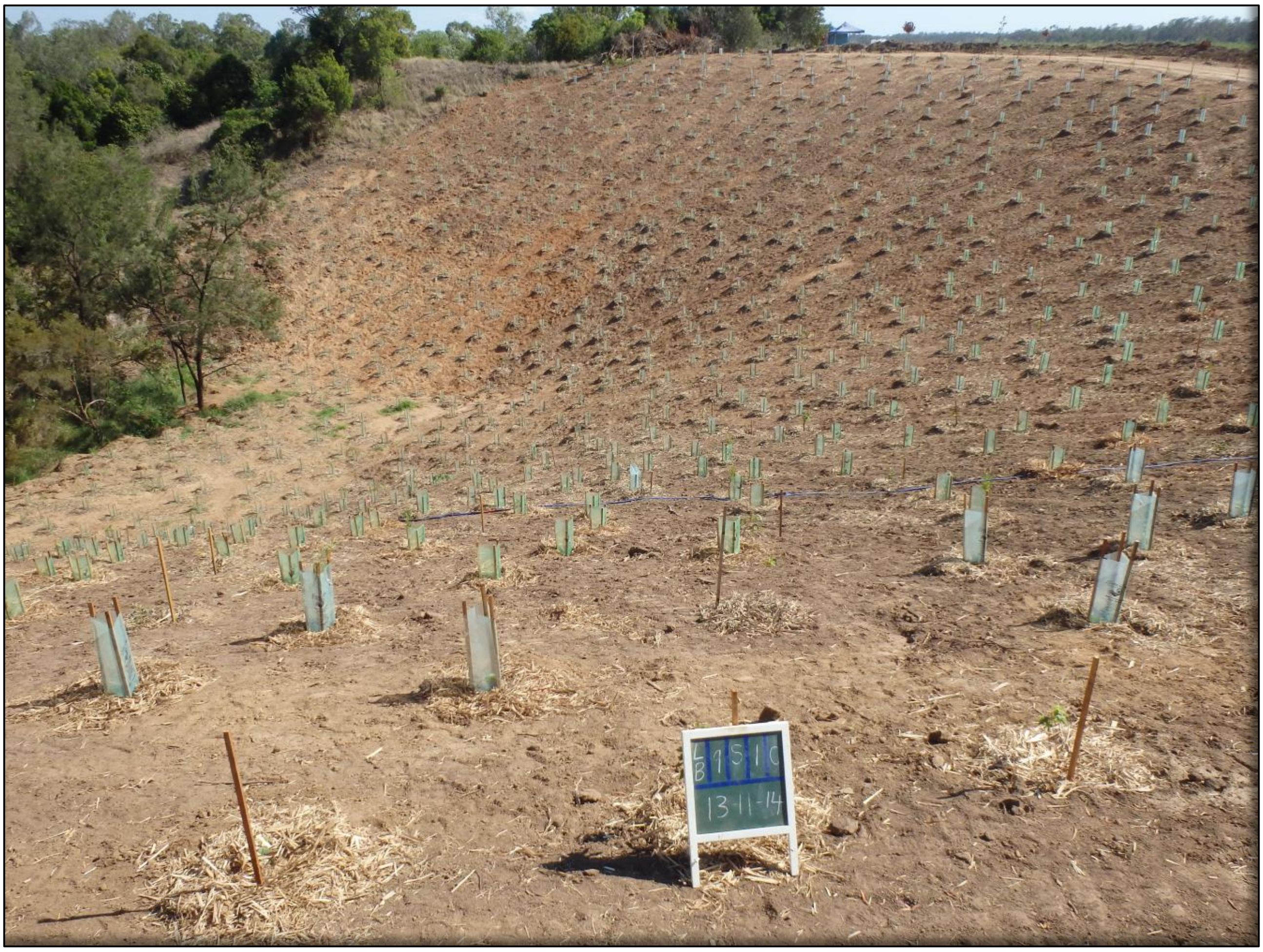
Streambank erosion baseline establishment project

Burnett & Kolan Rivers 2015



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Note:

The project title “*Streambank Erosion Baseline Establishment project”* was chosen to supersede the original (“*Streambank Erosion Monitoring and Evaluation Project”*) project titled used.

Contents

Preface

The outcome of the project is presented in the following files/documents:

1. Report
2. Appendix A – Map showing location of all sites
3. Appendix B – Field Method Statement
4. Appendix C – Maps showing site location and erosional processes
5. Appendix D – Site photo plates
6. Appendix E – Transect cross-section diagrams
7. Appendix F – Site report cards summarizing streambank condition transects

1. Introduction

Purpose
The Streambank Erosion Baseline Establishment Project (SEBE) for the Burnett and Kolan Rivers in Wide Bay Burnett (Queensland) was undertaken to:

- Establish the baseline condition of a suite of riverbank erosion rehabilitation sites to complement post-flood rehabilitation works undertaken by the Burnett Mary Regional Group (BMRG) and Burnett Catchment Care Association (BCCA) as part of the *Riverbank Stabilisation Project* under the *Flood Recovery Program 2013-2015*; and
- Facilitate the collection of baseline data for the Land Resource Asset indicator, streambank condition, presented in the *Wide Bay Burnett Environment and Natural Resources Management Plan 2012-2031*.

