Lake Baroon Catchment Care Group

Working with our community...for our waterways

Projects 2013-14

Mid Obi Riparian Corridor

Sunshine Coast Council

seqwater WATER FOR LIFE

PROJECT PLAN

Project No. 1314-017

This Project Plan has been prepared by:

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Disclaimer

While every effort has been made to ensure the accuracy of this Project Plan, Lake Baroon Catchment Care Group makes no representations about the accuracy, reliability, completeness or suitability for any purpose other than the particular project and disclaims all liability for all expenses, losses, damages and costs which may be incurred as a result of the Plan being inaccurate or incomplete in any way.

How to read this Plan

This Plan is split into three distinct sections:

The **Summary** (pp. 5-6) is a brief description of the project and includes broad details of stakeholders, budgets, outputs and outcomes.

The **Project Plan** (pp. 7-14) outlines the main details involved in implementing the project and in most cases should explain the project sufficiently.

The **Attachments** (pp. 15-47) provides additional information to support the Project Plan. The various numbered Contents in the Project Plan directly correspond with the numbered sections in the Attachments.

Terms used in this Plan

Lake Baroon and Baroon Pocket Dam are used interchangeably, although *Lake Baroon* is usually used when referring to the catchment and *Baroon Pocket Dam* refers to the dam as commercial water storage.

PROJECT VERSIONS & APPROVALS

Date	*Version/Description*	*Result*
Jan-Apr 2014	Draft Project Plan	n/a
8/5/2014	Project presented to LBCCG Committee	Approved (Minutes 0069.6.4)
12/5/2014	Project Proposal forwarded to Seqwater for approval (email)	Approved A. Purdy
23/4/2014	Application to Sunshine Coast Council (LEG program)	Approved

Cover photo: *Obi Obi Creek on the Marquardt property. Maleny Sewage Treatment Plant mid photo and Maleny Community Precinct in background.*

TABLE OF CONTENTS

PART A EXECUTIVE SUMMARY

PROJECT NUMBER & TITLE: **1314-017 Mid Obi Riparian Corridor**

The project will fence 2,200 metres of Obi Obi Creek over two adjoining properties managing livestock access and complete the establishment a fenced riparian zone between Maleny and Gardners Falls. Alternative off stream watering will be installed for the livestock and the endangered remnant vegetation on both properties will be enhanced through extensive weed management. The project will complement the recent LBCCG project on the Erowal property upstream, planned projects revegetating Walkers Creek, and the extensive environmental activities occurring on the Maleny Community Precinct – immediately across the Obi Obi Creek.

LANDMANAGER & PROPERTY DETAILS

Names	Stuart Marquardt	Col Waugh	Peter Carroll (lessee)
Phone Number	[redacted]		
E-mail			

Property Address	1134 Landsborough Rd	1114 Landsborough Rd	n/a
RP Number	RP895755 (Lot 21)	RP188625 (2)	n/a
Property Size	14.8 ha	18.4 ha	n/a
Existing Land-use	Cattle grazing	Cattle grazing	n/a
Stock Carried	60 (both properties)		
Sub-Catchment	Obi Obi Creek	***LBCCG Management Unit***	OB6
Latitude/longitude	-26.768272 / 152.868752	26.768080 / 152.868756	n/a

PROJECT PARTNERS/STAKEHOLDERS & ROLES/CONTRIBUTIONS

Lake Baroon Catchment Care Group (Seqwater 2013-14 Project Funding)	On ground project implementation Cash $29,155
Lake Baroon Catchment Care Group (Seqwater 2013-14 Administration Funding)	Project coordination, administration, reporting, monitoring & evaluation $11,640
Sunshine Coast Council	Project funding ($14,866)
Other (Green Hills &/or BMRG)	Funding ($2,000 cash)
Unitywater	Land manager ($5,000 in-kind)
Peter Carroll	Land manager, labour, funding ($4,380 cash & in-kind)
Col Waugh	Landowner, labour, funding ($3,510 cash & in-kind)
Stuart Marquardt	Landowner, labour, funding ($1,200 cash & in-kind)

PROJECT DETAILS

Project Start Date	Apr 2014	***Project Completion Date***	Sep 2014 (on-ground activities)
OUTPUTS			
Fencing	2,076 metres		
Off stream watering	1 system (1 x 5,000 gallon tank & 2 troughs)		
Weed management	6 hectares		
OUTCOMES			
Length of creek fenced (length of wildlife corridor)	2,250 metres		
Area of riparian zone fenced	11 hectares		
Area of remnant vegetation protected	3.9 hectares approx.		
Landholder engagement	2 landowners; 1 lessee		

Maintaining water quality is critical to providing safe bulk drinking water to 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; 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 on Seqwater's core business.

Mid Obi Riparian Corridor is designed to address unmanaged livestock access, degraded riparian buffers and the enhancement of wildlife corridors while improving property productivity through the implementation of improved practices. The reduction in risks 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.

The project aims to:

- implement an on-ground project that mitigates threats to water quality;
- promote integrated catchment management in the Lake Baroon catchment;
- reduce nutrient delivery to waterways;
- reduce sediment delivery to waterways;
- improve aquatic habitats;
- raise community awareness (including water quality issues);
- support and work cooperatively with like-minded community organisations;
- protect endangered remnant vegetation;
- restore links between vegetation and enhance wildlife corridors;
- contribute to the conservation of threatened species;
- contribute to climate change adaptation; *and*
- demonstrate best management practice of riparian zones.

The project will protect and enhance the vegetation buffers on the Obi Obi Creek on the Marquardt and Waugh properties. Riparian buffer zones are important for a number of reasons:

- they often contain diverse vegetation communities which provide a habitat heterogeneity for terrestrial and semi-aquatic organisms;
- they can influence water flow, both surface and subsurface, contributing to the improvement of water quality;
- they provide shade, which in turn helps control water temperature, algal growth and provides shelter for aquatic species;
- they are a source of leaf matter as a source of food, and woody debris for habitat;
- they improve bank stability; *and*
- they provide corridors for movement of native fauna and flora between geographically separate areas.

Effective riparian areas can benefit water quality by trapping sediment, reducing erosion, storing nutrients and filtering contaminants before they reach Lake Baroon. Riparian zone health is a key factor in a riparian area's ability to improve water quality.

PART B PROJECT PLAN

i. INTRODUCTION

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

Maintaining water quality is critical to providing safe bulk drinking water to 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). This is particularly true of the Lake Baroon catchment.

The project proposes to manage livestock access to the Obi Obi Creek on the Marquardt and Waugh properties through the installation of riparian fencing. Alternative off stream watering will be installed for the agisted livestock. The project will assist in the revegetation efforts currently underway on the Maleny Community Precinct (MCP) on the northern bank of the Obi immediately across the waterway from the properties.

As this project is consistent with the LBCCG (and Seqwater) aim of reducing risks to water quality from erosion, nutrients and pathogens, the activities to fence the riparian zone, and associated activities are considered sensible to support.

ii. BACKGROUND

The MCP on the northern bank of the Obi Obi Creek, opposite the Marquardt and Waugh properties, is undergoing major redevelopment. Along with a golf course, sporting fields and community facilities, the site is also the focus of major environmental activities – the most visible being extensive revegetation on the bank of Obi Obi Creek. This will provide wildlife corridors, broad biodiversity benefits and improve water quality in the Lake Baroon catchment.

The lead environmental community group on the MCP, Green Hills, has secured long term funding to establish seven hectares of riparian vegetation – much of it on the opposite bank to the Marquardt and Waugh properties. This has significant community support with over 400 people attending a community tree plant in 2010 and a further 125 attending a similar event in 2012.

Currently livestock from the Marquardt and Waugh properties can cross the creek and access the revegetation sites on the MCP.

1.0 WHAT

Above: Obi Obi Creek esplanade on the Marquardt property. The creek lies in the background at the foot of the remnant vegetation.

The project aims to complete three components:

1. Install riparian fencing on Obi Obi Creek;
2. Provide alternative watering points for agisted livestock – off stream watering system comprising tank and trough including the recommissioning of a derelict bore on the Marquardt property; *and*
3. Manage weeds within the fenced riparian buffer.

