view is more valuable than another. There is not going to be consensus on all issues.
- Appropriate people should be involved in planning the activities they are to manage or take part in, e.g. staff need to understand why they are doing the work (not just be told to do it).
- Balance idealism with practicality so bureaucracy is minimised while maintaining accountability.
- Developed processes are important for consistency but should be done so they build trust between project partners and participants.
- Governance needs to be undertaken within context. History of broader governance, or what people are used to, influences what they agree to.
- Perspective on governance depends on level of engagement and varies with participants. Governance is more obvious to those planning on-ground works than to those implementing them.
- Recognition of stakeholder monetary contributions needs to equate with stakeholders who contribute in other ways.
- Community driven bottom up approach balances the involvement and support of agencies responsible for broader catchment governance. Flexible alignment with established plans and processes.

Boorowa River headwaters.

LORI GOULD

A break during planting at Ballandarah.

Human resources

- Highly valued (over and above all other project components).
- Investment in knowledge and understanding tailored to various knowledge levels.
- Increased knowledge does not always change values or viewpoints to what is desired.
- Training and learning opportunities are essential to increase knowledge, awareness and behavioural change.
- Level of engagement depends on past experience and awareness of issues being addressed. NRM history in the catchment is important, as it can influence time taken for acceptance.
- Flexibility needed to adapt to different circumstances (while maintaining consistency and equity at a broader level). On-ground solutions should fit particular situations. Individuals need to help plan their projects.
- Projects with single focus can engage more participants over a shorter period by reducing complexity, though the projects may not address broader catchment issues that influence outcomes.
- Individuals can influence project direction. Manage this collaboratively.
- Ongoing relationships with participants fosters encouragement and pride. Honest feedback about potential outcomes is important.
- Wider community engagement influences behavioural change and promotes project acceptance.
- Need to be open to new opportunities and innovations.
- Expect some failures and manage them sensitively and proactively. Communicate honestly with stakeholders and learn from mistakes.
- Develop multiple communication outlets. Word of mouth becomes important as project develops.
- Prior knowledge of community is helpful, though true understanding develops as project becomes established and gains momentum.
- External project managers are beneficial as they have no pre-existing politics, yet local and long-term presence important. Gaining community trust may take time. Skilled coordinators need a clear understanding of their roles.
- Continue to engage those who are not involved in projects in other ways, e.g. control sites for monitoring.
- Project investment can be reduced as knowledge and acceptance increases.

Economics

- Difficult to analyse in relation to project outcomes because of external factors, variability in circumstances and land management, project type and its specific outcomes.
- Incentives critical to project uptake.
- Partial incentives preferable (e.g. material costs only). Participant contribution (time, machinery) ensures long-term ownership of projects.
- Funds to local businesses by purchase of materials / services. Particularly helpful during drought period.
- Overall, no significant monetary gain or loss with incentives provided. Negative returns likely without incentives.
- Indirect economic benefits were increased stocking rates and shelter, time savings (not having to retrieve stock from riparian zones).
- Land loss was outweighed by other benefits.
- Less tangible benefits include aesthetics, peace of mind, land stewardship, and 'good for the community'.
- Understanding economic gains or losses may not be significant to a project's success, especially because of the research needed to compare these to externalities and intrinsic values.
- Cumulative benefits of many linked projects at catchment level is not well understood and difficult to measure.

Fenced erosion gully. Photo Col Ellis.

SECTION 8

Boorowa landscape.

Conclusion

Social research into community engagement and human resources has found there are some key ingredients required to properly engage people in riparian restoration (and other) projects. One perspective (Lovett 2006) provides a good framework to summarise BRR, and is the concept of the 'five Ps', which are about ensuring more than just the biophysical aims are met. These are Profit (not necessarily economic), Proof (evidence), People (variety of skills, relationships, communication), Place (emotional connection to a place or program) and Promise (long-term commitment, achievement, recognition). Applying this concept to the BRR project explains why it was successful because it encompassed all these elements to varying degrees.

PROFIT

BRR did not appear to result in an economic gain for most people (at least that can be quantified), except for the purchase of materials from local business. Profit manifested in the form of improved stock management, landholders feeling good about looking after their land, the ability to fix long standing riparian problems and aesthetic benefits. There was some concern about land being 'lost' by fencing it off, but this was outweighed by other gains and not viewed as an important issue.

PROOF

BRR was underpinned by strong science and partnerships with research institutions and individuals. On-ground monitoring activities revealed positive trends towards ecological improvement, and that more time was needed to demonstrate environmental outcomes. Research into riparian lands management was made accessible to stakeholders (including leading scientists visiting the community), to provide evidence based rationale in the absence of strong catchment specific data.

PEOPLE

The cornerstone of the BRR project. Of particular note was the NGO–government–community partnership enhancing engagement opportunities. A wide range of individuals and groups performed a variety of functions on the BRR SC and included landholders, partner organisations, and the broader community. Results showed there were some areas for improvement, such as recognition of partners, more active engagement of some stakeholders, and more opportunities for training. However, overall communications, relationships and governance was a strong point of BRR.

PLACE

People became engaged with the BRR project because of a connection with their land and waterways, and a belief they were becoming involved in something they felt was beneficial for the community and other river users. They were happy to contribute considerable time and effort to make it work. BRR has evolved into a wider ranging 'Rivers of Carbon' project on the basis of the success of BRR. Participants continue to maintain their projects and have a great deal of pride about what they have achieved.

PROMISE

Although the main project has been finalised, BRR projects demonstrate long-term commitment from landholders and project managers through a continuing monitoring program, and ongoing funding for maintenance. A formal wrap-up would have been desirable but difficult because of ongoing commitment from some partners. BRR has since evolved into the 'Rivers of Carbon' project (which covers a wider area) and in essence continues under a similar project model.

Overall, BRR was considered successful, with lessons learnt that could improve future projects or inform projects in other areas that operate in a similar context. Success was ultimately based on the active implementation of IWRM principles where equal emphasis was placed on socio-political, economic and biophysical outcomes.

Inspecting a project along the Boorowa River.

Pudman Creek.

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APPENDIX

A

Ballyryan field day.

Boorowa River Recovery community engagement activities

The following activities / publications took place between 2005 and 2007 unless otherwise stated. This appendix demonstrates the variety and numbers of events but does not to provide detailed information about each activity.

Science Forum (May 2006)

Early in the project, a science forum (see photo below) was held in Boorowa showcasing up to date river science presented by leading scientists including Professor Ian Rutherfurd (Melbourne University), Dr Amy Jansen (Charles Sturt University), Dr Siwan Lovett and Dr Phil Price (Land & Water Australia). Topics were chosen on the basis of issues that were important in the Boorowa Catchment and included erosion control, snags, willow management, vegetation management and community engagement. More than 100 people attended the one-day forum which finished with a river walk in the afternoon.

Project materials and publications

- *Riverways, Shortcuts to River Management Information in Australia* booklet (Lori Gould & James Morris 2005).
- BRR video/CD. A 10 minute promotional video showcasing interviews with scientists, stakeholders, aerial photography and field images of the catchment's streams and rivers.
- BRR web book.
- BRR electrofishing web video.
- Four case studies of individual projects (see Appendix C).
- One project outline.
- Three BRR newsletters.
- Invitations to public meetings.
- Local advertisements.
- BRR launch invitations.
- BRR outdoor banners.
- BRR brochures.

Tzu Chi Foundation planting weekend.

Presentations/major events

- 6th Australia Stream Management Conference, Canberra (2012). Boorowa River Recovery monitoring and evaluation of riparian projects in Australia, using BRR as a case study.
- Gosford Probus Club (2008). River management and rehabilitation using BRR as case study.
- Greater Good Foundation (2008). BRR and Pudman Creek case study.
- River Symposium, Brisbane (2007). BRR case study.
- 5th Australian Stream Management Conference, Albury (2007). Project implementation models including BRR as case study.
- GACR meeting of local members (2006). BRR.
- General public meeting to announce project (2005).
- Project launch on the Boorowa River with more than 150 people attending (2005).
- Mt Carmel School, Yass (2008). River management and BRR.
- Greening Australia Green Team (see below).

Green Team

GACR runs a Green Team, consisting of volunteers who commit to one day per week to undertake on-ground environmental works around the capital region. In 2007 and 2008, the Green Team spent 14 days over winter and spring in the Boorowa Catchment assisting landholders plant 5000 tubestock in their project sites. The team were also given a presentation on BRR and spent a day touring four sites to ensure they had a broader understanding of the project, and their involvement in it.

Above: Replanting along the Boorowa River.
Right: Students from Mt Carmel School.

School involvement

- Boorowa Environmental Education Program presentations / field days and planting events (approx. 200 tubestock) including river walks and talks.
- Boorowa River planting by Boorowa Central and St Josephs School (150 tubestock).
- Waterwatch testing by Boorowa Central and St Joseph's School.
- Seed propagation with St Joseph's School (300 tubestock).
- Two National Tree Day events with St Joseph's School (300 tubestock).
- Two planting activities with Mt Carmel School, Yass, on a Pudman Creek site (900 tubestock).