Background
In January 2013, ex-tropical Cyclone Oswald caused widespread flooding across Southern Queensland including the Burnett, Mary and Kolan Catchments. These floods caused extensive damage to infrastructure, housing, land, economic productivity and the environment.

To assist regional disaster recovery, the Queensland and Commonwealth Governments jointly funded the *On-farm and Riparian Recovery Program* (Department of Natural Resources and Mines (DNRM), 2013) aimed at supporting the most heavily impacted primary producing areas, such as Bundaberg and the North Burnett Region, through natural disaster relief and recovery arrangements. The program commenced in April 2013 and was finalised in mid-2015.

Under the program, BMRG received $8 million to carry out activities to assist landholders to rebuild productivity, address major damage to waterways, manage weed spread by floodwaters and to increase future resilience. Over the two year period, this was achieved through the delivery of five major projects (BMRG, 2013):

- Flood debris removal;
- Land productivity;
- Flood plain management;
- Riverbank stabilisation; and
- Weed mitigation.

As part of the Riverbank stabilisation project, BMRG and BCCA undertook rehabilitation works at a total of 29 sites within the Wide Bay Burnett area – including 13 near Bundaberg and 16 in the North Burnett Region. Works included debris and weed removal, revegetation and various earthworks, and incorporated monitoring and maintenance as required. To supplement this work, the Bundaberg Technical Support Unit of the Department of Natural Resources and Mines (DNRM) established a post-flood streambank condition baseline for a suite of representative sites, comprising both natural and assisted rehabilitation sites along the Lower and Upper Burnett River and the Kolan River.

Establishing a streambank condition baseline will be useful for monitoring recovery over time, by providing a benchmark against which future condition can be compared. Such investigations will offer insights into the effectiveness of management practices and rehabilitation methodologies (for example, how resilient a rehabilitated site is to future flooding).

Scope
The scope of the SEBE project was to establish a streambank condition baseline following the floods of 2013 for 23 representative sites along the Upper and Lower Burnett and Kolan Rivers, by collecting relevant soil, vegetation and topographic data along a series of streambank transects at both natural and assisted rehabilitation sites. Data collection occurred over 12 months, commencing in March 2014.

Literature Review

A review of available literature related to streambank condition baseline establishment and monitoring was undertaken to investigate existing methods and their potential to be applied by the SEBE project.

The method to be adopted for the SEBE project required a focus on obtaining a baseline of streambank condition by monitoring the physical attributes of streambanks, including vegetation. In order to assess and to quantify the success of the rehabilitation works, the method needed to incorporate natural sites where no rehabilitation works were undertaken, and also areas where rehabilitation works had been implemented.

The literature review found that documented methods dealt with the assessment of riparian vegetation and/or revegetation or streambank erosion. No methods were identified to be specific to establishing baselines following catastrophic weather events, such as ex-tropical Cyclone Oswald in 2013.

Jansen *et al*. (2004) developed a method for measuring riparian condition for use at a large number of selected sites. The method was specifically designed for grazing areas that are naturally dominated by trees, with at least 60% canopy cover. The method used by Jansen *et al* (2004) is described as a general tool for assessing riparian zone function and biodiversity. The purpose of the SEBE project was to assess bank condition, as it relates to stability, and the application of rehabilitation treatments rather than biodiversity and riparian zone functioning. Accordingly, it was considered that the method of Jansen *et al*. (2004) would not meet the SEBE project objectives.

Ateyo and Thackway (2009) developed a field manual for monitoring and reporting revegetation program outcomes; however, there was no specific reference to riparian areas. The field manual focused on monitoring the condition and structure of un-revegetated vegetation communities, and areas which had already gone through some level of organised revegetation as a baseline, in order to determine the potential future recovery of these affected areas. The lack of reference to riparian areas deemed this method unsuitable for the SEBE project.

The West Virginia Department of Environmental Protection (2006) developed a method relating exclusively to streambank erosion potential. The aim of this method was to reduce water pollution from sources, such as erosion from runoff and eroding streambanks. This method did not include monitoring streambank structure, rather, its objective was to quantifying the amount of erodible material entering waterways as the streambank continues to erode. This method also appears to only be appropriate for application in small streams rather than rivers and accordingly would not be easily applied to the Burnett and Kolan Rivers. This method was not considered appropriate for the SEBE project, as it did not include options for recording streambank condition, vegetation data, streambank topography and streambank retreat during future flooding events.