2.0 WHERE

(a) Stuart Marquardt rural property
1134 Landsborough Maleny Road, Maleny 4552

Property is approximately 14.82 hectares – comprising the following:

- 14.52 ha of improved pasture and very lightly vegetated areas including riparian zones;
- 0.3 ha of residential dwelling, sheds etc

In addition to this livestock currently have access to:

- 3.95 ha of Sunshine Coast Council 'Esplanade'
- 1.4 ha of Water Reserve

Also featured are:

- 1.08 ha Maleny Sewage Treatment Plant (STP)
- 500 metre access easement to Maleny STP

(b) Col Waugh rural property
1114 Landsborough Maleny Road, Maleny, 4552

Property is approximately 18.42 hectares – comprising the following:

- 13.62 ha of improved pasture and very lightly vegetated areas including riparian zones;
- 3.12 ha of remnant vegetation (Gallery rainforest on alluvial plains RE12.3.1 & Complex notophyll vine forest RE12.8.3
- 1.68 ha of moderate to heavy regrowth vegetation areas degraded by weed species but accessible to, and grazed by livestock;

In addition to this livestock currently have access to:

- 1.4 ha of Water Reserve

The shape of the properties results in a frontage to Obi Obi Creek of approximately 2,250 metres; 1,200 metres Marquardt; and 1,050 metres Waugh.

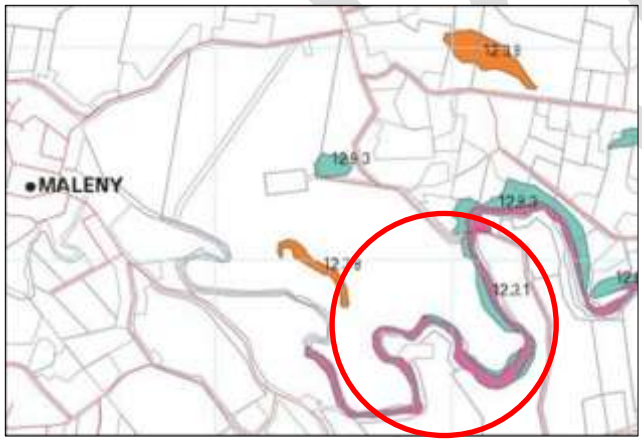
The Marquardt and Waugh properties are directly over the Obi Obi Creek from the Maleny Community Precinct. The MCP has significant riparian vegetation (including remnant vegetation) and is currently undergoing major revegetation programs (7 hectares of riparian revegetation linking urban Maleny with vegetation in the lower reaches of Obi Obi Creek). With no riparian fencing in place, the Carroll livestock have been able to cross the creek during low flows and enter the revegetation sites causing significant damage.

3.0 WHY

The current lessee (Peter Carroll) is keen to see the creek fenced in its entirety (provided alternative water sources are established) to improve livestock management. Repairing fences in the riparian zone of Obi Obi Creek following flooding is labour intensive. The riparian zone currently provides some feed resource however its benefit is outweighed by the increased management of the site.

The establishment of fencing on the Obi Obi Creek will:

- prevent livestock from crossing the creek and into revegetation on the MCP;
- improve livestock management on the Marquardt and Waugh properties;
- enhance the wildlife corridor on Obi Obi Creek;
- protect endangered remnant vegetation;
- manage livestock access to Obi Obi Creek from urban Maleny to Gardners falls;
- contribute to environmental activities on the MCP; *and*
- improve water quality in the Obi Obi Creek (and Lake Baroon) by removing livestock from the riparian zone.



It is good practice to manage livestock in riparian zones to reduce pathogen, nutrient and sediment inputs into the waterway and ultimately Lake Baroon – the Sunshine Coast's most important water supply.

Both properties have significant areas of endangered remnant rainforest along the Obi frontage – particularly the Waugh property. This Gallery rainforest (12.3.1) is considered endangered in SE Queensland and is therefore considered high priority for conservation. The fencing of Obi Obi Creek will contribute to the protection of the remnants.

Sunshine Coast Council through its progressive environmental programs (Landholder Environment Grants program funded by an environmental levy) seek broad environmental benefits such as wildlife habitat and corridors, water quality improvements, weed management, endangered species protection and particularly community partnerships. This project satisfies a majority of these aims.

4.0 HOW

4.1 FENCING

Above: The Marquardt riparian zone.

Above: The Waugh riparian zone. Note weeds.

Above: Standard cattle fencing will installed. A top plain wire will be installed (if possible) to minimise interference with wildlife.

Marquardt

The entire Marquardt frontage is currently un-fenced Sunshine Coast Council 'esplanade' (or road reserve). This esplanade provides a consistent 30 metre riparian buffer except immediately behind the Maleny Sewage Treatment Plant (STP) where a larger area lies within a bend of the Obi.

A livestock exclusion fence (timber posts at five metre spacings with three barbed and a single plain wire (wildlife friendly) if possible will be erected. The alignment will follow the esplanade boundary however where this is compromised by steep slopes, the fence will be moved into the paddock (no net loss of grazing).

In several areas the fencing of the esplanade boundary will result in considerable areas of grass banks included. It is suggested managed grazing, at suitable times of the year be permitted to manage excessive grass and weed growth.

Waugh

The Waugh frontage on Obi Obi Creek extends to the water's edge and is un-fenced. The frontage is well vegetated (remnant rainforest, regrowth vegetation and weeds) and the fencing will be erected along the edge of the vegetation with minimal loss of grazing. At the northern end (near Gardners Falls), an area of primarily regrowth vegetation will be included in the fencing to simplify erection and reduce the need for excessive alignment clearing (again minimal loss of grazing).

4.2 OFF STREAM WATERING

Above: Testing the derelict bore's capacity.

With the fencing of Obi Obi Creek and a lack of suitable watercourses or dams on either property, alternative livestock watering is required.

A disused bore that remains structurally sound is located on the Marquardt property approximately 50 metres from the dwelling. This bore can be recommissioned to provide a water source to supply a tank and trough system approximately 50 metres away adjacent to the existing stockyards which are located at the highest point of both properties.

With the toughs located next to the stockyards, livestock will be watered well away from riparian zones, near shade and near to the centre of the properties so that grazing pressure can be managed better with livestock spending less time near riparian zones.

The off stream watering system will consist of a 23,000 litre holding tank and two gravity fed troughs – one on the Marquardt property and one immediately through the fence on Waugh's.

4.3 WEED MANAGEMENT

The Obi Obi Creek riparian zone that does not have good stands of remnnant vegetation is significantly degraded by environmental weeds (lantana, small leaf privet, blackberry) which is impacting on preferred fencing alignments. Considerable clearing is required in some areas (on both properties) to able to erect the new fencelines on the esplanade boundary and also on an alignment that does not require excessive changes of angle which increases fencing costs and weakens the fence strength.

Above: The Obi Obi Creek on the Waugh property with heavy stands of lantana. Surrounded by remnant vegetation weed management should result in natural regeneration of native species.

Several methods of weed management are required:

1. Machine mulching which reduces heavy weed cover, mulches the weeds to provide ground cover and is cost effective over large areas;
2. On steeper ground where a machine's accessibility is compromised, brushcutting;
3. Stem injection and/or cutting and painting of larger woody weeds (such as camphor laurel and privet);
4. Follow up spraying of regrowth.

4.4 MAINTENANCE AND FUTURE ACTIVITIES

The lessee and landowners will assume responsibility for the maintenance of the fencing and off stream watering once the on-ground works have been completed and tested to a satisfactory standard. All infrastructure will remain the property of LBCCG for a period of five years to ensure it is not removed by either the lessee, current landowners or new landowners if either property is sold in the meantime.

LBCCG will not be responsible for any further costs once the project has been handed over to the lessee and landowners.

Weed management (including follow up control of woody weed regrowth) will be the responsibility of the lessee and landowners.

There are currently no plans for further activities although Stuart Marquardt has indicated he may be interested in revegetation within the riparian zone in the future (long term).

5.0 WHEN

In most years on-ground works occur during the dry period when watercourses are at base flow and paddocks are dry enough to access (usually between August-November). In 2013-14 below average rainfall has meant on-ground activities can be completed all year round.

