LAKE BAROON CATCHMENT CARE GROUP

Projects 2012-13

Upper Alcorn Creek Riparian Fencing

seqwater
WATER FOR LIFE

PROJECT PLAN

Project No. 1213-009

This Project proposal has been prepared by:

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PROJECT VERSIONS & APPROVALS

Date	***Version/Description***	***Result***
April 2013	Draft Project Proposal	n/a
11/4/2013	Project presented to LBCCG Committee	Approved (Minutes 61.6.5.4)
9/5/2013	Project Proposal forwarded to Seqwater for approval (email)	Approved B. Heck 22/5/2013

Cover photo: *Alcorn Creek – a major tributary of Bridge Creek.*

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i. SUMMARY

PROJECT NUMBER & TITLE: **1213-009 - Upper Alcorn Creek Riparian Fencing**

Maintaining water quality is critical to providing safe bulk drinking water for the population of south east Queensland. All of the raw water storages managed by Seqwater are located in catchments which are developed to varying extents and support active and growing communities, including important industrial and rural economic activity. To provide a multi-barrier approach to the supply of drinking water, Seqwater must influence the management of land not owned by, but which exert an influence over Seqwater's business.

Upper Alcorn Creek Riparian Fencing is a project designed to reduce the impacts of livestock access to a significant length of permanent waterway. The reduction in risk to water quality are expected to be significant and an integral part of the broader aim of protecting the Lake Baroon resource, addressing the issues and risks associated with the production of a safe water supply to the Sunshine Coast and beyond. However the project provides far broader environmental benefits, such as the protection of remnant vegetation and wildlife corridors that increasingly the community demands.

APPLICANT/LANDHOLDER DETAILS

Names	Debbie Thorne & Colin Eastmure
Postal Address	[redacted]
Phone Numbers	[redacted]
E-mail	[redacted]

PROJECT / SITE LOCATION

Property Address	196 Maleny-Kenilworth Road, Witta		
RP Numbers (Lot)	SP120150 (285)		
Property Size (ha)	104		
Existing Land-use	Beef grazing		
Stock Carried	100+		
Sub-Catchment	Bridge Creek	***Management Unit***	
M.U. Priority *(LBCCG IP)*	**Low**	***M.U. Priority*** *(Pollution)*	**Very High**

PROJECT PARTNERS/STAKEHOLDERS & ROLES

Lake Baroon Catchment Care Group	Project coordination, administration, reporting, monitoring & evaluation (In kind $8,525)
Seqwater	Project funding ($40,698)
Sunshine Coast Council	Technical advice
Hinterland Bush Links	Technical advice
Debbie Thorne & Colin Eastmure	Landowners, labour, funding ($44,950 cash & in-kind)

PROJECT DETAILS

Project Start Date	May 2013	***Project Completion Date***	October 2013
Fencing	1,100 metres (15.5 ha fenced; 1,100 lineal metres Alcorn Creek)		
Waterway crossings	3 (1 x low level concrete; 1 x beam bridge; 1 x pipe)		
Laneway rehabilitation	1,000 metres approx.		
Off stream watering	1 system (tank, troughs, poly pipe etc)		

The project will erect fencing and construct waterway crossings on Alcorn Creek - a major tributary of Bridge Creek and ultimately Lake Baroon. Approximately 15.5 hectares of riparian zone, remnant vegetation and quality regrowth vegetation will be included in the fencing. Livestock grazing will be limited to dry periods when damage to hill-slopes, waterway bed and banks, and vegetation will be minimal. The irregular livestock grazing will assist in the management of weeds within the riparian zone.

The project will occur in the upper reaches of Alcorn Creek on the Thorne/Eastmure property (100 hectares) in Management Unit BR1 - a very steep catchment with limited vegetation to prevent erosion and intercept run-off. Consequently it is a major contributor of pollution with more than 95% of samples exceeding guideline levels (Dunstan 2007).

The project will erect 1,100 metres of new fencing and construct three waterway crossings (of different design) to manage livestock in the riparian zone and improve the movement of livestock between the eastern and western sides of the property. Additionally the fencing will provide a link between remnant vegetation to the southern of the property to remnant vegetation on the north of the property.

Laneway rehabilitation will repair degraded laneways and improve access to the waterway crossings sites for the delivery of concrete, road-base, rock and other materials.

Once fencing has been completed excluding livestock from water, off stream watering will be installed (extending the current system).

The project is expected to commence once weather and site conditions permit (May – September 2013).

Left: Alcorn Creek on the Thorne/ Eastmure property. Note the remnant and regrowth riparian vegetation along the creek. To erect the fence on stable ground the fencing will include several large areas of open pasture which will require irregular grazing to manage weeds and maintain access.

1.0 INTRODUCTION

Lake Baroon Catchment Care Group (LBCCG) is a not for profit community group focussed on improving water quality in the Lake Baroon catchment primarily through the implementation of on-ground projects. This aim is consistent with Seqwater's objectives of producing efficient, high quality potable water for the Sunshine Coast (and greater south east Queensland) region.

Seqwater is primarily responsible for the storage and supply of treated water to more than 2.5 million people in SEQ, as well as the supply of raw (untreated) water for power generation, irrigation, recreation and the environment. Seqwater is required by the Water Act 2000, The Grid Contract, Seqwater Strategic Plan, and industry best practice to manage its drinking water catchments. However, the majority of catchment land within which these assets are located, is owned by others. To provide a multi-barrier approach to the supply of drinking water to SEQ, Seqwater must influence the management of assets not owned by Seqwater but which exert an influence over Seqwater's business (SKM 2012).

Maintaining water quality is critical to providing safe bulk drinking water for the population of SEQ. All of the storages managed by Seqwater involve catchments which are developed (to varying extents) and support active and growing communities, along with important industrial and rural economic activity (SKM 2012).

The landowners were approached by LBCCG to gauge their interest in on-ground activities as this part of the catchment has received virtually no investment in the past and little is known of the 'hidden' area (other than contributing high volumes of sediments and nutrients to the system). The landowners have been very active implementing not only best practice farm management, but also working on environmental issues on the property (managing livestock access to waterways).

As the project is consistent with LBCCG (and Seqwater) aims, the proposal to supply and erect fencing to manage grazing, and the formalising of waterway crossings was considered worthy to support.

1.1 BACKGROUND

Alcorn Creek is a major tributary of Bridge Creek which in turn supplies Lake Baroon, the Sunshine Coast's most important source of potable water. The catchment is steep and much of it is not visible from surrounding roads. Large properties dominate the catchment and access is limited.

The property was originally a dairy farm (up until dairy regulation in the early 2000's) but has since changed land use to beef production. The property is owned by Mrs RK Thorne; however it has been managed for ten years by daughter Debbie Thorne and Colin Eastmure who have actively improved the property for livestock production.

Like much of the catchment, the steep slopes result in management difficulties with the steeper areas prone to environmental weed invasion, land instability and soil degradation. Maintaining healthy pasture cover can be challenging and the eastern side of the property was considerably degraded when Debbie and Colin took over management, with large areas of lantana, spring-related waterlogging and instability, and poor fencing. By necessity fencing alignments are dictated by the lay of the land rather than placement for optimum paddock size and orientation.

1.2 PREVIOUS RESTORATION ACTIVITIES

There have been no incentives provided to the landholders for environmental (including water quality) activities in the past. Colin and Debbie have enquired to various agencies and community groups for assistance but were given no help.

Despite this, Colin and Debbie have been gradually fencing Alcorn Creek when time and funds were available. Overall property management has been focussed towards improving efficiencies associated with running beef cattle – paddock layout, effective crossings over Alcorn Creek and tributaries, provision of extensive off stream watering and other production focussed activities that also provide water quality benefits through improved pasture and livestock management.

Left: The western paddocks on the property provide good grazing and are carefully managed.

Left: Remnant vegetation previously fenced – although livestock can currently access the riparian zones of Alcorn Creek.

2.0 PROJECT LOCATION

2.1 INTRODUCTION

Lake Baroon is situated on the Maleny Plateau in the headwaters of the Mary River, located inland from Sunshine Coast approximately 13 km south west of Nambour and 7 km North East of Maleny. Obi Obi Creek forms both the primary inflow and outflow of the dam. Walkers, Falls, Bridge and Elston Creeks constitute the remaining significant creeks within the catchment providing water to Lake Baroon. The catchment encompasses an area of 74 km^2 (including the dam surface).

2.2 THE BRIDGE CREEK CATCHMENT

Above: Lower Bridge Creek has good riparian vegetation promoting stability. The headwaters however are prone to severe erosion and impacts from grazing.

