

BELLINGER RIVER ESTUARY ACTION REACH PLAN



Australian Government

Table of Contents

Acknowledgements.....	4
Introduction	5
Aims and Objectives.....	5
Site Description	5
Legislation and Best Management Practice.....	11
Links to other plans.....	11
Riverine Baseline Condition Assessment	11
Target condition.....	12
Appendix 1 -Site Action Plans	13
Part 1: Upper Bellinger Estuary – Reach Plan.....	15
Site 1 - Ford St, Bellingen NSW 2454	15
Site 2 - Hammond Street, Bellingen NSW 2454.....	21
Site 3 - 100 Wheatley Street, Bellingen NSW 2454.....	26
Site 4 - 1172 Waterfall Way, Bellingen NSW 2454.....	31
Site 5 - North Bank Road, Bellingen NSW 2454	39
Site 6 - 105 North Bank Road, Bellingen NSW 2454	44
Site 7 - 17 Doepel Street, Bellingen NSW 2454.....	50
Site 8 - Cahill Street; 1060 Waterfall Way, Bellingen NSW 2454.....	55
Site 9 - 224 North Bank Rd, Bellingen NSW 2454	62
Site 10 - 236 North Bank Rd, Bellingen NSW 2454	68
Site 11 - 278 North Bank Road, Bellingen NSW 2454	73
Site 11b - 864 Waterfall Way, Fernmount NSW 2454	80
Site 11c - North Bank Road, Bellingen NSW 2454.....	88
Site 12 - 850 Waterfall Way, Fernmount NSW 2454	93
Site 13 - 838 Waterfall Way, Fernmount NSW 2454	99
Site 14 - 794 Waterfall Way, Fernmount NSW 2454	104
Site 15 - 524 & 528 North Bank Road, Bellingen NSW 2454.....	112
Site 16 - Bell Street-Baker Street-Main Street-Waterfall Way, Fernmount NSW 2454.....	118
Site 17 - 4 Tyson Street, Fernmount NSW 2454	124
Site 18 - 528 & 606 North Bank Road, Bellingen NSW 2454.....	129
Part 2: Mid Bellinger Estuary – Reach Plan	135
Site 1a - 638 North Bank Road, Raleigh NSW 2454	135
Site 1 - 700 & 754 North Bank Road, Raleigh NSW 2454.....	141
Site 3 - 516 Waterfall Way, Fernmount NSW 2454	153
Site 4 - 461 Waterfall Way, Fernmount NSW 2454	160
Site 5 - 935 North Bank Road, Raleigh NSW 2454	166
Site 6 - 383 Waterfall Way, Fernmount NSW 2454	173
Site 7 - 282 Waterfall Way, Fernmount NSW 2454	178
Site 8 - 182 Waterfall Way; 1018 North Bank Road Raliegh NSW 2454	184
Site 8b - North Bank Road, Raleigh, NSW 2454	193
Site 9 - 160 Waterfall Way, Raleigh NSW 2454.....	200
Site 10 - 124 Waterfall Way, Raleigh NSW 2454.....	206
Site 11 - 100 Waterfall Way, Raleigh NSW 2454.....	212
Site 12 - 62 Waterfall Way, Raleigh NSW 2454.....	219
Site 13 - 44 Waterfall Way, Raleigh NSW 2454.....	224
Part 3: Lower Bellinger Estuary – Reach Plan.....	231
Site 1 - 1180 North Bank Road, Raleigh NSW 2454	231
Site 2 - Queen Street, Raleigh NSW 2454	236
Site 3 - Keevers Drive, Raleigh NSW 2454.....	241

Site 4 - Old Ferry Road, Raleigh NSW 2454.....	248
Site 5 - Mylestom Drive, Repton NSW 2454	254
Site 6 - 96 Mylestom Drive, Repton NSW 2454	260
Site 7 - 110- Mylestom Drive, Repton NSW 2454	265
Site 8 - Unnamed Road (Yellow Rock), Raleigh NSW 2454	272
Site 9 - 172 Mylestom Drive, Repton NSW 2454	277
Site 10 - 174 Mylestom Drive, Repton NSW 2454	282
Site 11 - 176-194 Mylestom Drive, Repton NSW 2454	287
Site 13 - Unnamed Road (Yellow Rock), Raleigh NSW 2454	297
Site 14 - 32 River Street, Mylestom NSW 2454	302
Site 15 - Yellow Rock Road, Raleigh NSW 2454	307
Site 16 - Mylestom Drive, Mylestom NSW 2454.....	312
Site 17 - Yellow Rock Road, Raleigh NSW 2454	317
Site 18 - Mylestom Drive-River Street, Mylestom NSW 2454	323

Acknowledgements

Front cover photo: courtesy of Bellinger Shire Council

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Many thanks to Shaun Morris (NRCMA), who has provided invaluable knowledge including map development, site assessment, data analysis, structural designs and development of rehabilitation strategies during the development of this plan. Thanks to Colin Mathews (Bellinger Landcare) who has provided key links to landholders and offered his support and local knowledge throughout the consultation and planning process. The Bellinger-Kalang Estuary Erosion Study (Cohen & Telfer, 2010) has been a key reference document in determining the fluvial and geomorphological context of the estuary at a broader temporal and spatial scale. Finally thanks to all the landholders who have supported this process and provided fundamental input through their local knowledge and past experiences living on the Bellinger River.

Introduction

This plan identifies key threats to the Bellinger River Estuary and makes recommendations in regards to actions to address those threats. These recommendations are made at the reach scale and then used to develop a Site Action Plan (SAP) for each property.

The SAPs also define a *target condition* for different parts of Bellinger Estuary and its tributaries. *Target condition* is an achievable goal that is defined based on the characteristics of the riparian vegetation, channel condition and fish passage. It is defined for each property in the SAP component of this Plan (Appendix 1).

Landholder support along the project reaches is: 84.5% for the upper-estuarine reach (12.3km out of 14.6km streambank), 66% for the mid-estuarine reach (8.6km out of 13.1km streambank) and 90% for the lower-estuarine reach (11.8km out of 13.1km streambank). This equates to a grand total of 80% landholder support over the entire estuarine reach (33km out of 41km streambank).

Land managers are encouraged to use this Plan to guide activities being undertaken as part of routine management. This Plan can also be used as a vehicle to secure funding for the implementation of actions outlined within this document. Potential funding sources include the NSW Environmental Trust, Caring for Our Country, Recreational Fishing Trust, Fish Habitat Grants, Better Boating and the NRCMA.

Aims and Objectives

The Bellinger River Estuary Action Plan - Reach Plan has been developed to guide rehabilitation efforts along the Bellinger River estuary.

Objectives

- Identify the main threats to river health.
- Develop general management recommendations to address these threats.
- Develop SAPs for each land manager that outline and cost activities in line with recommendations.
- SAPs used to guide routine management and to secure funding for staged implementation of on-ground works.
- Medium to long term aim to achieve *target condition* along the reach.

Site Description

The Bellinger River estuary includes a total of 50km of river bank from Lavenders Bridge in Bellingen to the River mouth at Urunga. For the purposes of this River Reach planning exercise, three reaches will be outlined respectively (upper, mid and lower estuary) totalling 41km of river bank.

The estuary behaves much like a freshwater river in its upper sections, running through mostly fine-grained sediments in the mid reaches (ie. cutting through an extensive

floodplain with backwater and wetland features separated from the channel by natural levees on the bank), before it meets a fluvial-tidal transition zone at the lower extent of the study area.

The geomorphic character of the three study reaches is well summarized in Cohen & Telfer (2010):

Bellinger – Fluvial-Dominated A: Bellingen to Fernmount

The most-upstream fluvially dominated reach extends from the tidal limit at Bellingen to Fernmount. This reach is characterised by a channel with a mixed sediment load (bedload and suspended load), gravel bar formation and variable floodplain topography with the last gravel deposit occurring immediately downstream of Fernmount bluff. Maximum depth (inclusive of floodplain height) is 8 – 10 m, with the floodplains 4 – 7 m above mean tide level. Generally, depth of bed scour is < 8 m. In this reach there is a distinct macro-channel with a low (younger) floodplain inset within a higher older alluvial surface with valley floor widths up to 1 km. Collectively the channel and low floodplain form the meander belt and zone of active overbank flow (300 – 500 m in width). This is a high-energy reach with the highest overbank velocities of all the tidal reaches.

Bellinger – Fluvial-Dominated B: Fernmount to McGeary’s Island

The reach from Fernmount is characterised by a significant reduction in grain size from gravel to sand, a maximum depth of 7 – 12 m but with lower floodplains (2.5 – 4 m above mean tide level). There less pronounced macro-channel and meander belt development with less floodplain topographic variability. Valley floor width increases to 1 km. Bar amplitude and occurrence is diminished with a subsequent increase in maximum bed scour (up to 10 m). Reduced channel dimensions and a reduction in stream gradient result in an increased proportion of discharge conveyed by lower velocity overbank flow.

Bellinger – Fluvial-Transition Zone: McGeary’s Island to Tuckers Island

The fluvial transition process zone reflects a reach of the Bellinger River which exhibit a pronounced marine influence whilst still exhibiting a fluvial form. On the lower Bellinger River it extends from McGeary’s Island to Tuckers Island with a maximum depth of 7 – 10 m but with a considerable reduction in the elevation of the floodplains above mean tide level (1.5 – 2.0 m). Floodplain topography is reduced in this reach, a characteristic of the infilled mud basin. The dominance of low stream gradients, a suspended load dominated channel with smaller and simpler channel geometry than upstream reaches results in an increased proportion of low-velocity overbank flow. Bed material in this zone is still dominated by fluvially-derived sediment.

River bank condition in the upper-mid Bellinger River estuary is generally moderate to poor, while in the lower estuary it is generally moderate to good. Geomorphic and fluvial drivers underpin the general character and behaviour of the estuary, while more recent anthropogenic influences have resulted in accelerated changes to the river system and surrounding environments. Specifically, historical gravel extraction, riparian clearing and introduction of exotic species have resulted in a degraded estuarine ecosystem with limited riparian stability and connectivity. The once dense riparian forest that would have covered the floodplain areas has now been all but removed. Consequently, resilience from further

degrading processes is generally low. Particularly in the upper-mid estuary, episodic fluvial processes (driven by freshes and floods) tend to create issues such as bank scour, slumps/sloths and slab/block failures. Further continuously degrading processes resulting from wave action (wind & boat), unmanaged stock access, inappropriate land use or the removal/suppression of riparian vegetation place ongoing pressure on the system in specific locations.

Following findings and recommendations from the Bellinger & Kalang Rivers Estuary Management Plan (BMT-WBM, 2008), the Bellinger River Health Plan (BSC/DECCW, 2010) and the Bellinger-Kalang Estuary Erosion Study (Cohen & Telfer, 2010), the three chosen reaches (Upper, Mid & Lower Bellinger Estuary) are considered to be high priority for planning and implementation of restoration works due to their generally moderate recovery potential, and links to strategic direction/funding opportunities through various government agencies.

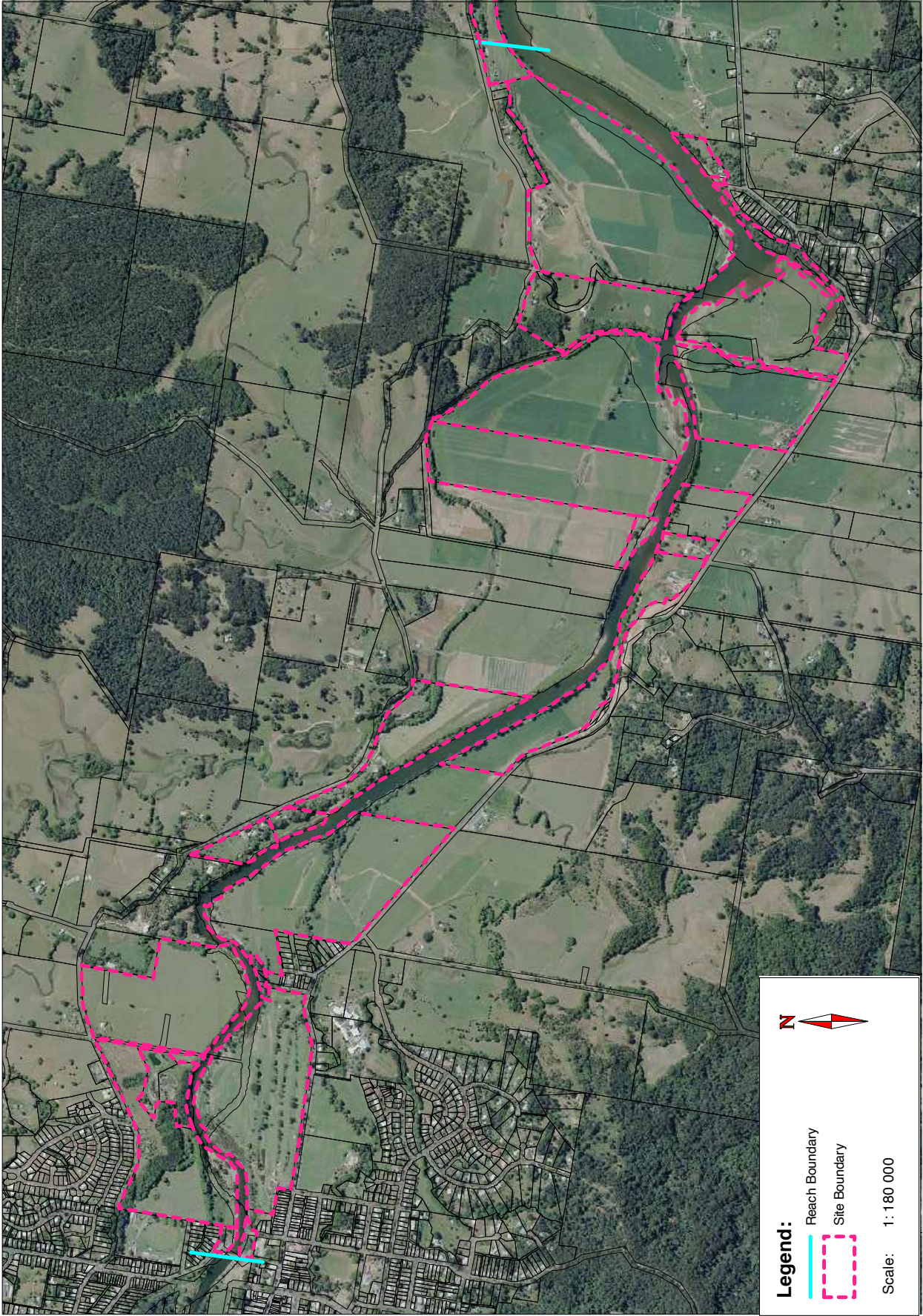


Figure 1: Location of the Upper Bellinger River Estuary Action Plan

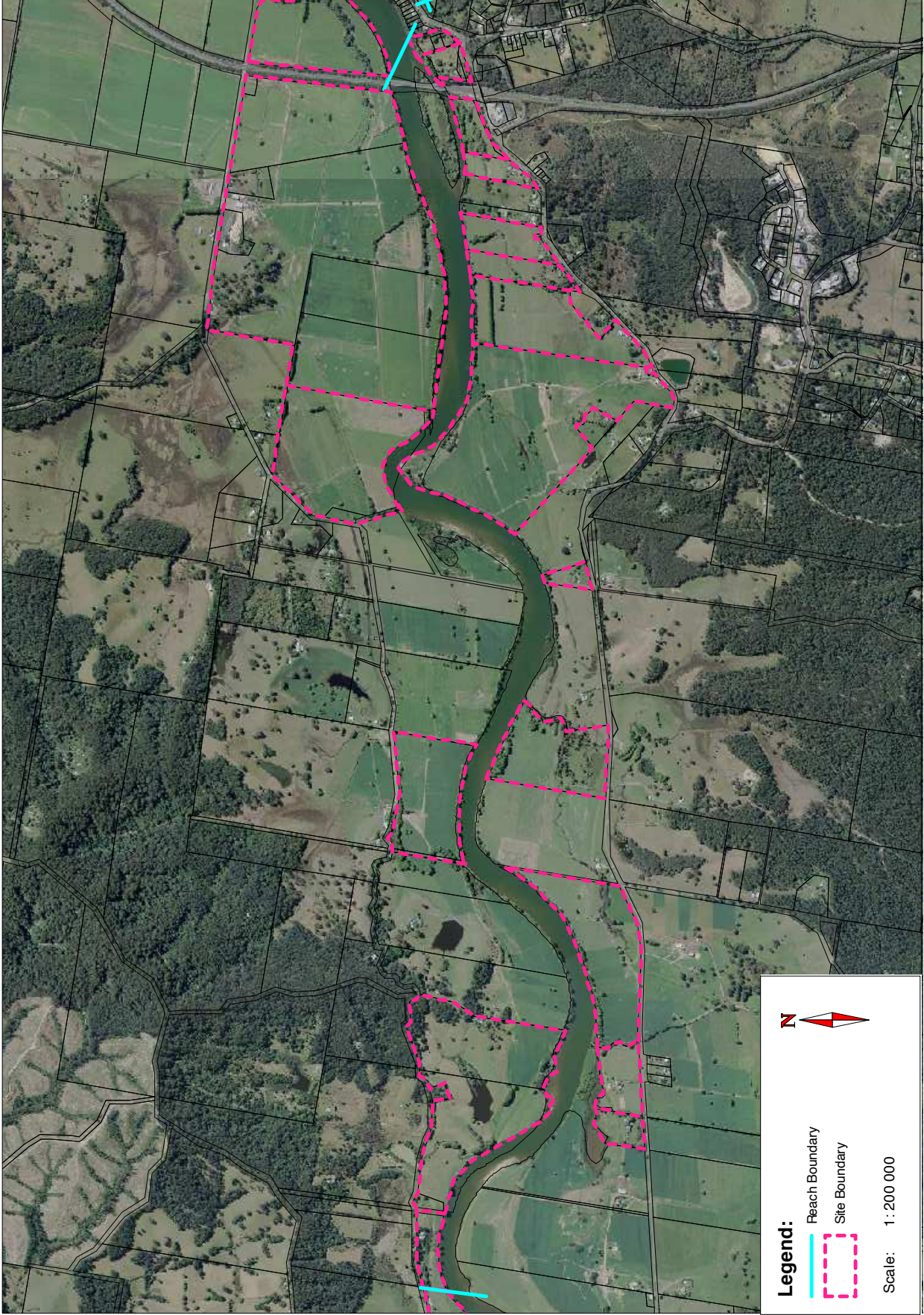


Figure 2: Location of the Mid Bellinger River Estuary Action Plan

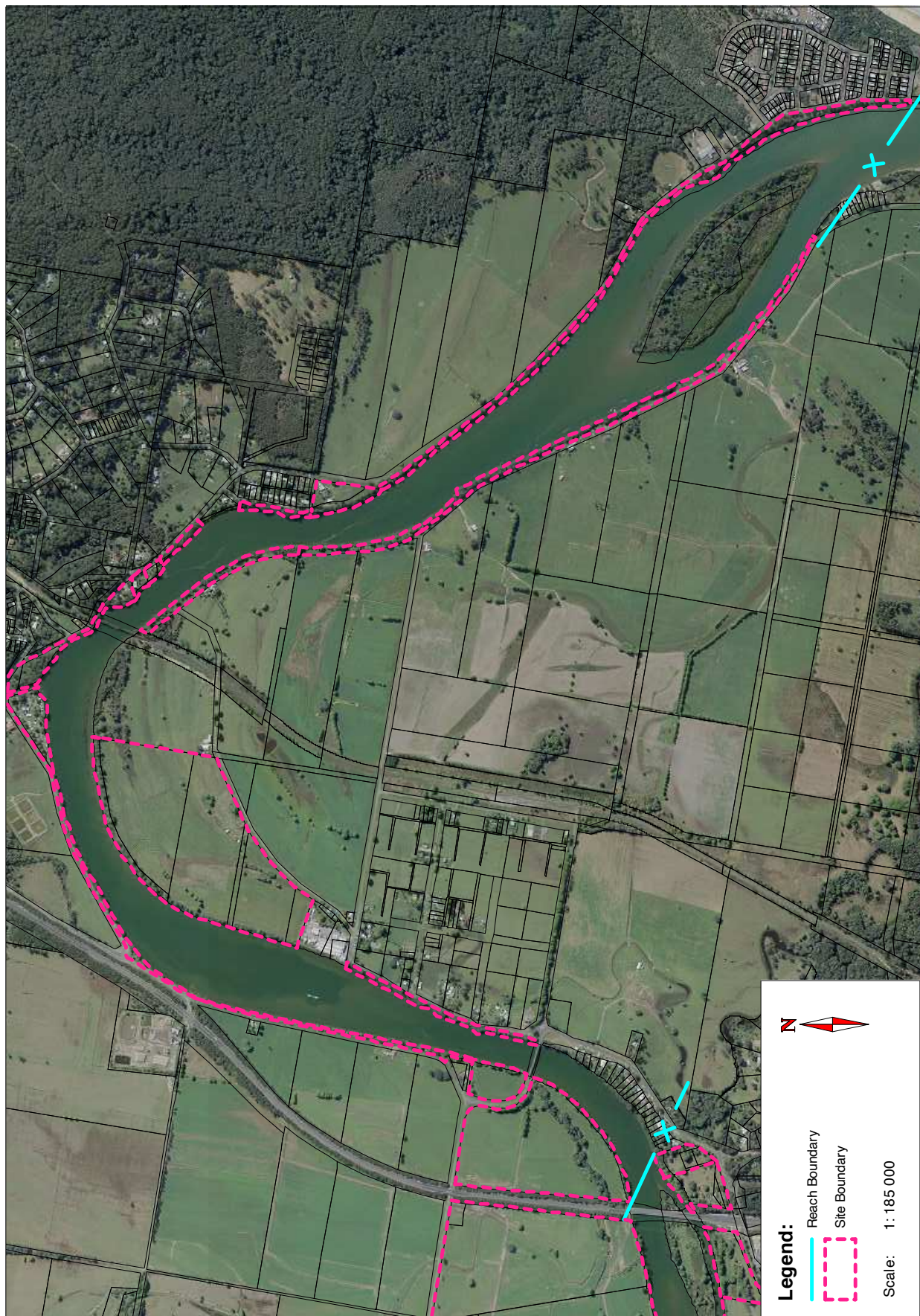


Figure 3: Location of the Lower Bellinger River Estuary Action Plan

Legislation and Best Management Practice

Land managers need to be familiar with several acts of legislation that either require particular activities to be undertaken or regulate certain activities. For this project the relevant legislation includes, but is not limited to:

- Fisheries Management Act 1994
- Native Vegetation Act, 2003
- National Parks and Wildlife Act, 1974
- Noxious Weeds Act, 1993
- Threatened Species Conservation Act, 1995
- Water Management Act, 2000.

If the Site Action Plans propose any activities that require specific approvals this will be noted.

Links to other plans

Outcomes from this plan link to priorities outlined in the following plans:

1. Bellinger & Kalang Rivers Estuary Management Plan (BMT-WBM, 2008): Management Objectives 1, 3, 4, 5, 8, 9, 10, 11, 15, 17, 22 & 23.
2. Bellinger River Health Plan (BSC/DECCW, 2010): Key River Health Issues (Agricultural Practices (p15); Riparian & Wetland Management (p23); Appendix B (p109));
3. Bellinger-Kalang Estuary Erosion Study (Cohen & Telfer, 2010): Section 7.2 – Specific recommendations for erosion management.

Riverine Baseline Condition Assessment

A riparian baseline assessment of the reach was undertaken by BSC and NRCMA staff during late August 2010. This data was used to determine the level of intervention required and the prospective target condition rating for the reach. This data will also be used to determine the level of success towards the target condition rating following intervention. Parameters collected include:

- Canopy, mid story and ground cover
- proportion of weed infestation within the canopy, mid story and groundcover zones.
- Weed species densities
- Areas of significant erosion
- Stock access
- Riparian regrowth
- Riparian width and suitability

Target condition

Generally speaking, the target condition for this plan can be summarised as:

- The elimination of vine weed infestations (chiefly Balloon Vine *Cardiospermum grandiflorum* Madeira Vine (*Anredera cordifolia*) and Morning Glory *Ipomea sp.*);
- A reduction in mid-story and canopy weed density by 25%;
- An increase in canopy and/or mid-story native vegetation cover by 25%;
- Stabilisation of identified erosion hotspot sites.

Table 1: List of weeds identified within the project area and their priorities.

Common Name	Scientific Name	Noxious Class*	WONS
Blue Billy Goat	<i>Ageratum houstonianum</i>	n/a	n/a
Camphor Laurel	<i>Cinnamomum camphora</i>	4	n/a
Morning Glory	<i>Ipomea sp</i>	n/a	n/a
Lantana	<i>Lantana camara</i>	4	Y
Easter Cassia	<i>Senna pendula</i>	n/a	n/a
Mistflower	<i>Eupatorium riparium</i>	4	n/a
Wild Tobacco	<i>Solanum mauritianum</i>	n/a	n/a
Coral Tree	<i>Erythrina sykesii</i>	n/a	n/a
Small Leaf Privet	<i>Ligustrum sinense</i>	n/a	n/a
Castor Oil Plant	<i>Rinicus communis</i>	n/a	n/a
Madiera Vine	<i>Anredera cordifolia</i>	n/a	n/a
Cat Claw Creeper	<i>Macfadyena unguis-cati</i>	4	n/a
Balloon Vine	<i>Cardiospermum grandiflorum</i>	n/a	n/a
* Noxious weed declarations for Bellingen Shire Council Available online http://www.northcoastweeds.org.au/site-files/docs/NCWAC-Weed-Book.pdf			

References

Cohen, T & Telfer, D (2010), *Bellinger-Kalang Estuary Erosion Study*, Bellingen Shire Council.

Johnson, S (undated), *Bellinger River Estuary Revegetation Guide*, Bellingen Shire Council/Bellinger Landcare.

Raine, A & Gardiner, J (1997), *Revegetating Streams in the Bellinger and Coffs Harbour Catchments*, Northern Rivers Catchment Management Authority/Landcare Australia.

Appendix 1 -Site Action Plans

The Site Action Plans outline specific activities to address the threats identified through the baseline condition assessment. Activities identified include weed control, revegetation and structural works to remediate bank erosion.

Table 2: Landholder contact details

<i>SITE ACTION PLAN</i>	<i>LANDHOLDER</i>	<i>CONTACT & EMAIL ADDRESS</i>
<i>UPPER-REACH</i>		
1,2,5,7 & 16	Bellingen Shire Council	<i>IAN TURNBULL (MANAGER NATURAL RESOURCES & SUSTAINABILITY)</i> Ph: (02) 6655 7338
3.	John Lavis	<i>PH: (02) 6655 1378</i>
4.	Bellingen RSL Country Club	<i>KEN LLOYD</i> (02) 6655 1341
6.	Allan Taylor	Ph: (02) 6655 1403
8.	Peter Sanger	(02) 6655 6325
9.	John Hope	(02) 6655 9866
10.	Dieter Muller	(02) 6655 1780
11.	Stuart Del- Vine Pty Ltd	Tim Stuart (02) 6655 0186
11b.	Bernie Martin	(02) 6655 1408
11c.	Crown Land	Ian Hanson (Group Leader Natural Resources & Property Services) (02) 6640 3436
12.	Steve Shields	(02) 6655 0499
13.	Jennifer Snell	John Bardsley (02) 6653 3608
14.	Mark Perry	(02) 6655 1464
15.	Christin Fahey Peter Barnett	(02) 6655 2504 (02) 6655 2783
17.	Daniel Freuden	(02) 6655 9955
18.	Peter Barnett	(02) 6655 2783

	Wal Tyson	(02) 6655 1072
Mid- Reach		
1a.	Jack Gothe	(03) 5983 5467
1.	Jack Gothe	(03) 5983 5467
2.	Neale Chapman	(02) 6655 2490
3.	John Hood	(02) 6655 0610
4.	David Pryor	(02) 6655 9902
5.	Chris Saeck	(02) 6655 4565
6.	Anne Perry	Mark Perry (02) 6655 1464
7.	Adam Gilmore	(02) 6655 4895
8.	Charlie Taylor	(02) 6655 4397
8b.	Raleigh Dairy Holdings	Stuart Brander (02) 6655 4470
9.	Bill Hodgson	(02) 6655 4565
10.	Barbara Benyon	Bill Hodgson (02) 6655 4565
11.	Blair Gilmore	(02) 6655 4341
12.	Errol Cooper	(02) 6655 4267
13.	Archibold Industries Pty Ltd	Martin Willis 0422 534 277
Lower- Reach		
1&4.	Raleigh Dairy Holdings	Stuart Brander (02) 6655 4470
2,3,5,7,8,11,12,13,15,16,17 & 18.	Bellingen Shire Council	Ian Turnbull (Manager Natural Resources & Sustainability) (02) 6655 7338
6.	Select Parks Pty Ltd	Tracey (02) 6655 4755
9.	Ted Durie	(02) 6655 4045
10.	Ern Mercer	(02) 6655 4477
14.	Doug Sawtell	0428 262 408

Part 1: Upper Bellinger Estuary – Reach Plan

Site 1 - Ford St, Bellingen NSW 2454

Lot/DP	Lot 7001 DP1054751
Property Owners	Land & Property Management Authority
Catchment Details	Upper Bellinger River estuary – south bank; 150m river frontage; Area: 0.2ha
Land Use	Greenspace/Public Road Reserve

Property Summary

This stretch of river bank borders the upper tidal limit of the Bellinger estuary and spans a section of alluvial high bank floodplain. Active erosion is considered to be moderate in severity (Cohen & Telfer, 2010). As a greenspace and road reserve area the property has been cleared of nearly all existing remnant vegetation however in 2001, a revegetation project was undertaken along the upper 50m riparian fringe (zone 1) of this site. Dominant native riparian species included in the revegetation project include Water Gum (*Tristaniopsis laurina*), Weeping Lilly Pilly (*Syzygium floribundum*), Sandpaper Fig (*Ficus coronata*), Moreton Bay Fig (*Ficus macrphylla*) and Spiny Mat Rush (*Lomandra hystrix*). Weed infestations in the revegetated section (zone 1) are dominated by vine species such as Morning Glory (*Ipomea* sp.), Balloon Vine (*Cardiospermum grandiflorum*), Blue Billy Goat (*Ageratum houstonianum*) and Lantana (*Lantana camara*).