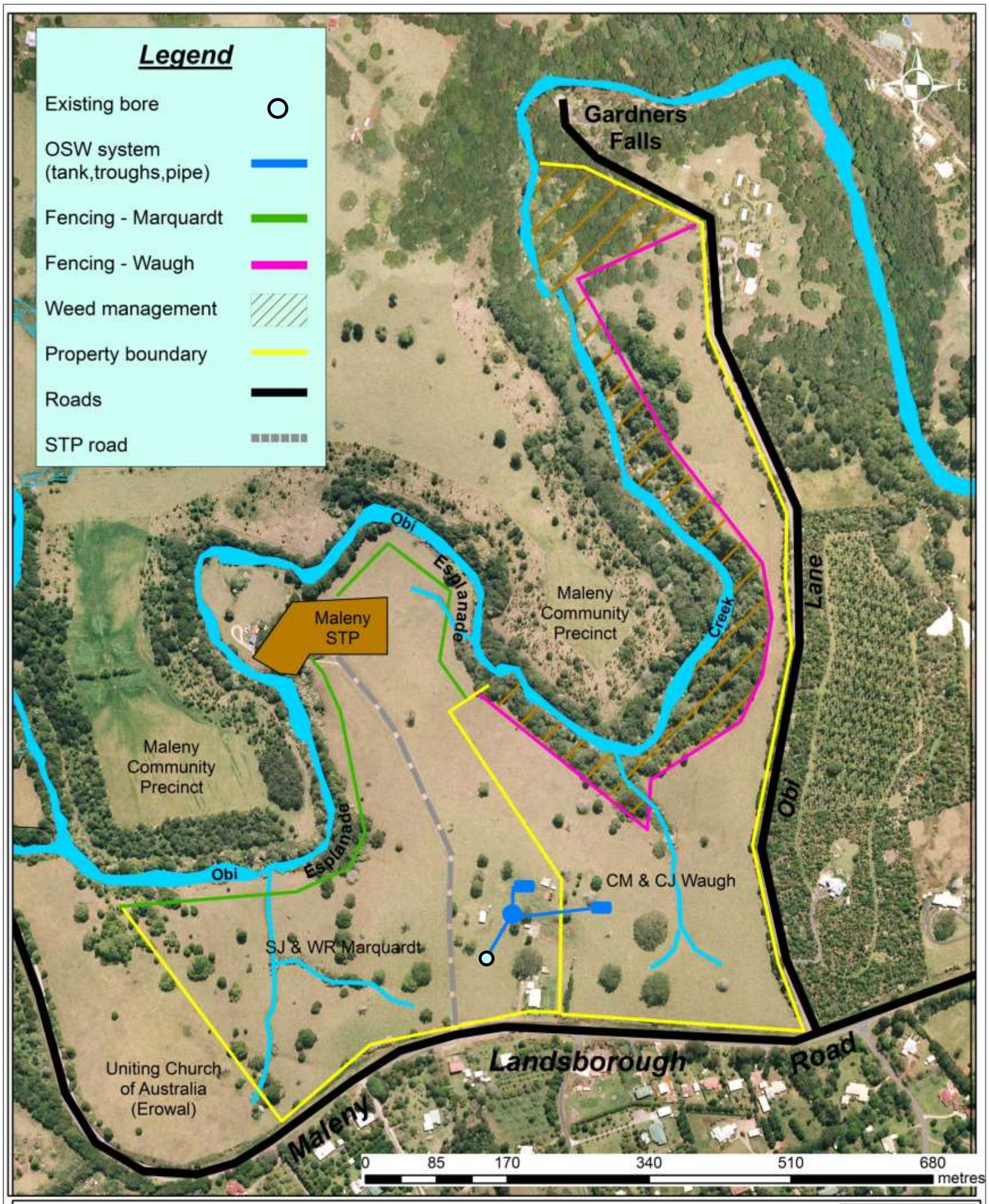
Off stream watering will be installed first with the riparian fencing following or concurrently. Ideally all activities will be completed by June 30, 2014 although this may be affected by weather conditions.

All figures exclusive of GST.

6.0 BUDGET

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.

7.0 PROJECT MAP



Mid Obi Riparian Corridor

Data shown in Map Grid of Australia coordinates (Universal Transverse Mercator, Zone 56).

LAKE BAROON CATCHMENT CARE GROUP

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PART C:

ATTACHMENTS

1.0 PROJECT RATIONALE

1.1 INTRODUCTION

In an ideal world, all waterways in the Lake Baroon catchment would be rehabilitated to provide riparian buffers, lower in-stream temperatures and provide suitable 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. 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.

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

The Lake Baroon Catchment Implementation Plan (2007) prioritisation of sub-catchments for works is effective and useful for rehabilitating waterways in the catchment through fencing and revegetation but does not adequately reflect the nutrient and sediment inputs to the waterways through land use, particularly intensive grazing (dairying and beef production) (Dunstan 2007). An alternative Management Unit Prioritisation was developed by LBCCG that focusses on 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 HIGH in priority.

Immediately over the Obi Obi Creek from the project site is the Maleny Community Precinct which is undergoing dramatic redevelopment including the reestablishment of vegetation buffers on the waterway. Currently livestock from can cross the Obi Obi Creek and enter the MCP – particularly the revegetation sites. Riparian fencing on the Marquardt and Waugh properties will stop livestock from entering the MCP.

Maintaining a healthy riparian system is essential for a productive landscape. When a riparian area is healthy it contains lush, thick vegetation, providing habitat for wildlife and aquatic species, maintains stream bank stability, influences morphology and provides shade which in turn lowers water temperatures and increases the oxygen carrying capacity of the stream. Additionally, riparian vegetation filters, utilizes and stores nutrients, thus preventing them from entering water systems.

Analysis of raw catchment water quality data (and targeted sampling and analysis) suggests that the Obi Obi Creek downstream of Maleny plays a significant and important role of improving water quality before it reaches Lake Baroon. It has been suggested this is due to a combination of aeration and vegetated riparian buffers over a considerable length of waterway. Therefore any activity that manages livestock and enhances the riparian buffer is likely to benefit raw water quality before it enters the storage (pers. comm. Peter Pollard, Griffith University).

1.2 GRAZING AND RIPARIAN ZONES

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

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; *and*
- decrease wildlife habitat and species.

However when tightly controlled fencing can be an invaluable, and sometimes essential tool to manage grazing in riparian zones whether permanent exclusion or managed grazed is performed.

The project will enhance vegetation buffers on the Obi Obi Creek. The effectiveness of a riparian buffer to provide multiple environmental and water quality benefits varies depending on several key factors, namely bank slope, vegetation species composition and age, and soil type. Slope gradient appears to be the most important variable in removal of sediment or particulate pollutants, whereas buffer width is most important for the effective removal of dissolved nutrients (Barwick et al 2009).

Riparian buffers comprising grassed buffer strips are effective at trapping sediments and nutrients adsorbed to sediments (such as phosphorus), but tend to be relatively poor at trapping dissolved nutrients, or for the provision of shade, food sources, in-stream structure or corridors for many species. Riparian buffers comprising taller, woody vegetation are typically good at providing shade, as a source of food and woody habitats, as a screen for light and noise, as corridors for terrestrial fauna (to a varying extent depending on species composition), and as a means for reducing soluble nutrient inputs. Designed riparian buffers usually incorporate multi-tiered systems of both native woody vegetation to enhance ecological function, and vegetated filter strips for the management of water quality. In essence, this approach seeks to mimic the complexity and effectiveness of a natural riparian buffer system, and often the best approach is to provide the required buffer width to enable a self-sustaining buffer of native vegetation (Barwick et al, 2009).

1.3 OFF STREAM WATERING AND RIPARIAN FENCING

In the sub-tropics, the majority of overland flow events occur during the summer to early autumn period. Conversely 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 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 in North America 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 when drinking at streams and dams enter the water to reduce bending; resulting in the stirring up of suspended solids (turbidity), and 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 directly into the water body (pers. comm. Colin Cork).

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 is likely to 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 riparian areas. In the warmer 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.

The troughs will be situated near shade and at the highest point on both properties.

