Lake Baroon Catchment Care Group

Working with our community...for our waterways

Projects 2018-19

Daley Creek Riparian Fencing & Off Stream Water Stage 1 (Thomas & Gartshore/Keyes)

seqwater WATER FOR LIFE

Sunshine Coast. COUNCIL

PROJECT PLAN

Project No. 1819-008

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How to read this Plan

This Plan is split into five sections.

PART A: Executive Summary (pp. 5-6) is a two-page brief description of the project and includes summarised details of the stakeholders, budgets, outputs and outcomes.
PART B: Project Background and Previous Stages (pp. 7-9) provides useful background information and summarises projects that have occurred on the property and nearby since 2000.
PART C: Project Plan (pp. 10-31) outlines the implementation of the latest Stage project.

Previous Projects

The Clark Creek sub catchment has been targeted by LBCCG recently to address unmanaged livestock access to watercourses. The following Plan was implemented on neighbouring properties in a previous financial year and may be useful for an improved understanding of the objectives of LBCCG in the nearby vicinity:

1718-008 Clark Creek Off Stream Water Project Stage 2 (Smith, Jones & Macleod)

Confidentiality

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DOCUMENT VERSIONS & APPROVALS

Version	*Date*	*Version/Description*	*Result*
1.0	April 2019	Draft LBCCG Project Proposal completed. Project emailed to LBCCG Committee for comments.	n/a
1.0	April 2019	Project Plan will be presented at April LBCCG Management Committee meeting for approval.	Approved (Minutes 116.7.2)
1.0	24/4/2019	Project Proposal forwarded to Seqwater for approval (email)	Approved 30/4/19

Cover: Daley Creek winding through the Gartshore and Keyes property.

TABLE OF CONTENTS

PART A: EXECUTIVE SUMMARY

Executive Summary **5**

PART B: BACKGROUND & PREVIOUS PROJECTS

i. Introduction 7
ii. Background 7
iii. Previous projects in area/catchment 8

PART C: PROJECT PLAN

1.0 What **10**
2.0 Where **11**
2.1 Location 11
2.2 The Obi Obi Creek Catchment 11
2.3 Catchment Land Use 12
2.3.1 Land Use in Management Unit OB1 13
2.3.2 Land Use in Management Unit OB2 14
2.3.3 Gartshore & Keyes Land Use and Property Management 14
3.0 Why **15**
3.1 Alignment with Key Plans & Strategies 15
3.1.1 Priority Actions for Obi Obi Creek and Project Objectives *15*
3.2 Water quality 17
3.2.1 Statistical Analysis of the Raw Water Quality Data Recorded from Aplin Lane 1993-98 *17*
3.2.2 Comparison of the Raw Water Quality Data from Obi Obi Creek 1991-2005 *18*
3.3 Options Analysis 20
4.0 How **21**
4.1 Riparian fencing 21
4.2 Off stream water 22
4.3 Stream crossings 23
4.4 Laneway rehabilitation 24
4.5 Alternative shade 24
4.6 Weed management 24
4.7 Riparian revegetation 25
4.8 Future Stages & Activities 25
5.0 When **26**
5.1 Schedule & Milestones 26
5.2 Monitoring, evaluation & reporting 26
6.0 Project Map **28**
7.0 Budget **29**
References **30**

PART A EXECUTIVE SUMMARY

PROJECT NUMBER & TITLE: **1819-008 Daley Creek Riparian Fencing & Off Stream Water Stage 1 (Gartshore/Keyes)**

Daley Creek Riparian Fencing & Off Stream Water will be implemented in moderate to high priority management units (headwaters of Obi Obi Creek including the major tributary Daley Creek) that deliver very high volumes of nutrients and likely high levels of faecal material (*E.coli* and pathogens) to Obi Obi Creek and ultimately Baroon Pocket Dam. Barry Gartshore and Sally Keyes own a 40 hectare property that has extensive frontage to Obi Obi Creek (800 metres) and Obi tributary Daley Creek (890 metres). Currently livestock have access to all riparian zones on the property and a lack of internal property fencing results in animals spending long periods in these areas grazing, drinking and loafing (minimal shade is present in paddocks). The proposed project will manage livestock in riparian zones (until riparian vegetation is established and livestock are excluded permanently), install alternative livestock water that will improve livestock management (split property into more paddocks) and pasture health, provide stable stream crossing points reducing erosion and establish shade in paddocks in conjunction with watering points stopping a reliance on natural watercourses for stock water. The project will also utilise funding from the Commonwealth Smart Farms Small Grants program *Maleny Sustainable Beef* contributing to the riparian fencing, off stream water and alternative shade. The project primarily aims to reduce livestock access contact with streams but will also support landholder (and Sunshine Coast Council) interest in protecting and revegetating property riparian zones.

APPLICANT/LANDMANAGER DETAILS

Names	Barry Gartshore & Sally Keyes

PROJECT / SITE LOCATION

Property Name & Address	Maleny Springs, Denning Rd, Wootha	
Latitude/longitude	-26.773755 152.800402	
RP Numbers (Lot)	RP890944 (7)	
Property Size	40 hectares	
Land-use & stock carried	Beef (45) Farm stay accommodation	
Sub-Catchment/MU	Obi Obi Creek OB1	Obi Obi Creek OB2
M.U. Priority *(LBCCG IP)*	**Low**	**Moderate**
M.U. Priority *(Pollution)*	**High**	**Moderate**
Water Quality (ANZECC) (Trail 2007)	Almost 100% of samples between 1991-2005 exceeded ANZECC guideline levels	80% of samples between 1991-2005 exceeded ANZECC guideline levels

PROJECT PARTNERS/STAKEHOLDERS & ROLES

Lake Baroon Catchment Care Group (Seqwater 2018-19 CORE Project Funding)	On ground project implementation **($54,613)**
Lake Baroon Catchment Care Group (Seqwater 2018-19 CORE Administration Funding)	Project coordination, administration, reporting, monitoring & evaluation (**In kind $3,951**)
Commonwealth Smart Farms Small Grants (Maleny Sustainable Beef)	Project funding, field day location **($12,462)**
Sunshine Coast Council (Landholder Environment Grant & Land for Wildlife)	Project funding and technical advice **(TBC – estimated $23,750)**
Landholder	Landowner, labour, cash and in-kind contributions (**$30,753**)

PROJECT DETAILS – STAGE 1

Start Date	April 2019	***Completion***	June 2019	**Duration** (implementation)	1 year (Stage 1)
OUTPUTS					
Off stream water		4 troughs	***Stream crossing***		2
Riparian fencing		2,000 m	***Laneway rehabilitation***		40 m
Alternative shade		25 trees	***Weed management***		1 ha
Riparian revegetation		1 ha			
OUTCOMES					
Length of watercourse fenced (stock managed)				890 metres	
Priority Property engagement				1 new property	
Area of land under improved management				40 hectares	

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 on Seqwater's core business.

The Gartshore & Keyes property straddles two LBCCG Management Units – OB1 and OB2. Three quarters of the property lies in OB1 - a high priority sub-catchment with the remaining quarter in the adjacent OB2, a moderate priority Management Unit. These MUs are characterised by deep, fertile Ferrosol soils, moderate slopes and as a result intensive agriculture, historically prime dairying country. LBCCG has been very active in the upper Obi Obi Creek catchment addressing unmanaged livestock grazing in riparian zones, erosion originating from dairying practices and improving land management.