Previous Management Efforts

Black Willow (*Salix nigra*) removal was undertaken along this bank followed by a riparian restoration project in 2000. The site was planted with local riparian species as a demonstration site and to stabilize a section of the eroding bank. The project was funded by a Natural Heritage Trust project and administered by the then Catchment Management Committee. Black Willow (*Salix nigra*) removal was undertaken by Bellingen Shire Council and the riparian revegetation was implemented by Bellingen Landcare using a Green Corps Team. The site has been subject to repeated flooding but has grown well. A variety of sources of funding have been used to maintain the site over the years. However, after the floods of 2009 vine weeds have invaded and further weed control work is required.

Rehabilitation Strategy

Target condition must be considered within the current landuse designation, and also desirable long term recreational/aesthetic values for this site. The existing revegetation plot should be enhanced. This will be complemented by existing grassed areas for recreation and leisure (e.g. picnicking, frolicking, etc). The proposed plan would be to extend the riparian buffer already established in the upper section of the park along the entire river bank to meet with the existing revegetation works established at site 2. The envisaged width of this riparian strip would be approximately 10m, however exact width along the road reserve would be dependent on property boundary limitations with the neighbouring property. This riparian buffer would

include canopy and understory species as outlined in the Bellinger Estuary Revegetation Guide (BSC/Bellinger Landcare). Existing and emerging weed infestations would need to be treated periodically to protect regeneration from weed invasion. The riparian buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment.



Figure 11: Site workplan map

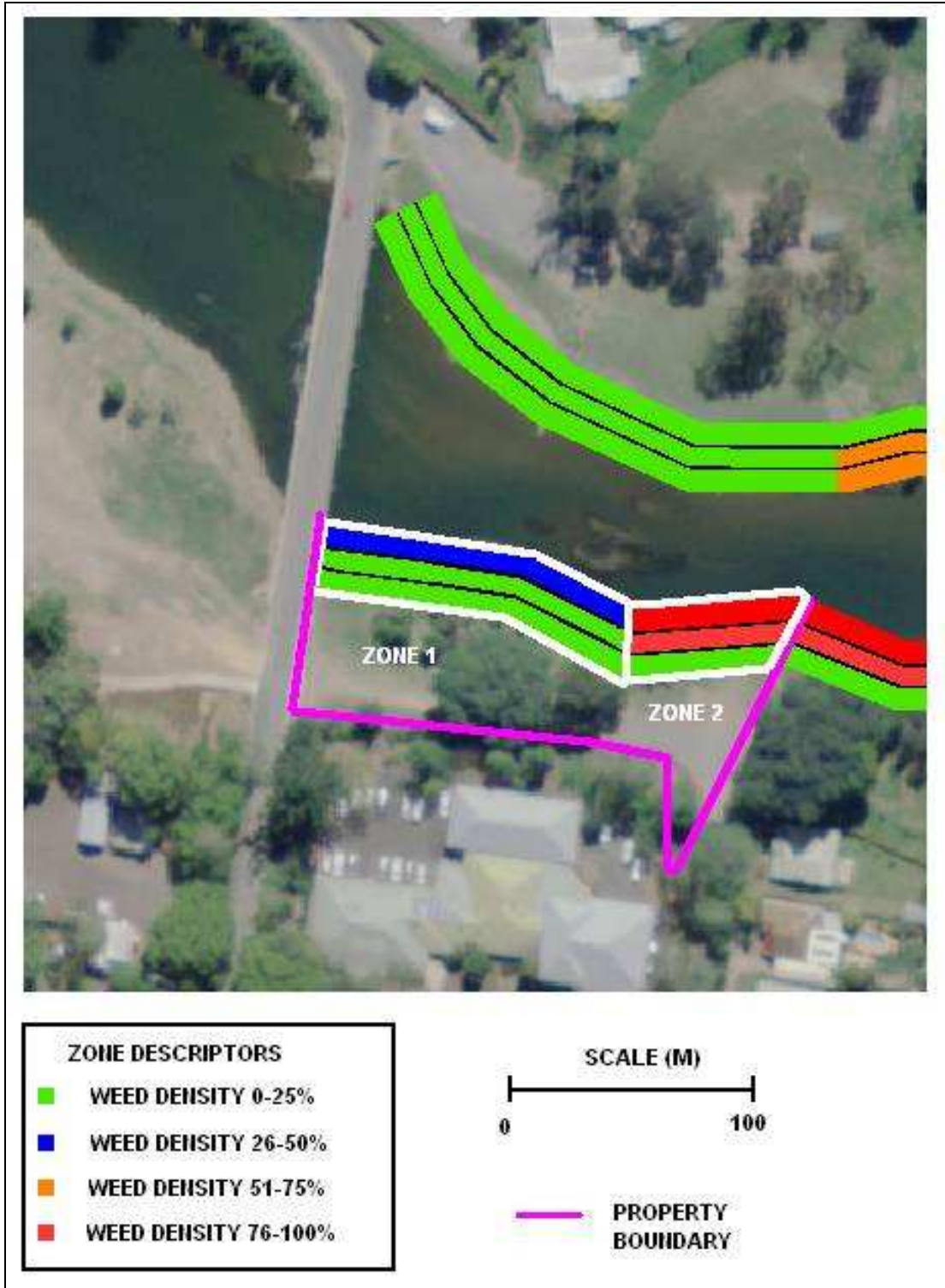


Figure 12: Riparian condition and extent

Table 3: Riparian condition summary

MGT ZONE	1	2
ASSESSOR	S. Morris	S. Morris
RIPARIAN WIDTH	10-20m	
CANOPY COVER	26-50%	26-50%
MIDSTOREY COVER	76-100%	<25%
GROUND COVER	76-100%	76-100%
APPROPRIATE COVER	Y	N
GRAZING IMPACT	N	N
NATURAL REGEN	Y	Y
CANOPY WEED	0%	<25%
MIDSTORY WEED	<25%	76-100%
GROUND COVER WEED	26-50%	76-100%
WEED 1	Lantana (<i>Lantana camara</i>)	Morning Glory (<i>Ipomea</i> sp)
WEED 1 DENSITY	Clumps (11-50%)	Dominant (>50%)
WEED 2	Blue Billy Goat (<i>Ageratum houstonianum</i>)	Blue Billy Goat (<i>Ageratum houstonianum</i>)
WEED 2 DENSITY	Dominant (>50%)	Dominant (>50%)
WEED 3	Morning Glory (<i>Ipomea</i> sp)	
WEED 3 DENSITY	Few Scattered (<10%)	
WEED 4	Mulberry (<i>Morus</i> sp)	
WEED 4 DENSITY	Few Scattered (<10%)	
BANK	South Bank	South Bank

Table 4: Property Workplan

<i>Mgt Zone</i>	<i>Activity</i>	<i>Activity Details</i>	<i>Source of Potential Funding (optional)</i>	<i>Indicative Cost (\$ ex GST)</i>			
				<i>Contributions</i>			
				<i>Landholder</i>	<i>Partners</i>	<i>Bellingen Shire Council</i>	<i>Total Budget</i>
All	Project Coordination	Technical, administrative & practical support (3 hrs @ \$50/hr)	Environmental Levy		150	150	150
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80	80	80
All	Weed control	Manual extermination of vine weeds; general treatment of other weeds	Environmental Levy		2570	2570	2570
All	Tree Removal	Lopping and stump grinding one Cadaghi tree	Environmental Levy		1500	1500	1500
All	On-going Maintenance	Follow-up weed treatment (quarterly inspections and suppression as necessary over 5 years)	Council Weeds		1285	1285	1285
			TOTAL		5585	5585	5585

Site 2 - Hammond Street, Bellingen NSW 2454

Lot/DP	Lot3 DP8086
Property Owners	Bellingen Shire Council
Catchment Details	Upper Bellinger River estuary – south bank; 120m river frontage; Area: 0.34ha
Land Use	Greenspace/Public Reserve

Property Summary

This site borders the upper tidal limit of the Bellinger estuary and spans an alluvial floodplain bench. This bench arises from the deposition zone on an inside bend. The site is considered stable according to Cohen & Telfer (2010). As a greenspace area the property has been cleared of nearly all existing remnant vegetation, however a few canopy trees exist as shade trees including Tallow Wood (*Eucalyptus microcorys*), Brush Box (*Lophostemon confertus*), Red Cedar (*Toona ciliata*), River Oak (*Casurina cunninghamiana*) and the locally introduced Cadaghi (*Corymbia torelliana*).

Previous Management Efforts

This site is actively managed as a grassed park and recreation area with access to the river for swimming. As such, grass is mown regularly and weeds are controlled around shade trees, park infrastructure and along the river bank.

Rehabilitation Strategy

Target condition must be considered within the current landuse designation, and also desirable long term recreational/aesthetic values for this site. The grassed area along the face of the gravel bench at this site is frequented by the public as a picnic and relaxation area, offering a pleasant vista over the river. While this site remains stable, it is recommended that current management can be continued in a similar manner. The removal of the Cadaghi (*Corymbia torelliana*) trees and subsequent replacement with locally native shade trees is the only suggested action at this stage. Continual monitoring should be undertaken to ascertain response and recovery from ensuing flood events. Should erosion become an issue at this site then actions should first be taken to secure the bank toe using Spiny Mat Rush (*Lomandra hystrix*). Additional revegetation and/or structural works may also be necessary.

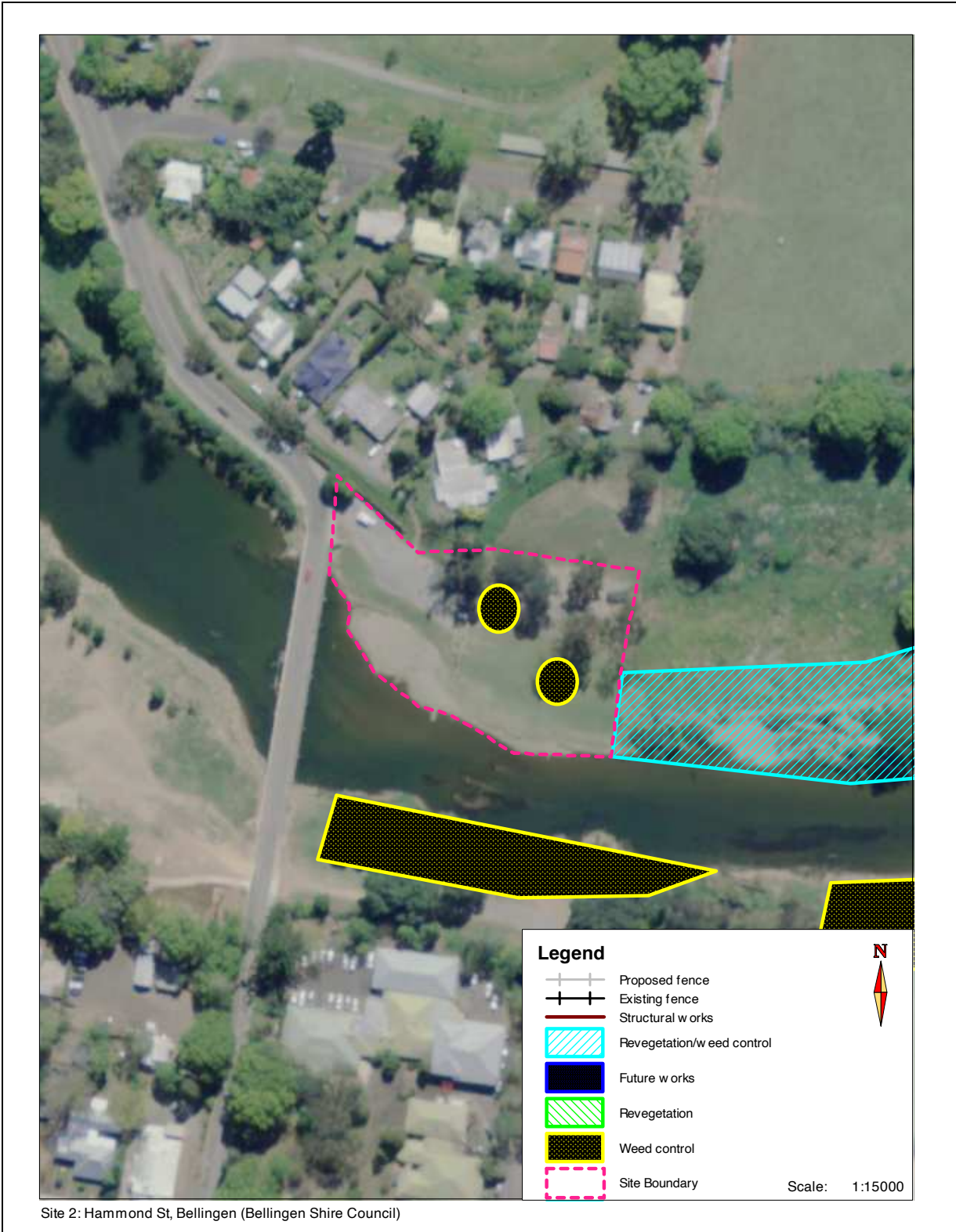


Figure 13: Site workplan map

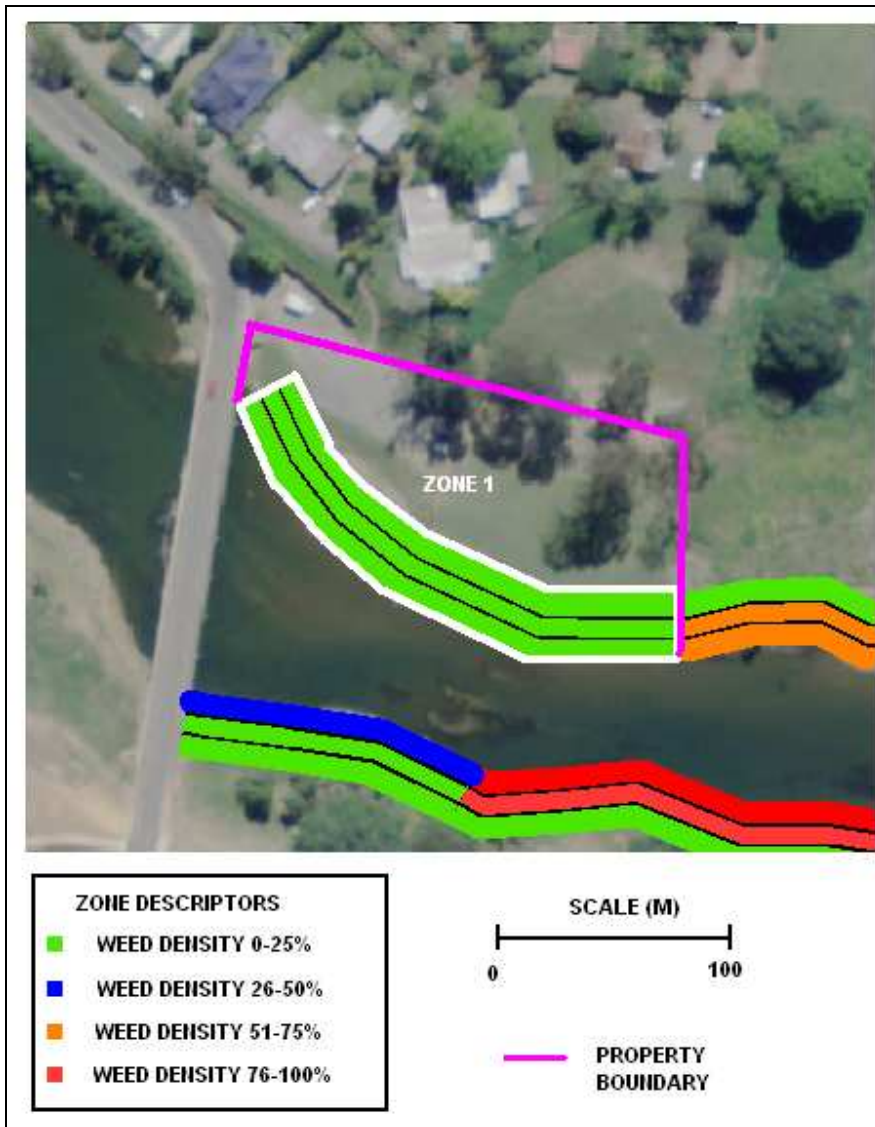


Figure 14: Riparian condition and extent

Table 5: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	20-30m
CANOPY COVER	26-50%
MIDSTOREY COVER	0%
GROUND COVER	76-100%
APPROPRIATE COVER	Y
GRAZING IMPACT	N
NATURAL REGEN	N
CANOPY WEED	<25%
MIDSTORY WEED	0%
GROUND COVER WEED	0%
WEED 1	Cadaghi (<i>Corymbia torelliana</i>)
WEED 1 DENSITY	Few Scattered (<10%)
BANK	North Bank

Table 6: Property workplan

<i>Mgt Zone</i>	<i>Activity</i>	<i>Activity Details</i>	<i>Source of Potential Funding (optional)</i>	<i>Indicative Cost (\$ ex GST)</i>			
				<i>Contributions</i>			<i>Total Budget</i>
				<i>Landholder</i>	<i>Partners</i>	<i>Bellingen Shire Council</i>	
All	Project Coordination	Technical, administrative & practical support (2 hrs @ \$50/hr)	Environmental Levy		100	100	
All	Tree Removal	Lopping and stump grinding of two Cadaghi trees	Environmental Levy		3000	3000	
			TOTAL		3100	3100	

Site 3 - 100 Wheatley Street, Bellingen NSW 2454

Lot/DP	Lot 42 DP814538
Property Owners	Mr Wilfred John Lavis
Catchment Details	Upper Bellinger River estuary – north bank; 530m river frontage; Area: 18.13ha
Land Use	Residential

Property Summary

This property is just below the tidal limit of the Bellinger River estuary incorporating an alluvial low flood plain bench and high bank. With the exception of the immediate surrounds to the residence, the majority of this property (including the entire riparian zone) is passively managed. However, past landuse practices (land clearing, cattle grazing) have resulted in a weed dominated landscape particularly towards the downstream end of the property (zones 3-4). The property can be further summarized according to two distinct sections:

1. Zones 1-2 comprise of recently deposited alluvium however this area is on the inside bend and considered stable (Cohen & Telfer, 2010), rather accretion has been observed during recent flood events. Patchy natural regeneration is taking place in this area with species such as Weeping Lilly Pilly (*Syzygium floribundum*) and River Oak (*Casurina cunninghamiana*). Notable weed species include Castor Oil Plant (*Rinicus communis*), Small Leaf Privet (*Ligustrum sinense*), Balloon Vine (*Cardiospermum grandiflorum*), Camphor Laurel (*Cinnamomum camphora*), African Pigeon Grass (*Seteria sphacelata*) and Elephants Ears (*Colocasia esculenta*).
2. Zones 3-4 are considered stable (Cohen & Telfer, 2010), however dominated by well established weed species, chiefly Small Leaf Privet (*Ligustrum sinense*), Balloon Vine (*Cardiospermum grandiflorum*) and Camphor Laurel (*Cinnamomum camphora*). The site exhibits moderate overall riparian condition with weed infestations being the chief threat to long term condition and resilience.

Previous Management Efforts

N/A

Rehabilitation strategy

Target condition can be achieved on this site by applying an overarching rehabilitation strategy which focuses on systematic, targeted weed control and subsequent revegetation to facilitate natural regeneration already occurring. Given the current landuse at this site, there is potential to create a very wide riparian buffer, however the ability of the landholder to undertake the initial works and maintain the works is limited. Immediate efforts should focus on establishing some key species within the site to allow for natural regeneration (refer to the Bellinger River Estuary Revegetation Guide, BSC/Bellingen Landcare). In the upper area (zones 1-2), this can be achieved with minimal initial weed control efforts, however maintenance requirements may be higher due to the effects of flooding. The lower half of the property (zones 3-4) will necessitate more targeted weed control to eliminate Privet and Camphor, then establish new canopy species in their place.

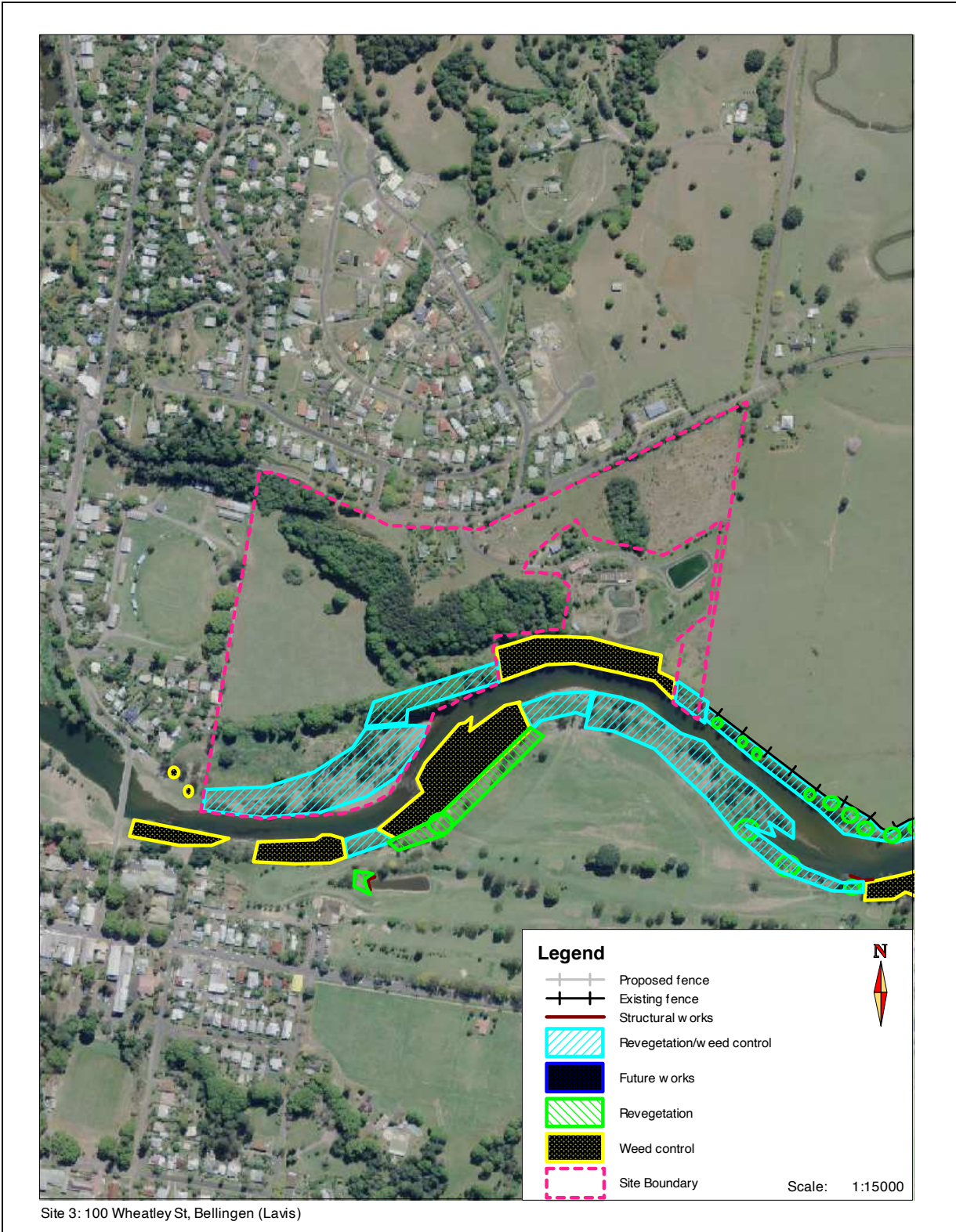


Figure 15: Site Workplan Map

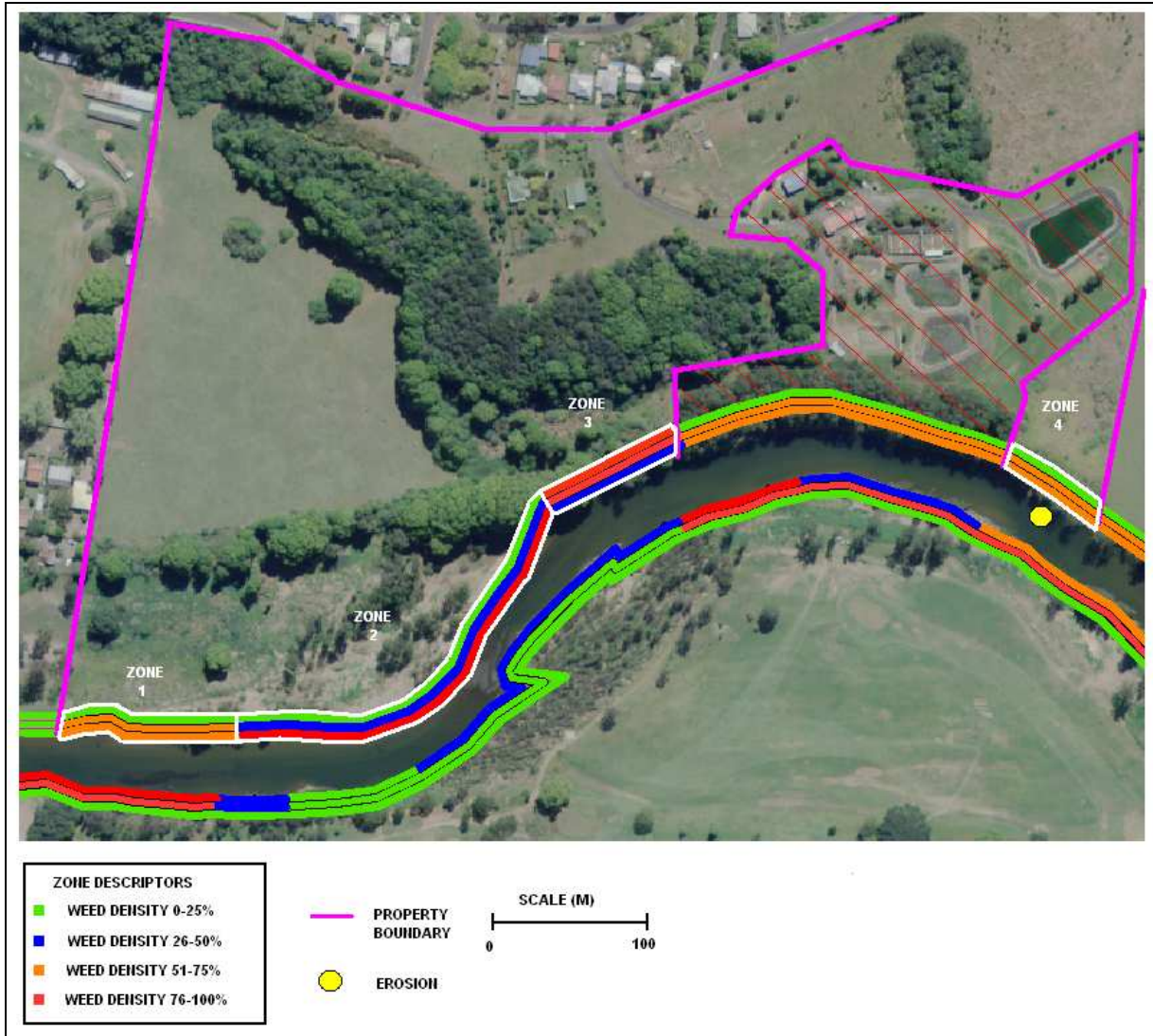


Figure 16: Riparian condition and extent

Table 7: Riparian condition summary

MGT ZONE	1	2	3	4
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	>30m	>30m	20-30m	5-10m
CANOPY COVER	Cleared	26-50%	76-100%	76-100%
MIDSTOREY COVER	51-75%	51-75%	76-100%	76-100%
GROUND COVER	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	N
GRAZING IMPACT	N	N	N	N
NATURAL REGEN	Y	Y	Y	Y
CANOPY WEED	0%	0%	76-100%	0%
MIDSTOREY WEED	51-75%	26-50%	76-100%	51-75%
GROUND COVER WEED	51-75%	76-100%	26-50%	51-75%
WEED 1	Blue Billy Goat (Ageratum houstonianum)	Castor Oil Plant (Rinicus communis)	Small Leaf Privet (Ligustrum sinense)	Small Leaf Privet (Ligustrum sinense)
WEED 1 DENSITY	Clumps (11-50%)	Clumps (11-50%)	Dominant (>50%)	Clumps (11-50%)
WEED 2	Castor Oil Plant (Rinicus communis)	Blue Billy Goat (Ageratum houstonianum)	Camphor Laurel (Cinnamomum camphora)	Blue Billy Goat (Ageratum houstonianum)
WEED 2 DENSITY	Clumps (11-50%)	Few Scattered (<10%)	Clumps (11-50%)	Clumps (11-50%)
WEED 3	Mistflower (Eupatorium riparium)		Mistflower (Eupatorium riparium)	Castor Oil Plant (Rinicus communis)
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)
WEED 4	Small Leaf Privet (Ligustrum sinense)	Balloon Vine (Cardiospermum grandiflorum)	Lantana (Lantana camara)	Camphor Laurel (Cinnamomum camphora)
WEED 4 DENSITY	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 5	African pigeon grass (Setaria sphacelata)	Few Scattered (<10%)	Balloon Vine (Cardiospermum grandiflorum)	Balloon Vine (Cardiospermum grandiflorum)
WEED 5 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)
WEED 6	Elephant ears (Colocasia esculenta)	Elephant ears (Colocasia esculenta)	Elephant ears (Colocasia esculenta)	Elephant ears (Colocasia esculenta)
WEED 6 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 7	Mistflower (Eupatorium riparium)	Mistflower (Eupatorium riparium)	Mistflower (Eupatorium riparium)	Mistflower (Eupatorium riparium)
WEED 7 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
BANK	North Bank	North Bank	North Bank	North Bank