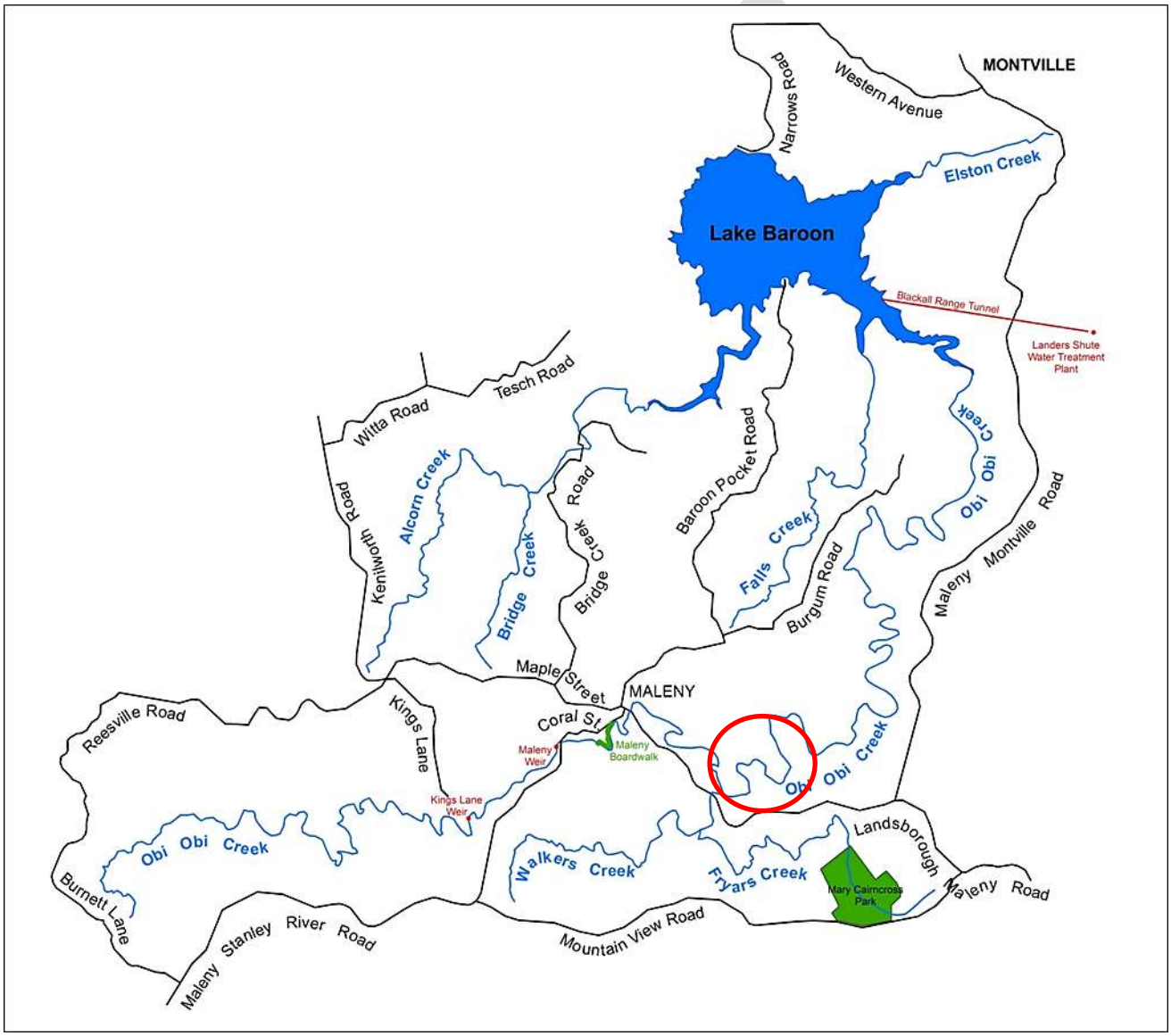
Left: Lake Baroon from Cork's hill.
Although the dam and immediate surrounds are owned and managed by Seqwater, the vast majority of the catchment is privately owned.
To influence land management that reduces the risk to water quality in the storage, Seqwater must engage the community. The most effective method to do this is work with existing community groups.

2.0 PROJECT LOCATION

2.1 BACKGROUND

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 LOCATION MAP



Above: The Marquardt and Waugh properties are located in LBCCG Management Unit OB6 which lies in the mid reaches of Obi Obi Creek. This MU is a significant contributor of excessive sediments and nutrients primarily due to its location downstream of urban Maleny.

2.3 CATCHMENT REVIEW

2.3.1 Background

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:

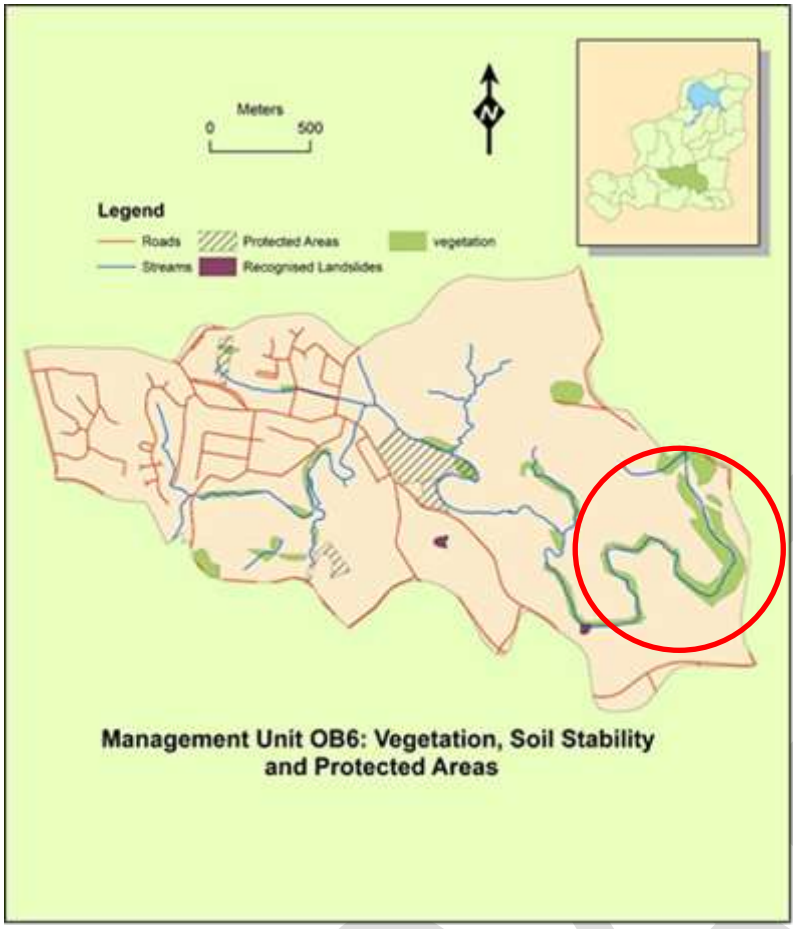
- vegetation fragmentation (as a result of clearing);
- increased erosion and sediment loads due to clearing and land use practices;
- changes to hydrology and water quality;
- altered natural processes such as grazing and urban development;
- introduction of foreign fill materials; *and*
- introduction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

2.3.2 Geology, soils & stability

The geology of the Maleny plateau is dominated by basalt lava flows occurring between 31 and 25 million years ago (MYA). However there are several other significant geological formations that influence the catchment – particularly soil type and consequently vegetation and stability.

The oldest rocks visible on the plateau are known as the North Arm Volcanics and originated somewhere in the North Arm region around 210 MYA. Multiple lava flows consisting of andesite and dacite to rhyolite form the northern bank of Lake Baroon and are visible in the lower reaches of Bridge Creek where erosion has exposed them. Rhyolite is very hard and resistant to erosion evidenced by the Narrows where the Obi Obi Creek was forced to cut a narrow gorge through (and where Baroon Pocket Dam wall was constructed). The North Arm Volcanics underlay the entire Maleny plateau and extend as far south as the Glasshouse Mountains. Between 210 and 180 MYA the North Arm Volcanics 'sagged' into broad depressions that were subsequently filled with sediment, forming the deep Landsborough Sandstone formation (Willmott 2007).

Other geological formations in the catchment include small areas of Cedarton Volcanics – visible in the upper reaches of Obi Obi Creek; andesite rock that produces lighter coloured moderately fertile soils; and an area of Amamoor Beds – 315 MYA of hard meta-sediment rocks that were historically folded and steeply inclined exposed at Howells Knob. Composed of quartzite, these rocks weather to variable cream or yellow soils. Maleny plateau basalts although outwardly appearing very hard have high concentrations of iron which promotes fracturing and therefore can be very prone to erosion. The Obi Obi, Bridge and Falls Creeks have gradually cut channels into the basalt plateau revealing the described layers underneath. The edges of the plateau have also eroded to form escarpments (Willmott 2007).



Soils on the site predominantly consist of basalt-derived red (krasnozem or ferrosol) soils. The bed of the watercourses on the site consists of thin, black alluvial soils that have been deposited by a combination of hill slope (paddock) erosion and gullying. Some sediment is likely having originated from development sites in urban Maleny (historically and currently). The velocity and volume of the Obi Obi Creek however limits sediment deposits forming.

Native vegetation is an indicator of soil types. The vegetation over the site therefore would have originally been consistent with RE 12.8.3 – as evidenced by the existing small remnant on the nearby Porter Sisters property and several small pockets or strips adjacent to the Obi Obi Creek. The endangered RE 12.3.1 is found in narrow strips along virtually 100% of the frontage of both properties.

The underlying geology of the properties is tertiary olivine basalts. The majority of the properties are composed of kraznozems, characterised by uniformly of gradational red, friable structured clay soils. The soil contains aluminium oxyhydroxides and iron with the soil having considerable capacity to absorb and retain phosphate. However, clay soils erode easily and tend to reach their infiltration capacity faster than other soils, promoting overland flow. A potential consequence is that both bound and unbound nutrients will enter the watercourses via erosion and runoff (Lake Baroon Catchment Management Strategy & Caloundra City Council 2007).

Preliminary studies by the University of Queensland in the catchment however indicate the exclusion of livestock and revegetation rapidly reduces compaction and improves infiltration (Gageler et al 2014).