The proposed project aims to complete seven components:

Activity	Description	Funded by
Off stream watering infrastructure (troughs)	4	LBCCG CORE/Commonwealth Government's Smart Farms Small Grants
Stream crossing	2	LBCCG CORE
Laneway rehabilitation	40 metres	LBCCG CORE
Riparian fencing	2,000 metres	LBCCG CORE/Commonwealth Government's Smart Farms Small Grants
Alternative shade	25 advanced trees	Commonwealth Government's Smart Farms Small Grants
Weed management	1 hectare	Landholders/other tbd contributors (Sunshine Coast Council)
Revegetation	1 hectare	Landholders/other tbd contributors (Sunshine Coast Council)

Note: the project was identified as a <u>Stand-by Project</u> in the LBCCG 2018-19 Annual Investment Strategy – Part 1: Projects.

Effectively this proposed project replaces the Preferred Project *Lower Obi Obi Creek (Mumford)* for 2018/19. This is primarily due to the uncertainty around the Mumford/Porter property future.

PART B BACKGROUND & PREVIOUS PROJECTS

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 producing high quality, competitively priced potable water for the Sunshine Coast (and greater South east Queensland) region.

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

The activities of LBCCG are supported by Seqwater as they align with Seqwater's commitment to the NHMRC Framework and to environmental stewardship by supporting catchment planning and targeted remediation for reduction of catchment based risks to water quality (Smolders 2011).

As this project is consistent with the shared aim of reducing risks to water quality from erosion, nutrients and pathogens and impacts on native vegetation from livestock and invasive species, the activities to install riparian fencing, control invasive environmental weeds and the revegetation of unstable slopes and watercourses are considered sensible to support.

ii. BACKGROUND

The upper Obi Obi Creek catchment has been targeted for major on ground activities (projects) since 2009 as this sub-catchment is recognised as delivering very high volumes of nutrients and other contaminants (the sub-catchment is largely agricultural). Two different approaches have been used in this part of the catchment. Many works or activities have directly targeted the sources of point and diffuse pollution – stream crossings, riparian fencing and laneway rehabilitation for example. Further downstream where there are opportunities to fence and revegetate the Obi Obi Creek riparian zone (Farmhouse Macadamia, Kings Land Weir) large scale revegetation been implemented. These plantings are believed to 'decontaminate' flows as they pass through the system as water monitoring downstream indicate.

The Lake Baroon Implementation Plan (2007) considered this part of the catchment as low priority for works as it was deemed too costly to achieve worthwhile water quality gains. However changes to how catchments are assessed for priority, has resulted in a greater emphasis on areas that are identified as high contributors of contaminants. When this is taken into account the Management Units are considered High Priority (almost 100% [OB1] and 80% [OB2] of samples exceeding ANZECC guideline levels 1991-2005 (Traill 2007).

Being primarily an intensive grazing Management Unit, the priority action is to reduce livestock contact with natural water; riparian fencing, alternative watering, stream crossings and rehabilitation of laneways.

The proposed project property has been owned By Barry Gartshore and Sally Keyes for almost a decade; before this it was part of the Thomas dairy (mainly used for dry dairy cows). Barry and Sally have continued to run moderate numbers of beef cattle and recently diversified into farm stay accommodation. Part of the reason for improving the management of riparian zones and livestock is to provide an enhanced experience for visitors.

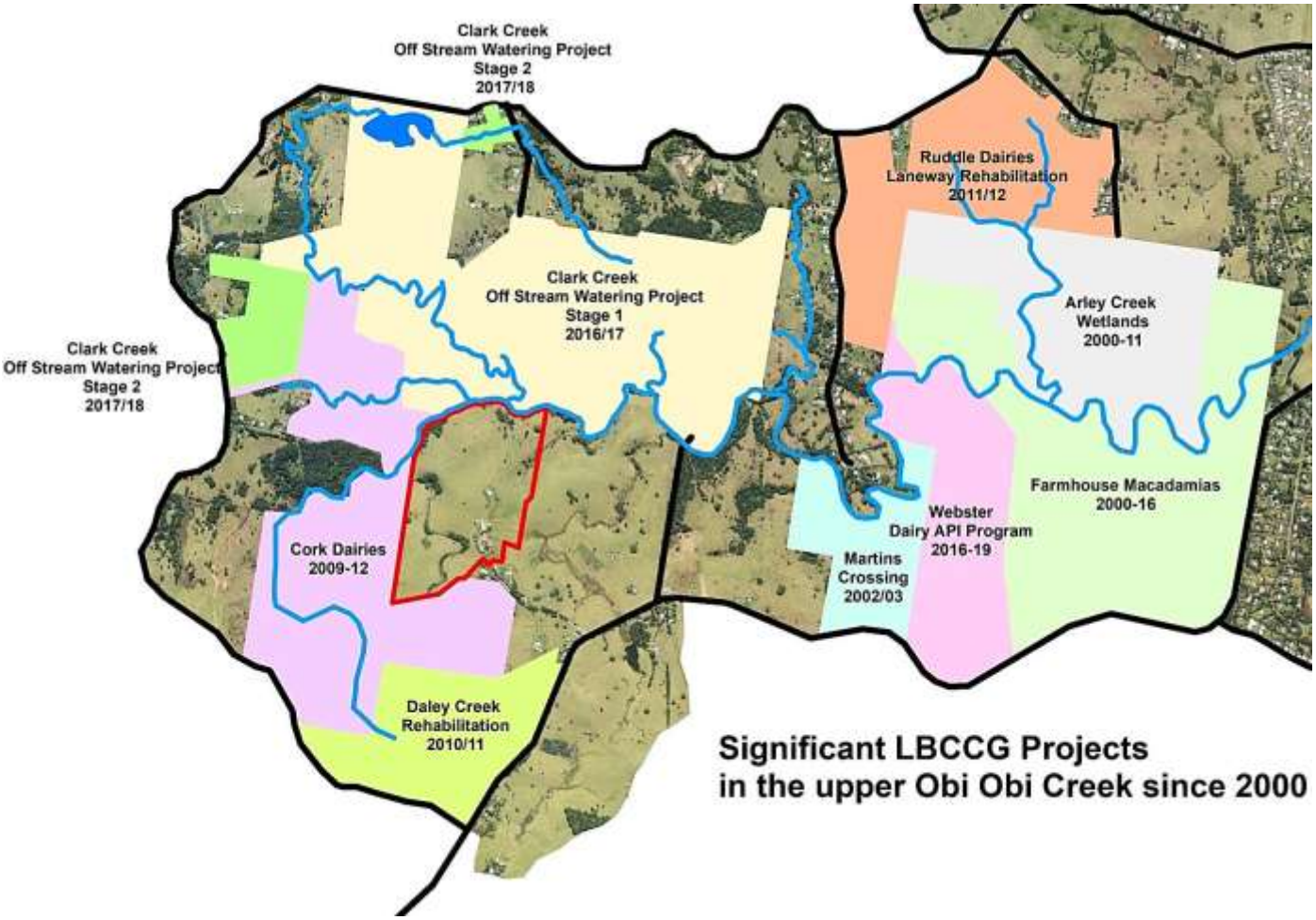
Alan Wynn from Sunshine Coast Council has provided advice to Barry and Sally regarding weed management and revegetation. LBCCG will provide additional advice in these areas but will not provide ongoing financial assistance.

iii. PREVIOUS PROJECTS IN AREA/CATCHMENT

Numerous large projects have occurred in the upper Obi Obi Creek catchment – where large agricultural properties still dominate. Since 2008 there has been a concerted effort made to engage the landholders in this area as the sub-catchment provides high levels of nutrients (including faecal material, fertiliser run-off and other pollutants) and likely pathogens.