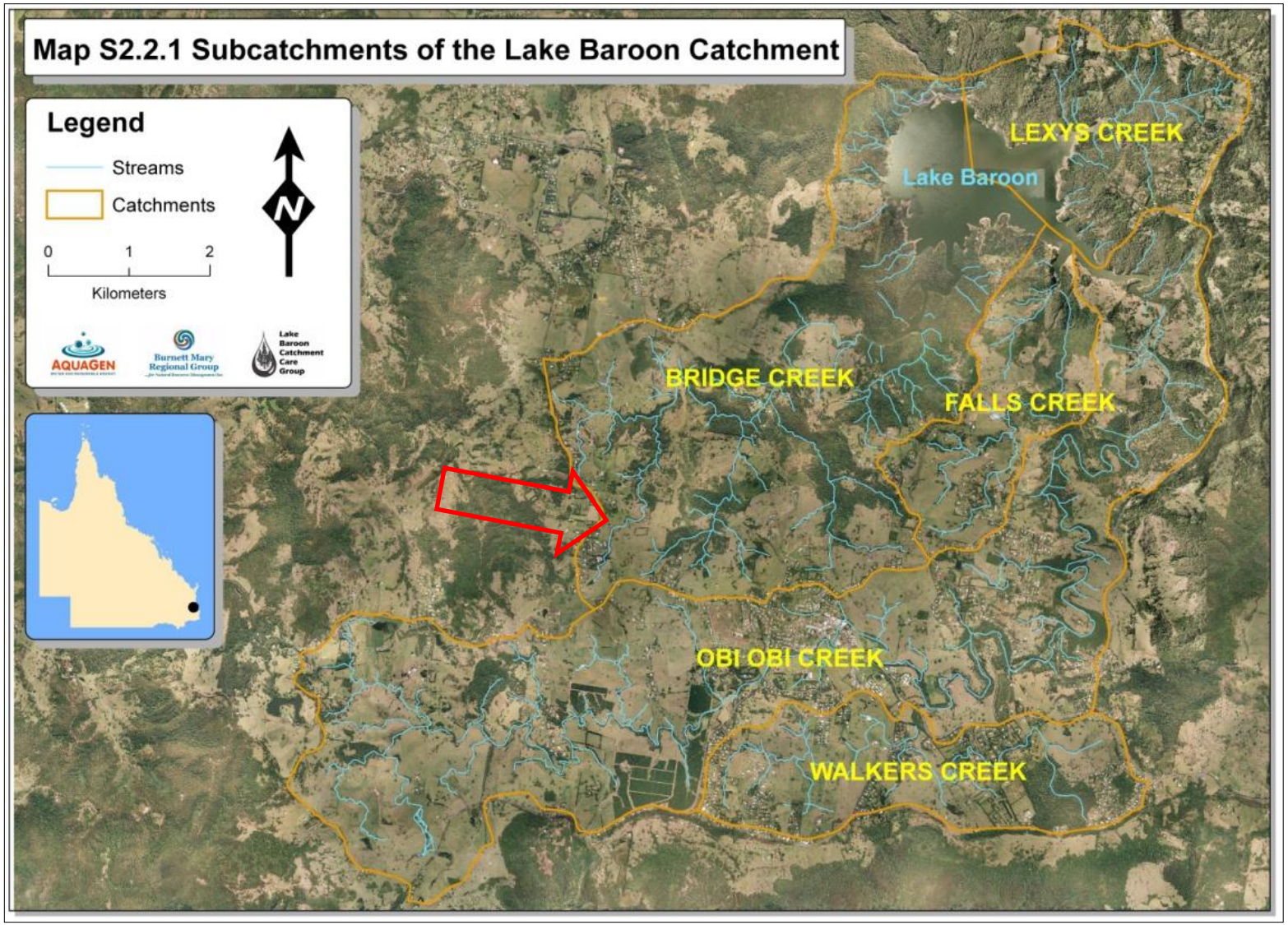
The Lake Baroon Catchment Implementation Plan 2007 describes the Bridge Creek sub-catchment as dominated by natural vegetation, although cattle grazing (and to a lesser extent dairying) remains a significant land use in several Management Units (smaller, similar parts of the catchment). The sub-catchment covers an area of 2,134 hectares and has a total stream length of 52 km (not including First Order streams). Approximately 43% of the sub-catchment has vegetation cover although much of this has suffered disturbance and is degraded by environmental weeds (Dunstan 2007).

Bridge Creek has been divided into six Management Units that reflect property boundaries, physiography, vegetation, land use and point and diffuse pollution sources. This provides administrative convenience and the ability to prioritise stream zones more accurately according to various threats.

The propose project is located within Management Unit BR1 – Alcorn Creek.

Left: A typical view of MU BR1. Steep slopes and vegetation interspersed with grazing land.

2.3 LOCATION MAP



Above: The Thorne/Eastmure property is located in Management Unit BR1 which encompasses virtually all of Alcorn Creek in its entirety. This MU is a significant contributor of excessive nutrients and sediments primarily due to the steep nature of the catchment.

3.0 CATCHMENT REVIEW

3.1 INTRODUCTION

Since the arrival of European Settlers, Lake Baroon and its catchment area have undergone significant change. Timber operators first settled in the region in 1853 and selectively cleared the best timber from the area. Following the removal of the most valuable timber (1906), the majority of remaining vegetation was cleared for beef and dairy cattle (1918) (Dunstan, 2007).

As a result riparian zones have been irreparably impacted such as:

- vegetation fragmentation (as a result of clearing)
- increased erosion and sediment loads due to clearing and land use practices
- changes to hydrology and water quality
- altered natural processes such as grazing and urban development
- introduction of foreign fill materials
- introduction of weeds, exotic plantings and exotic fauna.

3.2 GEOLOGY, SOILS & STABILITY

Approximately 25 million years ago extensive slow moving lava flows formed the Maleny plateau. The lava flowed from south of present day Maleny, northwards, meeting the far older North Arm Volcanics (220 million years ago) on the northern bank of present day Lake Baroon. Underlying the basalt is ancient sandstone (250 million years ago) which in places (notably Howells Lookout) was never covered by the lava flows.

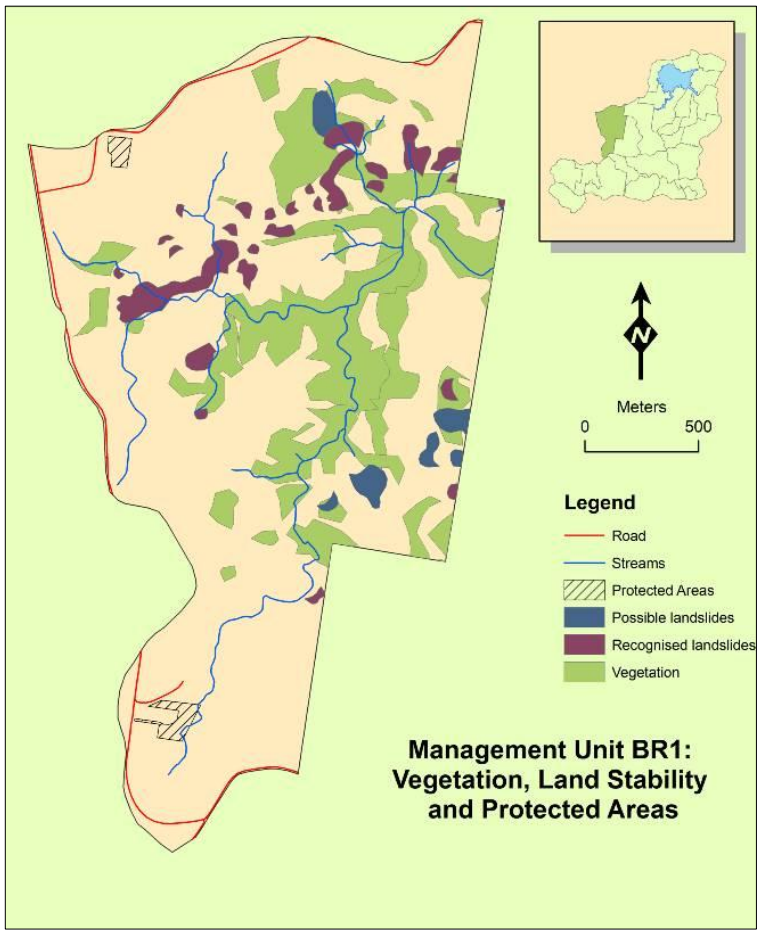
Erosion, particularly water erosion and the resultant formation of drainage channels (creeks) and mass movement has revealed these lower layers of sandstone throughout the catchment, influencing the presence and types of native vegetation.

The Thorne/Eastmure property has an elevation ranging between 360 metres (where Alcorn Creek leaves the property) to 450 metres above sea level at the entrance to the property on the Maleny Kenilworth Road. As a comparison Maleny has an elevation of approximately 450 metres and the highest point in the catchment – Howell's Knob has an elevation of approximately 550 metres above sea level. Consequently the property is quite steep – particularly on the eastern side, and Alcorn Creek in places is deeply incised.

Soils on the site vary with fertile red Krasnozem (Ferrosol) soils on the elevated, flat western side of the property, while the eastern side of the property is predominantly eroded, heavy black clays that can be prone to mass movement. The steep fall of Alcorn Creek which runs from south to north through the property has largely incised down to bedrock with little accumulation of alluvial material.

Mass movement is a characteristic of the Lake Baroon catchment largely confined to the edges of the plateau and lower catchment where erosion has exposed the underlying sandstone. Combined with the nature of the catchment, its physical characteristics, climate and vegetation it is highly susceptible to mass movement activity (East 1978). The climate, ranging from very dry to drought conditions through winter and high rainfall (approximately 2,000 mm/year) through summer; steep

slopes; shallow soils on impermeable sub-surfaces; cracking clays; and a lack of deep-rooted vegetation to bind the profile and manage soil moisture contribute to soil movement (Traill 2007).



The project site, although displaying some of the attributes that contribute to mass movement is relatively stable. There is evidence of old slips and accumulation of colluvial material – most obvious by the unmistakeable 'hummocky' appearance of the soil surface, surface cracking of dry soil and areas of waterlogging not directly associated with watercourses.