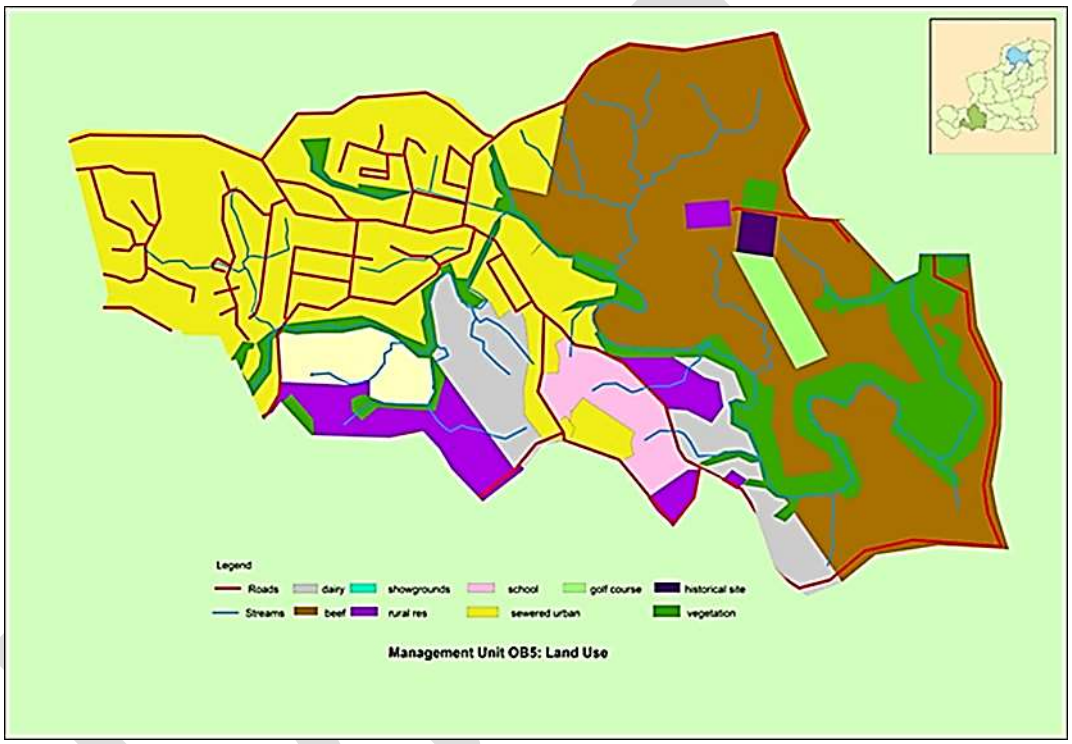
2.3.3 Land-use

Despite the extensive clearing, 17% of the Lake Baroon catchment is still heavily forested; a significant proportion in the immediate area around the dam, although much of this is degraded by environmental weeds. Today, the catchment is susceptible to impacts associated with an increasing diversity of land use (Keys 2009).

The area closest to the lake is popular with “tree changers” and has seen land use change from intensive grazing to smaller rural residential properties. This has resulted in the fragmentation of larger tracts of agricultural land into smaller 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.



2.4 THE OBI OBI CREEK CATCHMENT

The sub-catchment supplies both surface runoff and ground water to Baroon Pocket Dam. Obi Obi Creek continues to flow from the dam wall north-west until it reaches the Mary River at Kenilworth. The Mary River continues north to north-east until it eventually meets the Pacific Ocean at Hervey Bay.

The Obi Obi Creek is the most significant watercourse in the Lake Baroon catchment, consisting of 71 km of waterway in a sub catchment of 2,880 ha. A mere 18% of the sub catchment is covered in vegetation, with much of the area significantly disturbed, mostly supporting beef or dairy cattle; but also including urban Maleny (Dunstan 2007).

Obi Obi Creek has been divided into nine Management Units that reflect property boundaries, physiography, vegetation, land use, point and diffuse source impacts, and administrative convenience.

The project lies in Management Unit OB6.

Left: A typical reach of the Obi Obi Creek near the Maleny Sewage Treatment Plant.

2.5 MARQUARDT & WAUGH PROPERTY REVIEW

2.5.1 Land use and property management

The property owners do not run livestock but lease the pasture areas of the property to Peter Carroll. The breeding beef cows currently have full access to Obi Obi Creek and it is difficult to practise rotational grazing due to the location of water points. The properties carry young stock year round and evidence suggests these animals are more likely to shed pathogens, and therefore it is best practice to maintain appropriate distances away from water bodies.

2.5.2 Hydrology

2.5.2.1 Drainage Lines, Watercourses & Wetlands

The natural drainage lines of the site flow directly into the Obi Obi Creek, which flows into Baroon Pocket Dam, the region's principal water supply and major recreational and scenic resource. The majority of these drainage lines have minimal vegetation along them.

Due to the topography of the large site, stream form is varied and has been impacted by historical land use. Despite some siltation, the Obi Obi Creek provides a diverse range of characteristics and habitats. Many relatively large and deep pools connected by narrow gorges and riffles and runs not only provides habitat but also assists in the preservation of water quality.

2.5.2.2 Flooding

Due to the steepness of the terrain, flooding is generally confined to within the banks of the Obi Obi Creek except for the area behind the STP and downstream for approximately 100 metres. Floodwater velocity in the Obi Obi Creek are typically high, creating significant hazard (Obi Obi Creek Flood Study, GHD 2001 & Caloundra City Council 2007). All erected fencing as part of the project will be above flood levels.

2.5.3 Environmental Factors

2.5.3.1 Significant Vegetation & Ecosystems

The site has been predominantly cleared of vegetation to accommodate pastoral and agricultural activities. The majority of the remaining vegetation is located adjacent to Obi Obi Creek. An almost continuous strip of remnant vegetation along the Obi Obi Creek has been identified as an "endangered" regional ecosystem - RE 12.3.1 - Gallery rainforest notophyll vine forest (Caloundra City Council 2007).

The Maleny Community Precinct Environmental Management Scoping Document completed by Australian Wetlands in 2009 looked closely at the remnant vegetation on the MCP, but is also relevant to the Marquardt and Waugh properties, identifying:

RE12.8.3 – Complex notophyll vine forest

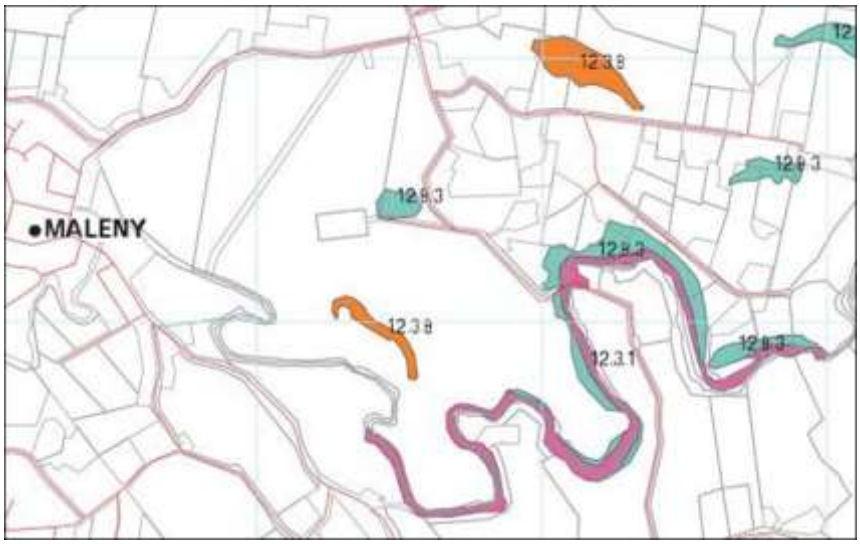
The majority of the two properties would historically have been covered by this Ecosystem. An example of this vegetation can be seen immediately adjacent to the MCP (Porter Sisters Wood) although considered to be at least partially re-growth and degraded from cattle access, it provides an indication what would have existed on the site prior to clearing.

Although not considered a high priority in Queensland, there are few areas of this RE within the Lake Baroon catchment assessed as in good condition.

RE12.3.1 – Gallery rainforest on alluvial plains

This RE usually occurs in narrow linear corridors associated with major watercourses on the Maleny plateau. Due to its reliance on alluvial soils and subsequent narrowness this RE is difficult to map, suffers from degradation more readily than many other Ecosystems and usually intergrades with the similar 12.8.3 Complex notophyll vine forest. A strip exists along most of the Obi Obi Creek.

This ecosystem is endangered and therefore considered high priority for protection.



Left: Map showing the remnant vegetation on the MCP and the proximity to urban Maleny.
Note the red coloured endangered remnant 12.3.1.

2.5.3.2 Fauna & Fauna Corridors

Remnant vegetation along the banks of the Obi Obi Creek, and the creek itself, provide key habitat areas and corridors for both arboreal and ground dwelling animals, birds and aquatic species. The continued presence of species on the site will be dependent upon the maintenance of habitat, weed control and the provision of adequate habitat linkages (Caloundra City Council 2007).