Field tours and workshops

Numerous tours were conducted around BRR sites for a wide variety of organisations. Because of the large number of requests, a set tour was developed showcasing four sites with interpretative material produced for each (case studies) and an overview of the project. This proved to be successful and the landholders who agreed to be on the BRR tour circuit were willing to speak to the groups and provided an insight into the project from their own perspective.

Tours

- BRR Steering Committee (initial tour).
- Field trip with Alcoa, Greening Australia and LCMA Board.
- Landcare Awards Coordinator.
- Yass willow field day.
- Second and third Rye Park Landcare farm walks.
- Land & Water Australia Corporate Services Team.
- Two tours for Land & Water Australia staff.
- NSW Department of Natural Resources and Greening Australia (water policy).
- NSW NRM facilitators.
- BRR volunteers.
- BRR Steering Committee / LCMA.

- Greening Australia NSW / Victoria / Tasmania.
- GACR CEO tour and *The Land* newspaper staff.
- TransGrid Environmental Executive Committee.
- Electrofishing field day.

Workshops

- Seed collection workshop.
- Conservation Action Planning workshop and follow up iteration workshop.
- Case study for NSW TAFE Agricultural conservation course (online).

Media articles / interviews

- More than 10 articles in *Boorowa News* addressing general project, erosion control, willow management, riparian fencing, electrofishing, project update, project partners, Tidy Towns winner, funding announcement etc. Includes three front page articles.
- Two full page stories and one article on Rivercare award in *The Land*.
- Full page article in *The Canberra Times*.
- Articles in the *Yass Tribune* and *Parkes Champion Post*.
- Advertisements in *Boorowa News*, *Yass Tribune*, *Crookwell Gazette*.
- Six separate interviews and coverage of associated topics on ABC Radio.
- Two interviews on Radio 2LF.


Boorowa News

RIVER RECOVERY WINS

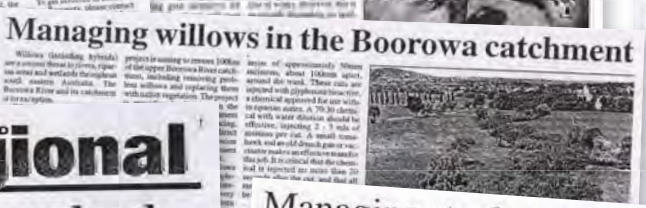
Boorowa takes title in Tidy Towns

INSIDE TODAY

BUZZ


Fish ladder planned for weir at Acramans Bridge


Great incentives for landholders to get involved with Boorowa River Recovery


Managing willows in the Boorowa catchment


An example of a concrete flume. Photo: David Hilhorst.

THE LAND Regional

Boorowa overhaul

Salt river to get $625,000 makeover


South West recovery plan


A fenced riparian zone in the Boorowa catchment.

Managing stock access to the upper Boorowa River

Fixing gully erosion

Fencing and revegetation

Concrete flume

APPENDIX

B

Boorowa River.

An example of environmental services ratio scoring

The environmental services ratio (ESR) was used to assess project sites.

This is an example of the scoring sheet. Each question is accompanied by a detailed assessment incorporating GIS analysis, and set parameters aligning scores with predetermined parameter ranges (e.g. Fragmentation 0% = 0, 1–20% = 2, 21–45% = 4, 46–70% = 6, 71%+ = 4 etc), which is used to complete the scoring sheet.

The final ESR score is converted to a percentage and indicates the public/private cost share for each project. In the example on the following page, the final ESR is 0.63, which means 63% of the total project cost (including labour) would be funded through the project.

ID #	Name	SAMPLE ONLY	Officer	Site #

Criteria		Weight	Score						Max. possible score
#	Detail		Nil = 0	Low = 2	Medium = 4	High = 6	V. high = 8	Total	
0.1	Is this a group application?	6	1					0	48
0.2	Is this project linked?	4					1	32	32
0.3	Is the project integrated?	3					1	24	24
0.4	NRM planning	3			1			12	24
1.1	Conservation status of veg. type	5					1	40	40
1.2	Amount of veg. type cleared %	5					1	40	40
2.1	Fragmentation	3				1		18	24
2.2	Connectivity	10			1			40	80
2.3	Total adjacent remnant area (ha)	5			1			20	40
2.4	Proximity of site to a riparian zone	5					1	40	40
2.5	SCS classification	2			1			8	16
3.1	Canopy	6				1		36	48
3.2	Shrub layer	6		1				12	48
3.3	Ground layer	6			1			24	48
3.4	Project size (ha)	30				1		180	240
3.5	Average width of vegetation	5		1				10	40
3.6	Shape of the project site	5				1		30	40
3.7	Exotic plant cover %	4	1					0	32
3.8	Habitat value	10		1				20	80
3.9	Degrading processes	4			1			16	32
3.10	Reveg. v cons	14	1					0	112
4.1	GFS priority – interception plantings	3				1		18	24
4.2	Priority stressed river sub-catchment	4				1		24	32
4.3	Average rainfall (mm)	4				1		24	24
4.5	Proximity to known salinity site	3					1	24	32
							TOTAL	692	1240
DISCHARGE PROJECTS								**ESR**	**55.81**
5.1	Discharge flow EC (dSm-1)	1				1		6	8
5.2	Soil EC level in discharge area	4				1		24	32
5.3	Site condition	2				1		12	16
5.4	Linkage to recharge treatment	2				1		12	16
							TOTAL	54	72
RIPARIAN PROJECTS							**DIS**	**Score**	**3.75**
6.1	Stressed river sub-catchment ranking	3					1	24	24
6.2	Length of stream to be treated	15				1		90	120
6.3	Woody weeds species distribution	3		1				6	24
6.4	Degree of groundcover on banks %	2					1	16	16
							TOTAL	136	184
							RIP	**Score**	**3.70**
GROUP									
7.1	Group application (riparian) – length	1						0	8
7.2	Group application – area	1						0	8
							TOTAL	0	8
							DIS & RIP	**Score**	**0.00**
CULTURAL HERITAGE									
8.1	Cultural significance	1						0	8
							TOTAL	0	8
							DIS & RIP	**Score**	**0.00**
							Total	**Score**	**7.45**
							Final	**ESR**	**0.63**

APPENDIX

C

Boorowa River headwaters.

Boorowa River Recovery case study fact sheets

On the following pages are fact sheets produced by Greening Australia Capital Region for four BRR project sites

- control of gully erosion control at Corcoran's Creek,
- conservation of remnant vegetation at Pudman Creek,
- erosion and salinity control at 'Taffs Hill',
- willow control in the Boorowa River.

The second page of each sheet was a topographic map overlaid with the project boundaries. A full-sized example is shown for Corcoran's Creek with smaller examples shown for the other three case studies.

These sheets are available from GACR office.

Boorowa River Recovery Field Tour

Gully Erosion Control Corcoran's Creek

Snapshot

- **Fenced off 2.2 km (17 ha) of erosion gullies from stock.**
- **Undertook 20 km of direct seeding.**
- **Carried out earthworks at three locations to control erosion nick points.**

Project contribution: $21,566
Landholder contribution: $10,686
Total area: 17 ha

Mark Corcoran and his family had many attempts at trying to control the significant erosion along Corcoran's Creek at 'Bindaree' over the years. In spite of the earthworks, the erosion continued to grow.

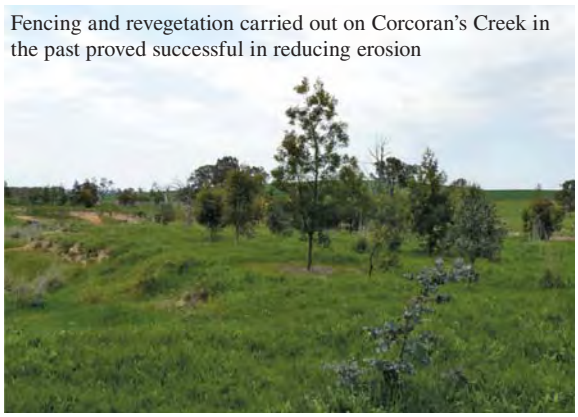
Mark then trialled fencing off and revegetating a small part of the erosion gully which halted the erosion and provided wind shelter for stock. On the basis of this result, and the availability of funding through Boorowa River Recovery, Mark decided to fence and revegetate the entire gully system—no small effort! Earthworks have also been carried out at key locations where vegetation alone is not likely to stabilise the erosion.

Complementary to this, neighbours upstream of Mark are undertaking similar works on the headwaters of Corcoran's Creek (fencing, revegetation and earthworks) to reduce soil loss and salinity, and improve biodiversity.