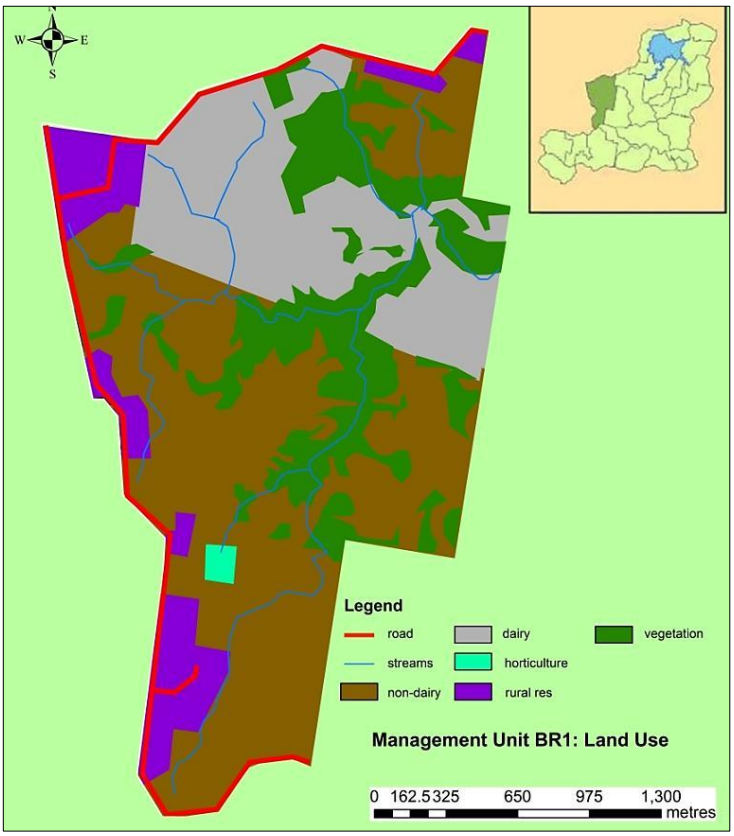
It is unlikely that the project activities will be affected by mass movement or land slips. The extensive vegetation along the watercourses provides excellent stability.

Below: The property is very steep towards the back or eastern side - particularly associated with Alcorn Creek which effectively splits the property in two.

3.3 LAND-USE

Despite the extensive clearing, 17% of the Lake Baroon catchment is still heavily forested, mostly in the immediate area around the dam. Today, the catchment is susceptible to additional impacts associated with an increasing diversity of land use (Keys 2009).

The area around the lake is popular with "tree changers" and has seen land use change from grazing to rural residential. This has resulted in the fragmentation of larger tracts of agricultural land into smaller rural residential parcels with a large increase in the number of on-site wastewater treatment systems in the catchment (Keys 2009).



Presently the catchment is susceptible to a number of land use impacts (Traill, 2007; Dunstan, 2007) including:

- dairying and cattle grazing;
- new developments and increased stormwater runoff;
- runoff from impervious surfaces of existing developed areas;
- irrigation of treated effluent associated with the Maleny sewage treatment plant;
- uncontrolled stock access to the lake and its tributaries;
- lack of riparian vegetation and integrity – a result of extensive vegetation clearing;
- abundance of weeds – shift in land ownership from land managers (e.g. farmers) to inexperienced residents has potentially led to the spread of weeds; and
- varying pollution sources related to increased population.

Land use in Management Unit (BR1) is predominantly beef grazing although the Sommer Brothers dairy remains a significant land user. Sommer Brothers only own a relatively small area within the catchment, however they agist the much larger (approximately 100 hectares) Newton property (this may have changed recently). Like the Oehmichen and Ruddle (and partly the R. Cork) properties, the actual Sommers dairy lies outside the Lake Baroon catchment.

The Management Unit is approximately 450 hectares in size and encompasses almost all of the recently named Alcorn Creek (LBCCG project *Name That Stream 2007-09*). Many of the middle to lower reaches of Alcorn Creek have riparian vegetation with pockets of remnant vegetation – some classified as Endangered or Of Concern Regional Ecosystems (Dunstan 2007). Like much of the Lake Baroon catchment, the upper reaches of Alcorn Creek have been extensively cleared with associated erosion and water quality problems.

The Thorne/Eastmure property sits in the middle to upper reaches of Alcorn Creek with most of the watercourses on the property having good vegetation cover, although some reaches are degraded by environmental weeds (primarily lantana).

4.0 WATER QUALITY

4.1 INTRODUCTION

The environmental health of the Lake Baroon catchment is considered generally poor, and in some respects declining. A State of the Rivers assessment (Johnson, 1996) indicated that significant sections of the waterways appear to be in moderately poor condition, with moderately to highly disturbed reach environs and considerable lengths of unstable banks and bed-streams. These were characterised by lack of native vegetation displaced by clearing, grass banks or exotic vegetation (Keys 2009).

Pollutants entering Bridge Creek occur from three main sources. Diffuse run-off from traditional grazing practices provides nutrient and pathogen inputs (fertiliser application and animal manure), and sediments (from paddock erosion and bank erosion in watercourses from unmanaged livestock access). There is little urban influence in this part of the catchment however road run-off, litter and organic matter contamination remains a risk. Poorly performing rural residential wastewater treatment systems (such as septic tanks) with high nitrogen, phosphorus and pathogens are high risk.

The sheer volume of excrement produced by cattle, horses, and to a far lesser extent other domestic animals, when in large herd sizes renders them significant contributors within an open drinking water catchment. Reducing connectivity, through the management of riparian fencing and revegetation, would reduce the likelihood of pollution at almost all high risk locations in the catchment (pers. comm. A. Smolders 2012).

Just under 45% of the sub-catchment is vegetated, and 27% of the waterways have riparian cover of varying quality. Despite the vegetation, the MU contributes a large nutrient load to Bridge Creek, with more than 95% of samples exceeding guideline levels (Dunstan 2007). This is most likely due to the steep topography, unstable soils and traditionally heavy grazing practices. Bridge Creek is noted for its naturally high phosphorus levels which are mobilised by mass movement and general erosion in the catchment. The riparian vegetation does not currently effectively buffer and filter nutrients originating in the catchment.

The Lake Baroon Catchment Implementation Plan (2007) rates BR1 a LOW priority for rehabilitation works due to its overwhelmingly poor condition (nutrients and erosion). When assessing the Management Unit using a modified version of the Prioritisation Process, which prioritises MU's on pollution input levels and land instability parameters, BR1 rates as a VERY HIGH (the highest in the Lake Baroon catchment).

4.2 STATISTICAL ANALYSIS OF THE RAW WATER QUALITY DATA RECORDED FROM WELLS ROAD (Bridge Creek) 1991-2005

Water quality monitoring and analysis sampled at the Bridge Creek crossing (Wells Road) between 1991-2005 by AquaGen shows, that despite a relatively dense coverage of vegetation, the catchment contributes significant nitrates, ammonia, phosphates, total phosphorus and faecal coliforms.

Parameter	*pH*	*Turbidity*	*NOx (N)*	*NH3 (N)*	*PO4 (P)*	*Total P*	*Faecal Coliforms*
(units)	*(pH units)*	*(NTU)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(number/ 100 mL)*
Guideline Value	*6.5-8.2*	*<25.0*	*<0.040*	*<0.010*	*<0.030*	*<0.030*	*<100*
Max	8.2	85.6	0.316	0.166	0.068	0.335	1480
Min	6.7	0.6	0.000	0.000	0.001	0.005	0
Mean	6.9	3.6	0.059	0.026	0.023	0.043	233
Median	6.9	1.4	0.036	0.010	0.013	0.027	60
Std Dev	0.3	16.0	0.214	0.183	0.047	0.068	4627
20th Percentile	6.8	1.0	0.003	0.006	0.008	0.020	20
80th Percentile	7.0	2.3	0.118	0.040	0.041	0.050	390
Count above GV	0	1	23	24	17	22	20
Count	51	51	50	50	51	50	51
% above GV	0.00	1.96	**46.00**	**48.00**	**33.33**	**44.00**	**39.22**

Alcorn Creek is a rugged and remote watercourse with large primary production properties the norm. Access is difficult when dry and impossible during wet weather – particularly in the 1990s/early 2000s - therefore AquaGen sampling sites were confined to the very upstream (Porters Farm) and downstream on Wells Road close to where the creek enters Lake Baroon. A short lived (1994-98) site on Wilson's Farm provides some mid-section data however this almost mirrors the data collected at the Wells Road site. Therefore even though the Wells Road site is a considerable distance downstream of the project site, it provides the best source of data.

The routine sampling programs (CalAqua, AquaGen, Seqwater and others) are suspected of not adequately capturing the major pollution events that regularly occur in the catchment. Conducted either monthly (1991 – 1998) or bi-monthly (1999 – 2005), significant rainfall events in the catchment have probably been missed and the data collected may over-estimate the catchment's water quality (Traill, 2007). The following data analysis has been sourced from Traill, 2007.

As previously mentioned, Wells Road is downstream in the catchment and is affected by numerous impacts – urban Maleny, rural residential impacts (septic tanks etc), dairy and beef grazing and large areas of vegetation. High volumes of sediment delivered to Lake Baroon from soil erosion also occur in the catchment.

Turbidity does not appear in the data as a major concern. All sampling sites throughout the catchment have recorded low turbidity despite evidence to the contrary (sediment slugs and visibly

extremely turbid water during rainfall events). Turbidity is a measure of the degree of scattering light, related to the amount of particulate matter suspended in water. Nutrients such as phosphorus adsorb onto soil particles suspended in the water column. Turbid waters can contain fine clay colloids that are difficult to remove from the water column. These clay colloids reduce light penetration into the water.