Previous major LBCCG projects in the immediate location include:

Project Name	*Years implemented*	*Project outputs*	*Total Project Value*
Martins Crossings (Martin)	2002/03	Stream crossings	$1,337
Daley Creek Rehabilitation (Woods)	2002/03 2010/11	Riparian fencing, stream crossing construction and repair	$36,420
Arley Creek Wetlands (Stevens) and other various projects	2002-2011	Riparian fencing, revegetation, stream crossings, off stream watering and weed management	$102,810
Obi Obi Partnership	2003-06	Riparian revegetation	$114,225
Kings Lane Weir	2005-10	Riparian fencing and revegetation	$21,331
Clark Creek Riparian (Barlow)	2009/10	Stream crossing, riparian fencing and revegetation	$13,197
Cork Dairies (Cork) (various projects)	2009-12	Stream crossings, laneway rehabilitation	$118,135
Farmhouse Macadamias (various projects)	2010-2016	Revegetation, stream crossings and weed management	$128,572
Ruddle Dairies Laneway Rehabilitation (Ruddle)	2011/12	Laneway rehabilitation	$60,729
Obi Obi Creek Fencing and Revegetation (Macleod)	2014/15	Riparian fencing, revegetation and alternative watering	$22,808
Webster Dairy API Program	2016-18	Off stream watering, fencing, laneway rehabilitation	$51,865
Clark Creek Off Stream water Project Stage 1	2016/17	Riparian fencing, off stream watering, stream crossings	$103,594
Clark Creek Off Stream water Project Stage 2	2017/18	Riparian fencing, off stream water, weed management, revegetation, wetland bank repair	$61,686



LBCCG projects since 2008 in the immediate area of the proposed project. Note the figure indicates the property individual projects occurred – not the actual on-ground activity. Proposed project property is identified by red border.

PART C PROJECT PLAN

1.0 WHAT

(What activities will be implemented?)

The proposed project aims to complete seven components before June 30, 2019 (weather dependent).

Activity	Description	Funded by
Off stream watering infrastructure (troughs)	4	LBCCG CORE/Commonwealth Government's Smart Farms Small Grants
Stream crossing	2	LBCCG CORE
Laneway rehabilitation	40 metres	LBCCG CORE
Riparian fencing	2,000 metres	LBCCG CORE/Commonwealth Government's Smart Farms Small Grants
Alternative shade	25 advanced trees	Commonwealth Government's Smart Farms Small Grants
Weed management	1 hectare	Landholders/other tbd contributors (Sunshine Coast Council) [(1)]
Revegetation	1 hectare	Landholders/other tbd contributors (Sunshine Coast Council) [(1)]

[(1)] Sunshine Coast Council Landholder Environment Grants (LEG).

The Gartshore and Keyes property is located in the headwaters of Obi Obi Creek on deep, fertile Ferrosol soils with gentle slopes – ideal grazing country.

2.0 WHERE

(Where in the catchment will the project occur?)

The project will be implemented on the Gartshore & Keyes property in the upper Obi Obi Creek catchment (including the Obi tributary Daley Creek).

Barry Gartshore & Sally Keyes

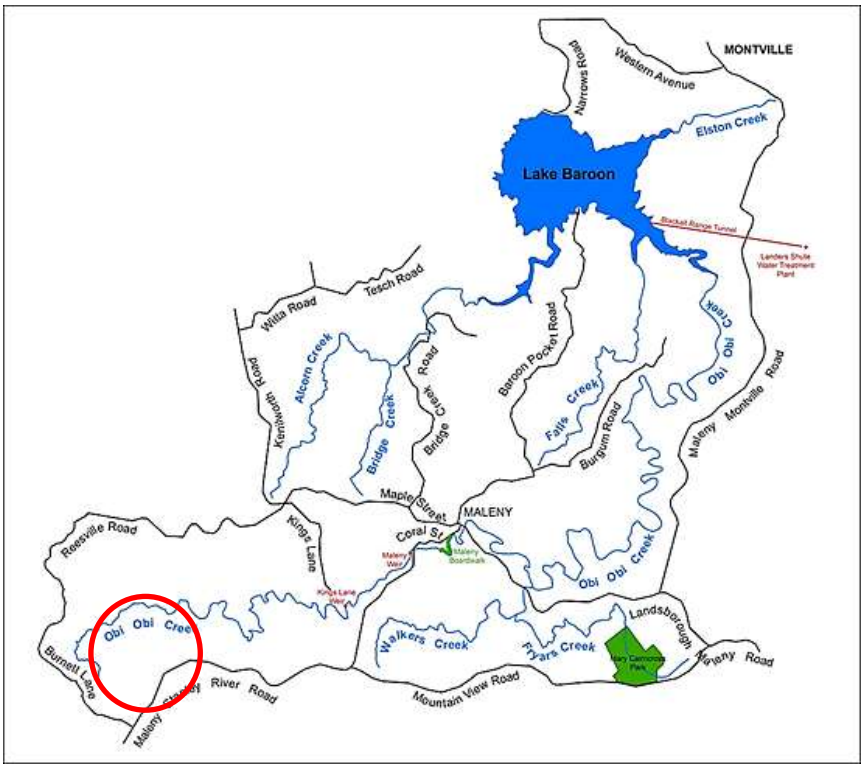
Denning Road, Reesville

Property is approximately 40 hectares + 1.5 hectares of Denning and Flesser Road easements – currently comprising the following:

- 38 ha of improved pasture;
- 3.5 ha of minor remnant, regrowth and other vegetation including woody weeds; *and*
- 0.75 ha dwellings, sheds and un-grazed driveways.

Daley Creek (major tributary of Obi Obi Creek) flows through the property with a total length of approximately 890 metres. Obi Obi Creek forms the northern boundary of the property for a distance of approximately 900 metres. The Obi Obi Creek here is fenced in a manner that provides access to water to both the Gartshore and neighbouring Barlow and Thomas properties and not strictly along property boundaries. There are no other significant watercourses on the property. Daley Creek has minimal vegetation coverage (small stand of remnant vegetation and several other weed dominated stands of vegetation)while Obi Obi Creek supports a moderate coverage of vegetation although much of this is comprised of woody weeds such as small and large leaf privet.

2.1 LOCATION



The Gartshore & Keyes property is located in LBCCG Management Unit OB1 and 2. These MUs lie in the uppermost Obi Obi Creek catchment in an area of intensive beef and dairy grazing. The establishment of riparian buffers and improved land management is a priority for LBCCG in this sub-catchment.

2.2 THE OBI OBI CREEK CATCHMENT

Daley Creek is a significant tributary of Obi Obi Creek and thus is a sub-catchment of Obi Obi Creek.

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).