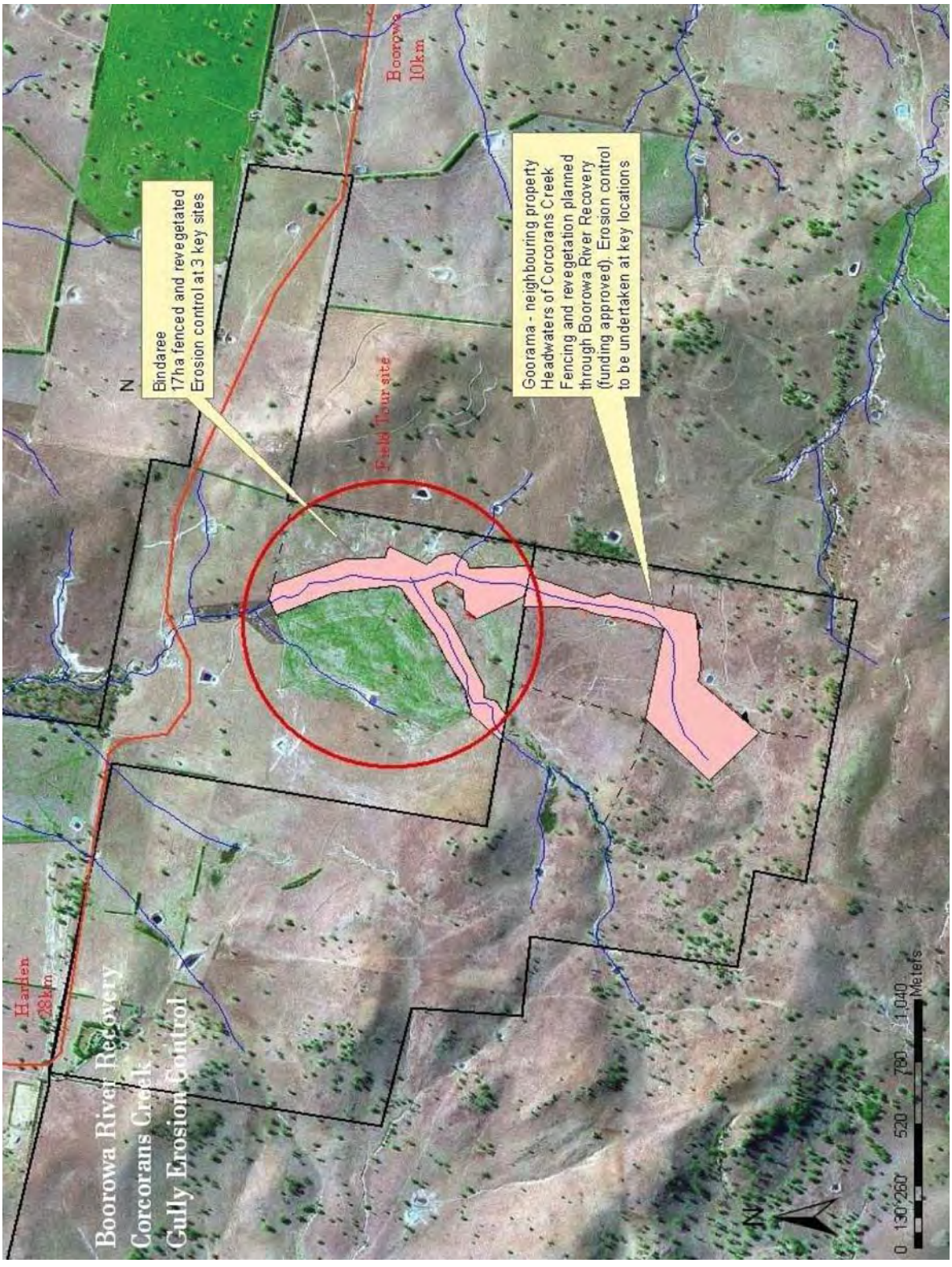
Significant erosion along Corcoran's Creek

Fencing and direct seeding along Corcoran's Creek

Fencing and revegetation carried out on Corcoran's Creek in the past proved successful in reducing erosion



Boorowa River Recovery Project 2009
Project: $1,630,000
Sixty landholders: $270,000
River rehabilitation: 72 kms
Area: 600 ha


Together We're Making a Difference
LACHLAN CATCHMENT
MANAGEMENT AUTHORITY
Greening Australia
Café Brindabella
BOOROWA COMMUNITY LANDCARE GROUP
TransGrid
Adapt2
ALCOA
australia's aluminium
Australian Government
Boorowa 10km
Bindaree
17ha fenced and revegetated
Erosion control at 3 key sites
Goorama - neighbouring property
Headwaters of Corcorans Creek
Fencing and revegetation planned
through Boorowa River Recovery
(funding approved). Erosion control
to be undertaken at key locations
Field Tour site
N
Harden 28km
Boorowa River Recovery
Corcorans Creek
Gully Erosion Control
0 130 260 520 780 1,040
Meters

Boorowa River Recovery Field Tour

Conservation of remnant vegetation, Pudman Creek

Snapshot

- **Fenced off 13 ha of remnant vegetation along 1.5 km of Pudman Creek at 'Mulloona'.**
- **Installation of a tank and trough system to supply alternative stock water.**

Project contribution: $28,546
Landholder contribution: $9,440
Total area: 13 ha

Sharman and Geoffrey Darnell moved to Boorowa from Sydney recently to enjoy their 'tree change' at Mulloona. Having owned the property for a couple of years, they knew their creek was special. Little did they know how special it was in terms of the fish! It was discovered (by DPI Fisheries) that the Pudman Creek was one of the few creeks in NSW without any feral fish, and very few barriers to fish migration.

This made the creek and some of its tributaries prime release sites for the nationally endangered Southern Pygmy Perch and a priority for conservation. Other fish species recently surveyed included the Australian Smelt, Flathead Gudgeon and Mountain Galaxias.

All that was required to protect this site was a fence and some stock water. No active revegetation was necessary as the natural vegetation is expected to regenerate with little intervention. A gully feeding directly into the creek was also fenced and revegetated to reduce the input of salt and sediment.

Boorowa River Recovery is also undertaking a fish habitat rehabilitation project on the Boorowa River that involves the installation of fish ladders and box culverts to improve fish migration.

Southern Pygmy Perch ©Hannon

Boorowa River Recovery Project 2009
Project: $1,630,000
Sixty landholders: $270,000
River rehabilitation: 72 kms
Area: 600 ha

Boorowa River Recovery Field Tour

Erosion and salinity control, Project 2006/07

Snapshot

- **Fenced off 4.5 km (38 ha) of erosion gullies and salt-effected land on 'Taffs Hill'.**
- **Planted 1000 tubestock (so far).**
- **30 km of direct seeding is planned but has been postponed until 2008 due to dry conditions.**

Project contribution: $18,117
Landholder contribution: $6,182
Total area: 38 ha
Community involvement: 1000 tubestock planted by students participating in St Joseph's school's BEEP program.

'Taff's Hill' is owned by Thomas and Sharon McGrath, and is a 1080 ha property that produces cattle, sheep and crops. Thomas and Sharon's aim is to successfully combine productive farming with environmental conservation.

Through Boorowa River Recovery (and a previous award winning project, Saltshaker), 38 ha of Box Gum woodland has been fenced and revegetated. Thomas and Sharon are also working with Greening Australia to investigate the feasibility of setting up a seed production area within this site in order to sell seed back into other revegetation projects.

The project will result in improved water quality, erosion control, reduction in salinity affected land, shelter and reserve feed for stock, habitat for wildlife and a much better view!

School children taking part in the Boorowa Environmental Education Program (BEEP) assisted with the project planting. The BEEP program is a city–country program where local Year 6 school children undertake a detailed study about their environment and teach Year 10 students from Sydney who come to visit. Part of the program also involves undertaking environmental restoration work like planting trees and shrubs.

Boorowa River Recovery Field Tour

Boorowa River willow control project

Snapshot

- **Willow removal along 29 km of Boorowa River by machine, river fenced from stock and revegetation using locally native species.**
- **Installation of alternative water supply for stock (dams / tank and trough systems).**
- **Follow up willow control 6 months after initial control, then annually.**

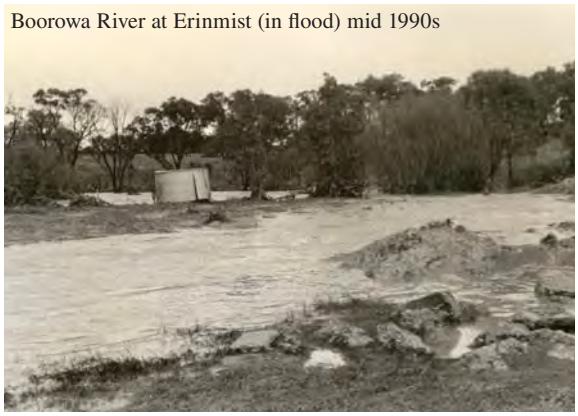
Project contribution: $600,000
Landholder contribution: $180,000
Total area: 255 ha
Community involvement: ~6000 tubestock planted by volunteers at 12 planting events.