Nitrate levels are consistently high with inputs likely to be largely as a result of upstream contamination. Nitrogen is essential for plant growth. However, increased levels of nitrogen can contribute to excessive algal growth (particularly in the Lake Baroon storage) and weeds.

Ammonia levels have remained consistently high. Ammonia is the initial product of the decay of nitrogenous organic wastes - high concentrations of ammonia can be toxic to aquatic life.

Phosphate levels were moderately high in the early sampling period but appeared to be declining. However as phosphates are usually bound to sediment and the low turbidity recorded it appears the high phosphate loads have not been captured by the sampling program.

Total Phosphorus has remained constantly high over the sampling period although significant rainfall events have probably been missed which would be expected to provide even higher levels. Phosphorus is an essential plant and animal nutrient, however, increased levels of phosphorus can contribute to excessive algal growth (particularly in the Lake Baroon storage) and weeds.

Faecal coliforms have remained relatively high. There have been considerable changes in land use over the sampling period and a growth in rural residential properties, indicating that either the majority of faecal coliforms are originating in the upper catchment and the intervening riparian vegetation ‘filters’ these pollutants to lower levels, or the replacement of livestock with people has merely changed the origin and not the levels of coliforms. Faecal coliforms are microorganisms found in animal and human excreta. Their measurement is used to indicate the potential presence of pathogens within water. Faecal coliform numbers are an important factor when determining the suitability of a water body for primary and secondary human contact.

Left: Livestock in waterways are high risk to water quality.

5.0 PROJECT PURPOSE & OBJECTIVES

5.1 BACKGROUND

A healthy aquatic ecosystem is one that is stable and sustainable; maintaining its physical complexity, biodiversity and resilience. It has the ability to provide ecosystem services that provide good water quality, wildlife habitat and recreation. This can potentially include limited and well managed grazing.

Riparian areas are the transition zones between land and water environments. They are generally more productive in terms of total biomass than the adjoining area (which contributes to their clearing) and are a critical source of biological diversity.

5.2 PROPERTY MANAGEMENT

Colin and Debbie both work off farm so livestock management needs to be efficient and well planned to minimise labour inputs and maximise returns. Livestock numbers are kept relatively low resulting in a lighter grazing regime. The better soils on the western side of the property are utilised more and subsequently paddock size optimises grazing rotations. Off stream watering infrastructure has been installed to enable cell/rotational grazing.

The poorer quality soils on the western side of the property are reflected in the larger paddock sizes with fence-line orientation dictated by land form rather than grazing considerations. Minor land slips, rocky soils, steep slopes, and weed infestations all complicate management. Weed management has been an ongoing program for the last ten years.

Accessing the eastern side of the property has always been a challenge and formal laneways and waterway crossings over Alcorn Creek and tributaries have been problematic. The steepness of the watercourses combined with the incised bed of Alcorn Creek have required expensive and elaborate solutions which require constant maintenance and repair.

With the installation of an extensive off stream watering system, Colin and Debbie have been gradually fencing off Alcorn Creek and the associated vegetation over many years. Time and funding have been the constraining factors. Currently almost one side of Alcorn Creek is fenced. A small tributary on the northern boundary of the property has been fenced to exclude livestock.

The completion of fencing on Alcorn Creek will improve livestock management by reducing mustering labour and reducing the risk of animal injury through misadventure.

5.3 WATER SUPPLY CATCHMENT

The whole of the property is within the Baroon Pocket Dam catchment. Alcorn Creek is a major tributary of Bridge Creek (2,134 hectares and 52 kilometres major stream length). Consequently it is a major supplier of total water to the dam.

5.4 ENVIRONMENTAL FACTORS

5.4.1 Significant Vegetation & Ecosystems

Like much of the Maleny region, the property has been substantially altered from its natural state and cleared for grazing; however there are significant remnants of the pre-clearing period. Primarily the steeper areas of the catchment were retained – mainly due to inaccessibility or reduced value for grazing. The majority of the remaining vegetation is located adjacent to the properties watercourses and the eastern side of the property.

The identified remnants are:

RE12.8.3 – Complex notophyll vine forest

The majority of the property would historically have been covered by this Ecosystem. Although not considered a high priority for conservation in Queensland, there are few areas within the Lake Baroon catchment considered to be in good condition. The ecosystem is relatively intact on the property but is degraded by environmental weeds (lantana) and grazing.

RE12.12.1/12.12.16 – Simple notophyll vine forest & Notophyll vine forest

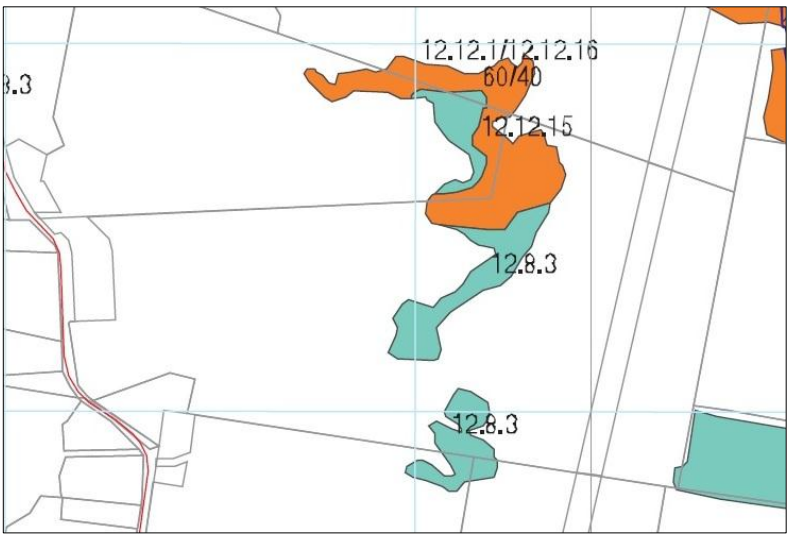
This mixed Regional Ecosystem takes into account the presence of both Brush Box (*Lophostemon confertus*) and Flooded Gum (*Eucalyptus grandis*). Although RE 12.12.16 is classified as Not of Concern, RE 12.12.1 is classified as Of Concern and therefore high priority for conservation. This RE intergrades with RE 12.8.3 along Alcorn Creek.

RE 12.8.8 - Eucalyptus grandis tall open forest

Although no longer present as remnant vegetation, there remains a number of large mature Flooded Gums on the higher rises on the eastern part of the property (Sunshine Coast Council mapping).

Other

In association with the remnant vegetation along Alcorn Creek there are further areas of vegetation classified as High Value (Sunshine Coast Council mapping).



Left: Map showing the remnant vegetation on the property.

Virtually all of this remnant vegetation will be included in the project and fenced.

5.4.2 Pest Species

The primary environmental weed on the property appears to be lantana. The landowners have been implementing a weed management program for many years and have made significant progress – particularly on the gentler slopes away from watercourses. Areas of steep slopes could potentially be quite unstable when vegetation (including weeds) is removed, so the staged approach appears to be the most sensible. Lantana can provide some refuge for bird species and mammals and shouldn't be removed for the sake of controlling weeds.

Weed management is continuing.

Wild dogs are a key threat to primary production in this area and Thorne/Eastmure property is one of the few properties that can undertake baiting programs. The relative remoteness of the property, vegetation and extensive shelter can be used as an advantage in baiting programs and the fencing of the creek may assist in the safety aspect of the program.

5.4.3 Fauna & Fauna Corridors

Remnant riparian vegetation along the banks of Alcorn Creek, and the creek itself, provide key habitat areas and corridors for both arboreal and ground dwelling animals and birds and aquatic species. A virtually unbroken and wide strip of vegetation runs the entire length of the property. Areas of remnant vegetation exist independently of Alcorn Creek on the property and the noted remnant on the nearby Daugaard property. The project has excellent corridor/linkage benefits and future work could provide a link to the nearby upper Mary River catchment.

There have been no fauna investigations to determine the species present however due to its quality of vegetation, linkages downstream, area and remoteness, it is likely the site/property is habitat to numerous at risk species. Koalas are regularly observed on the property.

5.5 OBJECTIVES

Upper Alcorn Creek Riparian Fencing is a project designed to reduce the impacts of livestock access to a significant length of waterway. The water quality benefits are expected to be significant and an integral part of the larger aim of protecting the Lake Baroon resource, addressing the issues and risks associated with the production of a safe water supply to the Sunshine Coast and beyond. However the project provides far broader environmental benefits that increasingly the community demands and expects.

The project aims to:

- implement on-ground project that delivers water quality benefits
- raise community awareness particularly of water quality issues
- promote integrated catchment management in the Lake Baroon catchment
- reduce nutrient delivery to waterways
- reduce sediment delivery to waterways
- reduce pathogen delivery to waterways
- improve aquatic habitats
- reduce impact of weeds

- restore links between vegetation and create corridors
- conserve threatened species
- work cooperatively with Sunshine Coast Council
- climate change adaptation
- demonstration of best practice

Effective riparian areas can reduce the risks to water quality by trapping sediment, reducing erosion, storing nutrients and filtering contaminants before they reach the water source (Lake Baroon). Riparian area health is a key factor in reducing risk.