Dairy grazing (three farms) remains a significant land use although has been in decline since deregulation in 2000. However dairying has made a resurgence since 2016 with all local milk being processed by either Maleny Dairies or Maleny Cheese. Beef grazing has replaced dairying as the dominant land use.

Kings Lane Weir on Obi Obi Creek. High nutrient and E.coli loads originating from intensive agriculture in the upper reaches of the catchment have been significantly reduced when flows reach Kings Lane Weir. It is believed riparian and aquatic vegetation to help filter and process raw water contaminants such as nutrients, pathogens and sediment.

2.3 CATCHMENT 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).

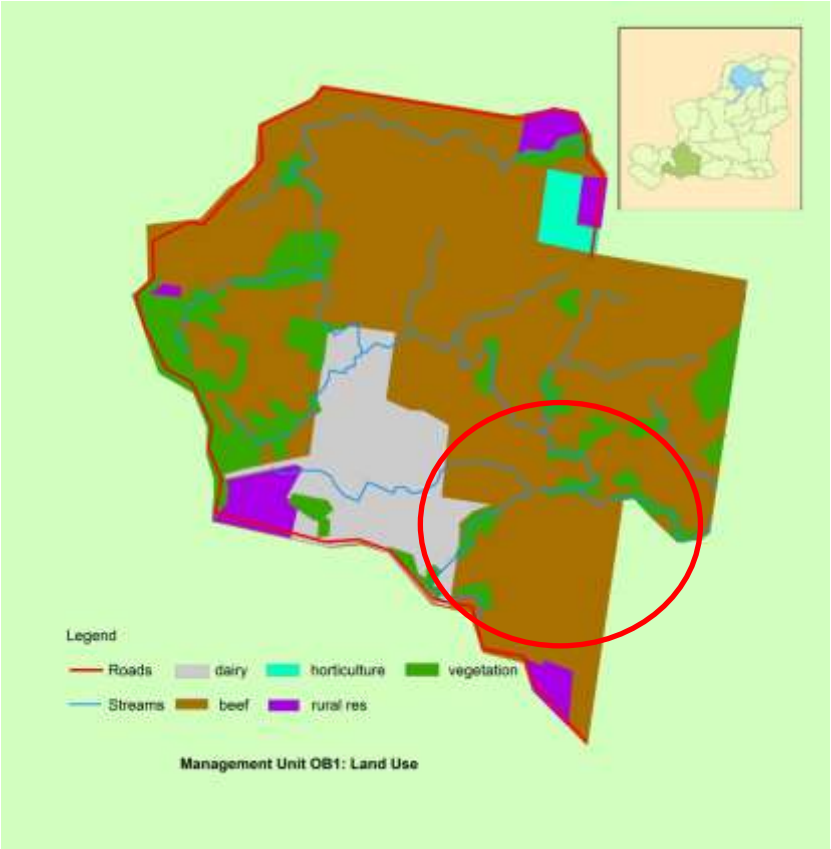
Presently the catchment is susceptible to a number of land use impacts (Traill, 2007; Dunstan, 2007) including:

- poorly managed 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 and proliferation of weeds (including emerging weeds); *and*
- varying pollution sources related to increased population.

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

The property lies in Management Units OB1 (75% of the property to the north of the Denning Road easement) and OB2 (25% of the property to the south of the Denning Road easement).

2.3.1 Land-use in Management Unit OB 1

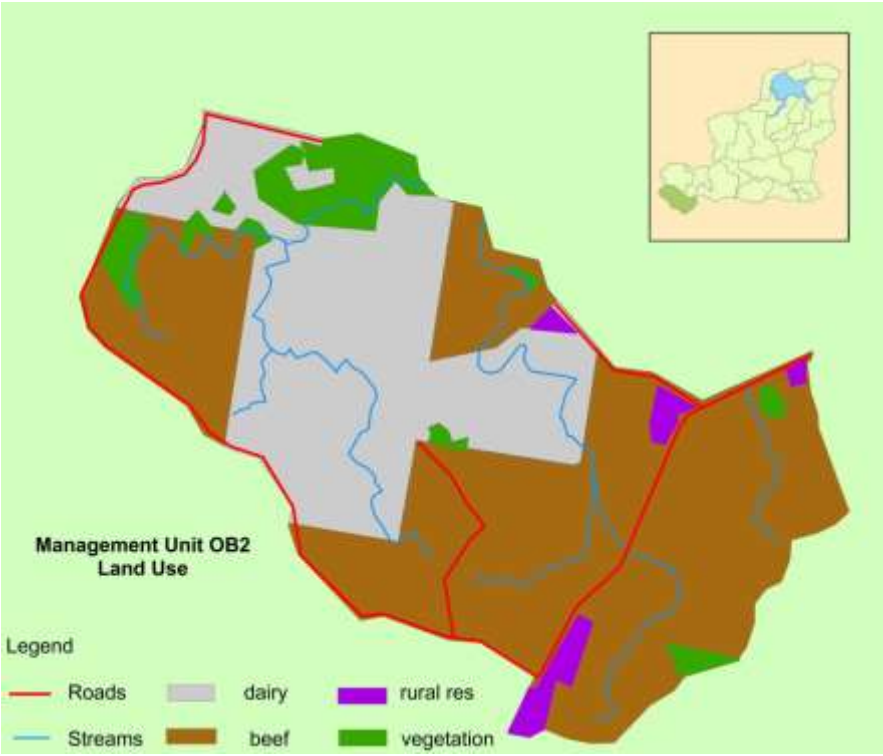


Management Unit OB1 covers an area of approximately 360 hectares and includes the headwaters of Obi Obi Creek (including Clark Creek); a highly disturbed landscape. The primary land use in the management Unit OB1 is beef grazing (75%) although dairying is still a relatively major land use at 20%. Other minor land use includes rural residential and plantation timber (<5%). A mere 10% of the MU is vegetated, while 11% of the waterways have riparian cover.

Despite the extremely stable geology of OB1, the MU contributes a huge nutrient load to the waterway (close to 100% of samples exceeded ANZECC guideline levels) (Dunstan 2007).

Major land use in MU OB1 include beef grazing (75%), and dairy farming (20%).

2.3.2 Land-use in Management Unit OB2



The primary land use in the management Unit OB2 is beef grazing dairying (60%) with dairying a significant land use at 35%. Less than 7% of the 342 hectare sub catchment is vegetated, while 8% of the waterways have riparian cover. Despite the extremely stable geology of OB2, the MU contributes a significant nutrient load to the waterway (approximately 80% of samples exceeded ANZECC guideline levels).

Intensive agriculture is characteristic of MU OB2 with extensive beef grazing and Cork Dairies.

2.3.3 Gartshore & Keyes land use and property management

The Gartshore/Keyes property is a moderate sized parcel of land with good access to water from Obi Obi Creek and the permanently flowing Daley Creek which runs through the property from east to west. The property is relatively flat with Red Ferrosol soils ideal for growing improved pasture. Originally part of a much larger dairy grazing property there is virtually no internal fencing which impacts the ability of the landholders to manage pasture efficiently. Approximately 45 head of adult beef cattle are run on the property (not including calves).

Currently livestock have unrestricted access to Daley Creek and to approximately half of Obi Obi Creek (irrespective of property boundaries neighbours on the other side of Obi Obi Creek; Kevin Thomas and Stewart Barlow have fencing in place to share access to the water in the Obi).