Many landholders along the Boorowa River felt they had lost their river to invasive Crack Willow (*Salix fragilis*). Water quality and biodiversity had significantly declined.

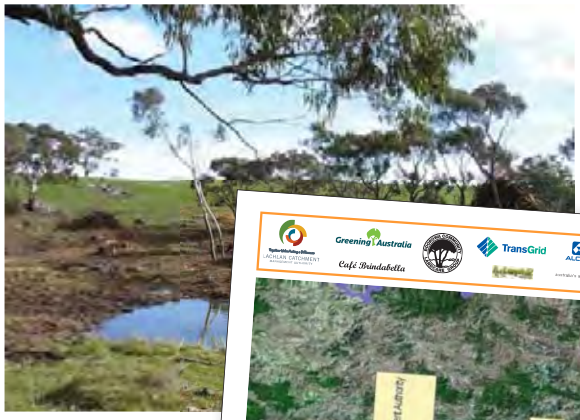
After in-depth planning, 13 km of willows were controlled using an excavator with a log grab / chainsaw attachment which incorporates a spray facility for poisoning the stumps. An additional rake attachment was also used to 'clean up' larger broken branches. Fencing and revegetation was undertaken to replace willows. The remaining 16 km will be undertaken in March 2009.

Landholders are so far very happy with the results. Many of them have commented that they had regained their river channel—with the flow being restored. Formal monitoring has also been carried out to evaluate changes to the environment over both the short and longer term.

Boorowa River at Erinmist (in flood) mid 1990s

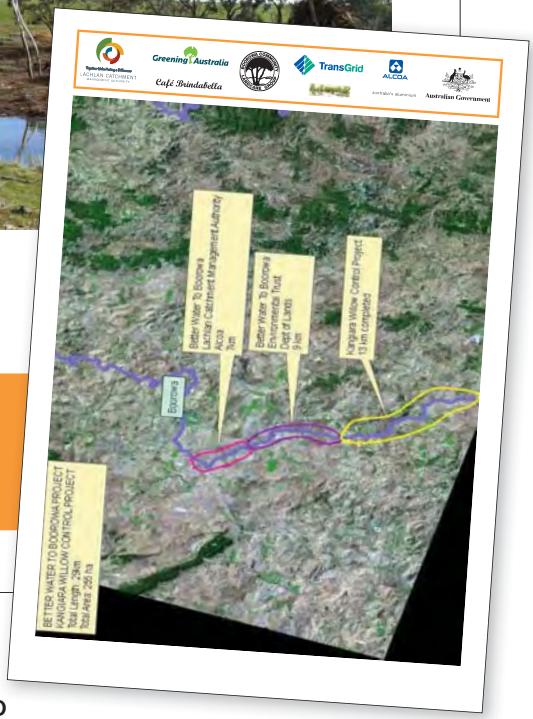


Boorowa River at Erinmist June 2006 before willow control (heavy willow infestation)



Boorowa River at Erinmist late June 2006 after willow control

Boorowa River Recovery Project 2009
Project: $1,630,000
Sixty landholders: $270,000
River rehabilitation: 72 kms
Area: 600 ha



LORI GOULD

APPENDIX D

Replanting.

On-ground data collection: Cross-sections

Results of linear mixed effects models examining responses to restoration works from the vegetation cross-section data. Three factors were included in these models:

1. Riparian treatment type (five 'types': being GFR, GEW, CFR, W, P).
2. Site treatment (two 'treatments': being project and control).
3. Year (three years: being 2008, 2010, 2012).

NOTES FOR TABLE OVERLEAF

Analysis of data collected from the 0.5 m cross-sections did not reveal any consistent responses to riparian works treatments. If within-site variability is high, then it is likely one cross-section will not provide an adequate representation of a site. If monitoring continues, it is recommended to focus sampling at the 100 m transect scale, or increase the number of cross-sections sampled (i.e. to approx. six) (Hale & Reich 2013).

The purpose of this appendix is to demonstrate the variability of results for the 0.5 m cross-sections referred to in this report.

	Type ($F_{4,35}$)		Treat ($F_{1,54}$)		Year ($F_{2,54}$)		Type * Treat ($F_{4,54}$)		Type * Year ($F_{8,54}$)		Treat * Year ($F_{2,54}$)		Type * Treat * Year ($F_{8,54}$)	
Response variable	F	P	F	P	F	P	F	P	F	P	F	P	F	P
Annual grasses	2.62	0.05	1.52	0.22	49.06	**<0.01**	2.16	0.09	0.76	0.53	0.69	0.50	1.28	0.27
Aquatic plants	1.38	0.26	0.48	0.49	14.54	**<0.01**	0.77	0.55	1.96	0.06	1.60	0.21	0.48	0.86
Bare ground	0.45	0.77	1.23	0.27	3.64	**<0.03**	0.42	0.80	1.66	0.12	1.33	0.27	1.55	0.16
Cryptogram	1.28	0.30	2.67	0.10	8.98	**<0.01**	1.38	0.25	1.27	0.28	2.67	0.07	1.38	0.22
Litter	1.17	0.37	0.69	0.40	7.13	**<0.01**	0.38	0.82	1.44	0.20	0.68	0.51	0.70	0.68
Native forb	1.93	0.13	0.70	0.40	11.42	**<0.01**	0.71	0.59	0.88	0.54	2.05	0.14	0.99	0.45
Native grasses	1.74	0.16	0.19	0.66	18.10	**<0.01**	0.49	0.74	1.22	0.30	2.00	0.14	2.47	**0.02**
Pasture plants	11.38	**<0.01**	0.04	0.84	34.85	**<0.01**	0.52	0.72	2.86	**0.01**	0.45	0.64	0.69	0.70
Shrubs	1.07	0.39	0.01	0.92	1.50	0.22	0.51	0.72	0.51	0.84	0.68	0.51	0.95	0.48
Weeds	0.69	0.60	0.34	0.56	11.51	**<0.01**	0.14	0.97	0.74	0.66	0.23	0.80	1.21	0.31

* = comparison between treatment method, control or project sites and year
Numbers in subscript are related to the statistical analysis program
Entries in bold type are statistically significant, based on the probability that p is less than 0.05

APPENDIX E

Corcoran's Creek.
Photo Col Ellis.

Additional information for on-ground monitoring results

Results of linear mixed effects models examining responses to restoration works from the 100 m vegetation transect data. Three factors were included in these models:

1. Riparian treatment type (five 'types': being GFR, GEW, CFR, W, P).
2. Site treatment (two 'treatments': being project and control).
3. Year (three years: being 2008, 2010, 2012).

Response variable	Difference between control and project sites?	Results
Shrub cover score	Yes	– Significantly increased shrub cover at project than control sites – For some treatments (particularly CFR, GEW and GEW) this reflects initial differences too (i.e. more shrubs at project sites in 2008) but shrub cover has increased at GFR and GEW project sites
Bare ground score	Yes—method specific	– No overall responses detected, but evidence that bare ground has decreased at some project sites (CFR and GEW) and increased at others (W)
Tree score	No	– No overall responses detected – Some evidence of more trees initially (and these patterns persisting through time) at CFR and P sites
Regeneration score	No	– Regeneration low but variable, only observed at treatment sites for some methods (GFR, GEW, CFR)
Native grass score	No	– No overall responses detected – Evidence of differences in cover between treatment methods
Pasture plants score	No	
Annual grass score	No	– No overall responses detected
Weeds score	No	– No overall responses detected
Litter score	No	– No overall responses detected – Some evidence of decrease in litter in 2012 at GFR, CFR and P (project and control sites)—potentially a flood response
Lichen score	No	– No overall responses detected
Macrophytes*	No	– No overall responses detected
Snags and woody debris	No	– No overall responses detected – Some evidence of decrease in 2012 at GFR, CFR, P and W (project and control sites)—potentially a flood response
Shade	No	– No overall responses detected – Significant initial differences in shade between sites in different treatment categories
Ephemeral stream assessment**	No	– No overall responses detected – Significant initial differences between sites in different categories—W and P sites most stable, gully sites most active – Evidence of overall increase in stability from 2008 to 2010 but not specifically related to treatment

*F ratio denominators for macrophytes = 29 and 54

**F ratio denominator for ephemeral stream assessment = 29 and 57

Summary of findings

Results of 100 m transect data—statistical analysis using linear mixed effects models (Hale & Reich 2013)