5.6 TARGETS

- a stable waterway with erosion reduced to natural levels
- exclude livestock from approximately 1,100 metres of Alcorn Creek riparian zone
- manage livestock from approximately 1,100 metres of tributary riparian zone
- extend vegetation corridor by 1,100 metres
- enhance approximately 15.5 hectares of riparian vegetation (area fenced)

5.7 OUTCOMES

Healthy catchments lead to healthy waterways. By improving the health of riparian zones we ultimately aim to reduce the impacts that can affect water quality. Seqwater provides generous funding and LBCCG offers appropriate incentives to landowners to implement activities that are designed to reduce the risk to water quality. Through the prioritisation and implementation of riparian protection and rehabilitation throughout rural catchments – particularly headwaters, we can provide multiple beneficial outcomes.

Outcomes are the 'end product' of the project – what we actually achieve. It can be very difficult to measure outcomes as they may take many years to be fully realised and can be enormously expensive to quantify – potentially far more than the actual implementation of the project. We must rely on best management practice, anecdotal evidence and sometimes partnerships with universities and/or Seqwater to produce 'hard' data to the actual effectiveness of the project.

1. Reduce nutrient delivery to waterways.
Nutrient delivery to waterways is continuous and increases during episodic rain events.

Managing livestock in the riparian zone reduces the opportunity for direct deposition of faecal material into the watercourses. Vegetative buffers intercept run-off contaminated with excessive nutrients from diffuse paddock sources.

2. Reduce sediment delivery to waterways.
Soil from erosion leads to high turbidity and is transported to Baroon Pocket Dam and beyond.

Managing livestock in the riparian zone reduces soil erosion from trampling. The enhanced vegetative buffer (resulting from the removal of cattle) stabilises eroding banks and intercepts paddock run-off contaminated by sediments.

3. Improve aquatic habitat.
Riparian vegetation plays a critical role in the creation and maintenance of aquatic habitats in freshwater ecosystems.

Riparian vegetation provides shade, limits nuisance aquatic plant growth, provides vegetative inputs that serve as habitat and food for aquatic species, and provides bank and bed stability. The project will enhance the condition of the riparian vegetation.

4. Raise community awareness.
The majority of land in the Lake Baroon catchment is privately owned and without landholder and community support, activities improving catchment health and water quality is impossible.

The project will demonstrate the value of managing livestock in riparian zones and the reestablishment of vegetation to reduce risks to water quality – both throughout the catchment and Lake Baroon. On-ground works provide the opportunity for land managers to apply their knowledge and experience at the local level whilst contributing to landscape scale outcomes, increasing the skills and capacity of the community.

5. Enhance links between vegetation and create corridors.
Riparian zones provide wildlife corridors so that fauna can safely move from one area to another.

The project will enhance Alcorn Creek as a link between areas of remnant vegetation. By linking areas of otherwise isolated habitat, wildlife corridors facilitate gene flow and colonization of suitable sites, and are critical in the modern disturbed landscape, helping to maximise the biodiversity of a given area can support. Research has shown that small habitats which are physically interconnected to larger source pools of organisms will support and maintain greater species richness than comparable habitats that are not physically connected (Barwick et al, 2009).

6. Provide terrestrial habitat.
Riparian vegetation provides important habitat for the adult stages of aquatic insects and amphibious organisms such as frogs and turtles.

The project will enhance riparian and associated vegetation improving, over time, valuable habitat for a variety of native fauna. The project will significantly reduce livestock access to approximately 15.5 hectares of riparian and remnant vegetation

7. Reduce chemical delivery to waterways.
Improved water quality monitoring and analysis by Seqwater has identified pesticide and herbicide contamination in Baroon Pocket Dam.

The project will enhance riparian vegetation on a 3rd Order stream adjacent to agricultural land providing a buffer to pesticides and herbicides.

8. Establish a healthy, diverse and resilient environment that will address climate change variability.
Future climate change impacts may impact on the survival of threatened and vulnerable wildlife, increase the occurrence of significant storm events leading to the degradation and decline in the environment and subsequently catchment water quality.

The project addresses key threats predicted by climate change - increasing the resilience of the catchment to the impacts and facilitating the movement of terrestrial species.

6.0 PROJECT JUSTIFICATION

6.1 INTRODUCTION

An estimated 80% of sediment and 35% of nitrogen in the waterways in south east Queensland comes from non-urban diffuse loads. Reduction of these loads clearly represents a major target for action if significant improvements in water quality are to continue to be achieved in South East Queensland (DERM 2010).

In an ideal world, all waterways in the Lake Baroon catchment would be rehabilitated to provide riparian buffers, lower in-stream temperatures and provide appropriate habitat for aquatic ecology. However the limited resources available means the catchment must be prioritised into areas where the greatest gains can be achieved through the smallest investment.

The LBCIP prioritisation of sub-catchments for works is effective and useful for rehabilitating waterways in the catchment through fencing and revegetation but does not reflect the nutrient and sediment inputs to the waterways through land use, particularly intensive grazing (dairying and beef production). An alternative Management Unit Prioritisation was developed by LBCCG that utilises MU stability; pollution and the degree of riparian vegetation present to determine the need for on-ground investment. In this context the proposed project rates VERY HIGH in priority (Dunstan 2007).

Maintaining a healthy riparian system is essential for a productive landscape. When a riparian area is healthy it contains lush, abundant vegetation, provides habitat for wildlife and aquatic species and potentially a source of forage for livestock. Healthy, primary vegetation in a riparian area stabilizes streambanks, influences bank morphology, aids in reducing streambank damage and provides shade which in turn lowers water temperatures, increasing the oxygen carrying capacity of the stream. As well, riparian vegetation filters, utilizes and stores nutrients, thus preventing them from entering water systems. When a riparian area is properly functioning and healthy, it can influence an increase in groundwater recharge.

We cannot realistically completely restore cleared riparian zones to pre-European conditions, but we can improve the ability of the zone to maintain the quality of water delivered downstream.

Grazing and browsing of vegetation in riparian areas can be considered a natural disturbance as it has occurred for thousands of years before European settlement. A healthy stream/riparian area will have greater resiliency, stability and resistance to disturbances.

Human-induced disturbances brought about by land use activities (clearing, over-grazing, roads, tracks, waterway crossings) have the greatest potential to harm a stream corridor. Physical disturbances can cause impacts locally as well as at locations far removed from the actual disturbance.

Livestock grazing is a land use activity that has the potential to alter the condition of a stream and riparian area if not performed properly. Improper livestock use of riparian areas can negatively affect riparian areas by changing, reducing or eliminating the vegetation within them.

6.2 GRAZING AND RIPARIAN ZONES

The direct effects of improperly managed livestock grazing on riparian vegetation include:

- change, reduce, or eliminate vegetation
- decrease the vigour, biomass and alter species composition and diversity
- change the channel morphology by widening and shallowing of the streambed
- alter the stream channel through trenching or braiding depending on soil and substrate composition
- alter the water column by increasing water temperatures, nutrients, suspended sediments and bacterial counts
- alter the timing and volume of water flow
- cause bank sloughing leading to accelerated sedimentation and erosion
- decrease wildlife habitat and species

An effective grazing management plan balances animal demand with available forage supply, distributes livestock evenly, avoids grazing during vulnerable periods, and provides ample rest after grazing. Good management of riparian zones provides productive grazing while still maintaining environmental functionality.

6.3 OFF STREAM WATERING AND RIPARIAN FENCING

In the sub-tropics, the majority of overland flow events occur during the summer runoff. Consequently during the winter and spring months, most faecal contamination in water channels occurs from an animal defecating directly into the water. Any practice that reduces the amount of time cattle spend in a stream will therefore reduce the manure loading and decrease the potential for adverse effects on water from grazing livestock.

Even without exclusion fencing of riparian zones, off-stream water sources reduce the amount of time free ranging cattle spend in or immediately adjacent to watercourses. Cattle prefer to drink from a watering trough over other sources of water available to them, resulting in a significant reduction in time spent in the stream (watering) and adjacent stream side area (grazing and loafing).

Studies overseas have shown that following the installation of the off-stream watering (OSW) infrastructure, stream bank erosion decreased by 77% and concentrations of total suspended solids, total nitrogen and total phosphorous decreased by 90, 54 and 81%, respectively (Sheffield et al, in McIver 2004). More recent studies indicate that although the installation of OSW by itself is effective, providing livestock supplements and shade near troughs reduced riparian zone pressures even further (Ganskopp 2001, McInnis and McIver 2001, Porath et al. 2002 in McIver 2004). Porath et al. (2002) also found that the provision of supplements increased weight gain in cows and calves.

Cattle prefer using troughs to other sources of water – streams, dams, puddles. A trough, even if utilising water from the stream or dam provides higher quality water. Cattle when drinking at streams and dams enter the water to reduce bending, resulting in the stirring up of suspended solids (turbidity). Additionally riparian zones can be difficult places for livestock to access (steep, muddy or rocky banks) placing greater effort and stress on individual animals. Additionally when cattle enter a water source they tend to defecate usually directly into the stream/source.

Troughs provide a level, relatively dry watering point where the animal does not have to bend excessively, reducing stress by providing improved footing, increased visibility and reduced physical effort. This can lead to healthier animals with less risk of injury.

Cattle use riparian areas for resources other than water - crossing points, forage, shade, grooming sites (scratching posts) and general loafing. A well designed OSW system needs to take into account all these factors. Research by Gillen et al. (1984) (in McIver 2004) shows that cattle prefer to graze within 200 metres of water. Therefore to optimise uniform grazing and water efficiencies, cattle should not have to walk more than 200 -300 metres to water.