Flooding is not considered a major issue as the properties placement high in the catchment means that high flows are generally brief however any fencing installed will need to account for flooding. Low level concrete crossings are not impacted by flooding (hence their preference over piped crossings)).

There is a very small area of significant (remnant?) vegetation at the lower end of Daley Creek and several small stands of regrowth vegetation along the Obi Obi Creek (largely dominated by woody weeds but have value as good revegetation starting points and providing stability to stream banks).

The vegetation along the Obi provides a limited corridor for wildlife but provides a good starting point for the reestablishment of an Obi Obi Creek linkage; an excellent stand of remnant vegetation lies approximately 200 metres upstream on the “Book Farm” while significant vegetation including remnant is present on the Macleod property – approximately 700 metres downstream.

3.0 WHY

(What benefits will the project provide?)

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).

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. Weed invasion is an indicator that the riparian system is in decline and has the potential to alter the vegetation structure to such an extent that habitat and water quality outcomes are threatened.

Lake Baroon Catchment Care Group is focussed on improving raw water quality in the Lake Baroon catchment and achieves this by working with private landholders in the catchment. Supporting landholders to improve land management, in turn provides multiple beneficial outcomes; water quality and broader environmental benefits while enhancing property management. Catchment activities not only benefit the raw water flowing into one of south east Queensland's most important water storages (hence Seqwater's significant support) but by providing a range of other environmental outcomes, generates support from other funding providers (most notably Sunshine Coast Council).

3.1 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 project's objectives and outcomes are consistent with:

- 2018-19 LBCCG Annual Investment Strategy (Lake Baroon Catchment Care Group 2018)
- Lake Baroon Catchment Implementation Plan (AquaGen/LBCCG 2007)
- Seqwater Natural Assets Management Plan – Lake Baroon Catchment (Seqwater 2012)
- Sanitary Survey of Baroon Pocket Catchment Report (Seqwater 2015)
- Catchment and In-Storage Risk Assessment for Water Quality – Baroon Pocket Dam (Seqwater 2009)
- Sunshine Coast Council Waterways & Coastal Management Strategy 2011-12 (Sunshine Coast Council 2011)
- Mary River and Tributaries Rehabilitation Plan (Mary River Catchment Coordinating Committee 2001)
- Lake Baroon Catchment Management Strategy (AquaGen/LBCCG 2004) ***see below***

3.1.1 Priority Actions for Obi Obi Creek and Project Objectives

Despite the 2004 Lake Baroon Catchment Management Strategy being a relatively outdated document, the identified actions to address poor water quality are sound and at a level where a local catchment group such as LBCCG can implement.

The Obi Obi Creek has three distinct reaches commencing from its head waters to the Baroon Pocket dam. The first reach is from the head waters to the township weirs, the second from the weirs to Gardners Falls and the third from

Gardners Falls to the Dam ending at the Narrows Gorge. Each reach has similar physical characteristics, experiences similar land uses and each requires its own unique strategy to address its particular attributes.

Obi Obi Creek Headwaters to the Weir and the Weir to Gardners Falls

The problems identified (in priority order):

i. Elevated nutrient levels from catchment land use, stock access and fragmented poor riparian buffers leading to poor water quality, blue green algal blooms and colonisation of aquatic weeds.

ii. Bank instability resulting from riparian clearance, cattle tracking (and other reasons), potentially increasing sedimentation of waterways.

iii. Invasion of woody and viny environmental weed eg. Camphor laurel, cats claw, and privet impacting upon aquatic ecology. (Note Celtis, Cats claw and Madeira vine are now considered priority weed species due to their ability to negatively impact riparian zones).

Priority Actions for Headwaters of Obi Obi Creek to the Weir

Priority Actions (AquaGen 2004)	Project activities to address Priority Action	Objectives met by project
1. Maintain adequate riparian buffers and erect riparian fencing and exclude or actively manage stock access to waterways, including the provision for off stream watering and shade and hardened access points.	a) Fence the entire Daley Creek riparian zone; b) Install off stream watering points in appropriate locations; c) Install alternative shade for stock well away from riparian zones; d) Harden a short length of eroding laneway.	• Significant reduction of faecal material, nutrients and sediments entering Daley Creek; • Reduce bed and bank erosion of Daley Creek; • Encourage livestock to water and loaf away from streams.
2. Actively promote the implementation of Industry relevant Environmental Codes of Practice.	a) Support the Gartshore & Keyes property to improve management of livestock in riparian zones and environmentally sensitive areas.	• Improved land management ; • Improved awareness of water quality issues & causes; • Improve land manager engagement (Priority Property).
3. Provide incentives, advice and encouragement for riparian landholders to retain and actively manage existing native vegetation within riparian buffers.	a) Fencing of Daley Creek to protect areas of vegetation and permit future weed management and revegetation by the landholders with Sunshine Coast Council support; b) Provide weed management advice that is practical and cost effective; c) Provide equipment and tools at no cost.	• Reduce erosion of the bed and banks of Daley Creek reducing turbidity and sedimentation; • Reducing direct faecal deposition (nutrients and pathogens) to Daley Creek and enhance the buffer to overland flows; • Revegetation of riparian zone improves ability of buffer to trap and/or process sediment, nutrients and faecal material.
4. Encourage good farming practices, particularly on floodplains and steep slopes which reduces the rate of soil	a) Installation of alternative livestock water – positioning of troughs in the centre of paddocks	• Promotes 'even' grazing, reducing risk of over grazing and resultant non-point source erosion.

loss to below that of natural soil forming processes.		• Improve livestock management (gain and maintain landholder acceptance and engagement); • build land manager engagement (particularly Priority Properties);

3.2 WATER QUALITY

The environmental health of the Lake Baroon catchment is considered generally poor, and in some respects declining (personal communication with Seqwater water quality staff). 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 originate 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.

3.2.1 Statistical Analysis of the Raw Water Quality Data Recorded from Aplin Lane 1991-2005

Analysis of the raw water sampled from the Aplin Lane (approximately one kilometre downstream of the Gartshore and Keyes property) sampling site between 1991 – 2005 (Traill 2007) shows:

- Turbidity levels exceeded guideline levels (ANZECC) only twice however it is unlikely the sampling program accurately captured rainfall events (the topography of the catchment means flood waters rapidly disperse when rainfall ceases and it is unlikely sampling occurs during peak flows);
- Nitrate levels exceeded the guideline value 59% of the time although this was falling as dairy farms converted to beef (less intensive grazing and use of fertiliser);
- Ammonia levels exceeded the guideline value 76% of the time and varied throughout the sampling period making it difficult to pin point causes;
- Phosphate levels exceeded the guideline level 38% of the time although this is likely to be higher in reality, as phosphates attach to sediment and turbidity levels have already been identified as unusually low;
- Total phosphorus levels exceeded the guideline level 93% of the time; *and*
- Faecal coliforms exceeded the guideline level 70% of the time although declining during the sampling period.