Table 8: Property Workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)		
				Landholder	Contributions	
					NRCMA or Other	Bellingen Shire Council
All	Project Coordination	Technical, administrative & practical support (8 hrs @ \$50/hr)	Environmental Levy		400 (In kind)	400
N/A	Publicity	Printing, educational activities, media release			80 (In kind)	80
1-2	Weed control (contractor)	Spraying of circles to facilitate canopy tree planting and establishment (360 circles /hr @ \$37/hr)		111		111
1-2	Weed control (14000m ²) (contractor)	Targeted weed control & removal (priority species mentioned above) (5 days @ \$760/day)		3800		3800
1-2	Revegetation (14000m ²) (contractor)	Planting of key species at 4m centres (\$6.50/ plant incl labour x 875 plants)		5688		5688
3-4	Weed control (5250m ²) (contractor)	Targeted weed control & removal (priority species mentioned above) (3 days @ \$760/day)		2280		2280
3-4	Revegetation (5250m ²) (contractor)	Planting of key species at 4m centres (\$6.50/ plant incl labour x 330 plants)		2145		2145
All	On-going Maintenance	Follow-up weed treatment- quarterly (10hrs / qtr) inspections and suppression as necessary for 10 years		13944 (In kind)		13944
			TOTAL	13944	480	28368

Site 4 - 1172 Waterfall Way, Bellingen NSW 2454

Lot/DP	Lot 20 DP852163
Property Owners	Bellingen RSL Country Club
Catchment Details	Upper Bellinger River estuary – south bank; 1500m river frontage; Area: 21.23Ha
Land Use	Golf Course

Property Summary

This property is just below the tidal limit of the Bellinger River estuary and includes a low floodplain bench, two high flow bypass chutes and a high bank terrace. The property is a golf course and thus has been cleared of all remnant vegetation, however windrows of trees separate the fairways and significant native vegetation exists along sections of the riparian fringe. Revegetation and structural works projects have been undertaken on two occasions along the upstream sections of this site (zones 1-4). Photogrammetrically derived high bank locations suggest that upstream sections of the bank (zones 3-4) have eroded severely (130m+) since 1982, while downstream sections (zones 5-7) have aggraded up to 50m of alluvium. Bank stability is considered to be reasonable with moderate and minor erosion severity mapped respectively along the upper and lower thirds of the site (zones 1-3; 7-9) (Cohen & Telfer, 2010). Dominant native riparian species include Water Gum (*Tristaniopsis laurina*), Weeping Lilly Pilly (*Syzygium floribundum*), Sandpaper Fig (*Ficus coronata*), River Oak (*Casurina cunninghamiana*), Spiny Mat Rush (*Lomandra hystrix*) and Eucalypt species. Dominant weed species on the site include Small Leaf Privet (*Ligustrum sinense*), Balloon Vine (*Cardiospermum grandiflorum*), Morning Glory (*Ipomea* sp.), Wild Tobacco (*Solanum mauritianum*) and Blue Billy Goat (*Ageratum houstonianum*). In general the site exhibits poor to moderate riparian vegetation condition, although revegetation works in 2001 (zones 1-4) have seen significant improvements despite major flood inundation in recent times.

Previous Management Efforts

A combination of bank stabilisation works and consolidation measures along the low floodplain bench have been undertaken since 1996. Structural works included placement of rock revetment along the toe of the outside bend and accompanying pin groin fences running both parallel and perpendicular to the river contour along the battered bank face. Extensive native plantings have also been established along the bank face, crest and low bench. Weed control has been undertaken periodically by both Bellingen Shire Council and Golf Club staff.

Rehabilitation Strategy

Target condition must be considered within the current recreational values for this site. Given the chief landuse for this site is a golf course, significant greenspace areas must be retained for golfing. However future targets for this site include extending the current riparian buffer a further 10-20m to create a total riparian buffer width of 20-30m. Ongoing weed management will be a key priority in facilitating regeneration and long term resilience of this site to the impacts of flooding. Particular attention should be placed on treating and controlling vine weeds on a regular basis. River oaks may also need to be managed in some instances.

Revegetation should follow recommendations as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Particular attention needs to be paid to further stabilizing the entry and exit points of the two flood chutes which span the site laterally (zones 4 & 8). The riparian buffer may need to be re-established in the advent of damaging flood events hampering successful plant establishment.

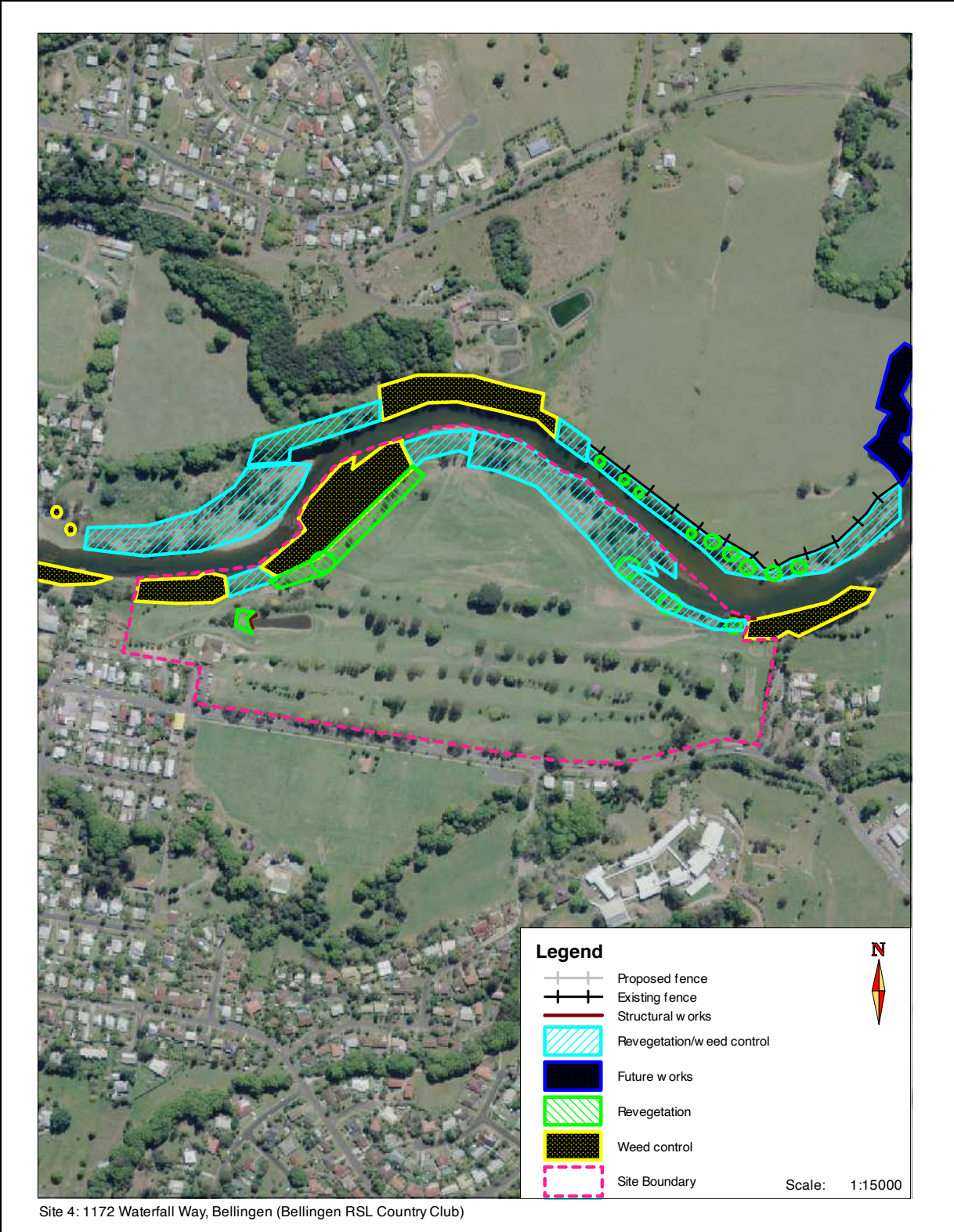


Figure 17: Site workplan map

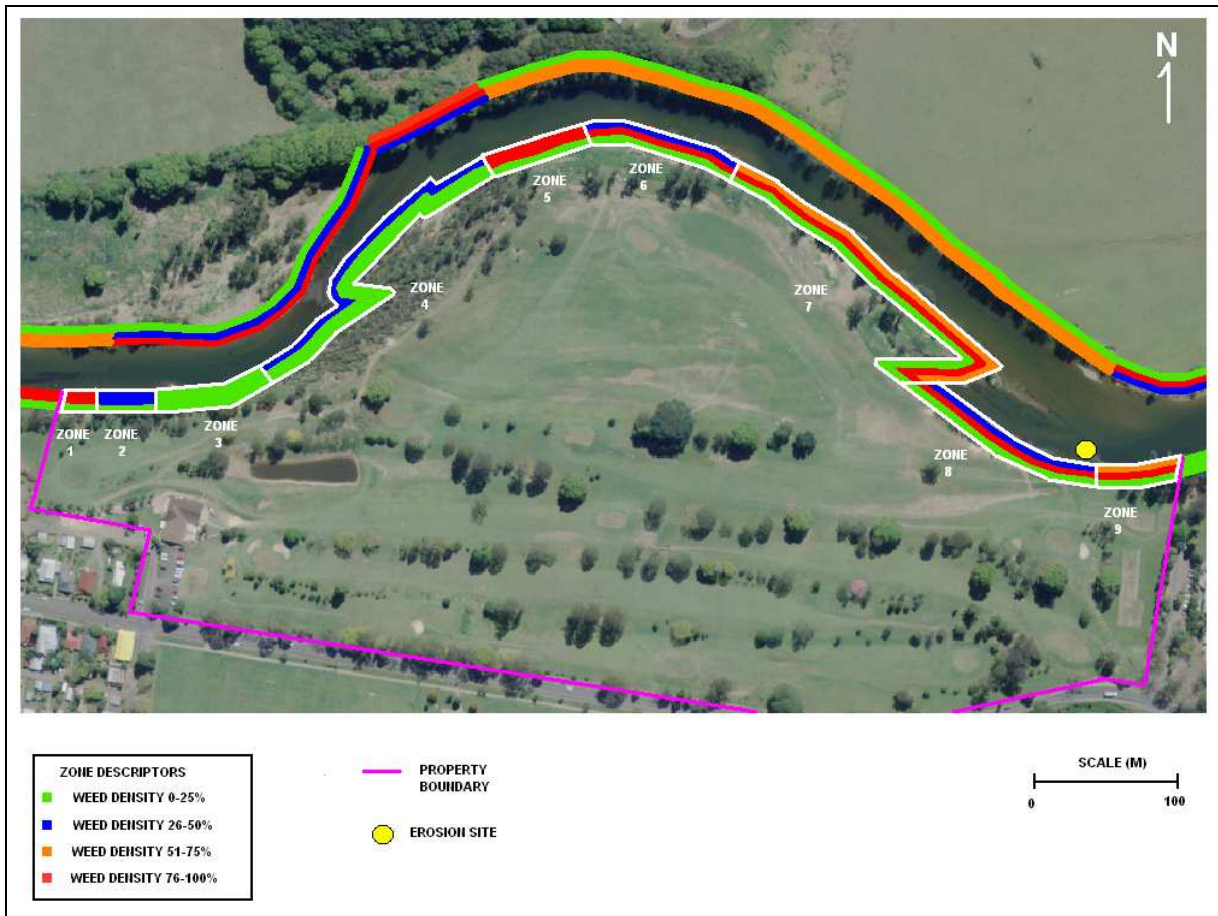


Figure 18: Riparian condition and extent

Table 9: Riparian condition summary

MGT ZONE	1	2	3	4	5	6	7	8	9
ASSESSOR	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris	
RIPARIAN WIDTH	5-10m	5-10m	10-20m	20-30m	10-20m	10-20m	10-20m	10-20m	
CANOPY COVER	51-75%	<25%	26-50%	51-75%	<25%	76-100%	<25%	26-50%	26-50%
MIDSTOREY COVER	26-50%	51-75%	26-50%	<25%	26-50%	76-100%	76-100%	76-100%	<25%
GROUNDCOVER	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	Y	N	N	Y	Y	Y	Y	Y	N
GRAZING IMPACT	N	N	N	N	N	N	N	N	N
NATURAL REGEN	Y	N	Y	Y	N	Y	Y	N	Y
CANOPY WEED	0%	0%	<25%	<25%	<25%	0%	0%	<25%	<25%
MIDSTOREY WEED	76-100%	76-100%	76-100%	76-100%	76-100%	<25%	<25%	26-50%	76-100%
GROUNDCOVER WEED	51-75%	26-50%	51-75%	26-50%	76-100%	26-50%	<25%	26-50%	76-100%
WEED 1	Lantana (Lantana camara)	Small Leaf Privet (Ligustrum sinense)	Wild Tobacco (Solanum mauritianum)	Balloon Vine (Cardiospermum grandiflorum)	Wild Tobacco (Solanum mauritianum)	Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	Morning Glory (Ipomea sp)
WEED 1 DENSITY	Clumps (11-50%)	Dominant (>50%)	Dominant (>50%)	Clumps (11-50%)	Dominant (>50%)	Clumps (11-50%)	Clumps (11-50%)	Clumps (11-50%)	Dominant (>50%)
WEED 2	Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	Balloon Vine (Cardiospermum grandiflorum)	Wild Tobacco (Solanum mauritianum)	Balloon Vine (Cardiospermum grandiflorum)	Morning Glory (Ipomea sp)	Lantana (Lantana camara)	Balloon Vine (Cardiospermum grandiflorum)	Blue Billy Goat (Ageratum houstonianum)
WEED 2 DENSITY	Dominant (>50%)	Clumps (11-50%)	Clumps (11-50%)	Clumps (11-50%)	Clumps (11-50%)	Clumps (11-50%)	Few Scattered	Clumps (11-50%)	Dominant (>50%)

WEED 3				Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	Morning Glory (Ipomea sp)	Wild Tobacco (Solanum mauritianum)	(<10%) Morning Glory (Ipomea sp)		
WEED 3 DENSITY				Dominant (>50%)	Clumps (11-50%)	Dominant (>50%)	Few Scattered (<10%)	Few Scattered (<10%)		
WEED 4				African Pigeon Grass (Setaria sphacelata)	African Pigeon Grass (Setaria sphacelata)	Blue Billy Goat (Ageratum houstonianum)				
WEED 4 DENSITY				Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)				
WEED 5				Small Leaf Privet (Ligustrum sinense)						
WEED 5 DENSITY				Few Scattered (<10%)						
BANK	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank

Table 10: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)		
				Landholder	Contributions	
					NRCMA or Other	Bellingen Shire Council
All	Project Coordination	Technical, administrative & practical support (8 hrs @ \$50/hr)	Environmental Levy		400 (In kind)	400
N/A	Publicity	Printing, educational activities, media release			80 (In kind)	80
3	Mid-Level Revegetation (3000m ²)	Planting of key species at 2m centres to replace vegetation lost during recent floods (\$6.50/ plant incl labour x 750 plants)		2250 (In kind)	2624	4874
4	Revegetation (12000m ²)	Planting of key species at 2m centres to increase riparian buffer width (\$6.50/ plant incl labour x 3000 plants) (landholder labour in kind)		9000 (In kind)	10500	19500
4; 8	Revegetation (4000m ²)	Planting of key species at 1m centres to stabilise flood chutes (\$6.50/ plant incl labour x 1000 plants) (landholder labour in kind)		3000 (In kind)	3500	6500
5-8	Weed control	Spraying of key weed species as identified above to facilitate revegetation program (~3 days @ \$760/day)			2337	2337
5-8	Revegetation (18000m ²)	Planting of key species at 2m centres along entire riparian zone (\$6.50/ plant incl labour x 4500 plants) (landholder labour in kind)		13000 (In kind)	15750	28750
8	Structural works	Installation of pin groynes at scour point			2390	2390
All	On-going Maintenance	Follow-up weed treatment- quarterly (54hrs / qtr) inspections and weed suppression as		62941 (In kind)	13535	76476

	necessary for 10 years								
			TOTAL		90191		50636		480
									141307

Site 5 - North Bank Road, Bellingen NSW 2454

Lot/DP	Lot1 DP222039
Property Owners	Bellingen Shire Council
Catchment Details	Upper Bellinger River estuary –north bank; 262m river frontage; Area: 2.33ha
Land Use	Wastewater Treatment Plant

Property Summary

This property bridges the first outside bend on the north bank of the Bellinger estuary including the high bank terrace. The property is the site of the Bellingen Shire Council wastewater treatment plant and includes associated infrastructure for treating and discharging effluent. Due to continued migration of the river towards the treatment plant assets, a significant bank stabilisation project was undertaken in 1997. The bank is considered stable (Cohen & Telfer, 2010), due to the combination of bank stabilisation and revegetation works undertaken. Dominant native riparian species are River Oak (*Casurina cunninghamiana*), Red Cedar (*Toona ciliata*), Weeping Lilly Pilly (*Syzygium floribundum*), Thin Fruited Tea Tree (*Leptospermum brachyandrum*) and *Flindersia* species. Notable weed species include Cadaghi (*Corymbia torelliana*), Small Leaf Privet (*Ligustrum sinense*), Madeira Vine (*Anredera cordifolia*), Trad (*Tradescantia albiflora*), Elephants Ears (*Colocasia esculenta*) and Balloon Vine (*Cardiospermum grandiflorum*), the latter of which is completely smothering the mid storey and canopy in some places. Riparian vegetation condition is moderate with weed infestations threatening long term regeneration at this site.

Previous Management Efforts

A large scale bank stabilisation project was undertaken along the entire bank margin of this property. Works included large scale rock revetment along the toe and face of the bank and complimentary revegetation along the bank crest and immediate flood plain area to a width of approximately 20m back from the crest of the bank batter.

Rehabilitation Strategy

Target condition for this site can be achieved through periodic weed control to eliminate the aforementioned species. The gradual culling of Cadaghi (in situ poisoning) is recommended to allow existing natives to fill in gaps in canopy. This will enhance growth and survival rates of existing and naturally recruiting vegetation.

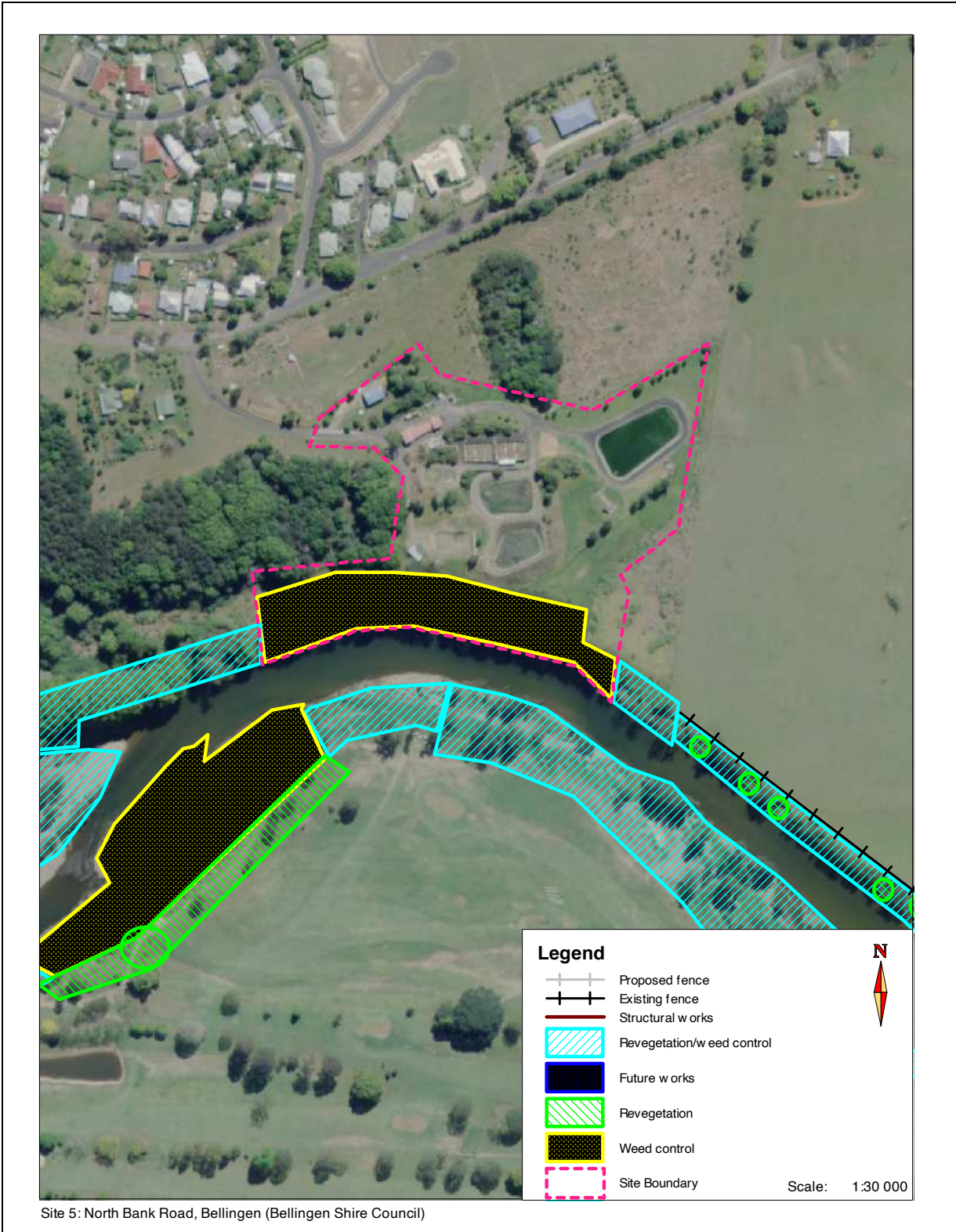


Figure 19: Site workplan map

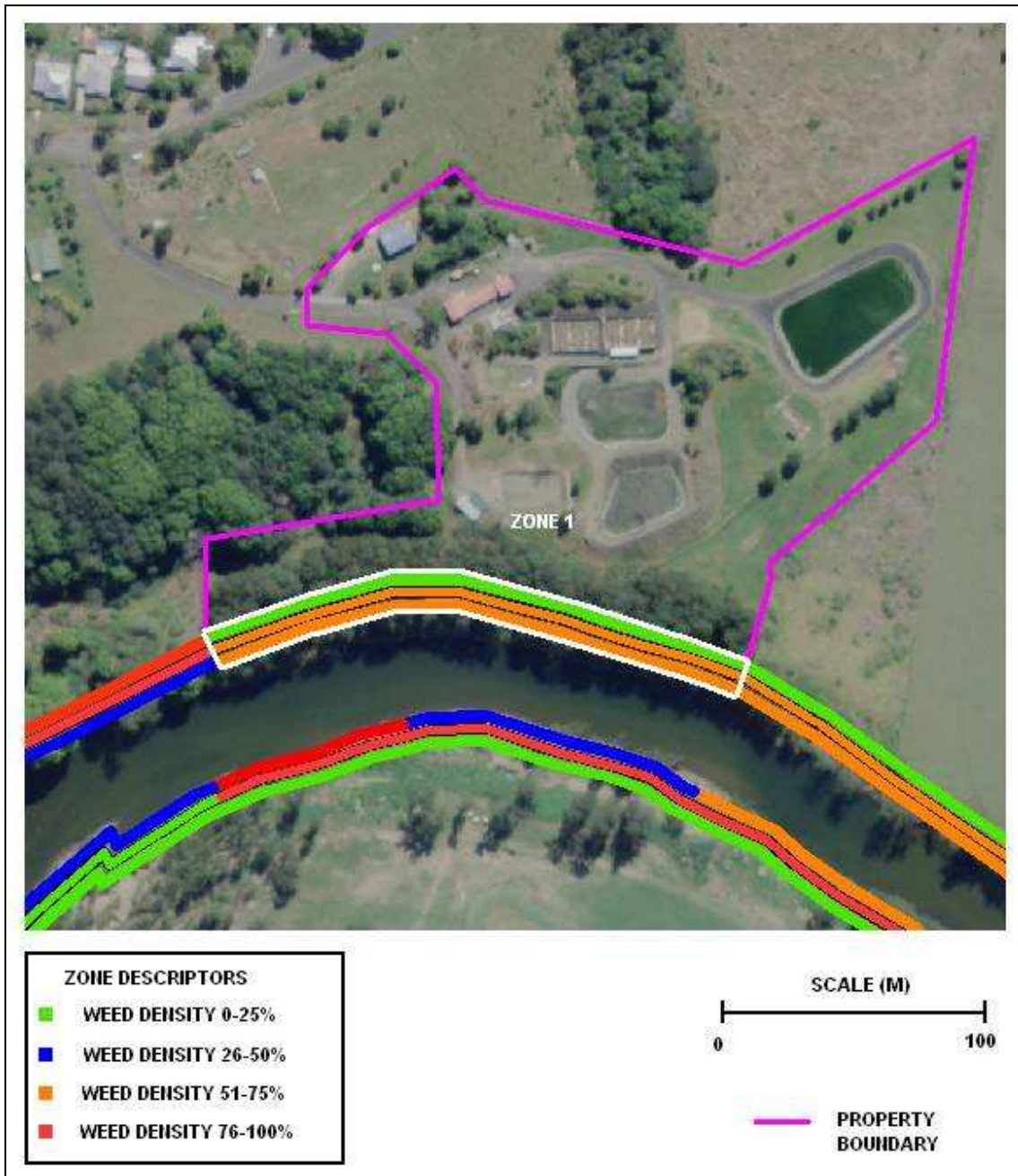


Figure 20: Riparian condition and extent

Table 11: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	5-10m
CANOPY COVER	76-100%
MIDSTOREY COVER	76-100%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	N
NATURAL REGEN	Y
CANOPY WEED	0%
MIDSTORY WEED	51-75%
GROUND COVER WEED	51-75%
WEED 1	Small Leaf Privet (<i>Ligustrum sinense</i>)
WEED 1 DENSITY	Clumps (11-50%)
WEED 2	Blue Billy Goat (<i>Ageratum houstonianum</i>)
WEED 2 DENSITY	Clumps (11-50%)
WEED 3	Castor Oil Plant (<i>Rinicus communis</i>)
WEED 3 DENSITY	Few Scattered (<10%)
WEED 4	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 4 DENSITY	Few Scattered (<10%)
WEED 5	Balloon Vine (<i>Cardiospermum grandiflorum</i>)
WEED 5 DENSITY	Few Scattered (<10%)
WEED 6	Madeira Vine (<i>Anredera cordifolia</i>)
WEED 6 DENSITY	Few Scattered (<10%)
WEED 7	Cadaghi (<i>Corymbia torelliana</i>)
WEED 7 DENSITY	Clumps (11-50%)
WEED 8	Trad (<i>Tradescantia albiflora</i>)
WEED 8 DENSITY	Clumps (11-50%)
WEED 9	Elephants Ears (<i>Colocasia esculenta</i>)
WEED 9 DENSITY	Few Scattered (<10%)
WEED 10	Mistflower (<i>Eupatorium riparium</i>)
WEED 10 DENSITY	Clumps (11-50%)
BANK	North Bank

Table 12: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)				
				Landholder	Contributions			Total Budget
					NRCMA or Other	Bellingen Shire Council		
All	Project Coordination	Technical, administrative & practical support (4 hrs @ \$50/hr)	Environmental Levy		200	200	200	
All	Weed control (contractor)	Targeted poisoning of Cadaghi stems @ \$6.50/stem incl labour) (40		260			260	
All	Weed control (contractor)	Weed control & removal (priority species mentioned above) (12 days @ \$760/day)		9120			9120	
	On-going Maintenance	Follow-up weed treatment (5 years)			4670		4670	
			TOTAL	9380	4870		14250	

Site 6 - 105 North Bank Road, Bellinger NSW 2454

Lot/DP	Lot7 DP810520
Property Owners	AS & NR Taylor
Catchment Details	Upper Bellinger River estuary –north bank; 550m river frontage; Area: 33.7ha
Land Use	Rural – Beef Cattle

Property Summary

1. This property extends along a length of alluvial river bank which has undergone significant migration in the past 70-150 years. Photogrammetrically derived high bank locations suggest that since 1942, upstream sections of the bank (zone 1) have eroded in the vicinity of 75m, while the channel has also widened significantly. Bank stability is considered to reasonable with minor erosion rates occurring (Cohen & Telfer, 2010). Ground truthing has identified three scalloped slump/sloth area which are currently at risk of further erosion (zone 1). A number of small gully type erosion scalds are also evident running laterally back from the bank in zone 2. The property has been fenced to exclude stock from the immediate bank slope and a narrow vegetated riparian strip currently exists with limited complexity and native plant diversity. This riparian strip is dominated by River Oak (*Casurina cunninghamiana*), Sandpaper Fig (*Ficus coronata*) and weed species such as Small Leaf Privet (*Ligustrum sinense*), Balloon Vine (*Cardiospermum grandiflorum*), Castor Oil Plant (*Rinicus communis*), Mistflower (*Eupatorium riparium*) and Blue Billy Goat (*Ageratum houstonianum*).
2. The property also adjoins Frenchman’s Creek along the eastern boundary. It appears that a headcut may have moved up the system from the mouth of the creek in recent times (Landholder suggests since major flooding in 2009). Further investigation is required to ascertain the progress of this bed erosion however initial investigations suggest that the headcut has not reached the culvert where the creek crosses North Bank Road. Increased runoff from residential developments in the upper part of Frenchman’s Creek catchment may have contributed to this issue. Additionally changes to the bed level at the junction with the Bellinger River may also be a factor. In any case significant bank slump has occurred (possibly also a result of bank saturation). The creek margins are not fenced and dominant vegetation species are Small Leaf Privet (*Ligustrum sinense*) and Camphor Laurel (*Cinnamomum camphora*).