Season and time of day also have an effect on the effectiveness of an off-stream water source in reducing degradation to a riparian area. In the warmer summer months, riparian areas give shade and protection from the heat and the coolness of the water often draws the animals to the water's edge. It is essential to ensure that alternative shade is provided within the paddock – preferably near the OSW trough and ideally on a high point exposed to cooling breezes.

Exclusion fencing suggests that riparian areas and cattle are unable to coexist, however, exclusion fencing is still required in areas that are significantly degraded and need extended rest to regenerate, or areas that are very sensitive to livestock grazing – particularly remnant vegetation.

6.4 PRIORITY LANDHOLDERS/LAND IN THE LAKE BAROON CATCHMENT

The Thorne/Eastmure property is one of the largest in the Lake Baroon catchment. It is also situated in the highest priority Management Unit when pollution and land instability is considered. The landowners are extremely keen to implement activities that not only improve the management of the property but provide significant broader benefits – that is reducing the risk to the Sunshine Coast's most important water supply and the environmental outcomes that are realised when managing riparian and remnant vegetation.

Priority landholders were identified in 2007 based on land-use, property size, and proximity to Seqwater infrastructure (Baroon Pocket Dam, Maleny Weir, and King's Lane Weir) and/or their potential to adversely impact on catchment water quality. The property was not identified as a priority landholding in 2007 for unknown reasons. From the Maleny-Kenilworth Road the property appears extremely well run with a cell grazing regime in place which does not over-graze. Potentially being a well-run property meant it was excluded from the Priority Landholder list. Nevertheless as the property is of considerable size, is in a very high priority MU and the landowners are extremely enthusiastic, it would be foolish to ignore the project on the basis they are not one of the identified Priority Landholders.

6.5 ALIGNMENT WITH KEY PLANS & STRATEGIES

Reducing the risk to water quality is particularly critical for the supply of bulk drinking water to the population of south-east Queensland. All of the storages managed by Seqwater involve catchments which are developed (to varying extents) and support active and growing communities, along with important industrial and rural economic activity. If these catchments are not managed properly, the risk of exposure to water quality hazards is heightened as development continues and the population increases. As a pre-emptive measure, Seqwater is undertaking initiatives to minimise and manage the risks to water quality in its storages. Identifying and engaging stakeholders on water quality issues is

critical to developing robust risk mitigation strategies and achieving good water quality outcomes in the broader catchment (Keys 2009).

The primary area LBCCG (and other community groups) can manage risk is in the area of land use – essentially livestock grazing and the associated key issue of pathogens. A number of factors can contribute to pathogen contribution by livestock. A high likelihood ranking has been attributed by Keys 2009 to any site where the following conditions exist:

- direct animal access to waterways;
- intensive feed lots and dairies;
- heavy broad scale grazing; and
- animal deposition (including bio-solids piles) possible within 50 m of intermittent or permanent waterways.

The sheer volume of excrement produced by cattle, horses, and to a far lesser extent other domestic animals, when in large herd sizes renders them significant contributors within an open drinking water catchment (Baker 2011).

With current control measures in place, water quality is still at high risk from risk sources dominated by land use activities and human access. Key issues in this section include hazards associated with the population growth in the area and the increasing rural lifestyle and urban and peri-urban land uses. Possible future mitigation measures are dominated by improved land management practices, land acquisition (especially close to the dam's edge), reduced access to the dam wall, increased public education and enforcement, as well as monitoring and research (Keys 2009).

The project's outcomes are consistent with:

- Lake Baroon Catchment Implementation Plan (2007)
- Lake Baroon Catchment Management Strategy (2004)
- Seqwater Natural Assets Management Plan – Lake Baroon Catchment (2012)
- Catchment and In-Storage Risk Assessment for water Quality – Baroon Pocket Dam (2009)
- Sunshine Coast Council Waterways and Coastal Management Strategy 2011-2012 (2011)
- Mary River and Tributaries Rehabilitation Plan (2001)

6.5.1 Lake Baroon Catchment Implementation Plan (2007)

The LBCIP was developed in 2007 – a joint initiative of AquaGen (pre-Seqwater) and BMRG, and was delivered via LBCCG. The document aligns the summarised actions from the Lake Baroon Catchment Management Strategy (2004) with actions from the NRM plan Country to Coast - a healthy sustainable future. Relevant actions include the development of on-ground works that address water quality, aquatic biodiversity, habitat recovery and particularly community involvement.

6.5.2 Lake Baroon Catchment Management Strategy (2004)

An LBCMS was initially developed in 1997 by AquaGen and LBCCG in an attempt to identify the causes of poor water quality in Lake Baroon and consequently guide catchment investment. Updates have occurred in 2004 and 2007 although the most recent version remains in draft form. The 2004 LBCMS identifies priority management actions similar to the LBCIP – the active management of riparian lands throughout the catchment, reducing nutrient delivery to Lake Baroon, negating the

impacts of development, addressing the loss of remnant vegetation, weed management and the engagement of the community – particularly large landholders.

6.5.3 Natural Assets Management Plan – Lake Baroon Catchment (Seqwater 2012)

The recent Seqwater NAMP (2012) reviewed the current and historical management plans for the Lake Baroon catchment and documented clear actions to improve the water quality in Lake Baroon, particularly through the development and strengthening of partnerships. Relevant actions relating to the project include weeds, erosion, catchment management, livestock management, stakeholder partnerships, erosion and biodiversity.

6.5.4 Catchment and In-Storage Risk Assessment for Water Quality – Baroon Pocket Dam (2009)

Seqwater conducted an extensive review of the risks to water quality in Lake Baroon and associated catchment in 2009. The project addresses the following identified risks:

Risk No. 3.6.2. High Inflow Events

High rainfall events in the catchment upstream of the dam can have a significant impact on the water quality of the lake. During and subsequent to a high rainfall event, the water quality of the lake is likely to be impacted due to an increase in nutrients, turbidity, colour, TOC, BOD, gross pollutants, pathogens, petroleum hydrocarbons and changes in temperature.

Management controls in place to manage the event of high rainfall include land, pasture and pest management, sediment and erosion controls, planning and regulation, dam operation and management, Seqwater's involvement in development within the catchment, rehabilitation and community involvement.

Risk No. 3.6.3. Steep and Unstable Slopes

Steep and unstable slopes can influence water quality via bank instability, erosion, high rainfall and land slippage. The hazards to water quality due to steep and unstable slopes include high nutrient loads, increased turbidity and changes in water colour.

Management actions include best management practice (BMP) land management, revegetation and landholder engagement.

Risk No. 3.6.5. Intensive Animal Husbandry

Intensive animal husbandry can impact on the water quality of the storage. Potential problems include dairy runoff, waste streams, pesticide use, chemical residues, erosion, fertilisers and animal carcasses.

Current management practices in place include licensing and conditions, enforcement, monitoring, community involvement, local planning, industry BMP and farm management plans, education, and rehabilitation and farm improvement within specific area of the catchment.

Risk No. 3.6.7. Livestock Management

Grazing management issues that may impact water quality include the use of pesticides and fertilisers, overgrazing of paddocks leading to accelerated erosion, livestock having direct access to streams, trampling of riparian vegetation, animal faecal contamination and animal carcasses.

Current management practices in place include BMP, covenants, rehabilitation, education and awareness and landholder engagement.

Risk No. 3.6.14. Cyanobacterial Blooms

Cyanobacterial blooms (also referred to as blue-green algae) can produce extremely potent toxins that present a risk to potable water supply and direct contact recreation. Potential causes of cyanobacterial blooms include increased nutrient loads, temperature, drought, dam water turnover events and light.

Current management controls include dam operation protocols, recreational management including closure if necessary, monitoring and research, signage about cyanobacterial blooms and effective catchment management to prevent blooms from occurring.

Risk No. 3.6.15. Land Use Changes (intensification)

The Sunshine Coast and Maleny in particular is popular with tourists and new residents and is experiencing unprecedented levels of population growth and intensification of housing developments. This is resulting in subdivision and development of rural residential blocks from farming lands. Intensification of land use can have detrimental effects on water quality through increased erosion, increased stormwater runoff and increased pollutant loads.

Current key management controls in place include regional and local growth management strategies and plans, education, community involvement, advice from Seqwater in development assessment processes, development offsets, covenants for conservation and riparian and land initiatives from the LBCCG.

Risk No. 3.6.22. Pest Flora and Fauna

Pest flora and fauna can impact upon Lake Baroon and its catchment through a range of environmental factors. A change in trophic conditions may present one species with greater availability of suitable habitat over another species. Interaction and competition between species may also result in the introduction of pests and breakdown in ecosystem function reducing their ability to improve and protect water quality. Pest flora and fauna can be detrimental to water quality by lowering dissolved oxygen, increasing total suspended solids, nutrients, turbidity and algal toxins.

Current management controls including pest management plans, regulations, community education and involvement and state legislation effectively manage these impacts for the Lake Baroon catchment.

6.5.5 Sunshine Coast Council Waterways and Coastal Management Strategy 2011-2021 (2011)

Sunshine Coast Council, particularly through the Rivers Initiative program, and various funding programs is committed to supporting community groups to improve the region's environment. The project addresses the following Strategy goals:

Natural waterways	***Goal: To provide a coordinated, integrated and informed approach to the protection, rehabilitation, sustainable use and enjoyment of natural waterways.***
NW3	Develop and sustain partnerships with government, industry, universities, regional natural resource management bodies and community groups.
NW8	Develop land management initiatives in partnership with the rural industry and state government to improve waterway health.
NW13	Undertake and support activities to improve the condition of riparian and in stream habitats.
NW16	Promote and inform the community about natural waterway values and management initiatives.