Several methods for taking monitoring photos were identified, such as Brodie (2003) and Rasmussen and Voth (2001), which provided useful information; however, due to the nature of the studies, no advice for the implementation of a streambank condition baseline method was provided.

The method outlined in the *National Vegetation Attribute Manual* (Department of Environment and Heritage, 2003) for capturing vegetation attributes was modified and used in the SEBE project. The original method was considered too detailed for this project so it was simplified for incorporation into the SEBE project.

The literature review did not identify a method considered suitable to meet the purpose of the SEBE project, and accordingly a project specific method was developed. Elements of the reviewed methods which were deemed useful were integrated or adapted into the final method for the SEBE project.

2. Method

The method to establish a streambank condition baseline comprised three components: site selection, field data collection, and data treatment and mapping. Each component is detailed in the relevant sections below.

Rehabilitation works were planned, designed, implemented, monitored and maintained by BMRG and BCCA every three months until site acquittal. This included vegetation establishment, weed control, fire management and irrigation. Site condition monitoring was undertaken once at each site by DNRM following the completion of works.

2.1 Site selection

The properties selected for the project were located within the North Burnett and Bundaberg regions, and comprised five properties along the Upper Burnett River, three along the Lower Burnett River and two along the Kolan River. Properties were chosen in consultation with BMRG and BCCA, and appropriate monitoring sites on each property were selected by DNRM Land Resources Officers. Sites included areas where rehabilitation works were being undertaken and areas not rehabilitated, and were chosen based on the following considerations:

- Erosion type and severity (e.g. scouring or slumping);
- Flood impacts (e.g. sand deposition and infrastructure damage);
- Land use (e.g. grazing, cropping and horticulture);
- Rehabilitation works (e.g. earthworks or revegetation);
- Timing of works (e.g. works needed to be completed within sufficient time to enable survey);
- Landholder amenability (e.g. accessibility of sites now and into the future); and
- Duplication (e.g. limited resources restricted replication of treatments).

It is noted that each individual site is influenced by a range of factors including flood impacts, location on river, topography and adjoining land use. Accordingly, it was not possible to select paired sites (i.e. two sites with identical attributes: one subject to rehabilitation treatments such as earthworks and/or revegetation, and one without (referred to herein as natural)). Instead, sites were chosen such that the widest array of rehabilitation treatments were included overall. See Table 1 for list of sites and transect treatments. Refer to Appendix A for a map showing the location of all ten sites.

Twenty three monitoring sites were located over 10 properties. At each monitoring site a transect was applied for data collection.
Terminology Note: 23 monitoring sites (“Transects”) were spread across 10 properties (“Sites”).

Table 1 – Site List

Site / Property No.	River	Transect	Treatment
1	Lower Burnett	T1	Nil earthworks. Revegetation only.
		T2	Nil earthworks. Revegetation only.
2	Kolan	T1	Nil earthworks. Revegetation only.
		T2	Nil earthworks. Revegetation only.
3	Kolan	T1	Nil earthworks. Revegetation only.
		T2	Nil earthworks. Revegetation only.
		T3	Nil earthworks. Revegetation only.
4	Upper Burnett	T1	Landholder earthworks before project. Revegetation only.
		T2	Landholder earthworks before project. Revegetation only.
		T3	Natural, no works.
5	Upper Burnett	T1	Natural, no works.
		T2	Earthworks & Revegetation.
		T3	Natural, no works.
		T4	Earthworks & Revegetation.
6	Upper Burnett	T1	Natural, no works.
		T2	Landholder earthworks before project. Revegetation only.
7	Lower Burnett	T1	Nil earthworks. Revegetation only.
		T2	Nil earthworks. Revegetation only.
8	Upper Burnett	T1	Landholder earthworks before project. Revegetation only.
		T2	Nil earthworks. Revegetation only.
9	Lower Burnett	T1	Earthworks & Revegetation.
10	Upper Burnett	T1	Earthworks & Revegetation.
		T2	Earthworks & Revegetation.

2.2 Field survey

Following site selection, a series of streambank survey transects were established on each property. Transects ran from the top of the bank to the edge of the water and were divided into segments. Segments were determined based on a change in slope, change in land use, or a pre-determined distance. At each segment, a clockwise series of four photos were taken i.e. looking downslope, right, upslope and left, and the surface soil field texture was recorded (NCST, 2009). Each segment was 10m wide, based on a 5m width on either side of the transect line. The attributes recorded for each segment included:

- Visual estimation of groundcover (percentage);
- Plant count, height and type (i.e. natural or planted)
- Presence/absence of weeds;
- Debris description; and
- Infrastructure or feature description (e.g. erosion gully, track, cropped paddock, etc.).