	Type ($F_{4,29}$)		Treat ($F_{1,29}$)		Year ($F_{2,58}$)		Type * Treat ($F_{4,29}$)		Type * Year ($F_{8,58}$)		Treat * Year ($F_{2,58}$)		Type * Treat * Year ($F_{8,58}$)	
Response variable	F	P	F	P	F	P	F	P	F	P	F	P	F	P
Shrub cover score	1.39	0.26	7.83	**<0.01**	4.80	**0.02**	0.67	0.62	1.52	0.17	0.47	0.63	0.79	0.61
Bare ground score	1.30	0.29	1.07	0.31	1.63	0.20	0.47	0.75	2.33	**0.03**	0.74	0.48	0.55	0.81
Tree score	1.13	0.36	1.97	0.17	2.39	**0.10**	1.74	0.17	3.32	**<0.01**	0.50	0.61	1.40	0.21
Regeneration score	2.73	**0.04**	0.88	0.35	0.74	0.48	0.15	0.96	2.58	**0.02**	0.34	0.71	0.22	0.98
Native grass score	13.15	**<0.01**	0.01	0.89	2.63	0.08	0.62	0.65	1.25	0.29	1.36	0.26	0.48	0.86
Pasture plants score	12.32	**<0.01**	0.23	0.63	19.58	**<0.01**	1.11	0.37	0.75	0.65	1.46	0.24	0.72	0.67
Annual grass score	2.32	0.08	0.16	0.68	12.89	**<0.01**	0.10	0.98	2.06	0.05	1.01	0.37	0.66	0.72
Weeds score	0.32	0.86	0.14	0.71	0.97	0.38	0.73	0.58	0.58	0.79	0.27	0.76	0.44	0.89
Litter score	1.11	0.37	2.29	0.14	17.31	**<0.01**	2.64	**0.05**	2.11	**0.04**	0.77	0.47	0.82	0.58
Lichen score	0.23	0.92	0.11	0.74	0.54	0.58	0.35	0.84	0.74	0.66	1.58	0.21	0.26	0.98
Macrophytes*	1.07	0.39	0.19	0.67	1.29	0.28	1.56	0.21	2.70	**0.01**	0.01	0.99	0.79	0.62
Snags and woody debris	1.31	0.29	0.38	0.54	10.94	**<0.01**	0.24	0.91	2.39	**0.02**	1.72	0.19	0.83	0.58
Shade	4.14	**<0.01**	0.62	0.43	0.13	0.87	2.33	0.08	0.98	0.46	0.02	0.97	0.62	0.75
Ephemeral stream assessment**	4.62	**<0.01**	0.52	0.48	7.30	**<0.01**	0.70	0.59	1.48	0.18	1.29	0.28	0.70	0.69
	Type ($F_{2,6}$)		**Treat ($F_{1,6}$)**		**Year ($F_{2,11}$)**		**Type * Treat ($F_{2,6}$)**		**Type * Year ($F_{4,11}$)**		**Treat * Year ($F_{2,11}$)**		**Type * Treat * Year ($F_{4,11}$)**	
Response variable	F	P	F	P	F	P	F	P	F	P	F	P	F	P
Macroinvertebrate SIGNAL score	1.36	0.32	0.72	0.42	21.43	**<0.01**	0.76	0.51	3.50	**0.04**	1.42	0.28	0.68	0.62

*F ratio denominators for macrophytes = 29 and 54.
**F ratio denominator for ephemeral stream assessment = 29 and 57
Numbers in subscript are related to the statistical analysis program
Entries in bold type are statistically significant, based on the probability that p is less than 0.05

BOOROWA RIVER RECOVERY

The following barplots are additional information, and are not presented in the main body of the report due to space constraints.

For each variable they show changes at control and project sites over six years of sampling and represent responses to riparian work types: GFR, GEW, CFR, W and P.

KEY TO BARPLOTS

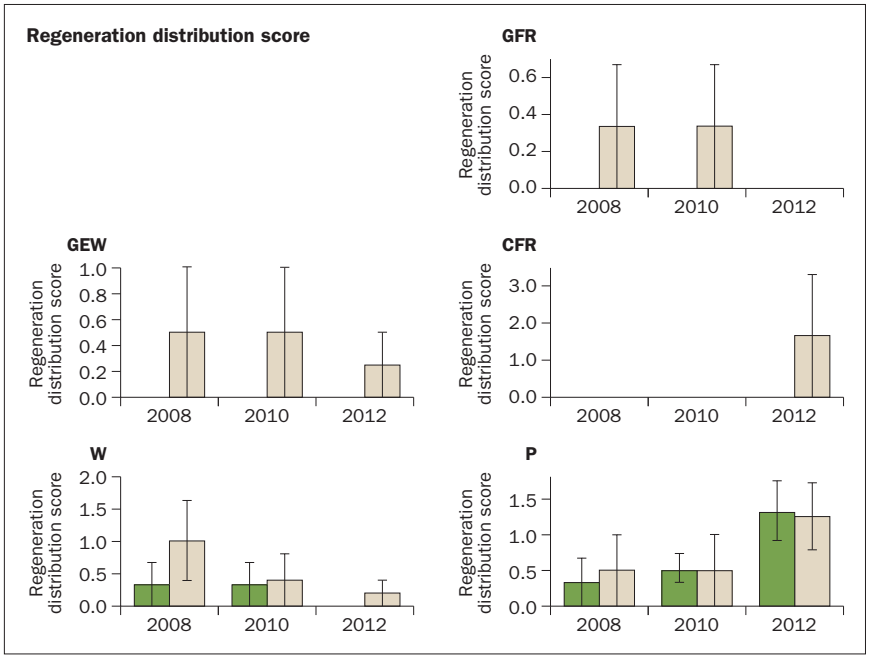
Data shows changes at control and project sites over six years of sampling for each work type.

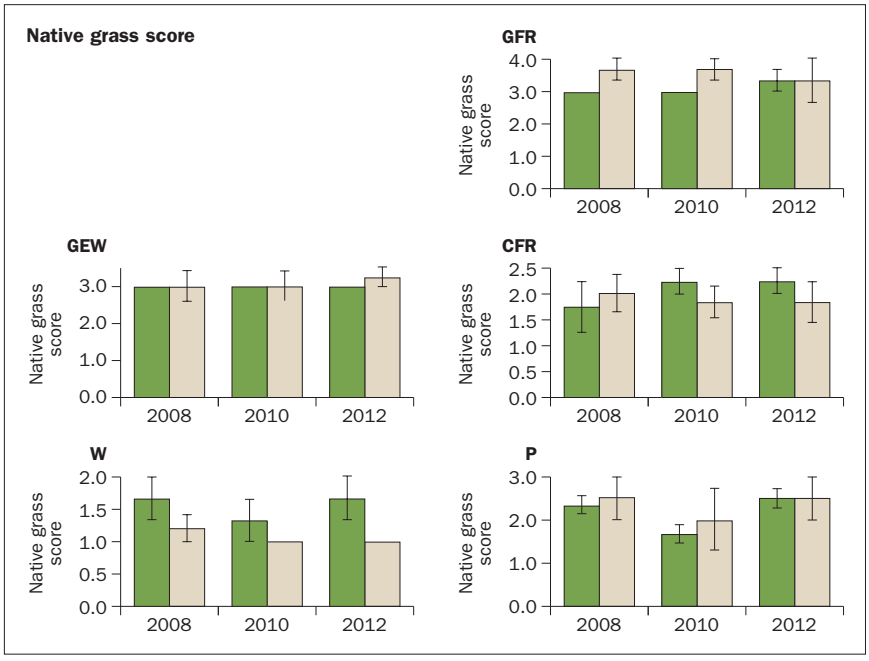
Work (or treatment) type

- **GFR** Fencing and revegetation of erosion gullies
- **GEW** Structural works, fencing and revegetation of erosion gullies
- **CFR** Fencing and revegetation of streams
- **W** Willow control, fencing and revegetation of streams
- **P** Fencing for protection