The enhancement and revegetation of the site will provide a continuous link (in conjunction with the Green Hills MCP activities) of vegetation in the lower Obi Obi Creek to vegetation upstream of Maleny.

3.0 PROJECT PURPOSE, OBJECTIVES & OUTCOMES

3.1 BACKGROUND

A healthy aquatic ecosystem is stable and sustainable; maintaining its physical complexity, biodiversity and resilience. It has the ability to provide ecosystem services that in turn contributes to good water quality, wildlife habitat and recreation.

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 critical for biological diversity. The protection, enhancement and rehabilitation of riparian zones is essential for sustainable catchment management and reducing risks to water quality.

3.2 WATER QUALITY

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 Obi Obi Creek occur from three main sources:

- Diffuse run-off from traditional grazing practices provides nutrient inputs (animal manure and fertiliser application) and sediments from paddock erosion;
- Urban run-off carries nutrients derived from fertilisers, car washing, heavy metals and hydrocarbons from road run-off, litter and organic matter; *and*
- There is also the potential for sewer overflows (from the urban sewer system and individual wastewater treatment systems such as septic tanks) with high nitrogen, phosphorus and pathogens.

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 (paddock to stream), through the management of riparian fencing and revegetation, would reduce the likelihood at almost all of the sites identified as high likelihood (pers. comm. A. Smolders 2012).

Less than 6% of the sub-catchment is vegetated, though 20% of the waterways have riparian cover of varying quality. Naturally the MU is highly disturbed and consequently contributes a large nutrient load to Obi Obi Creek, with more than 95% of samples exceeding guideline levels (Dunstan 2007). Other significant issues include the presence of aquatic passage barriers although some of these are naturally occurring (Gardners Falls).

The Lake Baroon Catchment Implementation Plan (2007) rates OB6 a LOW priority for rehabilitation works. 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, OB6 rates as a HIGH priority primarily due to urban impacts on the watercourse.

3.2.1 Raw Water Quality Data

Statistical Analysis of the Raw Water Quality Data Recorded from Gardners Falls (Obi Obi Ck) 1992-2005

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	8.6	33.6	1.047	0.370	0.102	0.305	30,000
Min	6.7	0.6	0.003	0.054	0.000	0.000	4
Mean	7.6	3.7	0.127	0.019	0.018	0.044	755
Median	7.5	2.1	0.084	0.073	0.010	0.030	115
Std Dev	0.3	5.2	0.138	0.008	0.019	0.046	3,163
20th Percentile	7.4	1.3	0.026	0.100	0.006	0.021	40
80th Percentile	7.7	3.6	0.211	0.040	0.027	0.050	406
Count above GV	6	3	80	77	21	58	60
Count	120	119	119	116	119	117	118
% above GV	5.00	2.52	67.23	66.38	17.65	49.57	50.85

Above: Gardners Falls on Obi Obi Creek.

Water quality analysis sampled at Gardners Falls (Obi Lane) 1992 – 2005 indicates the catchment contributes significant nitrates, ammonia, phosphates, phosphorus and faecal coliforms to Obi Obi Creek.

However the routine sampling programs (CalAqua, AquaGen, Seqwater and others) are suspected of not accurately capturing major pollution events. Conducted monthly (1992 – 1998) or bi-monthly (1999 – 2005), significant rainfall events in the catchment have likely been missed with the data collected over-estimating the catchment's water quality (Traill, 2007).

The following data assessment has been sourced from Traill, 2007.

From the data pH appears to be stable, although it is higher than other catchment sampling sites, including Maleny urban and Walkers Creek sites both relatively short distances upstream. This suggests a significant source of alkalinity – potentially from Maleny STP (as of early 2014 the STP has been upgraded and the risk

of pollution is minimal). pH is a measure of alkalinity or acidity of water bodies and is important for two reasons:

- extremely low or high pH can cause direct adverse effects on aquatic organisms;
- pH changes can result in significant increase in toxicity of pollutants such as ammonia and heavy metals.

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 visible extremely dirty 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.

Ammonia levels more often than not exceeded guideline levels during the period although the records suggest there has been significant improvement over time. This can be attributed to a reduction in waste being delivered to the watercourse and/or ammonia is being oxygenated and converted in nitrate. Ammonia is the initial product of the decay of nitrogenous organic wastes - high concentrations of ammonia can be toxic to aquatic life.

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 and aquatic weeds.

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 and aquatic weeds.

Similar to the nitrate levels, the majority of faecal coliforms appear to be originating from further up the catchment. 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: Excessive erosion and nutrients delivered from the catchment contribute to cyanobacteria (algae) blooms in Lake Baroon.

3.3 WATER SUPPLY CATCHMENT

Both properties are within the Lake Baroon Pocket Dam Catchment. The Obi Obi Creek (42.55 km^2) which runs along the southern border of the site, comprises one of Lake Baroon's three major sub-catchments. Consequently it is the major supplier of total water to the dam.

Baroon Pocket Dam (BPD) is a key source of water supply for Seqwater. Minimum flow volumes from BPD through the Northern Pipeline Interconnector (NPI) northwards are 7 ML/day (subject to availability if BPD falls below 60% capacity) to Noosa NTP; and 30 ML/day (20 ML/day if BPD falls below 70% capacity) southwards to Caboolture, Morayfield and Narangba. This indicates both surety of supply, location and cost effectiveness of Landers Shute Treatment Plant (AOP 2013).

BPD, along with Image Flat (South Maroochy System) is the predominant source of water supply for northern South east Queensland with Ewan Maddock Dam (EMD), Lake McDonald and Mary Valley Water Supply Scheme considered additional intermittent sources (AOP 2013).

EMD operates on an as needed basis, typically during high demand periods or when raw water quality in BPD is compromised by algal blooms (and possibly turbidity). EMD, relative to Landers Shute (LSTP) is more expensive to produce potable water (despite its recent construction), hence the reliance on BPD and LSTP (AOP 2013).

It's important to note that the NPI (and all pipelines for that matter) require minimum transfer flows at all times to maintain operation and water quality. Typically this is a minimum of 5 ML/day (AOP 2013).

BPD is a reliable source of raw water (volume) but is plagued by quality issues. These issues were somewhat expected when BPD was constructed and hence the design of LSTP, however demand for supply was never intended beyond the southern half of the Sunshine Coast region.

The value of the raw water that originates in the catchment as a whole greatly exceeds the value of primary production.

Lake Baroon catchment	= 74 km^2 or 7,400 hectares
Gross yearly value of water sold by Seqwater (Saxton et al, 2013)	= $60,000,000
Value of water per hectare	= $8,108 per hectare
Combined area of the two properties	= 33.2 hectares
Gross value of raw water originating from the two properties	**= $269,186 annually**

Tourism has become the dominant economic driver in the catchment but relies on both the agricultural landscape (rolling green hills) and natural values equally. This is demonstrated by the popularity of Maleny Dairies milk processing plant and farm tours (in excess of 12,000 visitors per year) and the popularity of Mary Cairncross Park (500,000 visitors per year?).

Seqwater who receive the benefits of raw water flowing from the catchment into BPD, have an obligation to invest back into the catchment if water quality improvements are desired; into activities that reduce risks to water quality and its maintenance and protection, and broad environmental health.

The likely scenario under climate change modelling suggests more variable and possibly severe weather events; longer and more severe droughts (below average rainfall per month) and more intense rainfall events. This will undoubtedly impact on both raw water quality entering BPD and on the storage itself. Since 2009-10 unseasonal dry periods followed by intense high rainfall events have seen an increase in erosion (land slips), turbidity and flood damage.

The community expects good water quality at their tap – free from discolouration, odours and the guarantee it will not impact their health, and increasingly demands the environment is protected as part of supply.

3.4 OBJECTIVES

Mid Obi Riparian Corridor is a project designed to address livestock access to Obi Obi Creek and the resultant risks posed to water quality.

The project aims to:

- implement an on-ground project that delivers water quality benefits;
- promote integrated catchment management in the Lake Baroon catchment;
- reduce nutrient delivery to waterways;
- reduce sediment delivery to waterways;
- improve aquatic habitats;
- raise community awareness (including water quality issues);
- support and work cooperatively with like-minded community organisations;
- reduce the impact of weeds (through the enhancement of remnant and regrowth vegetation);
- restore links between vegetation and re-establish corridors;
- contribute to the conservation of threatened species;
- contribute to climate change adaptation; *and*
- demonstrate best management practice of riparian zones.

Effective riparian areas can improve water quality by trapping sediment, reducing erosion, storing nutrients and filtering contaminants before they reach water storages (Lake Baroon). Riparian zone health is a key factor in a riparian area's ability to improve water quality.