Previous Management Efforts

A temporary electric fence line has been erected approximately 1-2 metres back from the crest of the bank to restrict cattle access to the immediate bank face.

Rehabilitation Strategy

1. Immediate treatment for this site would entail dense planting of species such as Spiny Mat Rush (*Lomandra hystrix*) and Water Gum (*Tristaniopsis laurina*) in the scalloped slump areas and gully erosion scalds (zones 1-2). Particular attention should be placed on revegetating the toe (lower third) of these areas. Accompanying fences will also need to be extended

around the perimeter of these slump areas. A minimum fence line set back of five metres from the crest of the bank is also recommended, however the landholder has concerns over maintenance. As such, current work will be limited to the bank face and immediate crest. Weed control should be undertaken in this area to eliminate problematic weed species and subsequent revegetation will be undertaken in this zone with deep rooted species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Ongoing weed management will also be critical to ensure the survival and recruitment of native plants. The riparian buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment.

2. The rehabilitation of the riparian zone along Frenchman's Creek first requires cooperation from the neighbouring landholder (currently no interest) as property boundaries overlap the creek. Focus should then be placed on determining the presence and location of the suspected headcut. Appropriate control structures may need to be installed here. Any weed control efforts must be coupled with revegetation as virtually no native species are present. Exclusion of stock would also be necessary and currently this is not feasible without cooperation from the neighbouring landholder. Any work undertaken on this area should be of secondary priority to the rehabilitation along the main River channel

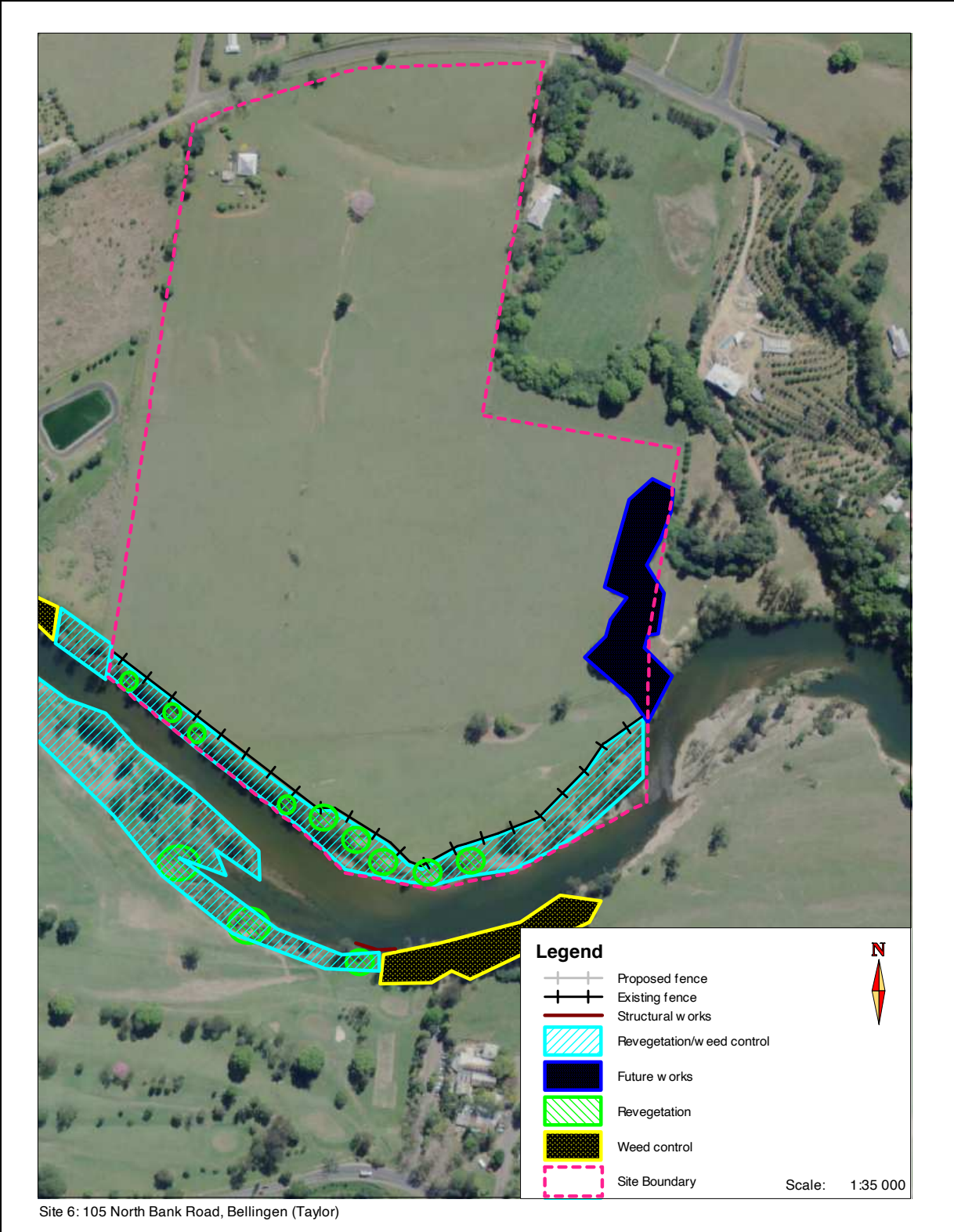


Figure 21: Site workplan map

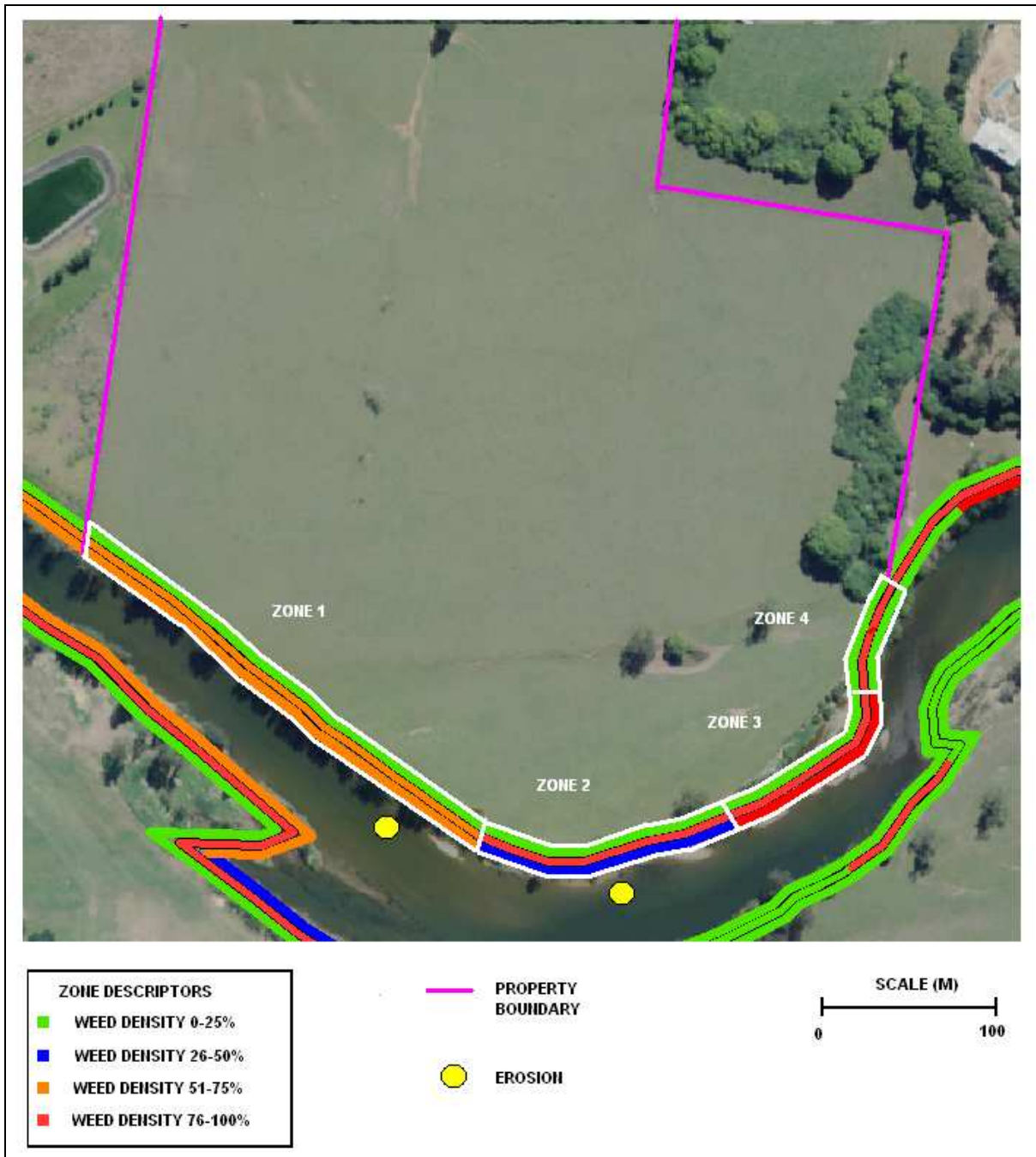


Figure 22: Riparian condition and extent

Table 13: Riparian condition summary

MGT ZONE	1	2	3	4
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	<5m	10-20m	<5m
CANOPY COVER	76-100%	<25%	26-50%	Cleared
MIDSTOREY COVER	76-100%	<25%	51-75%	76-100%
GROUND COVER	76-100%	76-100%	76-100%	51-75%
APPROPRIATE COVER	N	N	Y	N
GRAZING IMPACT	N	N	N	Y
NATURAL REGEN	Y	Y	Y	N
CANOPY WEED	0%	0%	0%	0%
MIDSTOREY WEED	51-75%	76-100%	76-100%	76-100%
GROUND COVER WEED	51-75%	26-50%	76-100%	<25%
WEED 1	Small Leaf Privet (Ligustrum sinense)	Small Leaf Privet (Ligustrum sinense)	Small Leaf Privet (Ligustrum sinense)	Small Leaf Privet (Ligustrum sinense)
WEED 1 DENSITY	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Dominant (>50%)
WEED 2	Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)
WEED 2 DENSITY	Clumps (11-50%)	Clumps (11-50%)	Clumps (11-50%)	Clumps (11-50%)
WEED 3	Castor Oil Plant (Rinicus communis)	Balloon Vine (Cardiospermum grandiflorum)	Camphor Laurel (Cinnamomum camphora)	Mistflower (Eupatorium riparium)
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 4	Camphor Laurel (Cinnamomum camphora)	Castor Oil Plant (Rinicus communis)	Castor Oil Plant (Rinicus communis)	Balloon Vine (Cardiospermum grandiflorum)
WEED 4 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 5	Balloon Vine (Cardiospermum grandiflorum)	Camphor Laurel (Cinnamomum camphora)	Mistflower (Eupatorium riparium)	
WEED 5 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	
WEED 6	Elephants Ears (Colocasia esculenta)		Elephants Ears (Colocasia esculenta)	
WEED 6 DENSITY	Few Scattered (<10%)		Few Scattered (<10%)	
BANK	North Bank	North Bank	North Bank	North Bank

Table 14: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (8 hrs @ \$50/hr)	Environmental Levy		400 (In kind)	400	
N/A	Publicity	Printing, educational activities, media release			80 (In kind)	80	
All	Weed control (contractor)	Weed control & removal (priority species mentioned above) (6 days @ \$760/day)		4560		4560	
All	Revegetation (4500m ²) (contractor)	Planting of riparian species at 4m centres along bank face (\$6.50/ plant incl labour x 281 plants)		1828		1828	
1-2	Revegetation (1000m ²) (contractor)	Planting of key species at 1m centres to stabilise erosion scalds/slumps. (\$6.50/ plant incl labour x 1000 plants)		6500		6500	
All	On-going Maintenance	Follow-up weed treatment- quarterly (9hrs / qtr) inspections and suppression as necessary for 10 years		12888 (In kind)		12888	
			TOTAL	12888	12888	26256	

Site 7 - 17 Doepel Street, Bellingen NSW 2454

Lot/DP	Lot1 DP802576
Property Owners	Bellingen Shire Council
Catchment Details	Upper Bellinger River estuary –south bank; 100m river frontage; Area: 0.164ha
Land Use	Public Reserve – Heritage Site (Alma Doepel Park)

Property Summary

This is the site of the old Bellingen town (Boat Harbour) wharf where boats transporting timber and other goods docked to load and unload. Photogrammetry records suggest that the alluvial high bank along this bend has eroded approximately 20m since 1942. However, in 1997 a rock revetment wall and accompanying revegetation plot was established which has all but halted bank erosion along this site (Cohen & Telfer, 2010). The revegetation plot is now reminiscent of a wet sclerophyl forest. Notable weed species include Balloon Vine (*Cardiospermum grandiflorum*), Camphor Laurel (*Cinnamomum camphora*), Elephants Ears (*Colocasia esculenta*) and Trad (*Tradescantia albiflora*).

Previous Management Efforts

A rock revetment wall has been placed along the bottom half of the bank and the immediate bank face and high bank riparian zone has been revegetated to a width of approximately 20m back from the bank crest. The riparian zone is dominated by native species including Dunns White Gum (*Eucalyptus dunnii*), Thin Fruited Tea Tree (*Leptospermum brachyandrum*), Bush Cherry (*Syzygium australe*), Wheel of Fire Tree (*Stenocarpus sinuatus*) and Bottlebrush (*Grevillea* sp).

Rehabilitation Strategy

Minimal intervention is necessary at this site. The canopy storey is well established and mid-understory plants are complementing well. The riparian strip is capturing flood debris well and adding to streambank roughness to reduce flood energies. Periodic weed control is recommended to suppress weeds as mentioned previously.

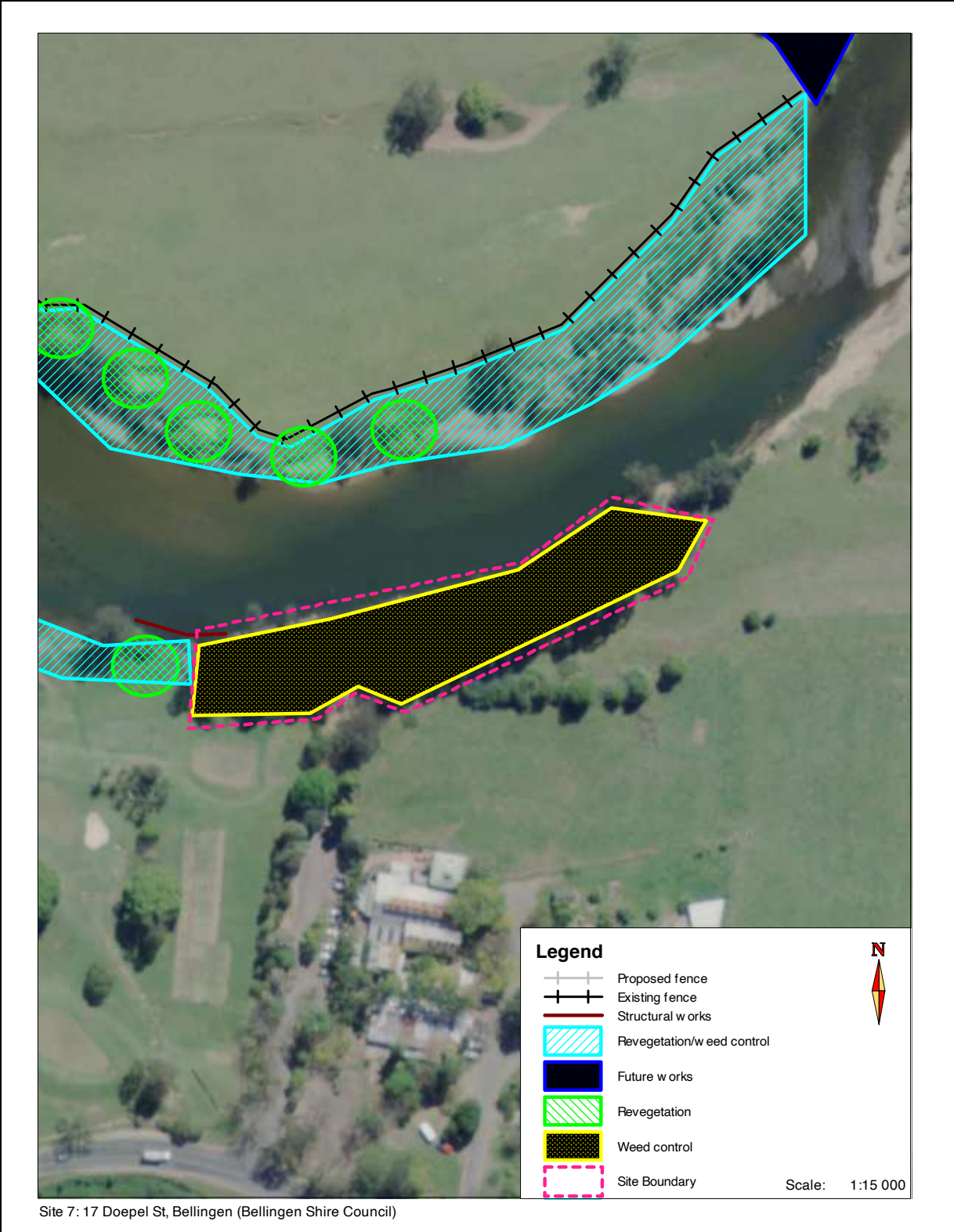


Figure 23: Site workplan map

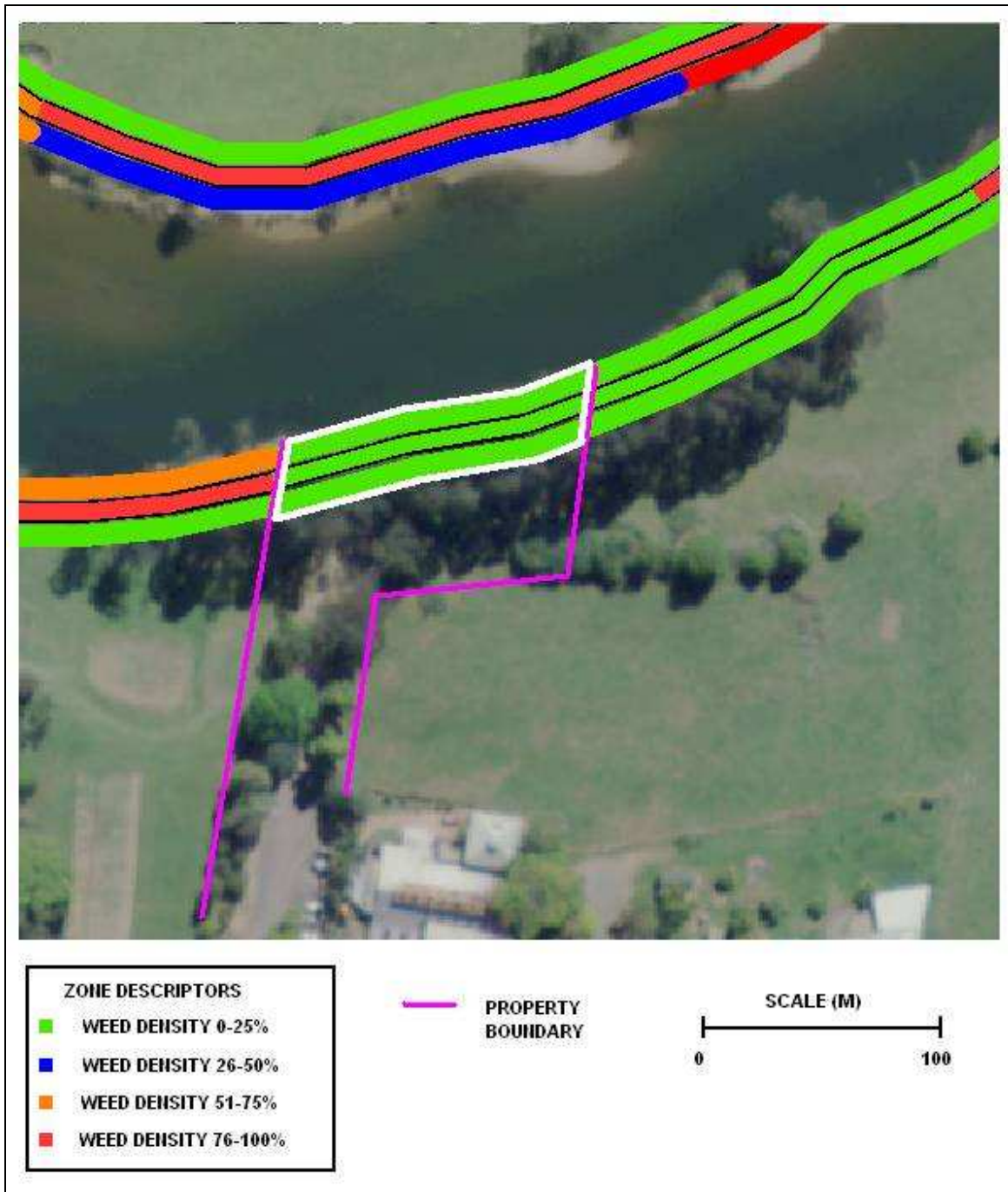


Figure 24: Riparian condition and extent

Table 15: Riparian condition summary

MGT ZONE	1
ASSESSOR	S. Morris
RIPARIAN WIDTH	5-10m
CANOPY COVER	76-100%
MIDSTOREY COVER	<25%
GROUND COVER	76-100%
APPROPRIATE COVER	Y
GRAZING IMPACT	Y
NATURAL REGEN	Y
CANOPY WEED	0%
MIDSTORY WEED	<25%
GROUND COVER WEED	<25%
WEED 1	Blue Billy Goat (<i>Ageratum houstonianum</i>)
WEED 1 DENSITY	Few Scattered (<10%)
WEED 2	Small Leaf Privet (<i>Ligustrum sinense</i>)
WEED 2 DENSITY	Few Scattered (<10%)
WEED 3	Lantana (<i>Lantana camara</i>)
WEED 3 DENSITY	Few Scattered (<10%)
WEED 4	Balloon Vine (<i>Cardiospermum grandiflorum</i>)
WEED 4 DENSITY	Few Scattered (<10%)
WEED 5	Elephants Ears (<i>Colocasia esculenta</i>)
WEED 5 DENSITY	Few Scattered (<10%)
WEED 6	Trad (<i>Tradescantia albiflora</i>)
WEED 6 DENSITY	Clumps (11-50%)
BANK	South Bank

Table 16: Property workplan

<i>Mgt Zone</i>	<i>Activity</i>	<i>Activity Details</i>	<i>Source of Potential Funding (optional)</i>	<i>Indicative Cost (\$ ex GST)</i>			
				<i>Contributions</i>			<i>Total Budget</i>
				<i>Landholder</i>	<i>Partners</i>	<i>Bellingen Shire Council</i>	
All	Project Coordination	Technical, administrative & practical support (3 hrs @ \$50/hr)			150	150	
All	Weed control (contractor)	General treatment of weeds as noted above (1 day @ \$760/day)			760	760	
All	On-going Maintenance	Follow-up weed treatment- annual (4hrs/yr) inspections and suppression as necessary over 5 years			760	760	
			TOTAL		1670	1670	

Site 8 - Cahill Street; 1060 Waterfall Way, Bellingen NSW 2454

Lot/DP	Lot1 DP100825; Lot1 DP210787
Property Owners	Mr Peter William Sanger
Catchment Details	Upper Bellinger River estuary – south bank; 1100m river frontage; Area: 30ha
Land Use	Rural – Dairy Cattle

Property Summary

This property encompasses two separate land parcels across an alluvial floodplain with a high flow bypass chute. Photogramatically derived cross sections suggest channel capacity adjacent to this site has actually exhibited a net reduction since 1942, with significant aggradation evident on the inside bench. However, severe erosion (~50m bank retreat) has occurred immediately downstream of the rock revetment works at Site 7 (Cohen & Telfer, 2010) in recent times. Active erosion along the much of this property (zones 1,2, 4 & 5) is considered to be moderate to severe despite the downstream extent being on an inside bend through straight section. Existing native vegetation is limited to River Oak (*Casurina cunninghamiana*) and Sandpaper Fig (*Ficus coronata*). Dominant weed species include Small Leaf Privet (*Ligustrum sinense*), Camphor Laurel (*Cinnamomum camphora*), Blue Billy Goat (*Ageratum houstonianum*), Balloon Vine (*Cardiospermum grandiflorum*), Lantana (*Lantana camara*) and Wild Tobacco (*Solanum mauritianum*).

Previous Management Efforts

N/A

Rehabilitation Strategy

A fence line should be constructed around the riparian margin of the site. A minimum set back of ten metres from the crest of the bank is recommended along the outside bend section (zones 1-2), while five metres should be sufficient along the straight section (zones 3-5). Weed control should be administered in this area to eliminate problematic weed species and subsequent revegetation will be undertaken in this zone with deep rooted species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Particular attention should also be paid to consolidating the flood chute exit point at the downstream section of the site (zone 4). Ongoing weed management will be critical to ensure the survival and recruitment of native plants. The riparian buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Off-stream water points are necessary to allow cattle to utilise the four paddocks under rotational grazing without accessing the River.