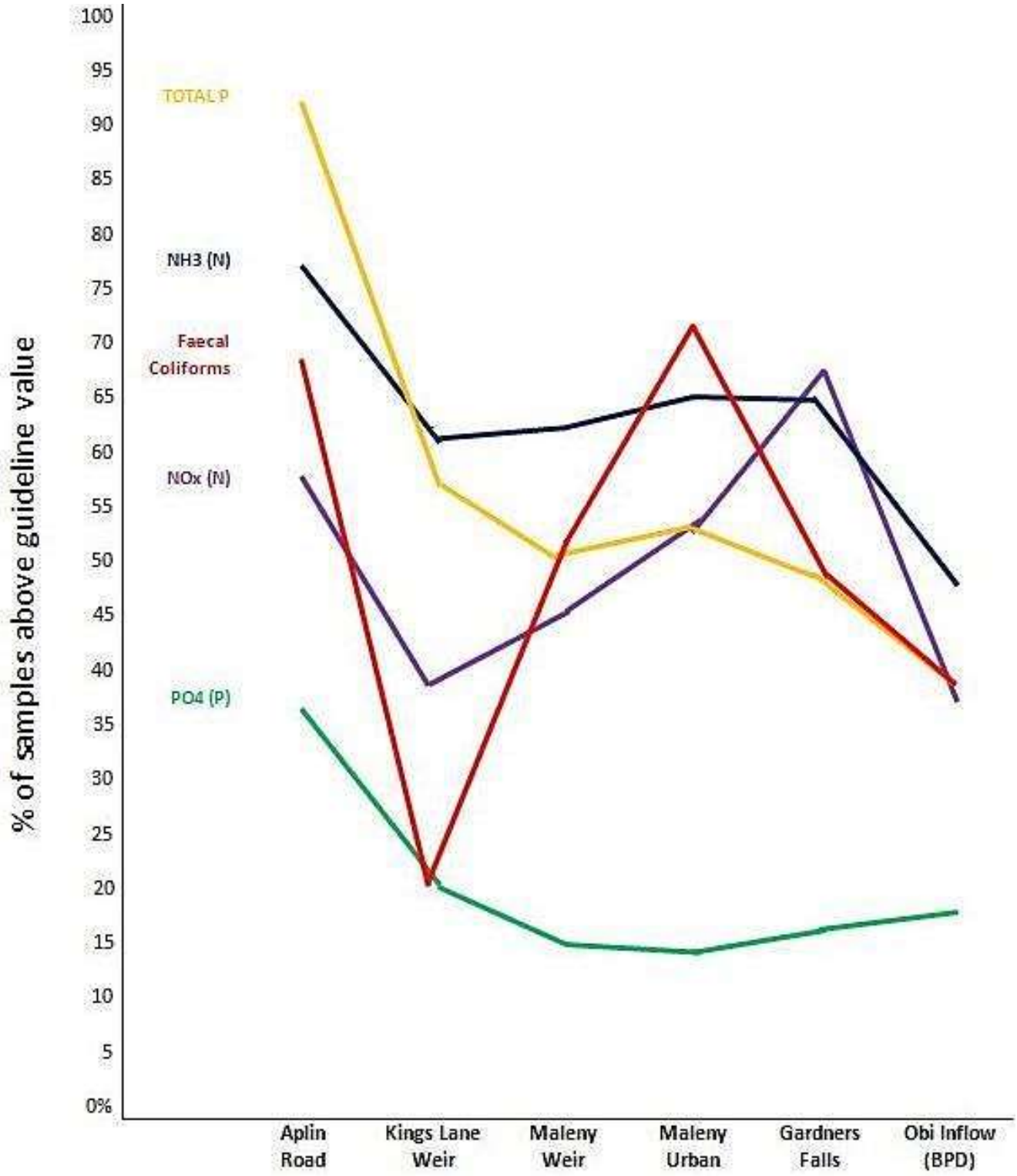
ANZECC - Australian and New Zealand Environment and Conservation Council.
These guidelines were part of a suite of 21 documents forming the Australian National Water Quality Management Strategy (NWQMS) originally released in 1992. The guidelines are intended to provide government, industry, consultants and community groups with tools to facilitate the assessment and management of water quality in a range of water resource types.

3.2.2 Comparison of the Raw Water Quality Data recorded from Obi Obi Creek 1991-2005

Sampling at Kings Lane Weir was only performed for a relatively short period (1993-98) with the actual sample site varying due to the observed effects of the weir (early sampling was conducted in flowing water below the weir; moved 200 metres upstream in 1997) and was abandoned in late 1998 as it was considered results resembled the Aplin Road sampling site a short distance upstream.

Comparing the data from Kings Lane Weir and the upstream Aplin Road sampling site clearly shows significantly lower levels of Nitrates, Ammonia, Phosphates and Total Phosphorus, and a substantial reduction in faecal coliforms. This is likely due to the upper Obi supporting intensive agriculture with large dairies and beef grazing. The drop in nutrients and faecal coliforms at Kings Lane Weir may be attributed to several causes; the dilution impact of the large body of water, less intensive agriculture between Aplin Road and Kings Lane, varying sampling points at Kings Lane Weir and quite possibly the improved coverage of riparian vegetation (and general catchment vegetation) and instream diversity between the two sampling points. Riparian vegetation, including woody weeds is likely to assist in trapping and processing nutrients and faecal material. This is supported by sampling points downstream of urban Maleny; Gardners Falls and the Obi Inflow at Baroon Pocket Dam. Between these two sampling points riparian vegetation is prominent, agriculture is much less intensive (no dairies) and livestock access to major watercourses is much more limited.

Most of the streams in the upper Obi Obi Creek catchment are unfenced to livestock (required for stock water)and the sub-catchment provides high levels of pollutants associated with intensive agriculture (grazing) – nutrients and E.coli.



NOx (N) – Nitrates	58.65	40.32	45.93	53.33	67.23	37.84
NH3 (N) – Ammonia	76.38	62.3	63.28	66.67	66.38	49.52
PO4 (P) - Phosphates	37.59	21.88	16.42	15.74	17.65	18.92
Total P – Total Phosphorus	92.74	58.73	51.97	53.77	49.57	40.54
Faecal Coliforms	69.92	22.22	52.99	72.48	50.85	41.44

Note: The routine sampling programs (CalAqua, AquaGen, Seqwater and others) are suspected of not accurately capturing major pollution events. Conducted monthly (1991 – 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).This is evidenced by the lack of turbidity results.

3.3 OPTIONS ANALYSIS

Proposed option highlighted.