6.5.6 Mary River and Tributaries Rehabilitation Plan (2001)

The MRTRP is a Mary River wide rehabilitation plan. The Obi Obi Creek is a major tributary of the Mary River and therefore an integral part of Mary River planning and rehabilitation. The project addresses riparian vegetation management, the conservation of remnants, revegetation, weed management, enhancing habitat for vulnerable and threatened species and building the capacity of both landholders and community groups.

7.0 IMPLEMENTATION

7.1 METHODOLOGY

7.1.1 Riparian Buffer Width

It is difficult to derive a general 'rule of thumb' regarding buffer width, as this will vary depending on the desired functions of the buffer, volume of water and sediment being transported, and vegetation composition. Whilst a 5-10 metre vegetated filter strip buffer may be adequate for removing the majority of sediment and adsorbed nutrients, it has been shown to be insufficient for removing soluble nutrients (Barwick et al 2009), and would likely serve limited ecological value. A combination of 10 metre of grass buffer and 10 metre of natural vegetation adjacent to the stream has been recommended as effective in many Australian situations from a water quality perspective. However, a 10 metre wide buffer of woody vegetation has been shown to be insufficient to protect Australian streams from changes in algal, macroinvertebrate and fish biomass and diversity (Barwick et al, 2009).

The Department of Primary Industries recommends buffers of 50 – 100 metres to freshwater systems to maintain ecological processes (Barwick et al, 2009). The DNR&M Regional vegetation Management Code: South East Qld specifies that clearing does not occur within 25 metres of each high bank of each stream order 3 and 4.

This project will provide between 15 and 140 metres of riparian buffer (from the centre of the creek), with an average of approximately 60 metres. At approximately 1,200 metres of lineal Alcorn Creek fenced, this equates to approximately 11.5 hectares of area managed.

7.2 ACTIVITIES

7.2.1 Fencing

Fencing will be erected according to existing vegetation and appropriate alignment. Fencing will consist of standard cattle fencing – timber split posts at 4-5 metre intervals with 4 strands of barb. Gates will be steel.

Above: Fencing will be erected well above the riparian zone on relatively flat areas.

7.2.2 Waterway crossings

With the fencing of Alcorn Creek, the existing crossings will require upgrading to cope with the concentrated traffic and to minimise the impacts of livestock and vehicles on the bed and banks. Alcorn Creek is deeply incised and all proposed crossings have difficult access. Getting equipment on site – particularly concrete presents particular problems and may have to be mixed on site. Weather conditions will also play a large role in timing.

All crossings have been designed to have a long effective life and require minimal maintenance. This is essential as both landholders work off farm and efficient property management is essential.

7.2.2.1 Crossing 1 – Upstream

This crossing will consist of a low level concrete ford. The advantage of such a construction is that it effectively sits at bank and bed level and is unlikely to suffer from flood damage. Relatively cheap and simple to construct, a concrete crossing requires minimal disturbance to install and can, with minor design modification, create a simple stable watering point (although this will not be required here). The cost of the crossing takes into account the difficult access for concrete trucks and the approaches which will require hardening with road base.

Above: Concrete low level crossing. This particular crossing has been raised to provide a watering point on the upstream side.

Above: Site for waterway crossing 1 (low level concrete ford).

7.2.2.2 Crossing 2 – Tributary

This crossing will be constructed over a tributary to Alcorn Creek to improve livestock mustering. The current crossing point is severely degraded by livestock and vehicles (and has deepened dramatically over the last few years). The crossing will utilise a 900 mm pipe and rock armouring.

Left: Site for waterway crossing 2 (pipe crossing).

7.2.2.3 Crossing 3 – Downstream

Above: *Site for waterway crossing 3 (beam bridge).*

This crossing will be constructed at the downstream end of the property and due to the incised bed of Alcorn Creek will consist of two parrallel poles with hard wood decking. This will provide a crossing that will sit above high flows and in the event of unanticipated flood events provide a low profile and be very unlikely to be washed away.

The span beams must be adequately anchored and will be placed on concrete footings. Getting concrete to the site is an issue and the cost includes the capacity to mix on site. Concrete aprons on either end of the bridge similarly will need to be mixed on site.

The approach to the crossing is very steep and will require essentially a laneway to be constructed on both sides of the waterway. Alternative crossings (low level concrete or traditional pipe/culverts would exacerbate the steepness of the crossing and would effectively be more expensive in the long term.

The crossing primarily improves property management and will only be used for the movement of small numbers of livestock.

This crossing will be funded by the landholders.

7.2.2.4 Off Stream Watering Infrastructure

The properties western paddocks are currently serviced by an extensive off stream watering system. With the completion of the Alcorn Creek fencing, the properties eastern paddocks will require alternative water access.

The existing system will be extended to the eastern paddocks of the property. Approximastely 1,000 metres of piping (50 mm diameter), holding tank of sufficient capacity for 100 livestock and series of troughs is required.

The design of the system is yet to be fully determined however when machine hire is taken into account is expected to substantially exceed $10,000 – the LBCCG/Seqwater contribution to the project.

7.2.2.5 Other Activities - Laneways.

Prior to 2000 the property was a dairy operation. An extensive laneway system was maintained although the existing crossing over Alcorn Creek and the laneways on the eastern side of the property were degraded and required constant maintenance and repair. With the change from dairy to beef grazing the importance of the existing laneways was diminished although with both landholders working off-farm, efficiency has once again become essential for property managwament.

The landholders have been maintaining the existing waterway crossing although the last three years of flooding/wet summers has meant maintenance has been high. The landholders will fund the rehabilitation of the current laneways and waterway crossing, as well as the construction of new laneways to facilitate improved livestock management. This will improve access for the LBCCG funded project activities.

The landholders will rehabilitate laneways and the existing major waterway crossing on the property.

7.3 PROJECT MAP

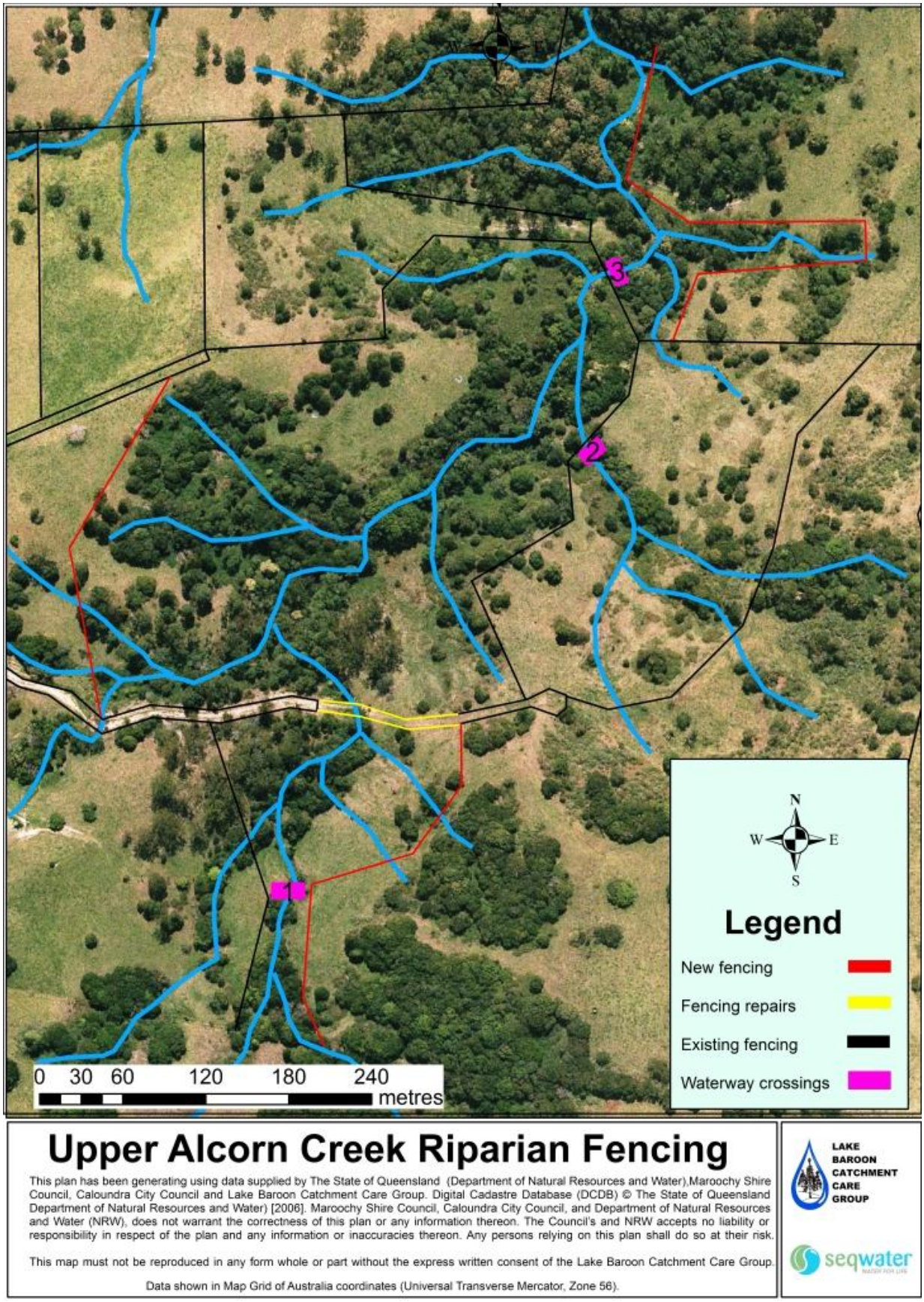


Figure 10: Proposed fencing and waterway crossing alignment.