Green = control sites

Beige = project sites





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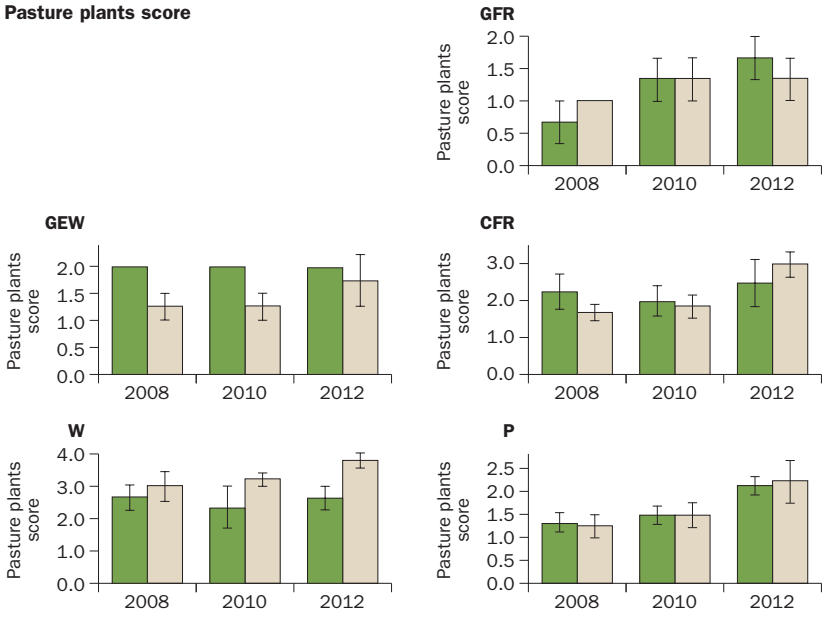
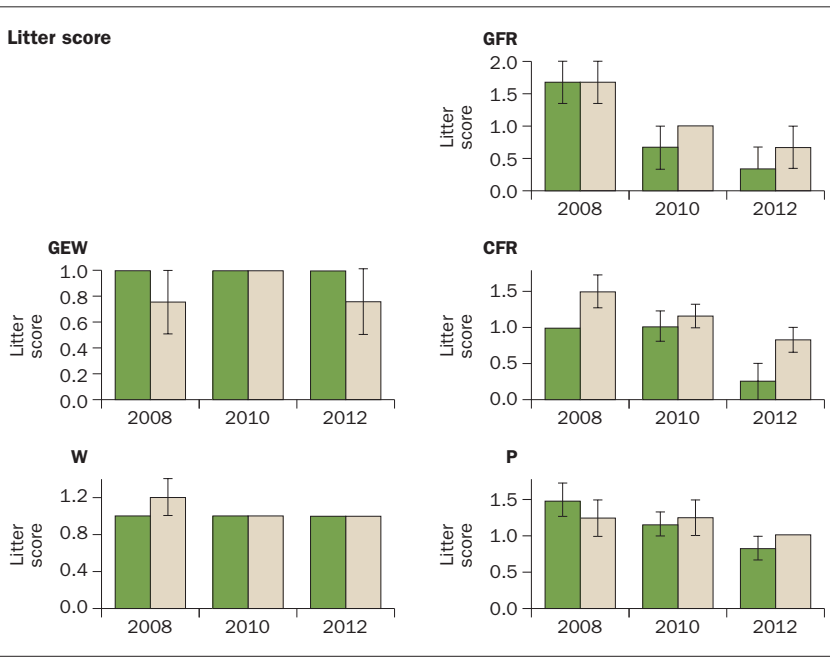
W Willow control, fencing and revegetation of streams

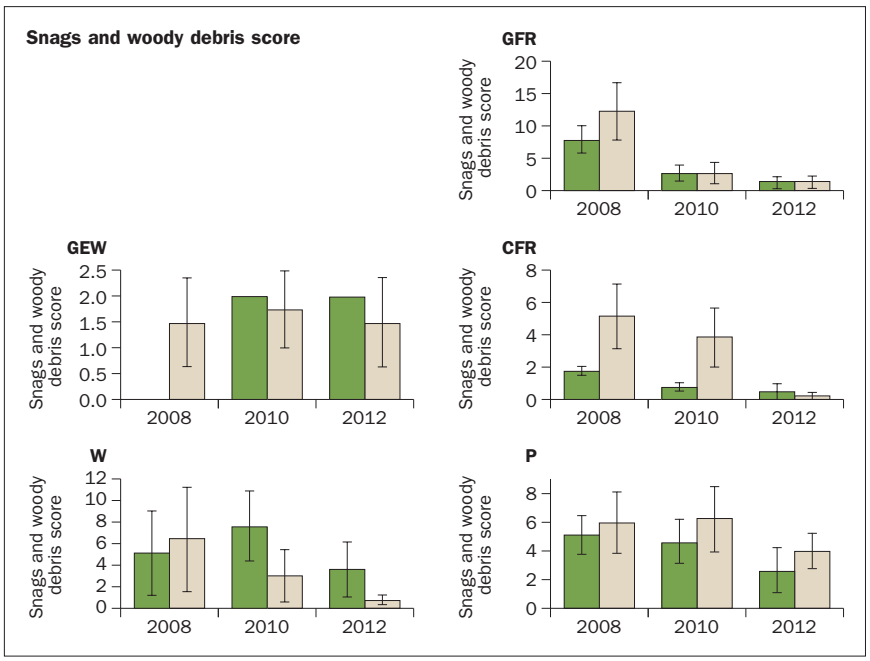
P Fencing for protection

Green = control sites

Beige = project sites







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Data shows changes at control and project sites over six years of sampling for each work type.

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CFR Fencing and revegetation of streams

W Willow control, fencing and revegetation of streams

P Fencing for protection

Green = control sites

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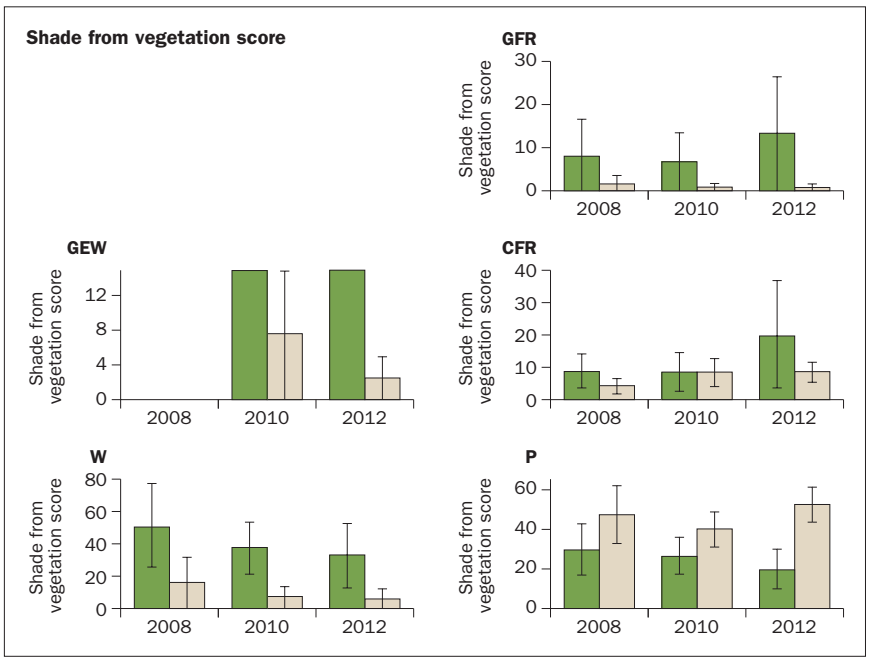

APPENDIX E

Ewes.

Summary of targeted stakeholder interviews

This appendix contains selected comments from stakeholder interviews. The interviews were confidential and any comments identifying participants have been removed.

The interviews complied with the University of Queensland's ethics procedures and policies.

1. **What is / has been your involvement in the Boorowa River Recovery project?**
   - BCLG partner.
   - Just kept up to date on project.
   - Sponsor / partner.
   - Community representative on Steering Committee (project set up and early part of implementation). Subsequently LCMA Board member.
   - Not involved in BRR. Decided against willow control. Lots of conservation work on property at large. No stock—choice to remain stock free as don't want to be tied to the place.
   - Coordination with GA, increasing community knowledge and referral of projects.
   - Locked up 7 ha of water country during the drought. Included fencing, spraying, ripping, willow control.
   - Steering Committee and participating landholder.
   - Field days e.g. TransGrid tour, Alcoa / Greening Australia tour.
   - Representative of LCMA on BRR Steering Committee.
   - LCMA accountability—administrative processes to address 1) probity along LCMA lines and consistency for customers through ESR process (i.e. not two systems) and 2) accountability and transparency—funds had to be reported on (GIS-based outputs reporting).

2. What is your understanding of the Boorowa River Recovery project?

- River rehabilitation project. Borne of government funded NRR—series of pilot projects around Australia—one of NSW examples. Targeted rivers across Australia with major issues. Aimed to bring back the health of these and at the catchment level. Involved local community, Aboriginal community, local government, business.
- Desire to remove grazing animals off river (not all the time). Increase diversity, fishing for carp. Willows removed to be replaced with natives. Alternative water for stock as well.
- Public private partnership to improve water quality above Boorowa town water supply. Addressed riparian health as part of National River Recovery. Boorowa was identified as a tributary in poor health.
- Stabilising banks, cleaner, purer water, less silt in water storage.
- It was a way to improve river ecosystems. Often perceived as a willow removal project but more than that. Catchment wide.
- Riparian management project—restoration and addressing threats that are detrimental to riparian ecosystems.