Option	Description	Benefits/Cons	Estimated remediation cost
Do nothing	Current livestock management continues with cattle having unrestricted access to Daley and most of Obi Obi Creek for water, grazing and shade.	No water quality or environmental improvements. Likely deterioration over time as bank and bed stability continues to decline.	$0
Install stream crossings only (2)	Low level concrete crossings over Daley Creek.	Moderate reduction of erosion by providing hardened crossing points over creek. Although livestock will preferentially cross at these points they will not walk long distances to do so. Riparian fencing is generally essential to get stock to use crossings.	$12,334
Install off stream watering (OSW) only (includes alternative shade)	Troughs are placed well away from watercourses in all paddocks. Advanced shade trees installed to provide shade lost from riparian fencing.	Troughs reduce time cattle spend in riparian zones, resulting in reduced faecal matter inputs and likely pathogens. Cattle will still graze riparian zone unrestricted and are likely to utilise the shade for loafing/resting. Unrestricted grazing limits natural regeneration of native species.	$21,257
Install riparian fencing only (Daley Creek)	Fencing to manage grazing of riparian zone.	Significantly reduces livestock access to riparian zone. Not currently feasible - no alternative livestock water sources on southern side of Daley Creek. Requires OSW.	$37,766
Install riparian fencing & OSW	Fencing to manage grazing and installation of OSW for alternative livestock water.	Reduces erosion of bed and banks of creeks, reduces faecal matter inputs and provides a buffer to overland flows that carry faecal matter. Permits revegetation of the riparian zone.	$59,023
Install OSW, riparian fencing and stream crossings.	Daley Creek fenced to manage livestock, stream crossing installed and OSW in paddocks.	Access to Daley Creek by livestock reduced by at least 80%. Livestock permitted only occasional access to manage pasture and weed growth. Crossings provide a controlled crossing point reducing erosion of bed and banks.	$71,357
Install OSW, riparian fencing, stream crossings with 100% stock exclusion. Revegetation of fenced area.	Fenced riparian zone revegetated with diverse range of local flora species (1 hectare only).	Ideal option but will take several years for revegetation to be completed. Landholders will assume responsibility for revegetation with support and assistance from Sunshine Coast Council (Landholder Environment Grants).	$121,578

4.0 HOW

(How will the activities be implemented?)

Activity/works	Description	Benefits	Responsibility & Contractor
1. Off stream watering & shade	Install of 4 x 6' concrete troughs strategically placed throughout the property. Utilise existing bore. Trench 40 mm poly pipe to a depth of 400 mm minimum. Establish alternative shade (demonstration) around trough below sheds.	Provides alternative water source for stock enabling fencing of Daley & Obi Obi Creek (2019/20) riparian zones. Promote alternative shade provision when fencing riparian zones.	LBCCG - Langdale Stud (Tim Simpson) P & K Nash (Phil Nash)
2. Stream crossings	Construct two low level concrete crossings on Daley Creek. Crossings are built at bed level and do not obstruct aquatic passage.	Provides hardened crossing points across streams for both stock and vehicles.	LBCCG - P & K Nash (Phil Nash)
3. Laneway rehabilitation	Narrow gap between Daley Creek and Denning Road boundary receives high stock traffic suffering from erosion. Profiling and hardening with road base will minimise erosion. A short length of fencing and gate will reduce stock trafficking through the area further reducing erosion.	Reduced erosion on the high bank of Daley Creek.	LBCCG – P & K Nash (Phil Nash) Weston Earthmoving (Mick Weston
4. Riparian fencing (Daley Creek)	Fence entirety of Daley Creek on Gartshore/Keyes property. Fencing will consist of four barbs; timber split posts at four metre spacing and timber strainers. Steel 3.6 metre gates.	Management of livestock in riparian zone dramatically reducing faecal matter (pathogen and nutrient) inputs, sedimentation and turbidity and other environmental benefits. Permits strategic planting of riparian vegetation and protects existing vegetation.	LBCCG - Langdale Stud (Tim Simpson)
5. Weed management & riparian revegetation	Strategic revegetation of Daley & Obi Obi Creek (2019/20) riparian zones with a diverse range of locally appropriate native species. Management of woody weeds in riparian zone – privet, lantana and others including in small stand of remnant vegetation.	Optimal management of riparian zones with total livestock exclusion. Provides numerous long term water quality and other environmental benefits (wildlife corridors, habitat etc).	Landholders with Sunshine Coast Council support.

4.1 Riparian fencing

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.

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.

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 Daley 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).

Daley Creek; most of the stream is straightforward to fence with relatively gentle banks. Currently livestock have unmanaged access to the stream.

4.2 Off stream watering

Even without 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 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 (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 (McIver 2004). Porath et al. (2002) also found that the provision of supplements in association with alternative watering points 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 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 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.

Existing bore on property that can be utilised to supply water to network of troughs.

4.3 Stream crossing

Formalised crossings protect livestock and watercourses from the issues associated with unrestricted access. The benefits include (Water and Rivers Commission 2000):

- improved water quality by limiting sedimentation and nutrient enrichment;
- enhanced livestock health through access to cleaner water;
- reduced loss of productive land and livestock deaths;
- provision of a relatively cheap option for providing livestock watering;
- maintaining stream pools to provide a water source that is available for longer periods of year;
- stabilisation of the river banks and bed; *and*
- improved riparian vegetation and riverine habitats.

Crossings can be designed to provide many other ecological benefits such as (Water and Rivers Commission 2000):

- having a riffling effect which aerates the water and provides a variety of riverine micro- habitats;
- allowing for aquatic passage;
- maintaining stream pools that are important in providing summer refuges and breeding areas for certain aquatic animal species, such as platypus, fish and crayfish; *and*
- contributing to channel stability by controlling the velocity of flow and reducing the downstream movement of sediments.

Locations for stream crossings. Left: downstream crossing will be installed in the old Denning Road extension easement. Right: upstream crossing will be placed in a location where the Daley Creek channel is moderately incised with gentle banks on either side of the stream. Note Cork Dairies on the hill in the background.

4.4 Laneway rehabilitation

Rehabilitated laneways significantly reduce erosion in high stock traffic areas resulting in less sediment run-off. Carefully designed laneways are shaped with strategic cross drainage (whoa-boys) to shed water to the sides (onto pasture) and direct run-off contaminated with faecal material (nutrients) to pasture that can trap and filter nutrients, rather depositing directly to watercourses. Although mainly constructed on dairy farms where stock movement is constant, in some situations on other grazing properties they are required to reduce erosion.

It is proposed to construct a short 40 metre log laneway on a 'pinch' point between Denning Road and Daley Creek. Additionally a short length of fencing at this point will create two paddocks and stop livestock tracking back and forth to water.

A new, short section of laneway will be required on the top bank of Daley Creek where the gap between entry road fence and new riparian fencing will be narrowed.

4.5 Alternative shade

The fencing of riparian zones often results in a loss of paddock shade for livestock. It is proposed to establish shade trees in association with one of the off stream watering points. Planting advanced trees (up to three metres) in a uniform pattern near to troughs and as high as practical on hillslopes will not only provide livestock shade but also encourage more even paddock grazing, provide a convenient point that supplements can be provided and also improve a landholders ability to monitor stock. Trees will be individually guarded until established and sufficiently mature that stock will not adversely affect them. Species will be selected on their shade canopy and availability at time of project implementation (likely trees include Bumpy ash [*Flindersia schottiana*], White beech [*Gmelina leichhardtii*]. This part of the project will be funded by the Commonwealth Smart Farms Small Grants program *Maleny Sustainable Beef* project.

4.6 Weed management

Normally LBCCG does not actively manage woody weeds in riparian zones as any vegetation in riparian zones is better than none (except for a few key species that have a detrimental impact on water quality). Weed management is only completed where:

- Priority weeds are present (Chinese elm, Madeira vine, Cats claw creeper)
- There is a long-term plan to ensure the weeds do not return (as part of a revegetation project)
- Weedy vegetation is affecting water quality (blocking flows, causing erosion, diverting flows etc)

The Daley Creek riparian zone (and Obi Obi Creek) has a low to moderate coverage of woody weeds and low-level management will assist in the protection of the limited native vegetation present.

This component of the project will be completed by the landholders with assistance and support from other contributors – most likely Sunshine Coast Council through the Landholder Environment Grants program. LBCCG will provide additional advice as required.