3.5 TARGETS

The project aims to:

- manage livestock access to 2,250 metres of Obi Obi Creek;
- improve the condition of 11 hectares of riparian buffer to enhance filtering capacity;
- protect 3.9 hectares of endangered remnant vegetation;
- reduce erosion , nutrient and pathogen delivery to Obi Obi Creek;
- establish efficient and effective off stream watering system that provides productivity gains through cleaner water, improved grazing management and improvement in livestock health;
- build LBCCG skills and capacity in designing and installing off stream watering systems; *and*
- raise community awareness by implementing project in an area of high importance.

3.6 OUTCOMES

Healthy catchments lead to healthy waterways. By improving the health of riparian zones we ultimately aim to mitigate 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 risks to water quality. Through the prioritisation and implementation of riparian protection and rehabilitation throughout rural catchments – we provide multiple beneficial outcomes.

Outcomes are the 'end product' of our activities – 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 ideally partnerships with universities and/or Seqwater to produce 'hard' data to prove the effectiveness of projects.

Our project will:

1. **Reduce pathogen delivery to waterways.**
   Excluding livestock from riparian zones reduces the volume of faecal material reaching waterways.

Vegetative buffers intercept run-off contaminated with faecal material (potentially pathogens) from diffuse rural sources. Off stream watering will encourage livestock to spend more time grazing and/or loafing away from natural water sources.

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

Vegetative buffers intercept run-off contaminated with excessive nutrients from diffuse rural and urban sources (stormwater). The project will protect and enhance the existing riparian zone, improving its buffering ability.

3. **Reduce sediment delivery to waterways.**
   Soil from erosion leads to high turbidity and is transported to Lake Baroon and beyond.

Vegetative buffers stabilise eroding riparian zones and intercept run-off contaminated by sediments. The project will enhance and modify (weed management and replacement) riparian vegetation that will slow flows reducing erosive potential while filtering sediments.

4. **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, and provides bank and bed stability. The project will protect and enhance existing riparian vegetation (including useful weed species).

5. **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 importance of excluding livestock from riparian zones and the enhancement and 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 in the community. Green Hills on the neighbouring MCP are conducting numerous community events (Field Days, Field Walks and community tree planting events) engaging, raising awareness and skilling the community.

6. **Protect endangered remnant vegetation.**
   The fencing of the Obi Obi Creek riparian zone will include a narrow but long linear strip of endangered gallery rainforest.

The project will remove livestock access from the gallery rainforest, protecting the endangered regional ecosystem from the impacts of grazing.

7. Restore 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 a link between the remnant vegetation on lower Obi Obi Creek and vegetation adjacent to and within urban Maleny. In 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. 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).

8. 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 the habitat for a variety of native fauna.

9. Reduce chemical delivery to waterways.
Improved water quality monitoring and analysis by Seqwater has identified pesticide and herbicide contamination at Gardners Falls.

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

10. 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 pressure on the environment and subsequently affect catchment water quality.

The project addresses key threats predicted by climate change by increasing the resilience of the catchment to predicted climate change impacts.

3.7 PRIORITY LANDHOLDERS/LAND IN THE LAKE BAROON CATCHMENT

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 Marquardt and Waugh properties are situated in a high priority Management Unit when pollution and land instability (according to broad water monitoring data) is considered (very high volumes of nutrients and other contaminants originating from urban Maleny). The land manager is extremely keen to implement activities that not only improve the management of the property but provide significant broader benefits – including reducing the risk to the Sunshine Coast's most important water supply and the environmental outcomes that are realised.

3.9 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 assist in the management of risk is 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)

3.9.1 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 and engagement.

The project's outcomes are consistent with the Lake Baroon Catchment Implementation Plan (2007) which takes into account the Burnett Mary Regional Group Country to Coast: A Healthy Sustainable Future management actions.

Alignment of relevant summarised actions from the Lake Baroon Catchment Management strategy with actions from the NRM plan Country to Coast – a healthy sustainable future.

LBCIP Activity Theme		*Implementation Activity*	*BMRG Program*
On ground	OG1	Develop on ground works for water quality improvement and aquatic biodiversity maintenance & improvement	Water Quality & Equitable Use
			Biodiversity Conservation
On ground	OG2	Support and develop on ground works for habitat recovery	Biodiversity Conservation
On ground	OG3	Locate high value areas within catchment and target for protection and remediation	Biodiversity Conservation
Catchment management	CM1	Develop a program where by all landholders involved in on ground activities initiate PMP's as part of application process	Biodiversity Conservation
Catchment management	CM2	Property Management Planning Toolkit	Sustainable Use
Catchment management	CM4	Adoption of BMP for point and concentrated diffuse pollution	Community Capacity and Partnerships
Catchment management	CM6	Community involvement	Community Capacity and Partnerships
Catchment management	CM7	Stakeholder Survey	Community Capacity and Partnerships
Catchment management	CM8	Transition in NRM practice	Community Capacity and Partnerships
Catchment management	CM11	Industry involvement in NRM	Community Capacity and Partnerships
Catchment management	CM12	Training and skilling stakeholders in NRM	Community Capacity and Partnerships
Monitoring & research	MR1	Water quality hotspots	Water Quality & Equitable Use

3.9.2 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.

3.9.3 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.

3.9.4 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. 3.6.7. 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.

3.9.5 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.

3.9.6 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.

4.0 IMPLEMENTATION

4.1 METHODOLOGY – 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 contaminant 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 metres of grass buffer and 10 metres of natural vegetation adjacent to the stream has been recommended as effective in many 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 35 and 75 metres of riparian buffer, with an average of approximately 40 metres.

LBCCG has a policy of only managing weeds as part of a larger project such as revegetation or if the weeds are threatening a high value asset (in this case fencing alignment and protection, and remnant vegetation).

4.2 ACTIVITIES

4.2.1 Fencing

Fencing will be erected between 35 and 75 metres from the Obi Obi Creek to provide a substantial area of buffer zone. Approximately 2,080 metres of standard cattle fencing (timber splits at 5 metre spacings, 4 strand wire; 3 barb and top plain) with steel gates where required (approximately 6). On the upstream Reach of creek the new fence will closely align to the SCC esplanade boundary, with a relatively significant loss of grazing. To assist management of this area it is envisaged managed grazing will occur at appropriate times of the year when livestock cannot cross the Obi onto neighbouring properties (MCP). The downstream Reach of the fence will be aligned with the existing riparian vegetation. It is expected minimal grazing will be lost as a consequence as the mature rainforest and heavy weed cover discourages pasture growth anyway.

4.2.2 Off Stream Watering Infrastructure

With access to the Obi Obi Creek removed, a reliable alternative supply of water is required for the livestock. It is proposed to utilise the unused groundwater bore near the Marquardt dwelling to supply a minimum 5,000 gallon tank (22,500 litres) that ideally would be installed adjacent to the stockyards approximately 60 metres from the bore. Two concrete troughs (approximately 600 litre capacity), one on each property will be installed.

4.2.3 Weed management

Major environmental weeds that pose a serious and immediate threat due to their ability to alter the structure and composition of a plant community over time, or inhibit natural regeneration will be targeted for management. These include, but are not limited to:

Weed Species	***Botanical Name***	***Occurrence/Distribution***
Camphor laurel	*Cinnamomum camphora*	Isolated individual trees throughout Marquardt & Waugh reaches.
Lantana	*Lantana camara*	Infestations throughout the project site – heaviest on previously cleared areas and adjacent to remnant vegetation.
Small-leaf privet	*Ligustrum sinense*	Extensive infestations throughout Marquardt & Waugh reaches.
Large-leaf privet	*Ligustrum lucidum*	Minor weed throughout project site.
BlackBerry	*Rubus spp.*	Infestations throughout the project site but mainly in pasture, grazed and moist areas.

The key aim of the woody weed management phase is to remove weeds adjacent to, or threatening the areas of remnant vegetation. Dense patches of lantana will be managed to enhance the opportunities for natural regeneration of native species.

Woody weed management will be implemented early in the implementation phase of the project with a maintenance program to ensure weeds do not re-establish. The majority of the weeds (excluding blackberry) occur adjacent to the canopy of the existing remnant vegetation/individual isolated native trees.

Follow up woody weed management (from six to thirty six months) will be regularly performed to ensure weeds do not re-establish or new weeds appear and establish.

4.2.4 Other activities

This project links with several other recent LBCCG projects:

Erowal Riparian Fencing and Off Stream Watering

http://www.lbccg.org.au/wp-content/uploads/2014/02/Erowal-Riparian-Fencing-and-Off-Stream-Watering-Project-Plan-website-version.pdf

Maleny Community Precinct Revegetation Fencing

Walkers Creek (working title)

A project planned for 2014-15 involving the revegetation of 400 metres of Walkers Creek immediately upstream of the Erowal project.