3. In your opinion, how successful has the project been in terms of:

a. Environmental outcomes

- Really good—big result.
- Very—biodiversity, platypus, water quality.
- Not familiar with results but extrapolating from the number of farms involved and enthusiasm of landholders—high chance that all the things set up to be done were done.
- Some preliminary—increased groundcover, reduced bank erosion, reduction in willows. Water quality too early to tell.
- Some improvement in aquatic biodiversity. Terrestrial too early.
- Banks grassed up, no more blue green water (contaminated).
- On the Pudman—fenced areas recovering but haven't seen top of river to bottom and as such hard to tell. Would have thought undertaking works would result in successful outcomes.
- River is thick with reeds and other water plants and concern that removal of willows will increase these. Native regeneration doesn't appear successful downstream and upstream.
- Successful in delivery but will require the outcomes to be shown.
- Causal evidence suggests water quality improvements, carbon capture, aquatic biodiversity, stability etc (e.g. Riparian Restoration Experiment), but hard to tell without relevant monitoring results.
- Colleague who was part of the willow control project noticed an increase in water flow and water quality. Boorowa River used to only run during storms and high flows but now runs all the time.
- Noticeable in dry times. Happy except for tubestock, much of which didn't survive. Happy with the grassed banks and outcomes overall.
- Water quality is better—no brackish smell (decay of willow leaves).
- In past—hot summers, holes would drop down. Since willows less water and holes would dry completely.
- Instant improvement—got more grass, no erosion.

b. **Social/community engagement**

- The way everyone's involved along the river is really good.
- Not sure about broader community knowledge (same challenge as what Landcare faces).
- Community relationship with river heightened—important for long term (river being looked after).
- Most important part of BRR project. Community has been involved so lasting value. Value river and will look after it in future.
- One of the things that came out of it was that not everybody wanted to be involved. Some people came around later in the process. People may share the vision but may not agree on the path required to get there.
- Landholder involvement was immediate (very successful).
- Greater engagement/ownership by Council and Landcare would have been better e.g. big plantings—tended to be LCMA that found and organised sites.
- Council are worried about the water in the weir especially water colour, but the link between this and catchment management (mainly erosion and turbidity) is not made by some Council staff. If Council were more actively engaged (e.g. training/catchment tours etc) it may have triggered a greater interest in project especially since water treatment is costly. Three to four days after high flows—poor water quality in weir.
- Greater communications earlier with Council would have benefited.
- Boorowa Council could have undertaken on-ground works as contractors rather than getting someone else in.
- Broader community—well advertised, high media coverage. People in region aware of project but don't necessarily understand the details or significance of it.
- Awareness that what you do on your place affects those downstream. People more aware of their effect on the Catchment.
- Important to educate community about how long it takes for ecological change. Can't expect short-term results.
- Different triggers for different personalities and groups.
- Need a suite of actions to suit different participants and can't do the same thing all the time.
- Weeds were there before fence goes in and maintenance is essential. It's like purchasing a house—don't just buy it and leave it. Same with riparian areas—need active management (weeds, grazing, pest control etc).
- People coming together, good feeling, cultural heritage. Finding that at least 90% of Aboriginal cultural sites are within 200 m of a permanent water course so very important. Boorowa was important Wiradjuri nation.
- People in town spoke about it—both for and against it in the community.
- Engaged landholders really well.
- Only three along our stretch didn't become involved.

c. **Economic outcomes for you or the community**

- Fencing the river—benefits are felt off farm as well as on farm.
- Land loss from fencing rivers negligible. Don't think it's a big issue.
- People wouldn't get involved if they thought they were going to lose lots of money. Although don't do it necessarily to make money.
- Part of the pay-off that governments often get wrong is the need to invest in the minds of people to increase chance of continued action and maintenance of existing sites.
- On farm—generally small bits of land and likely to be minimal lost production. Likely to be beneficial to bottom line overall.
- Timing was good especially in relation to drought. Funding helpful.
- Materials were bought locally so significant investment into local business. Especially fencing and alternative water supplies.
- Production—alternative water would have improved water quality for stock and reduced potential for liver fluke.
- Increases in property value over time (aesthetics).
- Not personally—lost production from locked up country (although will be grazed in future from time to time) but better for community—weir capacity and cleaner water. Also lost a water source (didn't access alternative water incentives) but have since changed the farm water system. BRR did not have an influence over this (were going to do it anyway).
- Not a negative economic outcome. Have fenced some land off but enabled better management of the area. Fenced remnant which enabled subdivision of a paddock.
- No impact on stocking rates but better grazing management enabled increase in stock from 400 to 450 (about 10%).
- Lost production—big area fenced. Once trees are big enough can crash graze. Haven't really noticed any difference in production though. Run about the same amount of stock.
- Obvious especially during drought in terms of pumping dollars into local businesses/community service.
- Hard to cost improved water quality and reliability (alternative water), stock off the creek and not drinking poor water (disease management) and other water borne diseases including worms.
- Relatively cost effective way of delivering funds to the community.
- Better stock movement and mustering—time gain. Major reason why people do it.
- Aesthetics, land value improvements.
- Big scale projects (e.g. CMA projects) get low hanging fruit at first and as more people become engaged can increase cost share with public (or reduce incentives). As budgets scale back—need to have community acceptance so more people are willing to invest their own money. Still have to recognise community benefit over private benefit. Expensive items e.g. willows, earthworks—need help to implement i.e. government funding.
- As people see results it becomes more efficient—people become keen and want to undertake similar works.

- With incentives—worked out even (didn't cost anything).
- Keeping stock off river, better for the river.
- Troughs help with management of the place (big help).
- No loss of production in spite of losing land. Management gains have offset any loss. Stock used to fall in the river, fall down steep banks.

d. Governance (legislation, broader catchment management as relevant)

- Good governance—cooperative.
- Similar outcomes wanted but everyone comes at it from a different angle.
- Were processes and procedures written down? Worked at BRR scale (mostly trust based) but would it stand up to scrutiny? For example, if one party did something untoward (e.g. corruption/defraud) would the system have stood up to this? In this case people involved with the project believed in what they were doing and were good people. It was also a specific geographic area. In larger catchments with more players would this system 'hold up'. How would it work with multiple managers across more diverse regions? May need tighter governance to minimise risk or to explain processes if things go wrong.
- Major partners TransGrid was a positive step. Continue to be really supportive.
- Stressful for Landcare groups to manage their own finances so it is positive for a group such as GA or LCMA to manage this side of things. (Speaking from viewpoint of someone who has managed Landcare projects with numerous landholders—difficult task.)
- Some people within Landcare viewed the establishment of LCMA as government taking over as they were managing financial resources for catchment management (especially with Landcare declining at this time). Took a long time to be accepted. First public meeting in Boorowa (which coincided with the announcement of BRR) LCMA were hammered by the community. Lots of bitterness from Landcare.
- Early part of BRR when Landcare were going through their worst time. Negativity and looking for someone to blame about changes to CMAs—money was given to CMAs and not to Landcare (due to perceived piecemeal approach of Landcare at the time). For example one member stopped going to Landcare meetings (very dedicated person) due to them being too negative and distressing.
- Governance has to be careful not to become too risk averse so that people don't get put off by bureaucratic processes but at the same time remain accountable. Needs to have a practical focus.
- Biggest risk for governance is that things change on a whim. Development of human capital is not valued.
- Fit in with LCMA minimum standards, best practice, landholder contractual arrangements etc.
- LCMA and Council—don't have regular meetings but communicate on the basis of issues. LCMA have a local government officer for the whole Lachlan.

– Once the BRR Steering Committee was set up their role became less significant. Petered out as funding was reduced. Last couple of years. Would have been good to have a formal end point and acknowledgement of people on the committee OR better communications on resourcing over the past couple of years.
– Not too much red tape—important.
– GA got neighbour involved in project to reduce pressure on flood gates. Was good thing.
– Worked well because of project management. GA have a view, CMA have rules, landholders also have views. Ability to negotiate important. Need someone to hold it all together.
– Council—want environmental outcomes and support of community. Council should only play a support role. They view Landcare and LCMA as responsible for environment, and they take care of municipal services. They shouldn't have to actually undertake the works (with BRR). There are no resources to do more.
– Need a councillor to be properly representing Landcare and constantly reporting. Much more open arrangement now. BRR didn't have strong Council links. Things very different now. Fish project probably would have happened. More politics back then.
– Good representation of all stakeholders.
– Possibly wouldn't have done it in Boorowa Catchment now with current prioritising. Current policy is to invest to protect sites in better condition.
– BRR SC/Council staff should have been involved more. Councillor was representative on SC but core staff should have been involved/engaged—not necessarily on the SC but invited to participate at relevant meetings, offered presentations (e.g. every six months), BRR activities.
– As a partnership project LCMA contributed c.$800,000— would have been good to get better badging of stakeholders for their contribution. For example TransGrid were getting more recognition than LCMA in spite of significant differences in contributions.
– LCMA often don't get acknowledged enough and politicians/community need to see what's being contributed by each stakeholder so they can make an informed decision. Need to see what is being done.
– People are often dismissive of government organisations and they get taken for granted because 'that's what they do' (role-wise). Expect government to invest, especially in the past. In recent years funds have gotten very competitive. Funding is competitive and we need to work together—not in silos. Pooling resources would be more efficient and effective.
– Planning often happens after the money is received as people don't want to invest before getting funds. Need set recurrent funds for NRM groups (e.g. with a cap) to deliver against certain targets.
– Tried for years to do something with the river but it never eventuated. BRR came along—done!
– Outside person better to negotiate deals along river rather than local person—too many politics.