Vegetation species were noted if known, however physical attributes were regarded as a priority with regard to streambank stability and soil loss.
An overall site photo was also taken at each transect. A landholder questionnaire regarding site management (historical, current and future) was also completed for each site. Refer to Appendix B for a detailed field method description.

In addition to the transect attribute survey, the topography of each transect was also recorded by capturing the eastings, northings and elevation (i.e. x, y, z coordinates) to an accuracy of 0.1m, at multiple points along the transect. The specific location of each survey point was at the discretion of the DNRM surveyor, and typically included abrupt change in elevation at each segment marker.

2.3 Data treatment & mapping

Following the fieldwork, data was compiled from a range of resources, using various tools as outlined in Table 2. A suite of outputs was generated, as outlined in Table 3.

Table 2 – Data compilation mediums

Item	Description	Medium
1	Site data spreadsheet (data from site field sheet)	MS Excel
2	Transect & veg data spreadsheet (data from transect field sheet)	MS Excel
3	Topo data spreadsheet (xyz data from surveyor)	MS Excel
4	Photo list spreadsheet	MS Excel
5	Site map (.mxd)	ArcGIS
6	Transect shapefile (spatial layer)	ArcGIS
7	2009 LiDAR raster (spatial layer comprising elevation pixels)	ArcGIS
8	Pre and Post- flood imagery (spatial layers)	ArcGIS
9	QLUMP 2009 shapefile (land use mapping spatial layer)	ArcGIS
10	2013 Flood extent mapping shapefile (spatial layer)	ArcGIS
11	2013 Flood erosion impacts shapefile	ArcGIS
12	Regional Ecosystem mapping shapefile (spatial layer)	ArcGIS
13	Soil mapping shapefile (spatial layer)	ArcGIS
14	Weirs location shapefile (spatial layer)	ArcGIS
15	Rainfall data	BOM website
16	Individual landholder questionnaires	MS Word

Table 3 – Survey Outputs

Item	Description	Type
1	Transect location maps	Pdf
2	Erosional process maps	Pdf
3	Site photo plates	MS Word doc
4	Transect cross section diagrams	MS Word doc
5	Site report cards	MS Word doc

Site field data was compiled into several MS Excel and ArcGIS databases. Spatial data was used to generate maps showing transect locations and streambank erosion processes. Spatial data was also used in desktop analysis to populate selected attributes in the site/transect databases (e.g. Regional Ecosystem and Soil Profile Class). Topographic data collected by the surveyor was used in conjunction with a LiDAR digital elevation model to generate transect slope data and cross section diagrams of the bank along each of the transects (for pre and post flood); and photos were compiled into a photo plate for each transect/site. Additional relevant information was obtained from the land use mapping, site rehabilitation plans produced by BMRG and BCCA), the landholder questionnaires and the Bureau of Meteorology website. Finally, all data was summarised into a single condition report card for each site.

3. Results

The data and information collected through this project represents a baseline i.e. a quantitative and qualitative description of various physical attributes and processes influencing streambank condition at nominated sites. Whilst an overall score for each site has not been calculated, to allow for comparisons between sites, sufficient suitable data has been collected, collated and stored or presented in such a way that repetition of the survey in the future will enable comparison of individual sites over time. This will enable evaluation of rehabilitation methodologies and management practices, offering insights into future strategic direction of resources.

The intended and viewable outputs of the project are listed below and are provided in the Appendices.

Item	Appendix
Site maps showing transect location and erosion processes	C
Site photo plates	D
Transect cross section diagrams	E
Site report cards summarising transect condition	F

4. Recommendations for future monitoring

In the absence of extreme and unpredictable events, such as flooding or disturbance from a change in land use, changes in streambank topographic stability are likely to be slow. Given suitable conditions (e.g. absence of weeds, fire, grazing and drought), growth of stabilising vegetation is likely to be rapid. It is considered acceptable to apply different monitoring frequencies for the various attributes monitored. For example, vegetation attributes may be monitored at a frequency of once every two - five years; however, bank cross-section may be monitored once every ten years. Survey effort will also be guided by funding and resource availability. In addition, monitoring immediately following a flood event is considered necessary.

Additional recommendations to assist with future monitoring efforts include:

- For consistency, survey of all sites (during a single monitoring period) should be conducted by the same person or team of people;
- To avoid confusion, transect attribute and topographic surveys for individual transects should be conducted on the same day;
- To further understand the implications of different flora species used in revegetation, it is recommended that a botanist is included in the fieldwork (or that the necessary capacity is built into the team);
- For strategic and accuracy purposes, take necessary measures to ensure effective communication with project managers, to ensure clear understanding of the nature and timing of works by both landholders and consultants/contractors.

5. References

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