5.0 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 Plan		LBCCG Project Manager	Jan 14	Apr 14	Project Plan
Project presented to LBCCG Committee for approval (includes Seqwater rep.)		LBCCG Project Manager & Committee	Apr 14	May 14	Approved Plan
Pre-works monitoring (including photo points)		LBCCG Project Manager	Jan 14	May 14	Photo & data set
Application to Sunshine Coast Council (LEG program)		LBCCG Project Manager, landholder	Apr 14	Jun 14	Approved Plan Funding granted
	Weed management	Contractor, lessee	May 14	Jun 14 ongoing	6 hectares
	Fencing	Contractor, lessee	May 14	Jun 14	2,076 metres
	Off stream watering	Landholder, lessee	May 14	Jun 14	1 OSW system 2 troughs
Post-works monitoring.		LBCCG Project Manager	Jun 14	Jul 2014 ongoing	Photo & data sets
Final Report		LBCCG Project Manager	Jul 14	Aug 14	Final Report

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

Weather conditions may affect implementation of project.

6.0 PROCUREMENT

6.1 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 (and in this case Sunshine Coast Council). Services and products will be sourced locally wherever possible and from not-for–profit community organisations if applicable.

Service/Product	*Supplier*	*Contact (if applicable)*
Weed management	DG Posi Track Mulching	Darrel Hinson
	Totem Fauna & Flora	Jason Flynn
	J & J Bateman	Jonothan Bateman
	Barung Landcare	Matt Bateman
Fencing	Fencing Contractor: Bald Knob Fencing	Tim Simpson
	Fencing Contractor: R. Ludwig	Rob Ludwig
Off stream watering	Earthmoving Contractor: P & K Nash	Phil Nash
	The Pump House	Michael Bevege
Electrical services	Eastmure Electrical	Colin Eastmure

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 must demonstrate full insurance and liability requirements and that all staff or personnel on site are appropriately licenced and/or experienced.

6.2 COST ESTIMATION METHODOLOGY

6.2.1 Weed management

Posi-track mulching has been estimated from previous experience on the recent Erowal project.

Totem Flora and Fauna have provided a quote for weed management activities and generally work to a set figure per day.

6.2.2 Fencing

Fencing rates have been estimated from recent similar activities conducted by LBCCG and confirmed by a quote provided by Bald Knob Fencing..

Bald Knob Fencing charges a indicative rate of $13.00 per metre for standard cattle fencing (timber posts at 5 metre spacings; 4 barb wires; 12‘ steel gates) with gates at $370.00 each. Gate costs includes extra strainer post, gate, fittings and labour to install. These figures rely on long straight strains and little to no rock encountered.

6.2.3 Off Stream Watering Infrastructure Costs

Figures are indicative only and dependent on site conditions.

Item	***Unit***	***Cost (GST exclusive)***
Bore pump & installation (quote)	each	$2,564.06
Electrical cable supply & install		$1,000.00
5,000 gallon tank	each	$2,200.00
600 litre trough	each	$550.00
1 1/4 poly pipe	per metre	$1.77
Fittings	each (average)	$20.00
Double action float valve	each	$140.00
Machine hire	per hour	$100.00
Road base & sand	per m^3	$30.00
Labour (excavator standby rate)	per hour	$50.00

7.0 N/A

8.0 HAZARD & RISK ASSESSMENT (HRA)

LBCCG has a comprehensive Safety Management System that clearly directs all aspects of Projects; Project selection (on the basis of safety), Project development, Contractor and/or volunteer engagement, Landholder expectations and requirements, Project implementation and ongoing Project monitoring and evaluation.

LBCCG adheres to the relevant legislation, policy and standard requirements:

- **AS/NZS Risk Management Standard 4360:1999**
  Establishes and implement a risk management process that involves the identification, analysis, evaluation, treatment and ongoing monitoring of risks.
- **AS/NZS 4084:2001 Occupational Health and Safety Management Systems – General Guidelines on Principles, Systems and Supporting Techniques**
  Provides guidance on the development and implementation of occupational health and safety management systems (OHSMS) and principles, and their integration with other management systems.
- ***Workplace Health and Safety Act 2011*** **(Qld)**
  To prevent a person's death, injury or illness being caused by a workplace, by a relevant workplace area, by work activities, or by plant or substances for use at a workplace.

8.1 ASSUMPTIONS AND LIMITATIONS

Assessment of hazard and risks associated with the project was undertaken as part of the project development process. As a result, the risks and hazards identified are based on existing information about the project at the time of writing, and proposed construction and operational features. Further risks and hazards may be identified in future stages or identified risks could be downgraded or upgraded in terms of the level of risk they pose. Additional mitigation measures as required will be developed and documented in the Implementation Risk Management Plans for the project which will need to remain live documents throughout the relevant project phases. The consideration of natural hazards is based on existing information about the project area including overlay mapping from the former Caloundra and Maroochy Shire Councils (now Sunshine Coast Council). This enables a high level assessment to be made of the risk of natural hazards in the project area, however, detailed modelling or prediction of natural hazards has not been undertaken.

8.2 IDENTIFICATION OF RISKS

Hazards (and related risks) have been identified relating to the three on-ground phases of the project:

1. Fencing;
2. Weed management*; and*
3. Off stream watering

The project is believed to be both a safe and efficient riparian fencing, weed management and off stream watering project. All activities and phases present some level of risk however, which can be identified through a HRA so that appropriate management measures can be implemented to reduce or remove the risk. The primary safety concern is the steep slopes associated with Obi Obi Creek. Sections of fencing will cross these steep slopes so it is imperative that fencing activities are implemented when dry conditions prevail. This may mean the fencing is not completed on schedule.

Similarly weed management will occur on steep slopes. A spotter will work with the posi-track mulcher to minimise high risk situations. Weed teams working on foot will undergo an extensive on-site induction to ensure sage work practices are adhered to at all times.

All site visitors will be provided with a site specific induction. Contractors engaged complete with the LBCCG Project Manager, a *Contractor Field Safety Induction Form* (LBCCG Form No. 007) providing current Insurances, accreditations and acknowledgement of Contractor responsibilities.

9.0 CULTURAL HERITAGE

The Native Title Determination in November 2012 awarded the Jinibara People non-exclusive title of the Maleny area including Baroon Pocket.

The paramount legislation in Queensland, with regard to Aboriginal cultural heritage issues, is the *Aboriginal Cultural Heritage Act 2003*, which states that a person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage (the 'cultural heritage duty of care') (Section 23[1]). The Act defines cultural heritage as (S8):

- a significant Aboriginal area or Aboriginal object
- evidence, of archaeological or historic significance, of Aboriginal occupation of an area.

A significant Aboriginal area is 'an area of particular significance to Aboriginal people' because of either or both of the following:

- Aboriginal tradition
- the history, including contemporary history, of any Aboriginal party for the area (S9).

The Act states that it is an offence for a person to harm, remove or possess cultural heritage if the person 'knows or ought reasonably to know that the object is Aboriginal cultural heritage' (S26).

The Maleny area and particularly the Baroon Pocket area have significant cultural heritage values for a long period of time. Items of cultural heritage significance can be discovered anywhere in the catchment however riparian zones are a likely location.

The project will involve three phases that could potentially unearth artefacts:

1. Weed management – above surface clearing of weed species on fence alignment ,within and adjacent to remnant and regrowth vegetation;
2. Fencing – shallow excavation to clear alignment, boring of moderately deep holes (up to one metre) for posts; mainly outside riparian zone; *and*
3. Off stream watering installation – excavation of trench(300 mm deep x 300 mm wide) from bore located near Maleny - Landsborough Road to existing sheds and stockyards. Minor and shallow excavation for tank and trough placement.

All activity locations have been largely disturbed since European settlement (deforestation) and have undergone significant movement of soil layers – particularly the areas to involve earthmoving activities. Visual inspection of the sites before and during activities will be carried out and if artefacts or suspected features are unearthed activities immediately suspended and the relevant representative contacted (Ken Murphy, Jinibara Elder).

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 – the waterway crossing and drainage works will be split into periodic and episodic monitoring.

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

Episodic monitoring will occur following significant storm/rainfall events (or extended dry periods) 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 REPORTING

Project updates will be provided at monthly LBCCG meetings. A Progress Report will be produced once all funded activities have been completed with a Final Report produced once all on-ground activities and initial monitoring and evaluation is completed (June 30 2014).

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 Committee	Sally Watter	LBCCG (Management Committee)
	Keith Schelberg	
	Gillian Pechey	
Technical advice	Colin Eastmure	Eastmure Electrical
	Tim Odgers	Seqwater
	Phil Nash	P & K Nash Earthmoving
	Michael Bevege	The Pump House
	Alan Wynn	Sunshine Coast Council

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