Riparian vegetation on the downstream reach of Daley Creek is impacted by woody weeds (primarily large leaf privet). Areas like this are ideal to expand revegetation from.

4.7 Riparian revegetation

Riparian vegetation provides a buffer between water and agricultural activities. Buffers trap sediment, nutrients and faecal material before it reaches a flowing watercourse. Additionally any contaminants that do reach the flowing water are more likely to be processed by in-stream vegetation if present. A combination of both native woody vegetation (trees) and grasses are ideal for buffers to utilise a wider range of nutrients so 'messy' riparian zones are likely more efficient despite possibly being 'ugly'.

Riparian zones due to their nature of being the most productive with good soils and moisture tend to grow thick stands of weeds (along with grass) and require either heavy management or require revegetation with native vegetation to out compete and shade most weed species. Revegetation therefore is a long term management solution for fenced riparian zones.

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).

4.8 FUTURE STAGES AND ACTIVITIES

Planned Stage 2 of the project (2019/20).

Riparian fencing (Obi Obi Creek)	Fence southern bank (580 m?) of Obi Obi Creek on Gartshore/Keyes property. Fencing will consist of four barbs; timber split posts at four metre spacing and timber strainers. Steel 3.6 metre gates.	Management of livestock in riparian zone dramatically reducing faecal matter (pathogen and nutrient) inputs, sedimentation and turbidity and other environmental benefits. Permits strategic planting of riparian vegetation.
Spring fencing	Small area (4,000 m^2) of remnant and regrowth vegetation adjacent to Obi Obi Creek. Erect short length (300 m) around vegetation on Gartshore/ Keyes property. Fencing will consist of four barbs; timber split posts at four metre spacing and timber strainers. Steel 3.6 metre gates.	Spring in vegetation maintains high saturation levels with unmanaged stock access exacerbating erosion. Protect existing vegetation to help manage spring.
Weed management & riparian revegetation	Strategic revegetation of Obi Obi Creek riparian zone with a diverse range of locally appropriate native species. Management of woody weeds in riparian zone – privet, lantana and others including in small stand of remnant vegetation.	Optimal management of riparian zones with total livestock exclusion. Provides long term water quality benefits. Improves property management by

Obi Obi Creek on the Gartshore and Keyes property. The landholders have shown interest in continuing fencing and revegetation of the riparian zone.

5.0 WHEN

(When will the activities be implemented?)

Stage 1 (2018/19) of the project only.

5.1 SCHEDULE & MILESTONES

Milestone	*Action*		*Completion Date*
1	LBCCG Project Plan (Stage 1) completed and approved, pre works monitoring completed		Apr 19
2	***IMPLEMEMNTATION 2018/19***	Off stream watering	Jun 19
		Stream crossings	Jun 19
		Riparian fencing	Jun 19
		Laneway rehabilitation	Jun 19
		Alternative shade installed	Jun 19
3		Weed management (landholder)	TBC

		Revegetation (landholder)	TBC
4	Post-works (LBCCG/Seqwater funded components) monitoring completed, Final Report		Jul 19
5	Recommendations for Stage 2		Sep 19

5.2 MONITORING, EVALUATION & REPORTING

Monitoring of rehabilitation activities, 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.

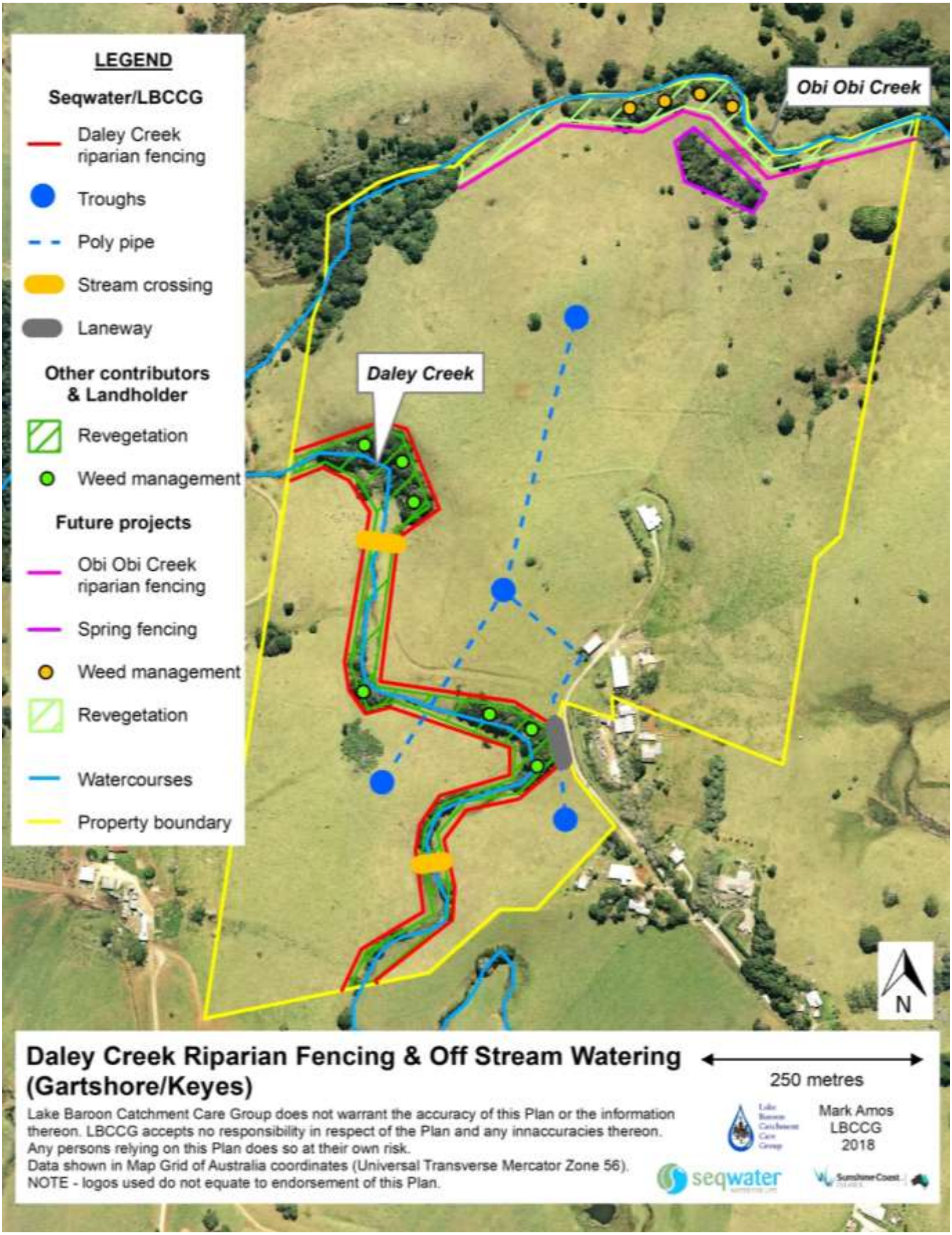
Episodic monitoring will occur following significant storm/rainfall events (or extended dry periods). This may, depending on the severity of the event, be achieved by a phone call to the landholders.

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.

Project updates will be provided at monthly LBCCG meetings.

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.

6.0 MAP



7.0 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.

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