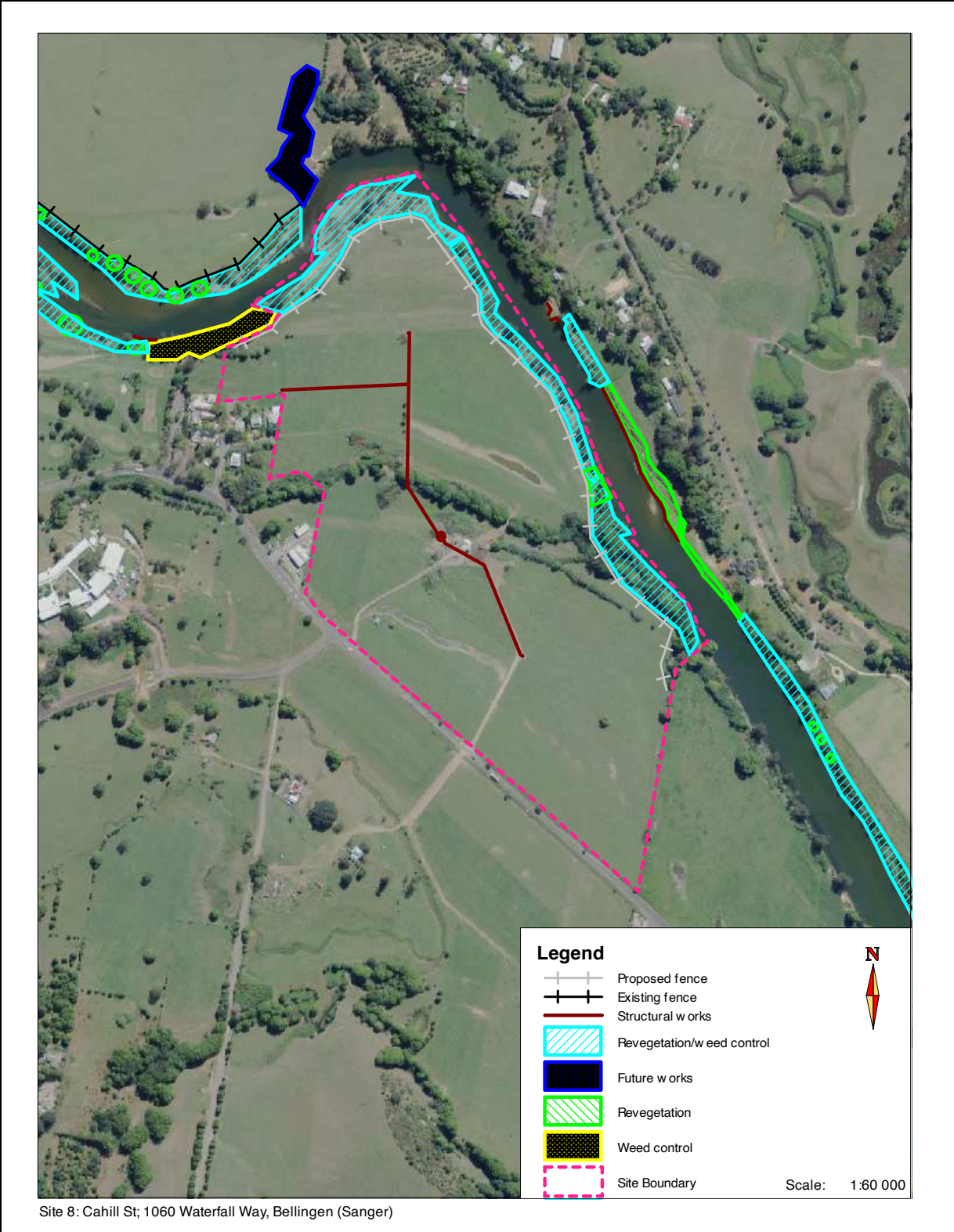


Figure 25: Site work plan map

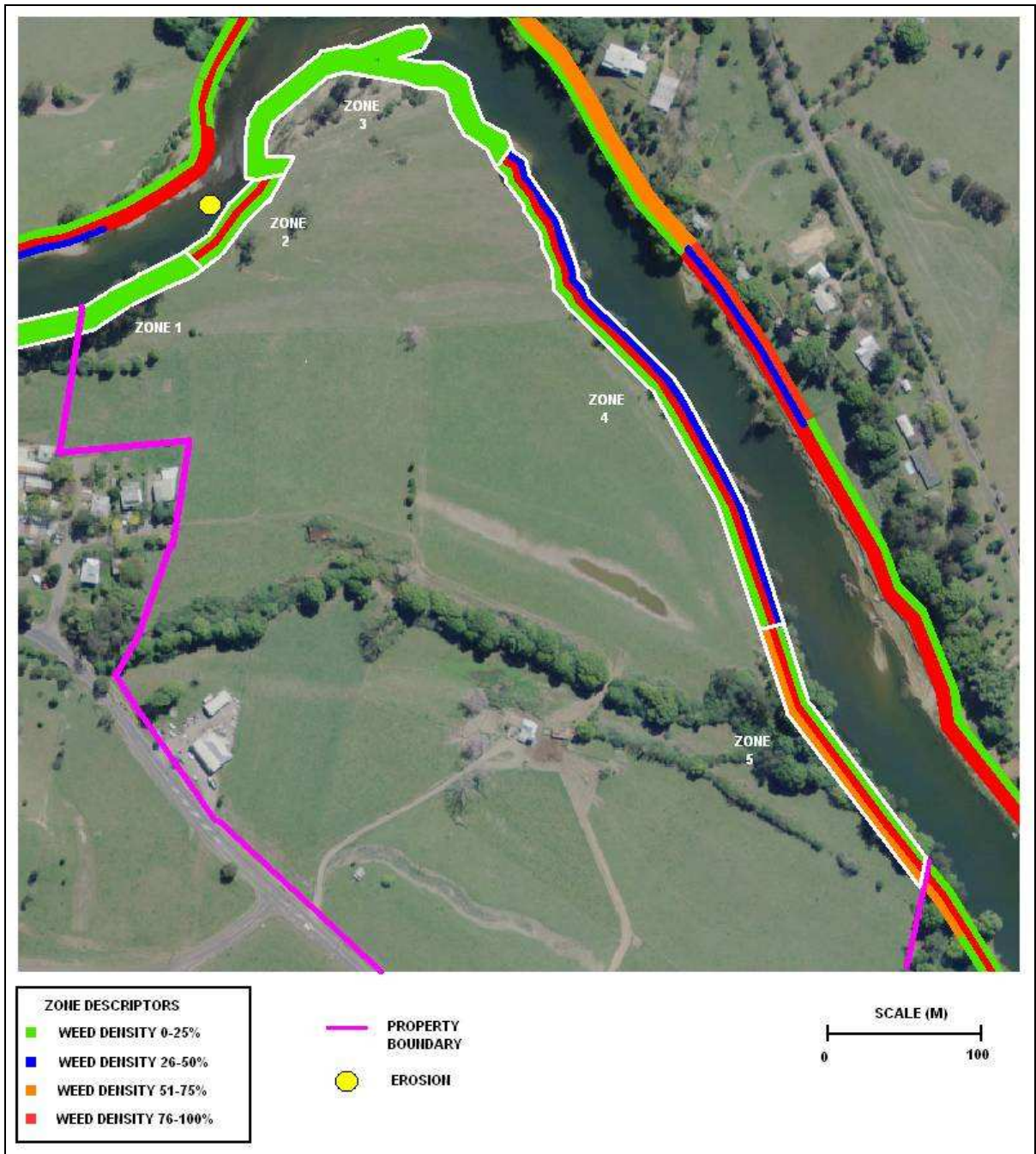


Figure 26: Riparian condition and extent

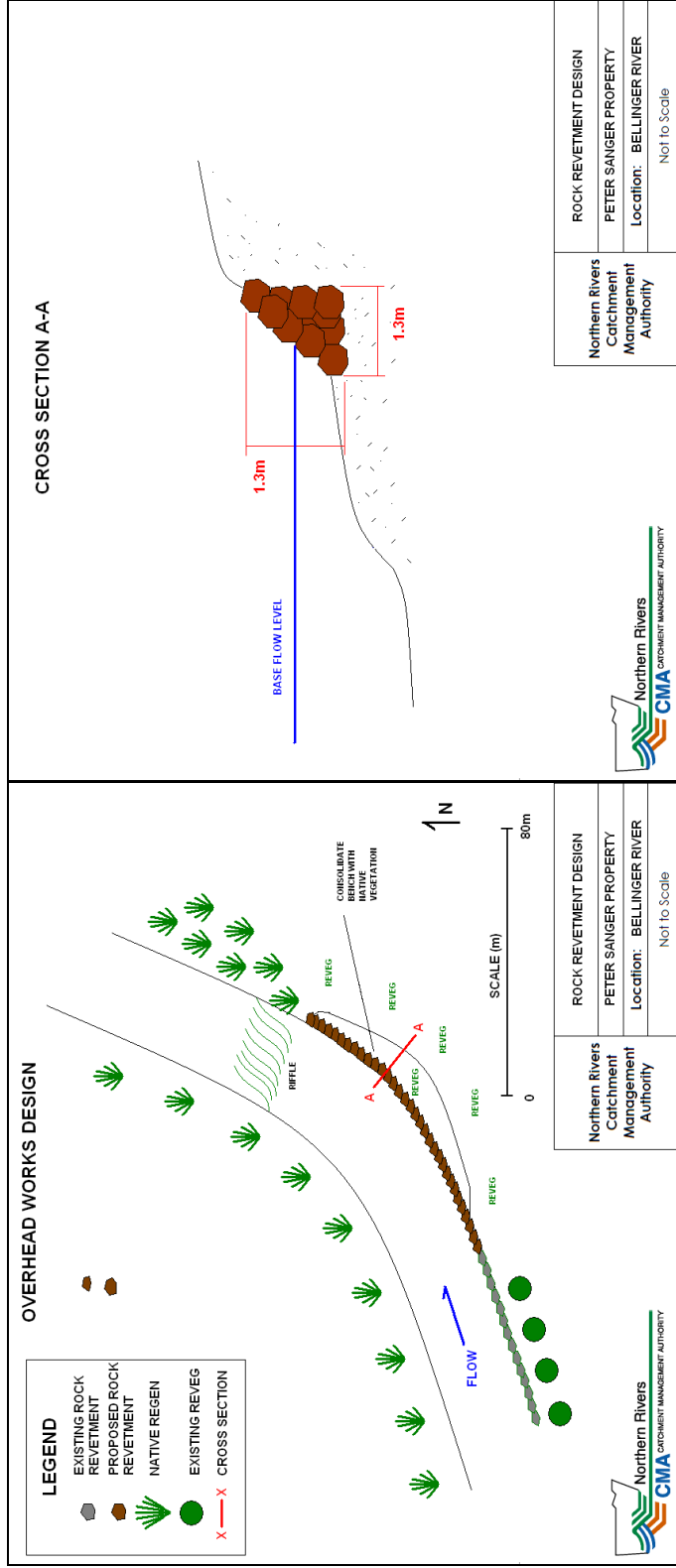
Table 17: Riparian condition summary

MGT ZONE	1	2	3	4	5
ASSESSOR	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris
RIPARIAN WIDTH	5-10m	10-20m	0m	5-10m	10-20m
CANOPY COVER	76-100%	<25%	<25%	<25%	76-100%
MIDSTOREY COVER	<25%	<25%	Cleared	26-50%	51-75%
GROUND COVER	76-100%	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	Y	Y	N	N	Y
GRAZING IMPACT	Y	Y	Y	Y	N
NATURAL REGEN	Y	N	Y	N	N
CANOPY WEED	0%	0%	<25%	<25%	51-75%
MIDSTOREY WEED	<25%	76-100%	0%	76-100%	76-100%
GROUND COVER WEED	<25%	0%	0%	26-50%	0%
WEED 1	Blue Billy Goat (Ageratum houstonianum)	Camphor Laurel (Cinnamomum camphora)	Coral Tree (Erythrina sykesii)	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)
WEED 1 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Dominant (>50%)
WEED 2	Small Leaf Privet (Ligustrum sinense)	Lantana (Lantana camara)		Small Leaf Privet (Ligustrum sinense)	Small Leaf Privet (Ligustrum sinense)
WEED 2 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)		Dominant (>50%)	Dominant (>50%)
WEED 3	Lantana (Lantana camara)			Lantana (Lantana camara)	
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)		Few Scattered (<10%)	
WEED 4	Balloon Vine (Cardiospermum grandiflorum)			Blue Billy Goat (Ageratum houstonianum)	
WEED 4 DENSITY	Few Scattered (<10%)			Clumps (11-50%)	
WEED 5				Wild Tobacco (Solanum mauritianum)	
WEED 5 DENSITY				Few Scattered (<10%)	
BANK	South Bank	South Bank	South Bank	South Bank	South Bank

Table 18: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Contributions			
				Landholder	NRCMA or Other	Bellingen Shire Council	Total Budget
All	Project Coordination	Technical, administrative & practical support (14 hrs @ \$50/hr)	Environmental Levy		700		700
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)		80
All	Fencing	Landholder to supply materials for and construct fence line to exclude stock (1100m @ \$5000/km)		5500 (In kind)			5500
1-3	Weed control (3500m ²) (contractor)	General treatment of weeds as noted above (2 days @ \$760/day)		608	912		1520
1-3	Revegetation (3500m ²) (contractor)	Planting of key species at 2m centres along entire riparian zone (\$6.50/ plant incl labour x 875 plants)		2275	3413		5688
2	Structural works	Rock revetment wall (2.5m x 100m @ \$125)		5000	7500		12500
4	Weed control (4000m ²) (contractor)	General treatment of weeds as noted above (4 days @ \$760/day)		1216	1824		3040
4	Revegetation (4000m ²) (contractor)	Planting of key species at 2m centres along entire riparian zone (\$6.50/ plant incl labour x 1000 plants)		2600	2900		6500
5	Weed control (2500m ²) (contractor)	General treatment of weeds as noted above (5 days @ \$760/day)		1520	2280		3800

5	Revegetation (2500m ²) (contractor)	Planting of key species at 2m centres along entire riparian zone (\$6.50/ plant incl labour x 625 plants)		1625	2438		4063
4	Revegetation (1000m ²)	Planting of key species at 1m centres to stabilise flood chute exit point (\$6.50/ plant incl labour x 1000 plants) (landholder labour in kind)		2600	3900		6500
All	On-going Maintenance	Follow-up weed treatment- annual (26hrs/qtr) inspections and suppression as necessary over 10 years		36611 (In kind)			36611
			TOTAL	59555	25167	780	85502



Site 9 - 224 North Bank Rd, Bellinger NSW 2454

Lot/DP	Lot21 DP589226
Property Owners	JL & MA Hope
Catchment Details	Upper Bellinger River estuary – north bank; 165m river frontage; Area: 2.79ha
Land Use	Residential/Commercial - Cottages

Property Summary

The property incorporates both a high bank and low floodplain bench. While the residences do not impact directly on the floodplain bench, associated leisure space and activities have resulted in a riparian area with an overall lack of diversity, thus bank stability is at risk. Furthermore, due to a high flow flood chute outflow point on the opposing bank (site 8, zone 4), high flood flows are being directed into the bank at this site. Ground truthing has revealed that existing log revetment structural works are beginning to fail and several large isolated River Oaks (*Casurina cunninghamiana*) along the bank toe are at risk of toppling into the river. Moderate erosion is also evident around the margin of the low lying bank near the western edge of the property (zone 2). Overall active erosion severity is considered moderate for this site (Cohen & Telfer, 2010). Existing vegetation at this site includes natives such as Thin Fruited Tea Tree (*Leptospermum brachyandrum*), Spiny Mat Rush (*Lomandra hystrix*), River Oak (*Casurina cunninghamiana*) and the weed species Small Leaf Privet (*Ligustrum sinense*), Camphor Laurel (*Cinnamomum camphora*), Castor Oil Plant (*Rinicus communis*) and Blue Billy Goat (*Ageratum houstonianum*).

Rehabilitation Strategy

In order to stabilize erosion and improve riparian complexity a number of actions should be undertaken:

1. Installation of rock revetment along the fringe of your low lying bank to protect from scouring events and preserve adjacent banks (see figure x).
2. Revegetate bank from toe to a distance at least 5m back from bank crest edge (where appropriate) using species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare).
3. Undertake a long term weed management strategy along the riparian zone to suppress invasive weeds as mentioned above.
4. Remove at risk River Oak (*Casurina cunninghamiana*) trunks above waist height while retaining their root complexes. The removed sections of trunks should be used as pins to stabilise and consolidate logs forming part of the revetment beneath your bank slope.

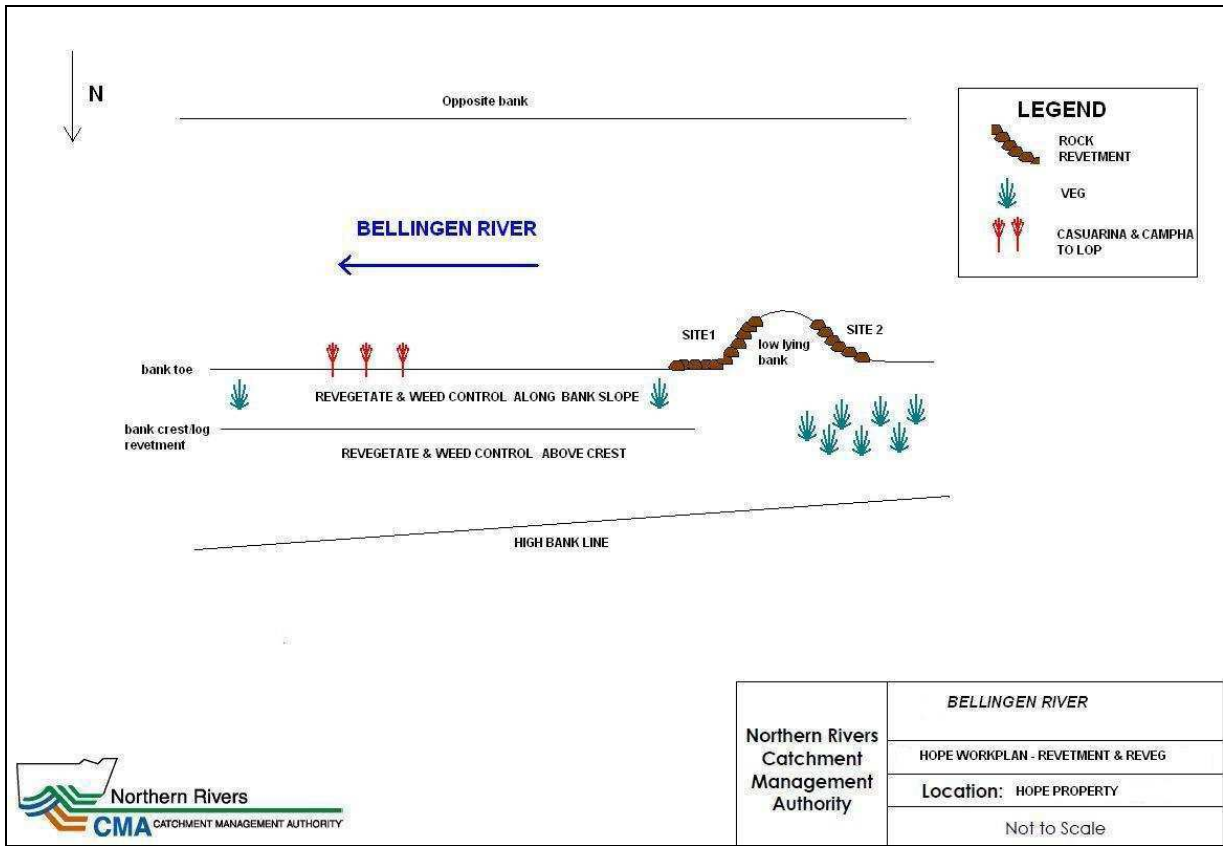


Figure 27: Design layout for rock revetment

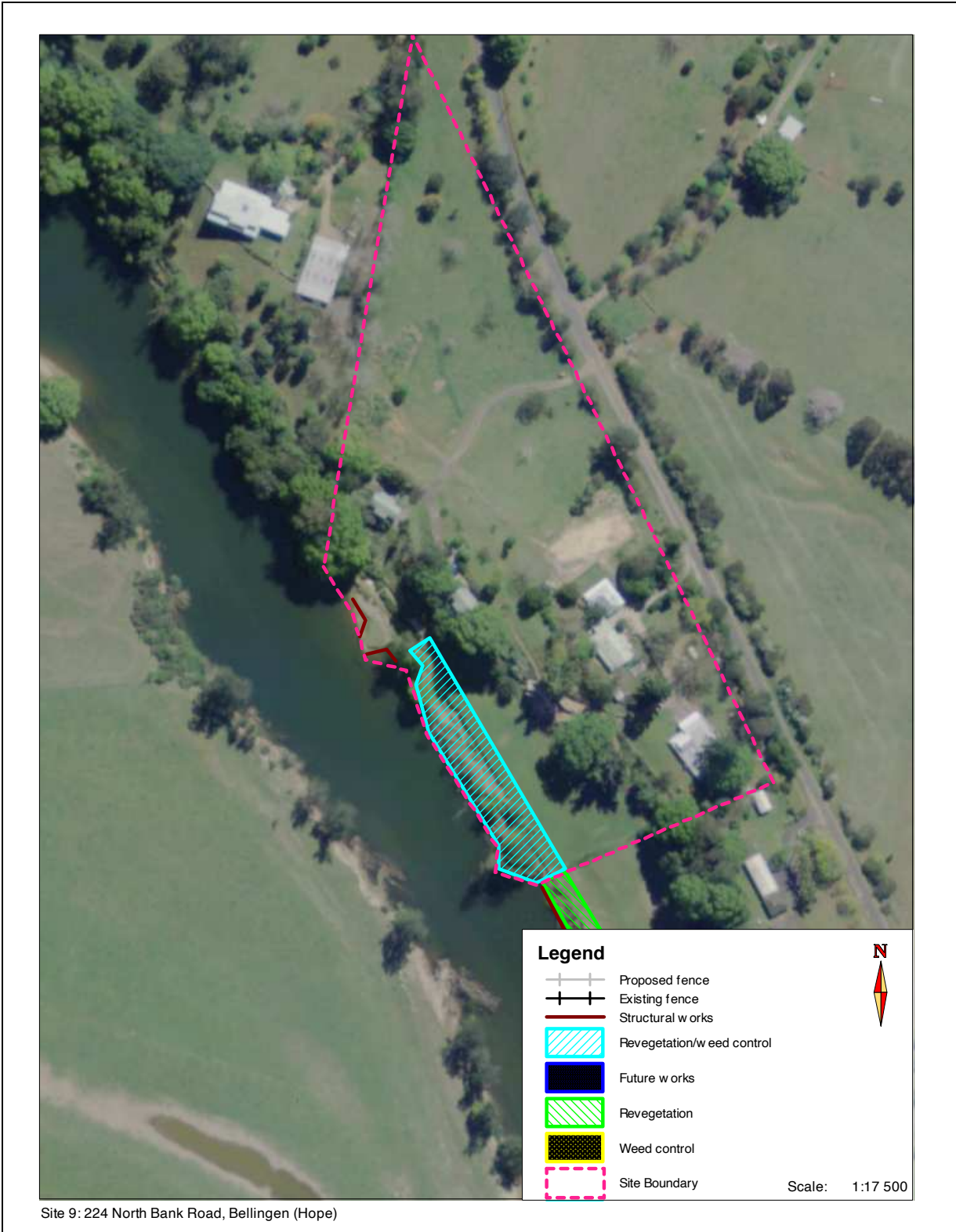


Figure 28: Site workplan map

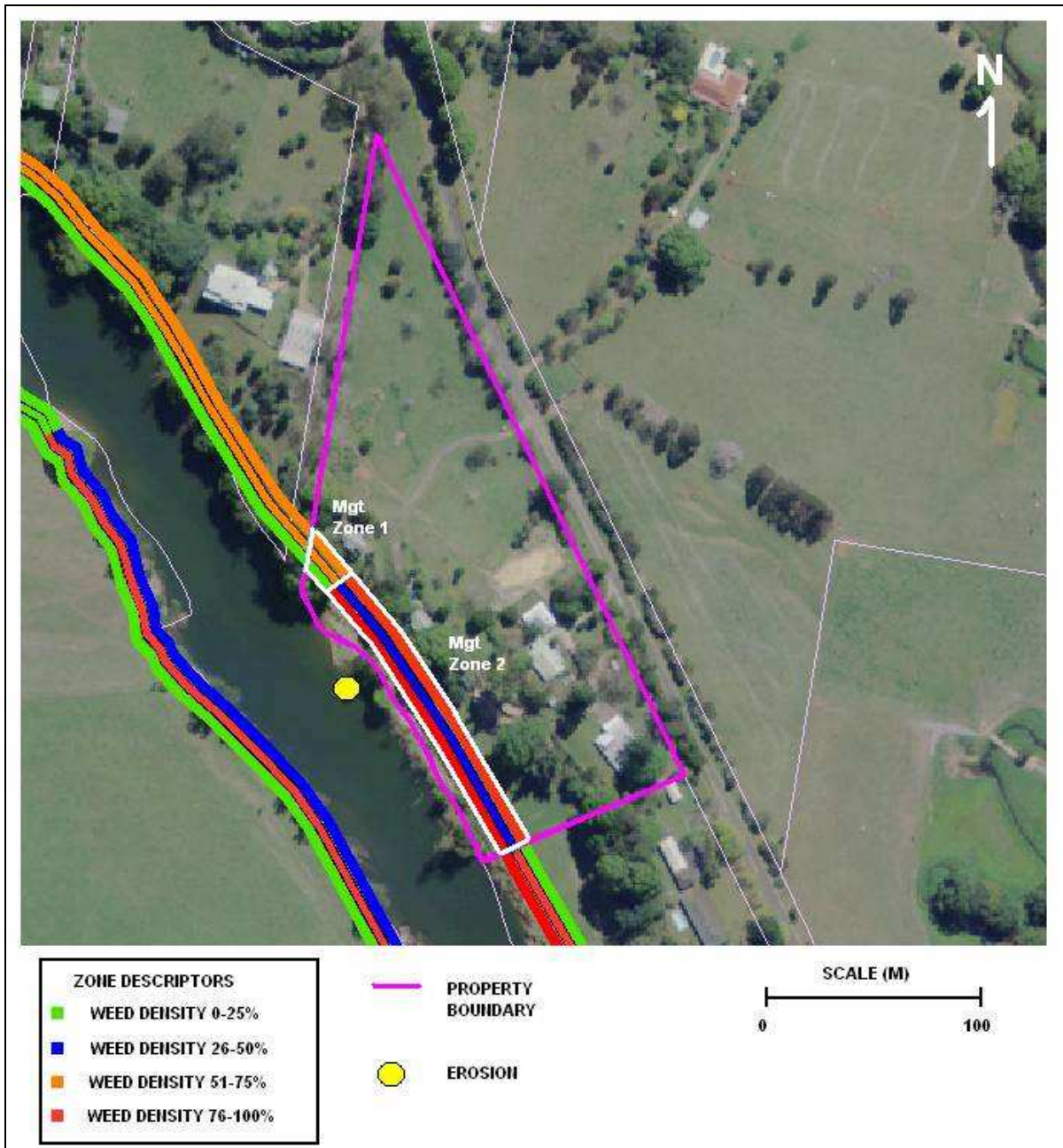


Figure 29: Riparian condition and extent

Table 19: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	10-20m
CANOPY COVER	<25%
MIDSTOREY COVER	51-75%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	N
NATURAL REGEN	Y
CANOPY WEED	76-100%
MIDSTORY WEED	26-50%
GROUND COVER WEED	76-100%
WEED 1	Paddy Lucerne
WEED 1 DENSITY	Clumps (11-50%)
WEED 2	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 2 DENSITY	Clumps (11-50%)
WEED 3	Blue Billy Goat (<i>Ageratum houstonianum</i>)
WEED 3 DENSITY	Dominant (>50%)
WEED 4	Mistflower (<i>Eupatorium riparium</i>)
WEED 4 DENSITY	Few Scattered (<10%)
WEED 5	Castor Oil Plant (<i>Rinicus communis</i>)
WEED 5 DENSITY	Few Scattered (<10%)
BANK	North Bank

Table 20: Property Workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (8 hrs @ \$50/hr)	Environmental Levy		400 (In kind)	400	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
2	Weed control	Weed control & removal (priority species mentioned above) (21hrs @ \$35/hr) (landholder labour in kind)		735 (In kind)		735	
2	Tree Lopping	Lop seven at risk trees overhanging bank (2hrs / tree @ \$100/hr) (landholder labour in kind)		1400 (In kind)		1400	
2	Revegetation (1000m ²)	Planting of key species at 2m centres to stabilise erosion scalds/slumps. (\$6.50/ plant incl labour x 275 plants) (landholder labour in kind)		825 (In kind)	963	1788	
2	Rock Revetment (contractor)	Purchase, delivery and placement of rock and associated materials (refer to CMA site action plan for details)			5096	5096	
All	On-going Maintenance	Follow-up weed treatment- quarterly (12.5hrs / qtr) inspections and suppression as necessary for 10 years		18038 (In kind)		18038	
			TOTAL	20998	6059	27537	480

Site 10 - 236 North Bank Rd, Bellingen NSW 2454

Lot/DP	Lot1 DP577039
Property Owners	DG & MA Muller
Catchment Details	Upper Bellinger River estuary – north bank; 235m river frontage; Area: 1.71ha
Land Use	Residential

Property Summary

This site incorporates both a high bank and low floodplain bench. Due to a complete absence of riparian vegetation and lack of roughness, the low floodplain bench alluvium at this site is highly unstable. Additionally, high flood flows from the outflow chute on the opposing bank are exerting continued erosive pressure on this bench. Ground truthing has revealed that the last remaining River Oaks (*Casurina cunninghamiana*) were toppled in 2009 flooding. Major flood events in 2009 have caused significant retreat (~15m) of this bench (D. Muller pers comm.) with as much as 40m of retreat since 1942. Overall active erosion is considered to be severe at this site (Cohen & Telfer, 2010). Some natural regeneration is now occurring at the lower terrace of this bench with Common Rush (*Juncus* sp.), Slender Knotweed (*Persicaria decipiens*) and River Oaks (*Casurina cunninghamiana*). Weed species include Blue Billy Goat (*Ageratum houstonianum*) and other exotic grasses.