8.0 ACTION PLAN

Activity Start and Completion dates are indicative only and will be dependent on weather conditions.

Action		*Responsibility*	*Start Date*	*Completion Date*	*Measurable Output*
Project Proposal		LBCCG Coordinator	Feb 13	Mar 13	Project Plan
Project presented to LBCCG Committee for approval (includes Seqwater rep.)		LBCCG Coordinator & Committee	Mar 13	Apr 13	n/a
Pre-works monitoring (including photo points)		LBCCG Coordinator	Jan 13	Mar 13	Photo & data set
PROJECT IMPLEMENTATION	Laneway rehabilitation	Landholder/Contractor	May 13	Sep 13	1,000 metres
	Fencing	Landholder/Contractor	May 13	Sep 13	1,100 metres
	Waterway crossings	Landholder/Contractor	May 13	Sep 13	3
	Off stream watering	Landholder	May 13	Sep 13	1
Progress report.		LBCCG Coordinator	Jun 13	Sep 13	Progress Report
Post-works monitoring.		LBCCG Coordinator	May 13	Dec 13 ongoing	Photo & data sets
Project completed/signed off. Final Report.		LBCCG Coordinator & Committee	Dec 13	Dec 13	Final Report

Note – the Project Action Plan will be used as the basis for Quarterly Reporting

9.0 PROCUREMENT

9.1 SERVICES & PRODUCTS

The Project Manager will have the authority to engage and arrange payment for services and products for all activities once the Project Plan is approved. Any deviation over $300 from the approved Project Budget requires approval from the Project Committee. Services and products will be sourced locally wherever possible and from not-for–profit community organisations if applicable.

Service/Product	*Supplier*	*Contact (if applicable)*
Fencing installation	Fencing Contractor: R & J Ludwig	Rob Ludwig
	Fencing Contractor: Langdale Stud	Tim Simpson
Waterway crossing installation	Earthmoving Contractor: P & K Nash	Phil Nash
	Earthmoving Contractor: Sommer Bros.	Ron Summer

Multiple service and product providers are listed to ensure timelines are met. In the event of a provider being unable to supply the requested service or product an alternative supplier will be selected from the list of preferred suppliers. All suppliers (where appropriate) must demonstrate full insurance and liability requirements and that all staff or personnel on site are appropriately licenced and/or experienced.

9.2 COST ESTIMATION METHODOLOGY

The standard cost for fencing material supply and erection is approximately $13.00 per metre plus $380.00 per gate. This is variable depending on site conditions, fencing alignment and materials.

9.2.1 Fencing Material Costs

LBCCG has a policy of keeping Project Costings confidential as individual project costings vary and can give misleading information.

Detailed Budgets can be supplied on request. Please contact the LBCCG Project Manager on info@lbccg.org.au for further information.

9.2.2 Waterway Crossing Costs

A quote for the installation of the three waterway crossings was supplied by P & K Nash. P & K Nash are regularly contracted by LBCCG to perform earthmoving services and provide a reliable and cost effective service.

9.2.3 Off Stream Watering Infrastructure Costs

LBCCG has a policy of keeping Project Costings confidential as individual project costings vary and can give misleading information.

Detailed Budgets can be supplied on request. Please contact the LBCCG Project Manager on info@lbccg.org.au for further information.

9.3 DETAILED PROJECT BUDGET

All figures exclusive of GST.

LBCCG has a policy of keeping Project Budgets confidential as individual project costings vary and can give misleading information.

Detailed Budgets can be supplied on request. Please contact the LBCCG Project Manager on info@lbccg.org.au for further information.

10.0 MONITORING AND EVALUATION

10.1 INTRODUCTION

Monitoring and evaluation strategies are essential components of any environmental rehabilitation project. Evaluation is the best way to improve our knowledge about what works, what doesn't and how we can best direct our rehabilitation efforts. Monitoring strategies are key components of the overall evaluation process that allows you and others to learn from the project and assess whether rehabilitation aims have been met.

Furthermore, monitoring results and information will be used to:

1. Raise awareness and encourage further remediation works with priority landholders (primary producers and large landholders in the Lake Baroon catchment).
2. Promote cooperative projects between Lake Baroon Catchment Care Group, Seqwater, Sunshine Coast Council and other Natural Resource Management organisations.
3. Critically examine techniques and methods used throughout the project to continually improve the service to landholders conducting on-ground works in the catchment and improve best practice management.
4. Develop cost-effective strategies and techniques to perform on-ground activities.
5. Continue to develop monitoring and evaluation program that meets the requirements of funding bodies, but also provides the relevant information and feedback to the LBCCG and Seqwater to improve project delivery.

It can be very difficult to measure outcomes as they may take many years to occur or reach the final result and can be enormously expensive to quantify – potentially far more than the actual implementation of the project. We must rely on best management practice, anecdotal evidence and sometimes partnerships with universities and/or Seqwater to produce 'hard' data to the actual effectiveness of the project.

10.2 MONITORING PROGRAM

Monitoring of rehabilitation activities, particularly the LBCCG funded component – fencing, will be split into periodic and episodic monitoring.

Periodic monitoring is important to measure the effectiveness of the fencing over time and will occur on a biannual basis by LBCCG.

Episodic monitoring will occur following significant storm/rainfall events (or extended dry periods or frosts) and will check all the fencing integrity. This may, depending on the severity of the event, be achieved by a phone call to the landholders.

Photo point monitoring will provide valuable evidence of works completion, a record of changes over time, and provide an important assessment tool to evaluate the project.

11.0 COMMUNICATIONS

Project reports will be provided at monthly LBCCG meetings. A Progress Report will completed once all Seqwater funded activities have been completed with a Final Report produced once all on-ground activities are completed.

A modified version of the Project Plan (specific financial details and landholder contact details deleted) will be placed on the LBCCG website www.lbccg.org.au.

The project will also be included in the LBCCG newsletter.

12.0 REPONSIBILITIES & ROLES

The Project Manager will be responsible for project implementation, management, reporting, evaluation and general management of the project. Other contributions will be on an as-needed basis and the following register of roles will ensure the project is implemented efficiently, effectively and follow best practice.

Role	***Individual***	***Organisation***
Project Manager	Mark Amos	LBCCG
Project Owner	Peter Stevens	LBCCG (President)
Project Sponsor	Tim Odgers	Seqwater
Project Committee	Steven Lang	LBCCG (Management Committee)
	Steve Skull	
	Gillian Pechey	
Technical advice	Matt Bateman	Barung Landcare
	Susie Duncan	Hinterland Bush Links
	Rob Ludwig	Fencing contractor

13.0 REFERENCES

Abal, E.G., Bunn, S.E & Denison, W.C. (Eds.) 2005, *Healthy Waterways Healthy Catchments: Making the connection in South-east Queensland, Australia*, Moreton Bay Waterways and Catchments Partnership, Brisbane.

Alt, S., Jenkins, A. & Lines-Kelly, R 2009, *Saving Soil – A landholder's guide to preventing and repairing soil erosion*, Northern Rivers Catchment Management Authority, NSW.

Baker, D. 2011, *Sanitary Survey of Somerset and Obi Obi Catchments*, ALS Water Resources Group, Penrith, NSW.

Barwick, M, Wassman, D & Pitman, K. 2009. *Maleny Community Precinct Environmental Management Scoping Document*, Australian Wetlands Pty Ltd, Caloundra, Qld.

Department of Environment and Resource Management, *Development of a water quality metric for south east Queensland*, 2010

Dudgeon, S & Dunstan, M. 2007 *Large Scale Waterway Rehabilitation Business Case: Final Report*, Natural Solutions Environmental Consultants, Noosa Heads, Qld.

Dunstan, M 2007, *Lake Baroon Catchment Implementation Plan*, AquaGen Water & Renewable Energy, Palmwoods.

Keys, S., Murton, S., Costanzo, S. & Thompson, A. 2009, *Catchment and In-Storage Risk Assessment for Water Quality – Baroon Pocket Dam*, Sinclair Knight Merz, South Brisbane.

Murton, S. & Keys, S. 2012, *Seqwater Natural Asset Management Plan – Lake Baroon*, Sinclair Knight Merz, Brisbane

Stockwell, B., 2001, *Mary River and Tributaries Rehabilitation Plan – Implementation Edition*, Mary River Catchment Coordinating Committee, Gympie, Australia.

South East Queensland Healthy Waterways Partnership 2007, *South East Queensland Healthy Waterways Strategy 2007-2012*, South East Queensland Healthy Waterways, Brisbane.

South-east Queensland Regional Water Quality Management Strategy Team, 2001. *Discover the waterways of South-east Queensland: Waterways health and catchment management in South-east Queensland, Australia*, South East Queensland Healthy Waterways, Brisbane.

Sunshine Coast Council 2011, *Sunshine Coast Waterways and Coastal Management Strategy 2011-2021*, Sunshine Coast Council, Nambour, Qld.

Traill, C.B. 2007, *State of the Lake Baroon Catchment, Volume 2: Appendices*, AquaGen Water and Renewable Energy, Palmwoods.

Ziebell, D & Richards, PL 199, *Gully Erosion in South Gippsland*, Landcare Note SC0039, State of Victoria, Department of Natural Resources and Environment.