e. **Project management — delivery of outputs and outcomes**

- No complaints — would have heard about it if there was a problem.
- Not much knowledge on broader project. Anecdotally (through field days and the like) seems to have been met.
- BRR more flexible than CMA projects. Able to negotiate on projects.
- There was some negativity around willow control as coincided with Peter Andrews book which promoted willow retention.
- Good at building relationships.
- Coordination of willow control was efficient — done in one big lot.
- High percentage of landholders engaged.
- Over time achieved a lot in terms of on-ground works.
- Very well managed — follow up was good. Important to stop project being undermined long term. No point in doing it in the first place if no follow up works (or funding to do it).
- Co-contribution between project and landholders good.
- Wouldn't have done it if no incentives — job way too big and expensive for individual landholders.
- All good from a landholder perspective.
- Steering Committee reporting back good. Knew what was going on.
- Not too much paperwork.
- Takes time for a result.
- Could use a hand to put the trees in — volunteers for example.
- Spot on. Agreements good. Happy to sign 10 year agreement.

f. **Other processes (e.g. communications, networks etc)**

- Communications outcomes good.
- Administration for large projects is outside Landcare capacity.
- Lots of work for volunteers and accountability is difficult when systems are not in place. Too much for volunteers [Landcare].
- Communications fairly good — at basic level (field information etc).
- Towards the end of project more engagement of TransGrid executive would have benefited. For example, a newsletter (monthly / quarterly update). Also for property owners and the like.
- Promoted well at conferences / awards nights etc.
- Not sure whether communications got across well to outsiders.
- Be good to take further especially as part of the national program.
- Tried to engage partners as best as possible but not all were.
- LCMA invested a lot of money and would have liked to have seen better recognition of all partners in line with what they were contributing with cash or in-kind.
- LCMA would have liked to support the project more closely in terms of field days and more local events to promote broader community buy in. Often resource dependent, e.g. opportunistic field days when willow works / earthworks were being carried out.
- When volunteers came out such as GA Green Team, would have been good to get more locals involved. Same with Tzu Chi and North Sydney Bushcare.

- Follow up works important and TransGrid contribution has been essential. LCMA projects lack any maintenance funding/follow up.
- Would like to see field days/walks around BRR sites especially for Council water treatment staff and broader community members.
- BRR came out of Landcare over past 20–30 years. All these projects have been important for BRR.
- Would be good to keep it going or if not continuing, have a final get together to thank people. Get a PowerPoint presentation with an overview of what the project achieved and a couple of landholder perspectives.
- GA ran project from Canberra. Perhaps easier if based in the community (e.g. one day a week at LCMA office?). On the other hand—good to have an independent person who does not have a localised point of view. Now over time people have got to know GA and viewed as landholder friendly. Developed over many years now.
- Drought made everyone tired.
- LCMA were perceived to do Landcare's job early on but after a few years realised that this wasn't the case. Landcare have made a pushback more recently. Coordinators were housed with LCMA which was a problem for some people.
- Communications good—just a phone call away.
- Too much of a gap between updates. Minimal quarterly or shorter. Got to get out to all stakeholders.

4. **Do you think the project implementation model was a successful way to implement a river rehabilitation project in agricultural landscapes?**
   - Can't see any other way to do it.
   - Incentives are a big part.
   - Did exactly what it was supposed to do—great model.
   - Whole gamut—government, corporate, Council, NGO, landholders, scientists—working together. Rare to get that working properly.
   - Needs to be taken on board to inform other projects.
   - Can't comment but conservation works are important in agricultural landscapes (more generally).
   - Multiple benefits—connectivity with lots of landholders.
   - LCMA targets high value reaches now, but not necessarily any more successful as many sites are not connected. Ideally will eventually connect up.
   - One struggle is the revegetation. Competition in pasture improved areas. Other areas with native grasses seem to come back OK. Question whether we worry about replanting where there are improved pastures—especially where trees are (natural regeneration eventually).
   - Fencing is very important.
   - Sitting down together and working it out in advance was good.
   - Transparency, probity—haven't moved away from this.
   - GA were following LCMA processes so OK in terms of transparency. Maybe need open EOIs.
   - Best way. Preferred the individual negotiations rather than as a group.

5. **Has the project successfully engaged you or your organisation as a partner / participant?**
   - Yes everything OK. Always fine tuning to be done but was done well.
   - Could have done more to engage TransGrid more broadly. TransGrid Executive Committee changed significantly within the life of the BRR project and some internal champions were lost (very supportive of BRR). When Executive changed, could have done more to engage the new people to ensure continued support.
   - Yes definitely. Icon project for LCMA.
   - Ticks all the boxes — partnership, good governance, education, environment, community etc.
   - Expectations were clear to community.
   - Consistency — cost share, communications.
   - Monitoring baseline is good.
   - Macroinvertebrates and water quality — looking at 10–15 years.
   - Yes. Important landholders are involved. Happy to do work but tree planting needs help. Couldn't have done it without the volunteers.

6. **What improvements could be made to the project to make it more successful?**
   - Not sure how you could improve it.
   - Got runs on the board.
   - Perhaps engagement of those who opted out of the project — probably never get those people on board anyway.
   - National communications — results, NRR as a whole entity, of model. Better engagement outside.
   - No formal wrap up of BRR (no end date). Petered out — just ticking along now with M&E and maintenance. Now Rivers of Carbon with no formal transition. Happens with a lot of similar projects — no matter how successful, peter out with no results communicated or lessons learnt presented. Never written up to inform others.
   - Review community engagement — needs analysis to see if we understand what the community understands. Most people will support something being done if they understand it (including those not involved directly).
   - Project partners should be recognised in line with their investment. LCMA put in a lot of funding but were recognised at the same level as Landcare and Council. Partners should be pushed on the basis of their involvement / investment with media and other communications. A suggestion would be to list partners in order of their support or use a gold, silver, bronze type sponsorship scale. Really successful projects operate this way (e.g. mining).
   - Community engagement could be better but not sure how to go about it.
   - Direct seeding — a lot of trees are now starting to come along. Seem to only get one chance before grasses grow and out-compete it. Tubestock seem to perform better but more expensive and don't look natural. Direct seeding provides more of a cross section of species.
   - All good overall — nothing glaringly obvious.

7. Please provide your thoughts on riparian rehabilitation implementation methodology more generally.

- We didn't fence our creek specifically because we are holistic managers. Would lose a lot of grazing land and can achieve similar outcomes from holistic practices. Negated the need to fence the creek.
- Climate change will necessitate altered land management but hard to convince people to do it. Is a major change in mindset. Paradigm shift is a barrier—was for us until the penny dropped one day. Had to change the way I thought but it is so obvious now. Much lower inputs, saves money. Difficult because the agricultural industry survives on chemical sales and a lot of information comes from these sources. People don't realise that it can be done—just got to give it a go.
- Having an identified problem to focus on is a good thing. Enables people to understand what they are doing without being too complex.
- People understand distribution of dollars if they understand the rationale. Investment justification.
- Need to spend on social engagement—projects are often based on short-term outputs.
- Most workshops attended are run by LCMA or Murrumbidgee CMA.
- Very much depends on landholder and what fits with their business.
- Many landholders fence above floodlines anyway. Can see advantage of not having stock on the river. Challenge with floodplain fencing.
- Had often thought of doing project but wasn't economical without funding—enabled us to do project.
- Not a great benefit in terms of farming (apart from stock management) but biodiversity outcomes—linking remnant vegetation was good.
- Main issue is that it comes down to personal ideas.
- Personal choice. Up to farmers to do something.
- Willow control projects—not convinced it is a wise investment (CBA [cost benefit analysis]) and there is a shading issue (i.e. shade removed from river all at once).
- Now greater recognition of Aboriginal history and attachment to riparian areas. Opportunity to engage wider community on Aboriginal heritage.
- Threatened species are an issue. Targeted as these remain in relatively intact ecosystems. Use the threatened species as a media focal point of the project to get community attention.
- Assessment data is needed.
- Depends on the position near the river e.g. floodplain lucerne needs incorporation into project. Need to know your river in advance.

8. Do you have anything you wish to add?

- Reiterate commitment to projects long term. The shorter the time frame for grant funding, the more poorly planned projects tend to be. Poor engagement, poor projects—box ticking exercise to get funds then little time for planning properly.
- Projects/grants should be less prescriptive and we should 'think outside the square' in terms of the incentives available. For example, be able to fund activities such as site preparation as well as fencing and the like.

In the 19th century,
we devoted our best
minds to exploring nature.
In the 20th century,
we devoted ourselves
to controlling and
harnessing it.
In the 21st century,
we must devote
ourselves to restoring it.

Stephen Ambrose, historian, 1936–2002

Corcoran's Creek. Photo Col Ellis.