Rehabilitation Strategy

A combination of structural works and revegetation are recommended at this site in order to halt bank erosion and facilitate deposition of material along the lower eroded terrace:

1. Placement of a rock revetment wall along the lower bench margin from the downstream property extent for a distance of approximately 180m upstream.
2. Approximately 20 pin/hinge lock retard groynes placed along lower bench from downstream property extent for a distance of 90m upstream. The remainder of the river frontage should be stabilized with revegetation.
3. An accompanying revegetation program will establish a riparian zone and appropriate root complexes to further consolidate the low floodplain bench. Appropriate species can be selected from the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). A minimum of 5-7m riparian buffer back from the crest of the bank will be necessary to maximize resilience against further flood damage. This buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment.

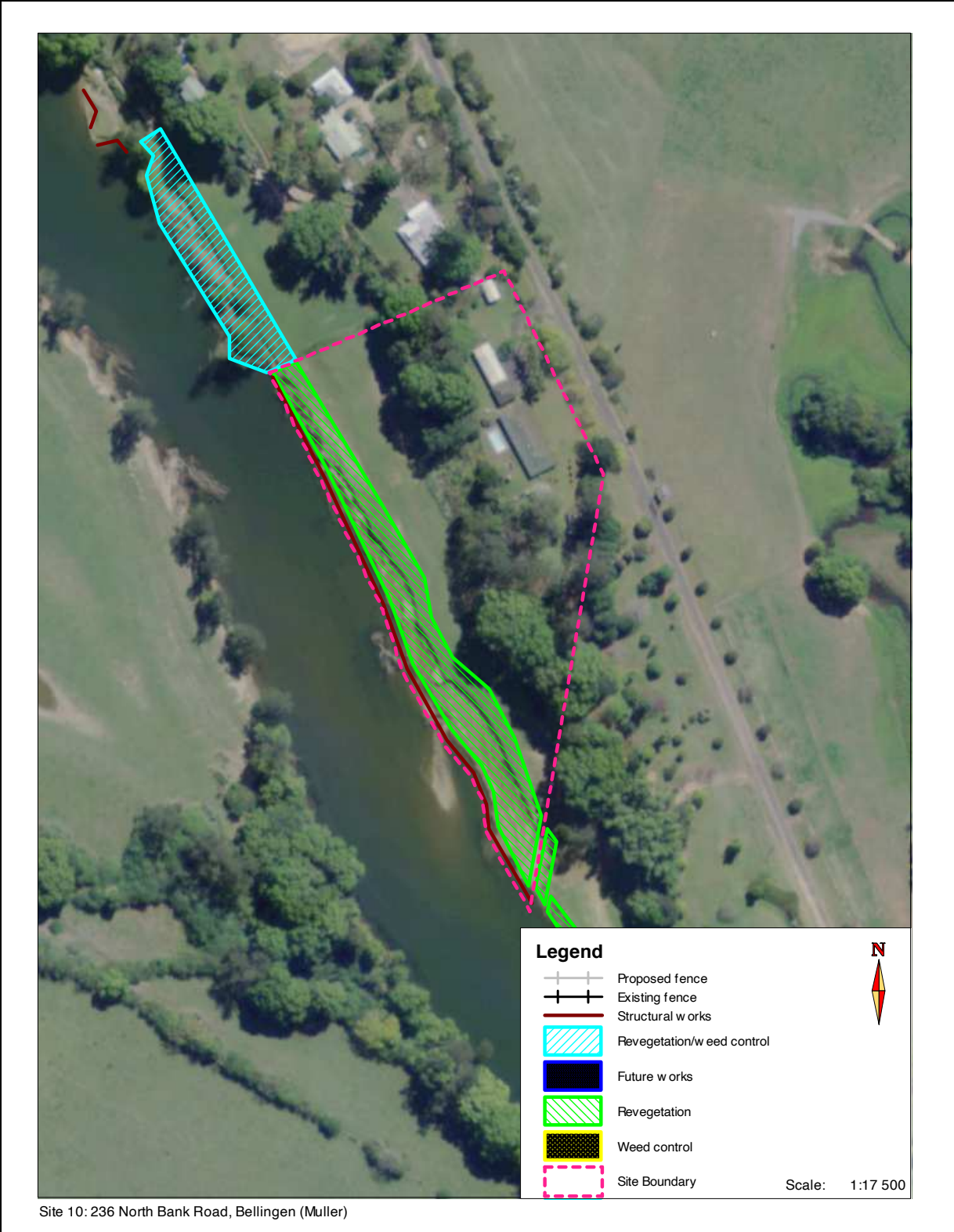


Figure 30: Site workplan map

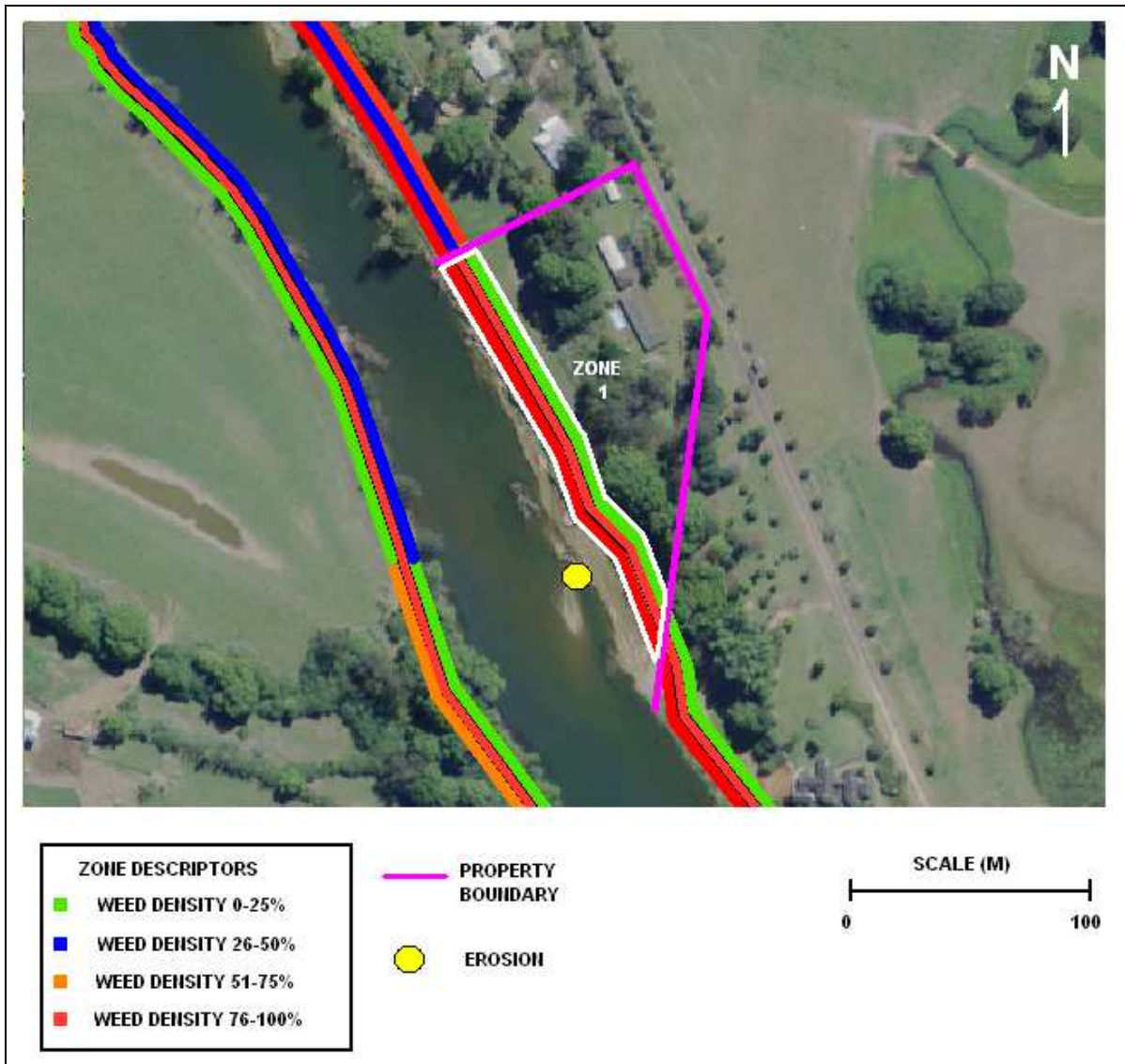


Figure 31: Riparian condition and extent

Table 21: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	5-10m
CANOPY COVER	Cleared
MIDSTOREY COVER	<25%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	N
NATURAL REGEN	N
CANOPY WEED	0%
MIDSTORY WEED	76-100%
GROUND COVER WEED	76-100%
WEED 1	Blue Billy Goat (<i>Ageratum houstonianum</i>)
WEED 1 DENSITY	Dominant (>50%)
WEED 2	Exotic grass
WEED 2 DENSITY	Clumps (11-50%)

Table 22: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)				
				Landholder	NRCMA or Other	Contributions		Total Budget
						Bellingen Shire Council		
1	Project Coordination	Technical, administrative & practical support (8 hrs @ \$50/hr)	Environmental Levy			400 (In kind)	400	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy			80 (In kind)	80	
1	Revegetation (4000m ²)	Planting of key species at 2m centres to stabilise erosion scalds/slumps. (\$6.50/ plant incl labour x 1000 plants) (landholder labour in kind)		3000 (In kind)	3500		6500	
1	Structural Works (contractor)	Purchase, delivery and placement of materials for rock revetment and pin groynes. (refer to CMA site action plan for details)			30 000		30 000	
1	On-going Maintenance	Follow-up weed treatment- quarterly (4.5hrs / qtr) inspections and suppression as necessary for 10 years		6500 (In kind)			6500	
			TOTAL	9500	33500	480	43480	

Site 11 - 278 North Bank Road, Bellingen NSW 2454

Lot/DP	Lot2 DP1083297
Property Owners	Stuart Del Vine Pty Ltd
Catchment Details	Upper Bellinger River estuary – north bank; 920m river frontage; Area: 8.94ha
Land Use	Residential/Commercial – Turf Farm Lease

Property Summary

This site can be divided into two distinct sections:

1. The upstream section at this site incorporates both a high bank and low floodplain bench. Due to landholder concerns about continued erosion along the margin of the low floodplain bench, a rock revetment wall was placed along the bank of the low floodplain bench (approx 100m). In response to further concerns about outflanking of the wall, a second rock wall was keyed laterally back into the bench at the upstream extent (bordering site 9). Spiny Mat Rush (*Lomandra hystrix*) have been planted in very high density belt along the margin of this rock key wall. This key wall at the upstream extent of the site is at risk of causing a plunge effect during flooding as water moves over the wall and exerts downward force on the other side. While the belt of Spiny Mat Rush (*Lomandra hystrix*) will help to minimize this risk, the plunge effect may extend beyond the width of the current vegetation belt. The remainder of this section lacks riparian complexity and is managed as a lawn except for the immediate bank face which consists mainly of annual weed species such as Blue Billy Goat (*Ageratum houstonianum*) and exotic grasses. Overall, this section of the site is considered stable (Cohen & Telfer, 2010), however immediately downstream from the bank revetment wall there is also a small length of the low floodplain bench that has slumped into deeper water in recent floods (T. Stuart pers comm.) and future flooding may exacerbate this issue.
2. The downstream section is a straight alluvial high bank section approximately 800m length. This section is relatively stable with the exception of three scalloped slump/sloth areas near its upper extent. Overall active erosion severity is considered to be minor (Cohen & Telfer, 2010). Major weed infestations compromise the ecological value of this section. Native regeneration is severely hampered due to competition from exotic plants such as Small Leaf Privet (*Ligustrum sinense*), Balloon Vine (*Cardiospermum grandiflorum*), Turkey Rhubarb (*Acetosa sagittata*) and Lantana (*Lantana camara*) and Castor Oil Plant (*Rinicus communis*).

Rehabilitation Strategy

1. In order to maximize stability around the rock key wall, it is necessary to extend the width of the vegetation belt an additional five metres. Other species such as Water Gum (*Tristanopsis laurina*), Lilly Pilly (*Syzigium* sp.) and Bottlebrush (*Callistemon* sp.) should be included to improve ecological diversity. Downstream from the bank revetment wall, the slump section should be lined with weed mat and densely planted with Spiny Mat Rush (*Lomandra hystrix*) and other deep rooted species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellingen Landcare). A similar approach is also recommended for the bank face above the revetment wall, however this would be considered of secondary priority to the aforementioned works.

2. Immediate action is recommended to stabilize the scalloped slump/sloth areas. This would involve dense planting of species such as Spiny Mat Rush (*Lomandra hystrix*), Water Gum (*Tristaniopsis laurina*) and Weeping Lily Pily (*Syzygium floribundum*), with particular attention to be focused on the toe (bottom third) area. The remainder of this section necessitates a systematic, long term approach to suppressing weeds and allowing the reestablishment of native riparian species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Current riparian vegetation width is probably appropriate; however the severe weed infestations are limiting the ecological value of this corridor.

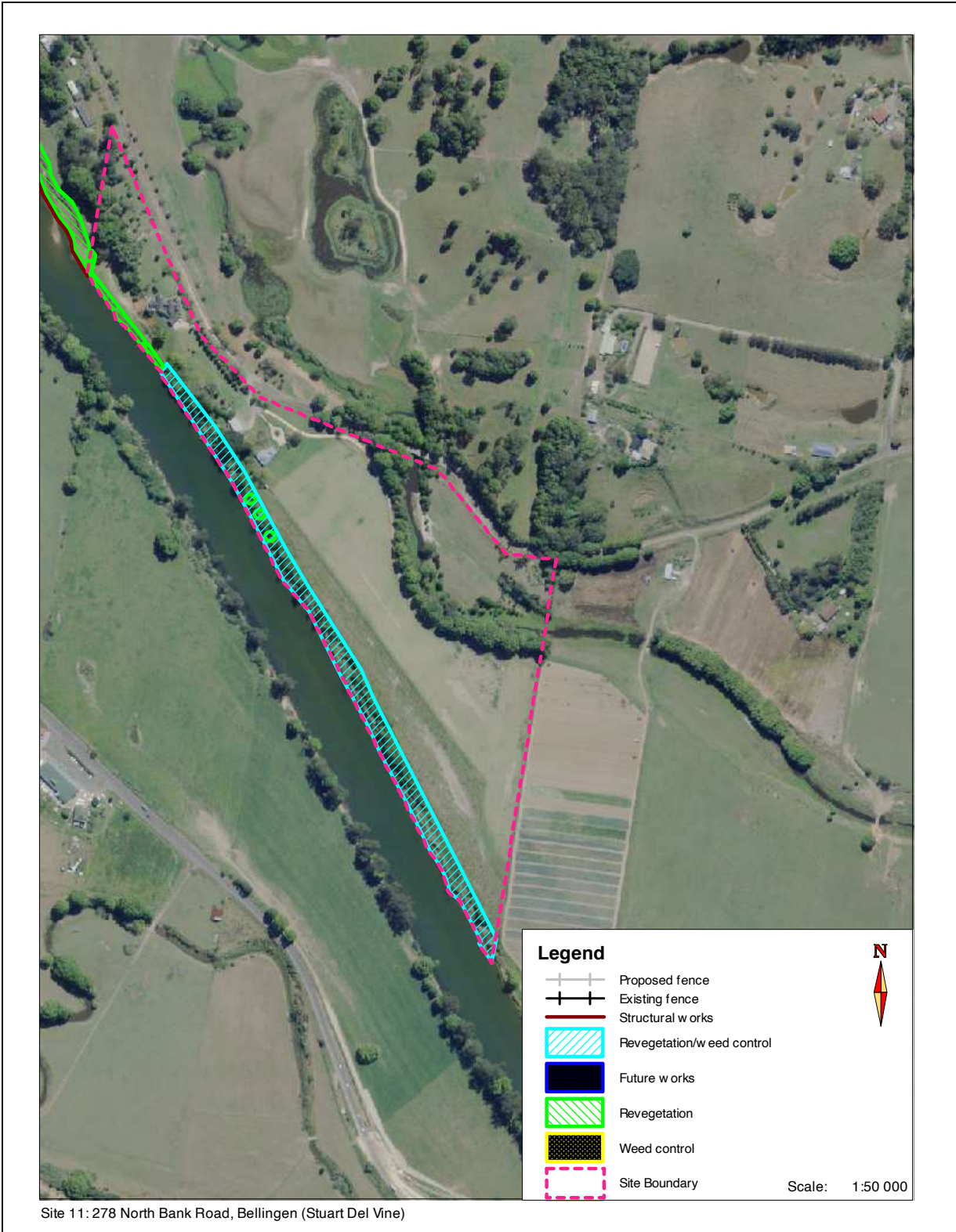


Figure 32: Site workplan map

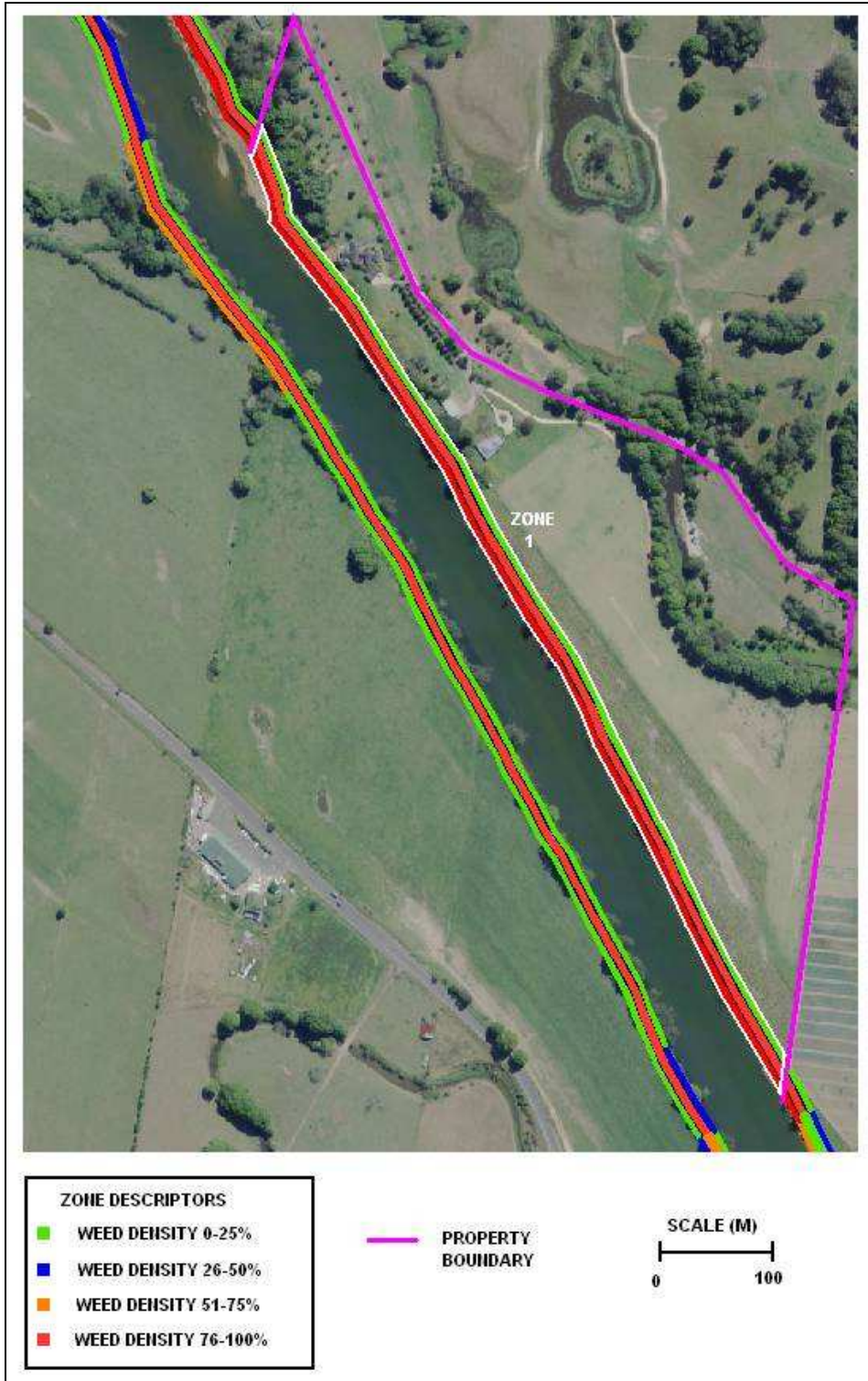


Figure 33: Riparian condition and extent

Table 23: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	10-20m
CANOPY COVER	<25%
MIDSTOREY COVER	76-100%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	N
NATURAL REGEN	N
CANOPY WEED	0%
MIDSTORY WEED	76-100%
GROUND COVER WEED	76-100%
WEED 1	Small Leaf Privet (<i>Ligustrum sinense</i>)
WEED 1 DENSITY	Dominant (>50%)
WEED 2	Blue Billy Goat (<i>Ageratum houstonianum</i>)
WEED 2 DENSITY	Clumps (11-50%)
WEED 3	Lantana (<i>Lantana camara</i>)
WEED 3 DENSITY	Dominant (>50%)
WEED 4	Balloon Vine (<i>Cardiospermum grandiflorum</i>)
WEED 4 DENSITY	Dominant (>50%)
WEED 5	Exotic grass
WEED 5 DENSITY	Few Scattered (<10%)
WEED 6	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 6 DENSITY	Few Scattered (<10%)
WEED 7	Wild Tobacco (<i>Solanum mauritianum</i>)
WEED 7 DENSITY	Few Scattered (<10%)
WEED 8	Castor Oil Plant (<i>Rinicus communis</i>)
WEED 8 DENSITY	Few Scattered (<10%)
WEED 9	Turkey Rhubarb (<i>Acetosa sagittata</i>)
WEED 9 DENSITY	Few Scattered (<10%)
WEED 10	Paulownia (<i>Paulownia tomentose</i>)
WEED 10 DENSITY	Few Scattered (<10%)
WEED 11	Mulberry (<i>Morus sp</i>)
WEED 11 DENSITY	Few Scattered (<10%)
BANK	North Bank

Table 24: Property Workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
1	Project Coordination	Technical, administrative & practical support (8 hrs @ \$50/hr)	Environmental Levy		400 (In kind)	400	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
1	Revegetation (100m ²)	Planting of key species at 1m centres to protect plunge at keywall. (\$6.50/ plant incl labour x 100 plants)		650		650	
1	Revegetation (300m ²)	Planting of key species at 1m centres to stabilise d/s of rock revegetment. (\$6.50/ plant incl labour x 300 plants) (landholder labour in kind)		900 (In kind)	1050	1950	
1	Revegetation (550m ²)	Planting of key species at 1.5m centres above revegetment wall. (\$6.50/ plant incl labour x 275 plants) (landholder labour in kind)		825 (In kind)	962	1787	
1	Revegetation (300m ²)	Planting of key species at 1m centres in erosion scallop/slump areas. (\$6.50/ plant incl labour x 300 plants) (landholder labour in kind)		900 (In kind)	1050	1950	
1	Weed eradication (contractor)	Track machine with mulching head (3 days @ \$1400/day plus float)		2000	3000	5000	
1	Weed eradication & follow-up (contractor)	Site preparation and two spraying follow-ups after mulching machine works (7 days @ \$760/day)		2128	3192	5320	

1	Revegetation (13000m ²) (contractor)	Planting of key species at 2m centres along entire riparian zone (\$6.50/ plant incl labour x 3250 plants)		9750	11375		21125
1	On-going Maintenance	Follow-up weed treatment- quarterly (27hrs/qtr) inspections and suppression as necessary for 10 years		37782 (In kind)			37782
			TOTAL	54935	20629	480	76044

Site 11b - 864 Waterfall Way, Fernmount NSW 2454

Lot/DP	Lot10DP1073931
Property Owners	BJ Martin
Catchment Details	Upper Bellinger River estuary– south & north bank; 1480m river frontage; Area: 62.5ha
Land Use	Rural – Dairy Cattle

Property Summary

This property spans a straight section through outside-inside bend alluvial flood plain. Severe erosion is evident along the outside bend section immediately upstream from bedrock outcropping at Marx Hill (zone 5). This is exacerbated by a complete lack of riparian vegetation. The remainder of the banks on this property generally exhibit minor erosion with some relatively stable sections (Cohen & Telfer, 2010). An unconsolidated laneway runs from the dairy on the high bank at Marx Hill directly down the bank to a gravel riffle section where cattle cross the river (zone 7). This area is compacted and denuded of all vegetation. Additionally, water quality is compromised (through faecal contamination and erosion) when cattle spend more time near the water's edge. Off-stream watering points and shade belts exist on both sides of the river to encourage cattle to loiter away from the river bank. Riparian vegetation exists along the majority of the remaining river bank on this property however these patches are dominated by River Oak (*Casurina cunninghamiana*) and weeds including Camphor Laurel (*Cinnamomum camphora*), Balloon Vine (*Cardiospermum grandiflorum*), Small Leaf Privet (*Ligustrum sinense*) and Lantana (*Lantana camara*).

Previous Management Efforts

N/A

Rehabilitation Strategy

A number of immediate opportunities exist to improve bank stability and riparian condition at this site. The proposed outcome will produce a passage for the cattle which minimizes impact on the River and associated riparian corridor. This can be achieved with the following approach:

1. Construction of a new concreted laneway to a restricted river cattle crossing point. The laneway will begin at the dairy on the high bank and run in a v shape across the bank where it will meet the river at the gravel bar. A fence line would be constructed along each margin of the laneway. This will concentrate cattle movement to the laneway to minimize water quality issues and degradation to soil structure in the riparian zone.
2. Two sections of rock revetment are suggested to improve bank stability and susceptibility to mass failure:
 - a. A rock revetment wall should be constructed downstream from the restricted access cattle crossing to meet with the existing revetment wall on the property immediately downstream (zone7). This will alleviate scour and slump issues

occurring during flood events as water is deflected away from the gravel riffle towards the South Bank.

- b. A second rock revetment wall is proposed for the severe erosion scald on the outside bend upstream from the bedrock outcropping at Marx Hill (zone 5).
3. It is crucial that both of these sections of revetment are fenced and accompanied by vegetation. A minimum fence line setback of five metres from the crest of the bank is recommended. Within this area, accompanying revegetation using species outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare) will be critical to ensuring flood resilience over the long term. Root complexes provided by the vegetation strip will bind the mid-upper bank and minimise the potential for outflanking behind the revetment structure during floods. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

Additional work may be negotiated with the landholder at a future time to improve the riparian condition along the straight section upstream of the aforementioned works.

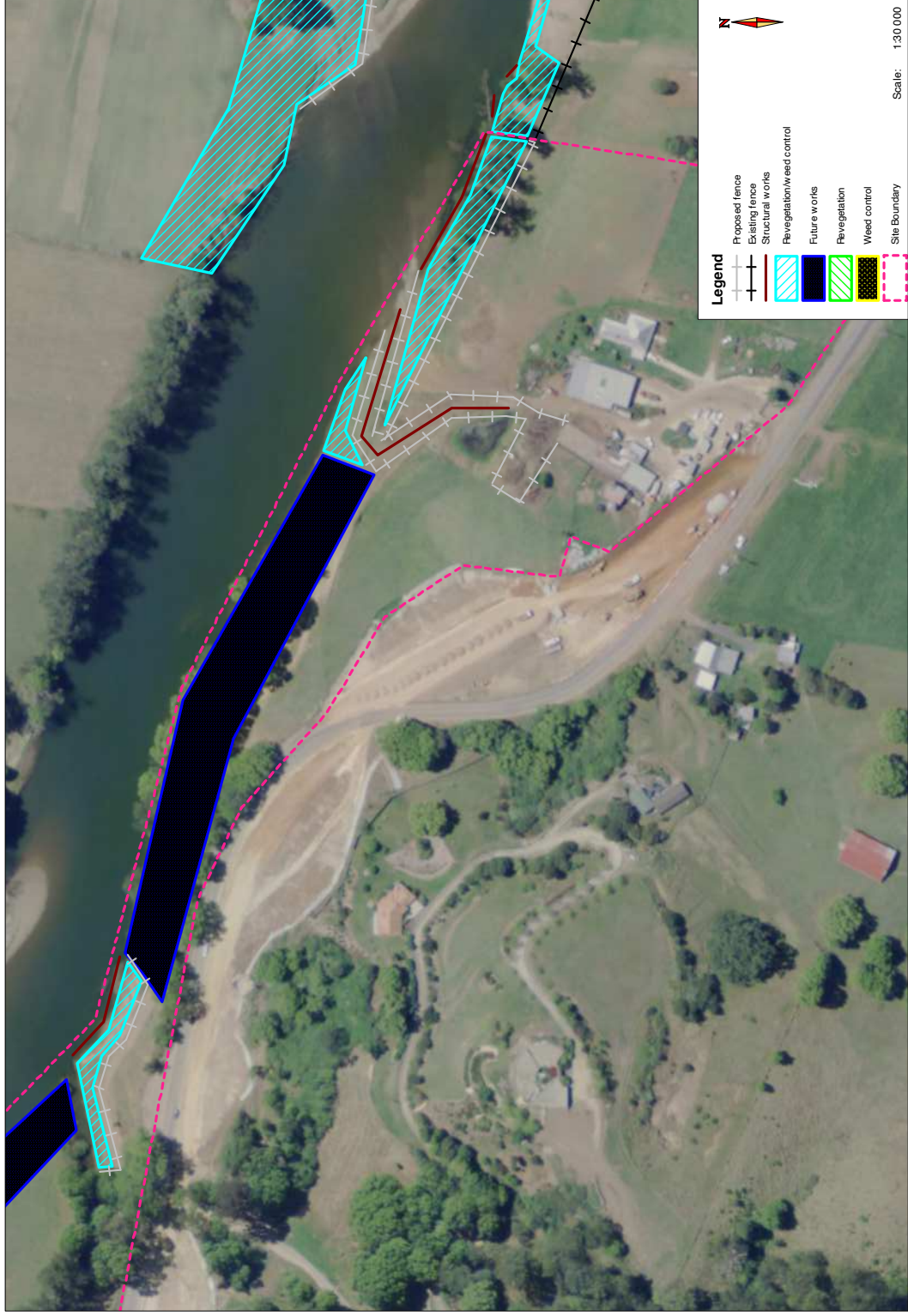


Figure 34: Property workplan map

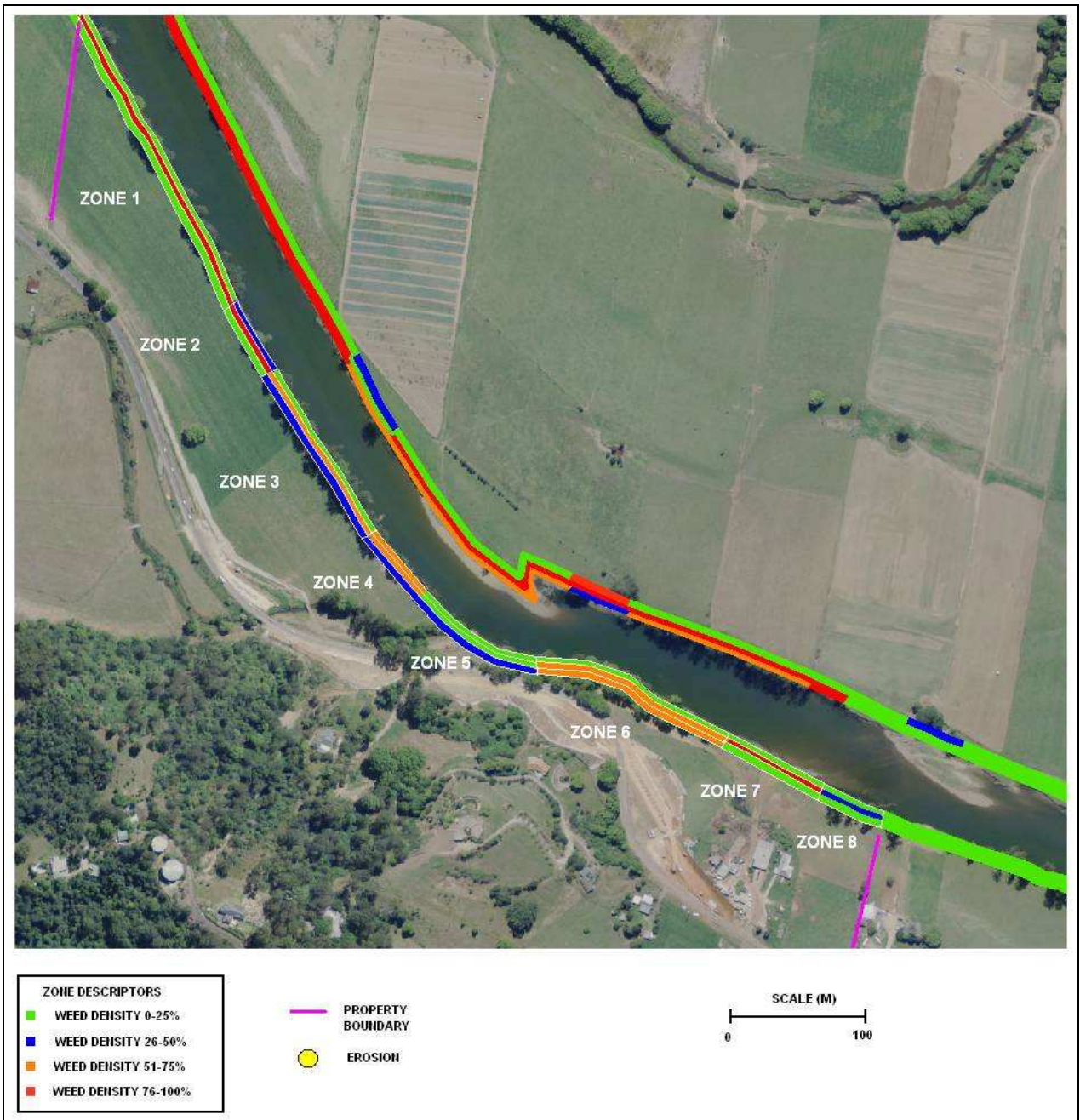


Figure 35: Riparian condition and extent

Table 25: Riparian condition summary

MGT ZONE	1	2	3	4	5	6	7	8
ASSESSOR	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris
RIPARIAN WIDTH	5-10m	5-10m	<5m	<5m	10-20m	10-20m	5-10m	5-10m
CANOPY COVER	76-100%	Cleared	76-100%	26-50%	<25%	76-100%	Cleared	51-75%
MIDSTOREY COVER	26-50%	26-50%	51-75%	26-50%	<25%	76-100%	<25%	<25%
GROUNDCOVER	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%	51-75%	76-100%
APPROPRIATE COVER	N	N	N	N	Y	Y	N	N
GRAZING IMPACT	Y	Y	Y	N	N	N	Y	N
NATURAL REGEN	N	N	Y	Y	N	N	N	Y
CANOPY WEED	<25%	0%	26-50%	26-50%	26-50%	51-75%	0%	0%
MIDSTOREY WEED	76-100%	76-100%	51-75%	51-75%	<25%	51-75%	76-100%	26-50%
GROUNDCOVER WEED	0%	26-50%	<25%	51-75%	0%	<25%	0%	<25%
WEED 1	Camphor Laurel (Cinnamomum camphora)	Small Leaf Privet (Ligustrum sinense)	Camphor Laurel (Cinnamomum camphora)	Small Leaf Privet (Ligustrum sinense)	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)	Wild Tobacco (Solanum mauritianum)	Lantana (Lantana camara)
WEED 1 DENSITY	Clumps (11-50%)	Dominant (>50%)	Clumps (11-50%)	Clumps (11-50%)	Few Scattered (<10%)	Dominant (>50%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 2	Small Leaf Privet (Ligustrum sinense)	Balloon Vine (Cardiospermum grandiflorum)	Lantana (Lantana camara)	Lantana (Lantana camara)	Small Leaf Privet (Ligustrum sinense)	Small Leaf Privet (Ligustrum sinense)		Camphor Laurel (Cinnamomum camphora)
WEED 2 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Clumps (11-50%)	Few Scattered (<10%)	Dominant (>50%)		Few Scattered (<10%)

WEED 3	Balloon Vine (Cardiospermum grandiflorum)	Wild Tobacco (Solanum mauritianum)	Balloon Vine (Cardiospermum grandiflorum)	Camphor Laurel (Cinnamomum camphora)	Lantana (Lantana camara)	Blue Billy Goat (Ageratum houstonianum)
WEED 3 DENSITY	Dominant (>50%)	Few Scattered (<10%)	Clumps (11-50%)	Clumps (11-50%)	Clumps (11-50%)	Few Scattered (<10%)
WEED 4		Blue Billy Goat (Ageratum houstonianum)	Balloon Vine (Cardiospermum grandiflorum)		Wild Tobacco (Solanum mauritianum)	Wild Tobacco (Solanum mauritianum)
WEED 4 DENSITY		Clumps (11-50%)	Few Scattered (<10%)	Clumps (11-50%)	Clumps (11-50%)	Few Scattered (<10%)
WEED 5			Mistflower (Eupatorium riparium)	Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	
WEED 5 DENSITY			Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)	
WEED 6			Small Leaf Privet (Ligustrum sinense)			
WEED 6 DENSITY			Clumps (11-50%)			
BANK	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank

Table 27: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (14 hrs @ \$50/hr)	Environmental Levy		700 (In kind)	700	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
	Structural Works (contractor)	Purchase, delivery and placement of materials for rock revetment (70m @ \$200/m)		14000		14000	
	Fence construction (125m)	Landholder to supply materials and erect fence lines to restrict cattle to laneway and river access ramp (125m @ \$5000/km)		625		625	
	Revegetation (300m ²)	Planting of key species at 2m centres along top of bank and face. (\$6.50/ plant incl labour x 75 plants)			488	488	
	Laneway construction	Extension of concreted laneway to connect dairy with limited access river crossing (140m x 2.4m @ \$50/m) (Landholder labour in-kind, 40hrs @ \$50/hr)		2000 (In kind)	7000	9000	
	Structural Works (contractor)	Purchase, delivery and placement of materials for rock revetment (50m @ \$350/m)			17500	17500	
	Fence construction (550m)	Landholder to supply materials and erect fence lines to restrict cattle to laneway and river access ramp (660m @ \$5000/km)		2750		2750	
	Revegetation (1600m ²)	Planting of key species at 2m centres along top of bank and face.			2600	2600	

									1050	1050
All	Batter shear bank (optional)	(\$6.50/ plant incl labour x 500 plants) Batter crest of shear bank face to facilitate better plant establishment (7hrs @ \$150/hr)								
	On-going Maintenance	Follow-up weed treatment- quarterly (6hrs / qtr) inspections and suppression as necessary for 10 years				8400 (In kind)				8400
			TOTAL			13775		42638	780	57193

Site 11c - North Bank Road, Bellinger NSW 2454

Lot/DP	Lot7302DP1162884
Property Owners	Crown Land
Catchment Details	Upper Bellinger River estuary – south bank; 225m river frontage; Area: 0.8ha
Land Use	Unallocated Crown Land

Property Summary

This site is mid-way along a straight section alluvial floodplain. However due to a gravel riffle/bar running diagonally across the river immediately downstream, the site behaves as if on a slight inside bend with deposition of material occurring at the downstream end (zone 3). At the upstream end of the site (zone 1), the bank is undermining with overall active erosion considered to be minor in severity (Cohen & Telfer, 2010). Vegetation cover at this site is sparse with a few weed species such as Turkey Rhubarb (*Acetosa sagittata*), Small Leaf Privet (*Ligustrum sinense*) and Lantana (*Lantana camara*).

Previous Management Efforts

N/A

Rehabilitation Strategy

The rehabilitation strategy should focus on recreating a riparian corridor with deep rooted local native plant species. As an unallocated parcel of Crown Land, it is recommended that the entire land parcel be revegetated. Accompanying fence lines will need to be erected, both on the landward and river side of the revegetation plot. This will minimise the chance of dairy cattle (adjacent property, Site 11b) from straying into the area after crossing the river. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

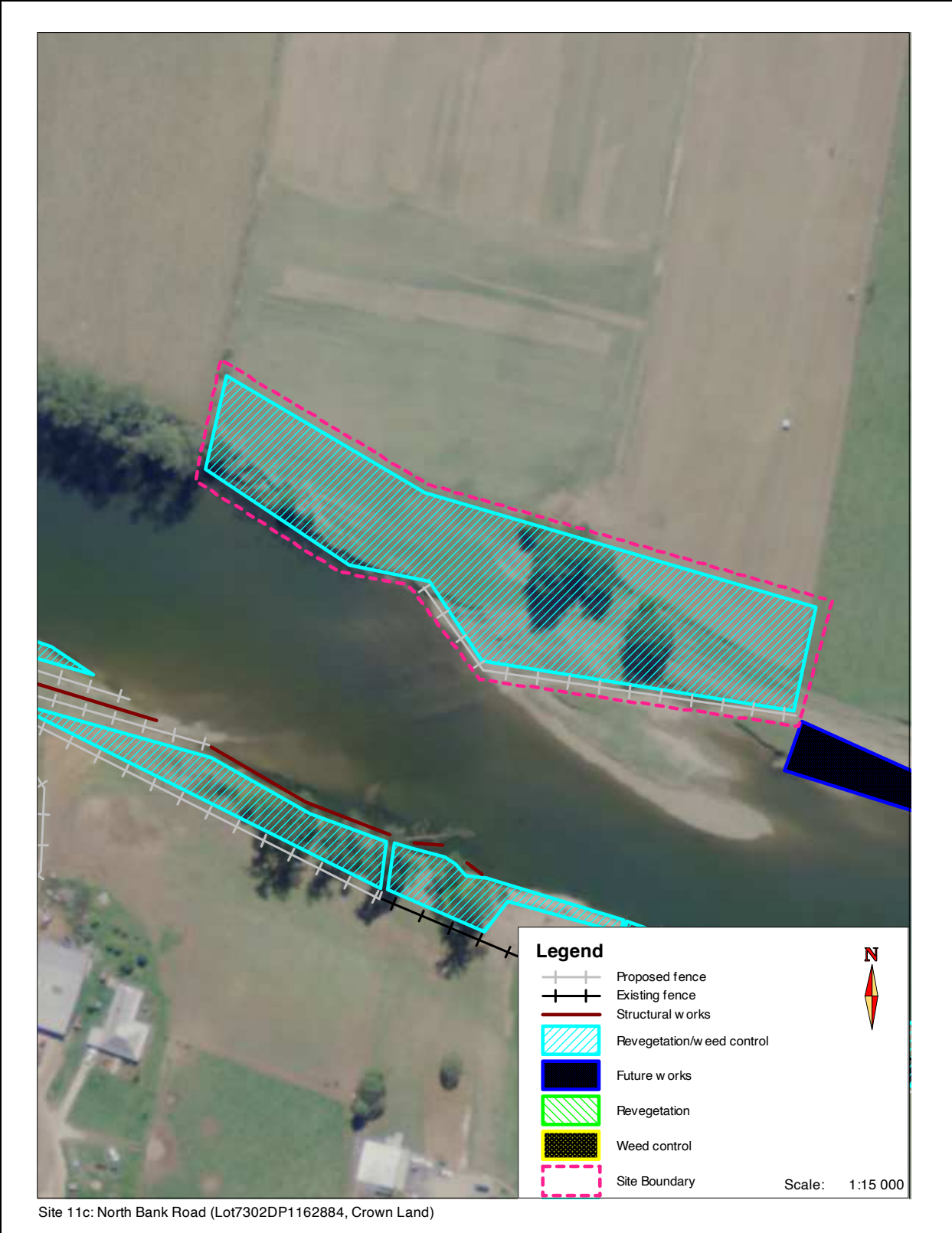


Figure 36: Site workplan map

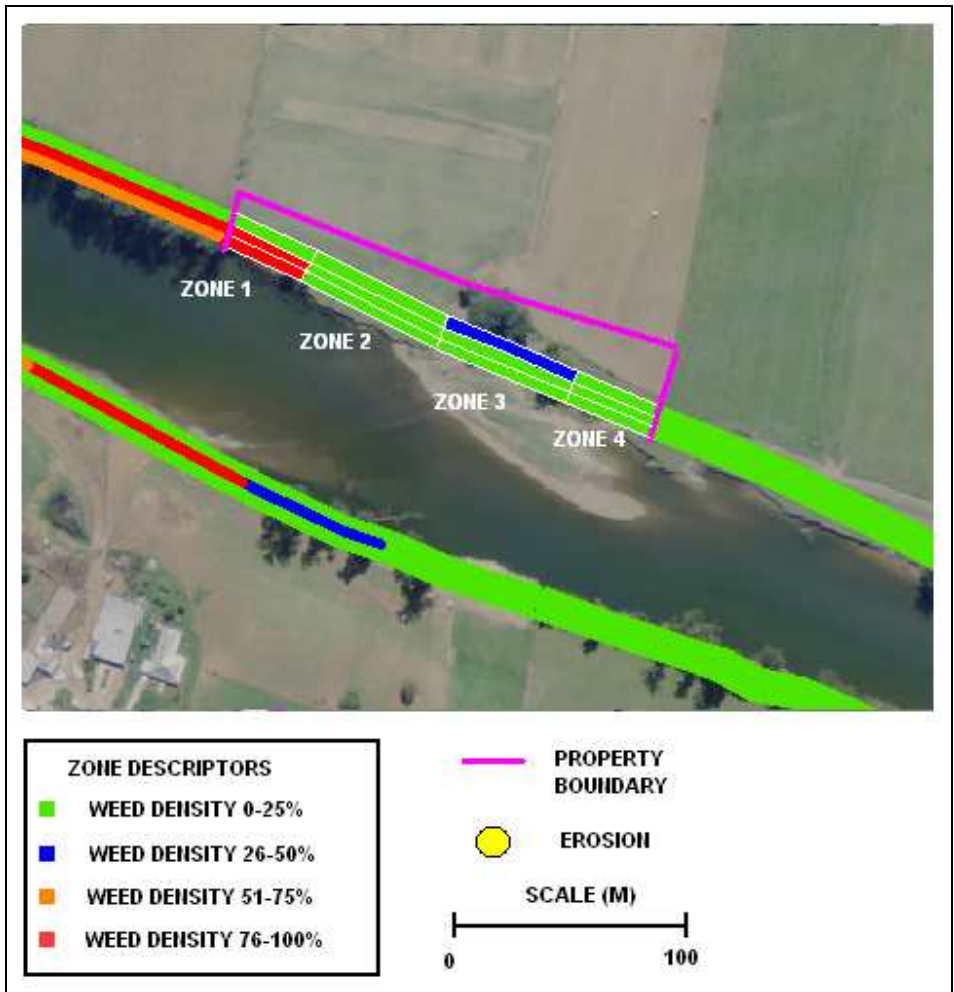


Figure 37: Riparian condition and extent

Table 28: Riparian condition summary

MGT ZONE	1	2	3	4
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	<5m	20-30m	5-10m
CANOPY COVER	Cleared	Cleared	<25%	Cleared
MIDSTOREY COVER	76-100%	Cleared	Cleared	Cleared
GROUND COVER	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	N
GRAZING IMPACT	Y	Y	Y	Y
NATURAL REGEN	N	N	N	N
CANOPY WEED	0%	0%	26-50%	0%
MIDSTORY WEED	76-100%	0%	0%	0%
GROUND COVER WEED	76-100%	<25%	0%	<25%
WEED 1	Small Leaf Privet (Ligustrum sinense)	Mistflower (Eupatorium riparium)	Camphor Laurel (Cinnamomum camphora)	Blue Billy Goat (Ageratum houstonianum)
WEED 1 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)
WEED 2	Mistflower (Eupatorium riparium)	Blue Billy Goat (Ageratum houstonianum)		Fire Weed (Senecio madagascariensis)
WEED 2 DENSITY	Clumps (11-50%)	Few Scattered (<10%)		Few Scattered (<10%)
WEED 3	Blue Billy Goat (Ageratum houstonianum)	Fire Weed (Senecio madagascariensis)		
WEED 3 DENSITY	Clumps (11-50%)	Few Scattered (<10%)		
WEED 4	Castor Oil Plant (Rinicus communis)	Turkey Rhubarb (Acetosa sagittata)		
WEED 4 DENSITY	Clumps (11-50%)	Few Scattered (<10%)		
WEED 5	Lantana (Lantana camara)			
WEED 5 DENSITY	Few Scattered (<10%)			
BANK	North Bank	North Bank	North Bank	North Bank

Table 29: Property workplan

<i>Mgt Zone</i>	<i>Activity</i>	<i>Activity Details</i>	<i>Source of Potential Funding (optional)</i>	<i>Indicative Cost (\$ ex GST)</i>			
				<i>Landholder</i>	<i>Contributions</i>		<i>Total Budget</i>
					<i>NRCMA or Other</i>	<i>Bellingen Shire Council</i>	
All	Project Coordination	Technical, administrative & practical support (8 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Fencing (contractor)	Fencing contractor to erect fence to stop livestock from entering revegetation plot (440m @ \$5000/km)		2200		2200	
2	Weed Control (contractor)	Spray herbicide and/or remove weeds site (1 day @ \$800/day)		800		800	
All	Revegetation (8000m ²)	Planting of key species at 2m centres (\$6.50/ plant incl labour x 2000 plants)		13000		13000	
All	On-going Maintenance	Follow-up weed treatment- quarterly (12hrs / qtr) inspections and suppression as necessary for 10 years		16680		16680	
			TOTAL	32680	880	33560	

Site 12 - 850 Waterfall Way, Fernmount NSW 2454

Lot/DP	LotA DP913988
Property Owners	S & JE Shields
Catchment Details	Upper Bellinger River estuary – south bank; 82m river frontage; Area: 1.72ha
Land Use	Residential/Commercial – Cabins

Property Summary

This site is mid-way along a straight section alluvial high bank. However due to a gravel riffle/bar running diagonally across the river immediately upstream, low-mid level stream flows are deflected into the bank at this site, resulting in significant erosion in recent times. In an attempt to combat this issue, a rock revetment wall has been constructed along the downstream two thirds of this site which has been successful in stabilizing the bank toe. Immediately upstream of the revetment wall are two scalloped scour points which are largely denuded of vegetation and at risk of further undermining of the bank. Overall active erosion for this site is considered to be minor in severity (Cohen & Telfer, 2010). Vegetation cover at this site is sparse with a limited number of Spiny Mat Rush (*Lomandra hystrix*) remaining after destructive floods in 2009 and a few other isolated trees including Weeping Lily Pily (*Syzygium floribundum*), Thin Fruited Tea Tree (*Leptospermum brachyandrum*) and Camphor Laurel (*Cinnamomum camphora*). The remainder of the bank face is managed as a lawn. Overall the site lacks diversity and deep rooted complexes.

Previous Management Efforts

Funding was obtained to construct a rock revetment wall along part of the eroding bank. Some accompanying revegetation was undertaken using mainly *Lomandra* (*Lomandra longifolia*).

Rehabilitation Strategy

The rehabilitation strategy should focus on recreating a riparian buffer with deep rooted plant species. This should be accompanied by additional structural works to increase hydraulic roughness and stabilize the bank upstream of the revetment wall. Initial structural works would include installation of double pin sets and rock revetment to deflect flows away from defined scour points and stabilise adjacent banks (see figure x). Following structural works the bank face would be revegetated with a mix of plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). A minimum vegetation width of five metres back from the bank crest is recommended to maximize resilience against future flood events. This buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment.

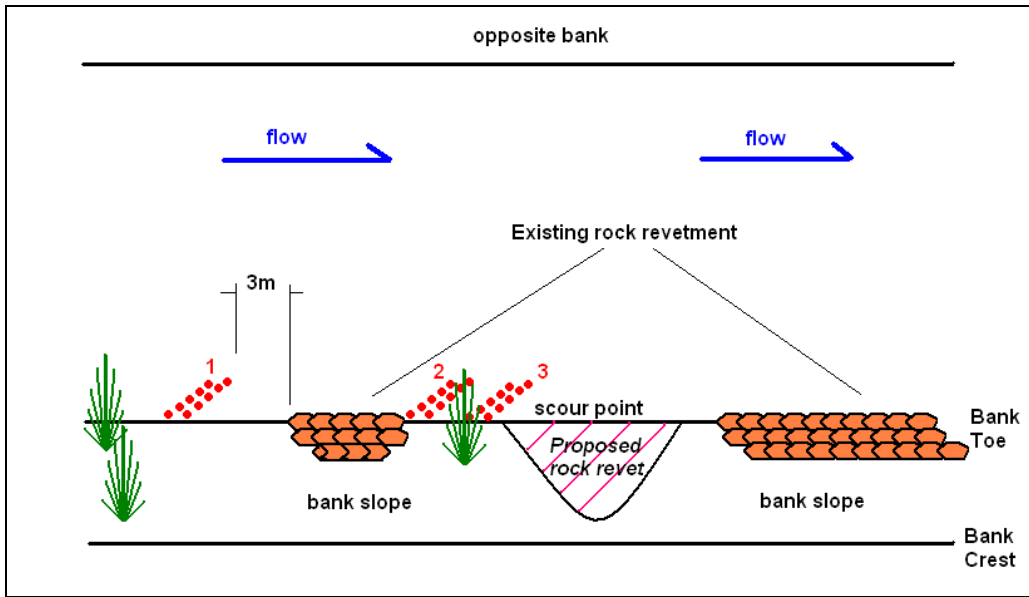


Figure 38: Design and layout for structural works



Figure 39: Site workplan map

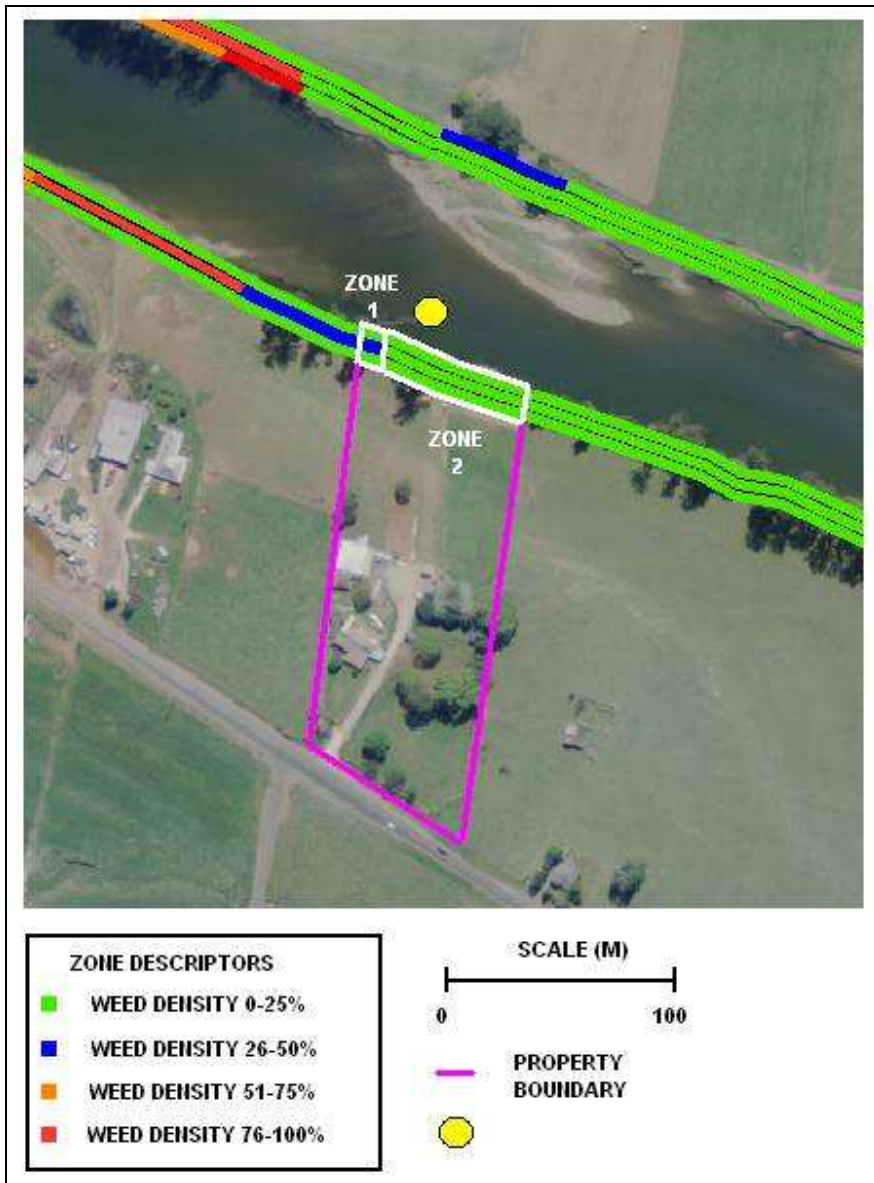


Figure 40: Riparian condition and extent

Table 30: Riparian condition summary

MGT ZONE	1
ASSESSOR	S. Morris
RIPARIAN WIDTH	5-10m
CANOPY COVER	<25%
MIDSTOREY COVER	<25%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	N
NATURAL REGEN	N
CANOPY WEED	<25%
MIDSTORY WEED	<25%
GROUND COVER WEED	0%
WEED 1	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 1 DENSITY	Few Scattered (<10%)
BANK	South Bank

Table 31: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (8 hrs @ \$50/hr)	Environmental Levy		400 (In kind)	400	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Fence realignment	Landholder to dismantle (4hrs @ \$30/hr); fencing contractor to erect after job completed to stop livestock from entering river bank area (120m @ \$3000/km) (landholder labour in kind)		120 (In kind)	360	480	
2	Structural Works (contractor)	Purchase, delivery and placement of materials for rock revetment and pin groynes. (refer to CMA site action plan for details)			6182	6182	
2	Preliminary weed control on scallop area	Spray herbicide and/or remove weeds from scalloped area (2hrs @ \$30/hr + herbicide)		65 (In kind)		65	
All	Revegetation (1400m ²)	Planting of key species at 2m centres (\$6.50/ plant incl labour x 350 plants) (landholder labour in kind)		1050 (In kind)	1125	2175	
All	On-going Maintenance	Follow-up weed treatment- quarterly (4.5hrs / qtr) inspections and suppression as necessary for 10 years		8677 (In kind)		8677	
			TOTAL	9912	7667	18059	480

Site 13 - 838 Waterfall Way, Fernmount NSW 2454

Lot/DP	Lot1 DP1085422; Lot2 DP1085422
Property Owners	Jennifer Anne Snell
Catchment Details	Upper Bellinger River estuary – south bank; 128m river frontage; Area: 3ha
Land Use	Rural – Beef Cattle

Property Summary

This property spans the lower end of a straight section high bank alluvial floodplain. Due to a relatively intact and well established riparian corridor and the geomorphic character of this stretch of the river, bank erosion issues at this site are minimal. The bank is considered stable according to Cohen & Telfer (2010). Vegetation along this site includes notable native species such as River Oak (*Casurina cunninghamiana*), Sandpaper Fig (*Ficus coronata*) and Guoia (*Guoia semiglauca*). Widespread native regeneration is also evident, however significant weed infestations chiefly Small Leaf Privet (*Ligustrum sinense*), Balloon Vine (*Cardiospermum grandiflorum*), Lantana (*Lantana camara*) and Camphor Laurel (*Cinnamomum camphora*) are threatening long term regeneration potential.

Previous Management Efforts

A fence line has been erected to restrict stock access to the river approximately 2-4 metres back from the bank crest.

Rehabilitation Strategy

Target condition can be achieved at this site by expanding canopy cover and increasing mid-understory diversity within the riparian zone. Initial weed control should be undertaken along the bank face to control the aforementioned weed species. Subsequent follow up planting should be undertaken to fill in canopy gaps, understory and increase structural complexity along the bank face. It is recommended that the riparian zone is extended an additional five metres back from the crest of the bank to ensure resilience against future flood events. The Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare) will provide a list of suitable species for revegetation. An accompanying fence line will need to be established to exclude cattle from the regeneration area. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

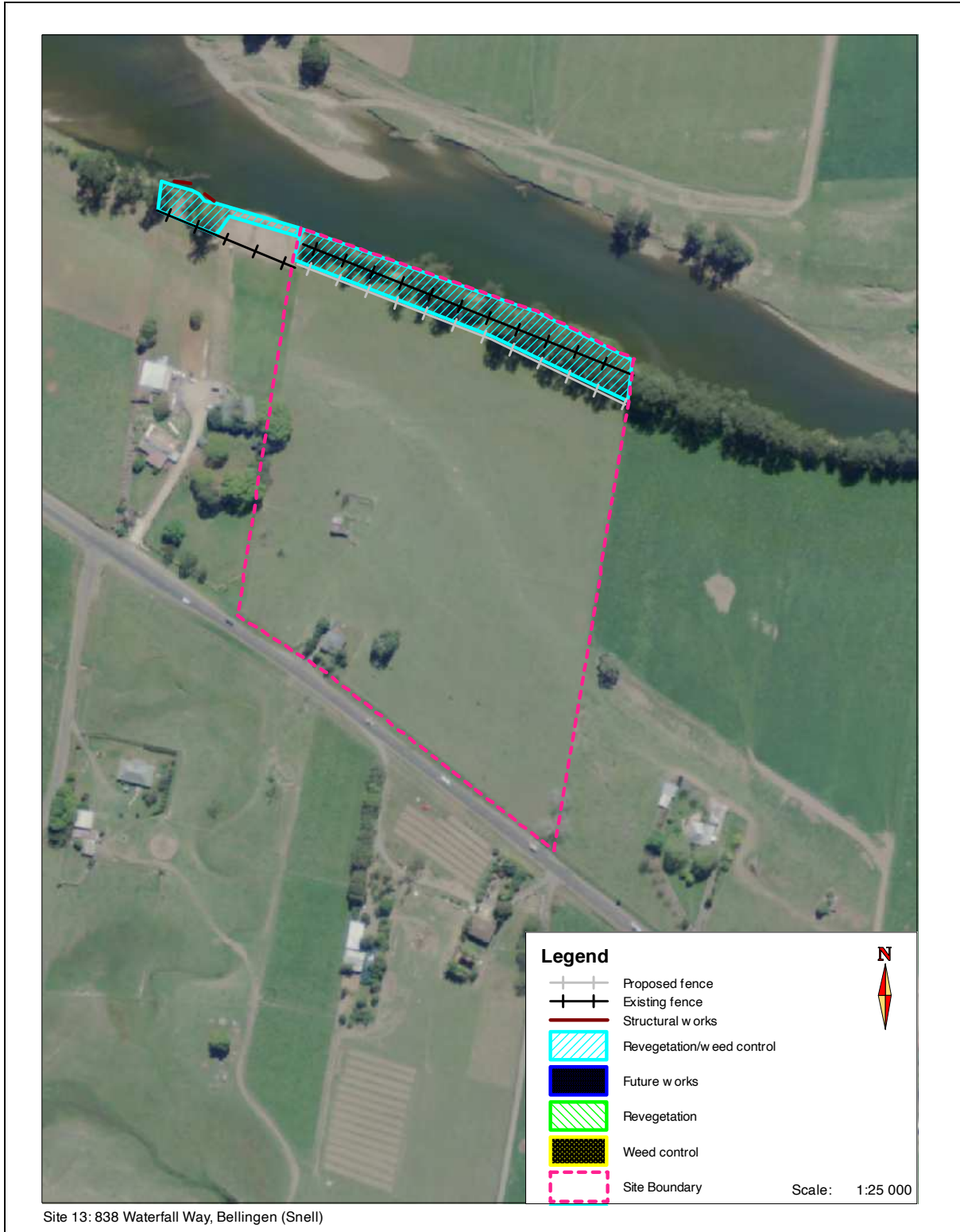


Figure 41: Site workplan map



Figure 42: Riparian condition and extent

Table 32: Riparian condition summary

MGT ZONE	1
ASSESSOR	S. Morris
RIPARIAN WIDTH	5-10m
CANOPY COVER	76-100%
MIDSTOREY COVER	<25%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	N
NATURAL REGEN	Y
CANOPY WEED	<25%
MIDSTORY WEED	<25%
GROUND COVER WEED	<25%
WEED 1	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 1 DENSITY	Clumps (11-50%)
WEED 2	Balloon Vine (<i>Cardiospermum grandiflorum</i>)
WEED 2 DENSITY	Clumps (11-50%)
WEED 3	Small Leaf Privet (<i>Ligustrum sinense</i>)
WEED 3 DENSITY	Few Scattered (<10%)
WEED 4	Blue Billy Goat (<i>Ageratum houstonianum</i>)
WEED 4 DENSITY	Few Scattered (<10%)
WEED 5	Lantana (<i>Lantana camara</i>)
WEED 5 DENSITY	Clumps (11-50%)
BANK	South Bank

Table 33: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
1	Project Coordination	Technical, administrative & practical support (6 hrs @ \$50/hr)	Environmental Levy		300 (In kind)	300	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
1	Weed Control	Spraying of weeds along bank crest and upper bank face with tractor spray unit (7hrs @ \$80/hr plus herbicide)		650 (In kind)		650	
1	Weed Control (contractor)	Manual weed eradication along bank face and toe (5 days @ \$760/day)			3800	3800	
1	Revegetation (2500m ²) (contractor)	Planting of key species at 2m centres along top of bank and face. (\$6.50/ plant incl labour x 625 plants)			4062	4062	
1	Fence construction	Materials to be supplied for landholder to erect fence (128m @ \$9250/km)		500 (In kind)	682	1182	
1	On-going Maintenance	Follow-up weed treatment- quarterly (7hrs / qtr) inspections and suppression as necessary for 10 years		9694 (In kind)		9694	
			TOTAL	10844	8544	19768	380

Site 14 - 794 Waterfall Way, Fernmount NSW 2454

Lot/DP	Lot12 DP848075
Property Owners	MW & ML Perry
Catchment Details	Upper Bellinger River estuary– south bank only; 380m river frontage; Area: 16.2ha
Land Use	Rural – Dairy Cattle

Property Summary

This property spans an outside-inside bend alluvial flood plain which has undergone significant channel migration since the first aerial photographic records in 1942. Photogrammetrically derived high bank locations suggest that the outside bend at this site (zones 1-2) has eroded approximately 65m and the south bank in 1942 was located where a vegetated gravel bar now lies on the opposing north bank. Bank erosion appears to have slowed significantly since 2002 and channel alignment appears to be approaching a more stable equilibrium. Nevertheless, due a lack of riparian vegetation this section of the bank is vulnerable to undermining in future flood events. Currently there is a sheer face (approx 4-5m in height) that appears to be undergoing mass failure during flood events. Active erosion is considered severe along this outside bend. On the contrary, the inside bend at this site is aggrading material and considered to be stable (Cohen & Telfer, 2010). Cattle damage is a major issue to bank stability along the length of this site. An unconsolidated laneway runs along the top of the high bank and this area is compacted and denuded of all vegetation. Cattle cross the river at the beginning of the inside bend section (zone 3). Stock tend to trample and loiter around this crossing point where they are exacerbating bank degradation issues. Additionally, water quality is compromised (through fecal contamination and erosion) when cattle spend more time near the water's edge. Off-stream watering points and shade belts exist on both sides of the river to encourage cattle to loiter away from the river bank. A concrete laneway also runs laterally through the property from the dairy to the river's edge at the apex of the outside bend (boundary zone 2 & 3), where it meets with the unconsolidated laneway running along the top of the high bank. Some riparian vegetation remains at this site, mainly at the upper and lower extents of the outside bend. These patches are dominated by River Oak (*Casurina cunninghamiana*) and weeds including Camphor Laurel (*Cinnamomum camphora*), Balloon Vine (*Cardiospermum grandiflorum*), Blue Billy Goat (*Ageratum houstonianum*) and Mistflower (*Eupatorium riparium*).

Previous Management Efforts

N/A

Rehabilitation Strategy

A number of opportunities exist to improve bank stability and riparian condition at this site. The proposed outcome will produce a passage for the cattle which minimizes impact on the River and associated riparian corridor. This can be achieved with the following approach:

1. Construction of a new concreted laneway to a restricted river access point. The laneway will begin at where the cattle cross the river (zone 3) and run diagonally across the paddock

where it will merge with the existing concreted laneway. A fence line would be constructed along each margin of the laneway. This will concentrate cattle movement to the laneway which will be as far away from the river bank as practicable to minimize water quality issues and degradation to soil structure in the riparian zone.

2. Construction of a restricted cattle access ramp at the River crossing. Two options are available for this ramp:
 - a. Extend the concrete laneway all the way to the water's edge. This has the benefit of being more permanent and easy to maintain if floods deposit alluvium onto the ramp. However in the advent of adverse flooding causing further erosion, the ramp could be undermined or outflanked.
 - b. Construct a gravel bed ramp using rail ballast material. This could potentially be sourced from the adjacent aggrading gravel bar, however relevant approvals would be required. The drawback of this option is that further deposition of material on top of the gravel ramp may compromise its functionality.

In both cases the ramp would be fenced and the currently degraded batters on either side of the ramp area would be heavily revegetated.

3. The existing unconsolidated laneway that runs along the edge of the high bank should be revegetated to a minimum distance of five metres back from the crest of the bank. Accompanying vegetation should be planted along the bank face and toe (where possible). This will provide a bare minimum in terms of resilience against future erosion and slumping during flood events. Battering of the bank crest may be advantageous in terms of minimizing the potential for further mass failure; however the cost of this exercise may outweigh the long term benefits. A diversity of deep rooted plant species (refer to Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare)) should be chosen in order to create root complexes to buffer against erosive flood forces. This buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Accompanying fence lines will need to be established to exclude cattle from the regeneration area. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

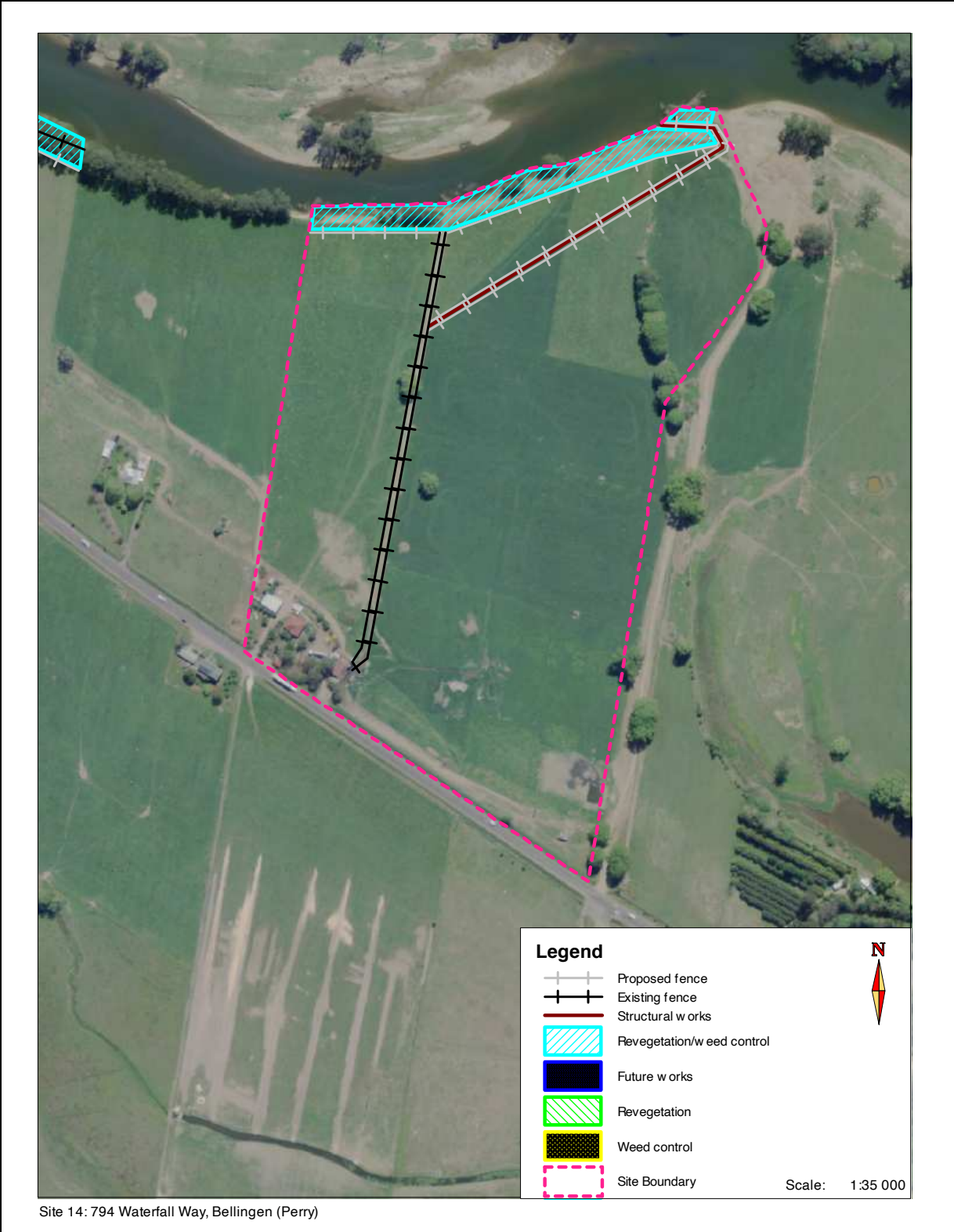


Figure 43: Property workplan map

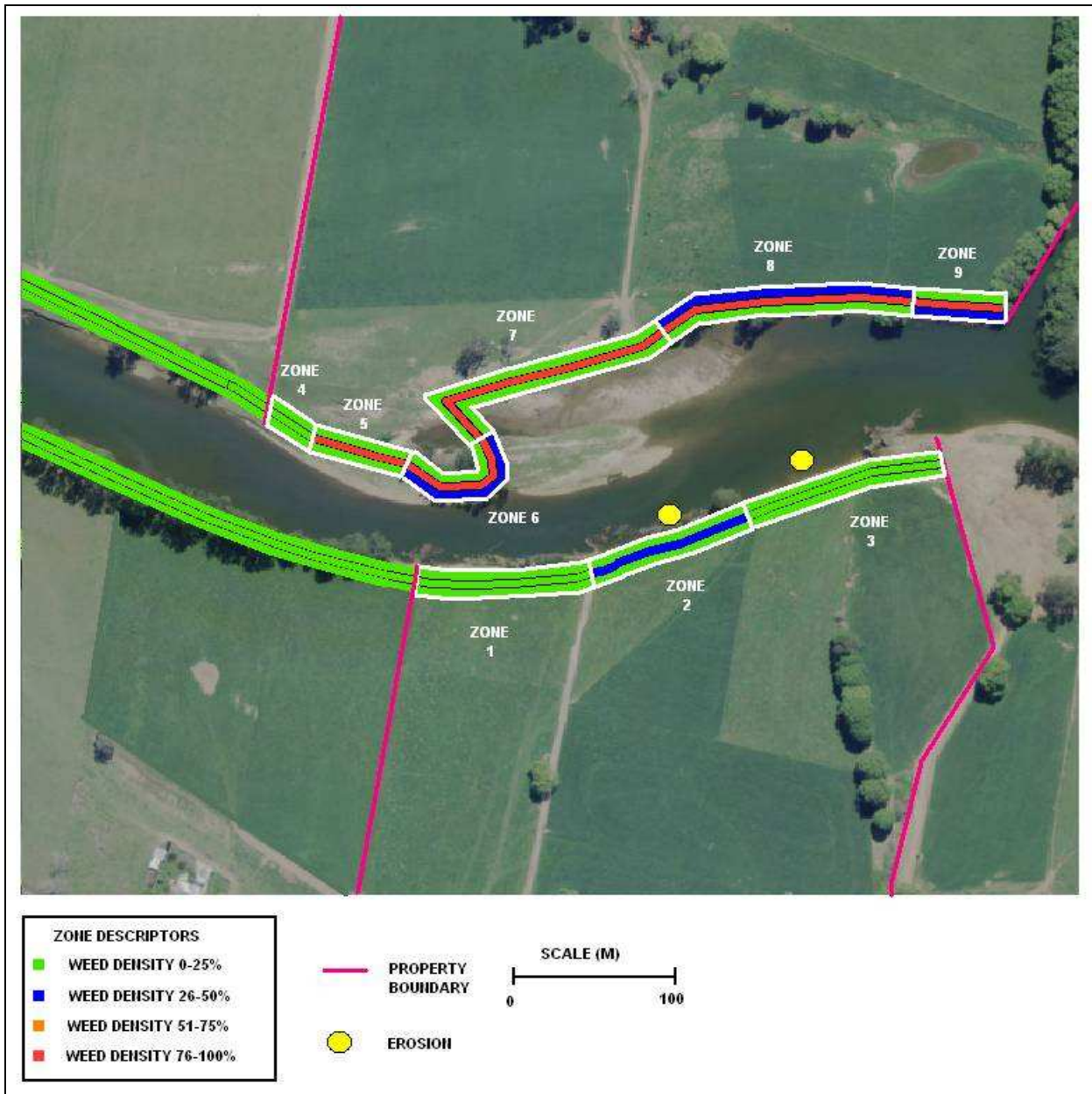


Figure 44: Riparian condition and extent

Table 34: Riparian condition summary

MGT_ZONE	1	2	3	4	5	6	7	8	9
ASSESSOR	S. Morris	S. Morris	S. Morris	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	5-10m	0m	0m	0m	5-10m	<5m	<5m	<5m
CANOPY COVER	51-75%	<25%	Cleared	Cleared	Cleared	76-100%	Cleared	51-75%	Cleared
MIDSTOREY COVER	26-50%	<25%	Cleared	Cleared	<25%	<25%	<25%	<25%	<25%
GROUNDCOVER	76-100%	51-75%	26-50%	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	N	N	Y	N	N	N
GRAZING IMPACT	N	N	Y	Y	Y	Y	Y	Y	Y
NATURAL REGEN	Y	Y	N	N	N	Y	N	Y	N
CANOPY WEED	0%	0%	0%	0%	0%	0%	0%	26-50%	0%
MIDSTOREY WEED	<25%	26-50%	0%	0%	76-100%	76-100%	76-100%	76-100%	76-100%
GROUNDCOVER WEED	<25%	0%	0%	<25%	0%	26-50%	<25%	<25%	26-50%
WEED 1	Balloon Vine (Cardiospermum grandiflorum)	Camphor Laurel (Cinnamomum camphora)	Fire Weed (Senecio madagascariensis)	Blue Billy Goat (Ageratum houstonianum)	Coral Tree (Erythrina sykesii)	Camphor Laurel (Cinnamomum camphora)	Castor Oil Plant (Ricinus communis)	Wild Tobacco (Solanum mauritianum)	Small Leaf Privet (Ligustrum sinense)
WEED 1 DENSITY	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 2	Lantana (Lantana camara)	Lantana (Lantana camara)		Fire Weed (Senecio madagascariensis)	Fire Weed (Senecio madagascariensis)	Small Leaf Privet (Ligustrum sinense)		Small Leaf Privet (Ligustrum sinense)	Wild Tobacco (Solanum mauritianum)

WEED 2 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 3	Blue Billy Goat (Ageratum houstonianum)	Fire Weed (Senecio madagascariensis)		Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	Blue Billy Goat (Ageratum houstonianum)	Camphor Laurel (Cinnamomum camphora)	Mistflower (Eupatorium riparium)
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)		Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)
WEED 4	Mistflower (Eupatorium riparium)			Mistflower (Eupatorium riparium)	Mistflower (Eupatorium riparium)	Mistflower (Eupatorium riparium)	Mistflower (Eupatorium riparium)	Mistflower (Eupatorium riparium)	Mistflower (Eupatorium riparium)	Mistflower (Eupatorium riparium)	Blue Billy Goat (Ageratum houstonianum)
WEED 4 DENSITY	Few Scattered (<10%)			Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Clumps (11-50%)
WEED 5	Fire Weed (Senecio madagascariensis)			Wild Tobacco (Solanum mauritianum)					Balloon Vine (Cardiospermum grandiflorum)		Fire Weed (Senecio madagascariensis)
WEED 5 DENSITY	Few Scattered (<10%)			Few Scattered (<10%)				Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 6				Fire Weed (Senecio madagascariensis)				Fire Weed (Senecio madagascariensis)	Fire Weed (Senecio madagascariensis)		
WEED 6 DENSITY				Few Scattered (<10%)				Few Scattered (<10%)	Few Scattered (<10%)		
BANK	South Bank	South Bank	South Bank	North Bank	North Bank	North Bank	North Bank	North Bank	North Bank	North Bank	North Bank

Table 35: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (14 hrs @ \$50/hr)	Environmental Levy		700 (In kind)	700	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
2-3	Laneway construction	Extension of concreted laneway to connect dairy with limited access river crossing (270m x 2.4m @ \$50/m)		5400	8100	13500	
3	Limited access crossing ramp (concrete option)**	Construction of limited access ramp for cattle to cross river (40m x 2.4m @ \$50/m)		800	1200	2000	
2-3	Fence construction (700m)	Landholder to supply materials and erect fence lines to restrict cattle to laneway and river access ramp		2100		2100	
	Weed Control (contractor)	Manual weed eradication along bank face and toe (2 days @ \$760/day)			1520	1520	
All	Revegetation (3800m ²)	Planting of key species at 2m centres along top of bank and face. (\$6.50/ plant incl labour x 950 plants) (landholder labour in kind)		2850 (In kind)	3325	6175	
2-3	Batter shear bank (optional)	Batter crest of shear bank face to facilitate better plant establishment (7hrs @ \$150/hr)			1050	1050	
3	Revegetation (300m ²)	Planting of key species at 1m centres around river access ramp (\$6.50/ plant incl labour x 300 plants)		900 (In kind)	1050	1950	

		(landholder labour in kind)							
All	On-going Maintenance	Follow-up weed treatment- quarterly (19hrs / qtr) inspections and suppression as necessary for 10 years			27125 (In kind)				27125
			TOTAL		39175	16245	780		56200

** Cost estimate for construction of a gravel limited access ramp crossing is estimated as the same for materials plus additional machine time to excavate the bed and lay the gravel material (5hrs @ \$150/hr). Should in situ gravel be sourced this option would be significantly cheaper.

Site 15 - 524 & 528 North Bank Road, Bellinger NSW 2454

Lot/DP	Lot661DP600804; Lot1DP842068; Lot2DP1136869
Property Owners	AR & CR Fahey; PO & BD Barnett
Catchment Details	Upper Bellinger River estuary – north bank; 2500m river frontage; Area: 103.54Ha
Land Use	Rural/Residential – Dairy Cattle

Property Summary

The area under scrutiny for the purposes of this plan incorporates two adjoining properties along a mid section outside bend alluvial floodplain (zones 8-10). The majority of the bank along this section is shear, resulting primarily from flood scour and subsequent mass failure (including rotational slips, undercutting and tree fall). Minor to severe erosion is evident along this section of bank with photogramatically derived cross sections suggesting channel migration of more than 50m since 1942 (Cohen & Telfer, 2010). With the exception of the area immediately surrounding the confluence of Hydes Creek, riparian vegetation is sparse, consisting mainly of weeds (chiefly Camphor Laurel (*Cinnamomum camphora*)).

Previous Management Efforts

N/A

Rehabilitation Strategy

The placement of a rock revetment wall is recommended along the lower third of the bank. Once complete, construction of a fence line with a minimum setback of ten metres from the crest of the bank is recommended. Within this area, battering of the bank (where possible) and accompanying revegetation using species outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare) will be critical to ensuring flood resilience over the long term. Root complexes provided by the vegetation strip will bind the mid-upper bank and minimise the potential for outflanking behind the revetment structure during floods. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

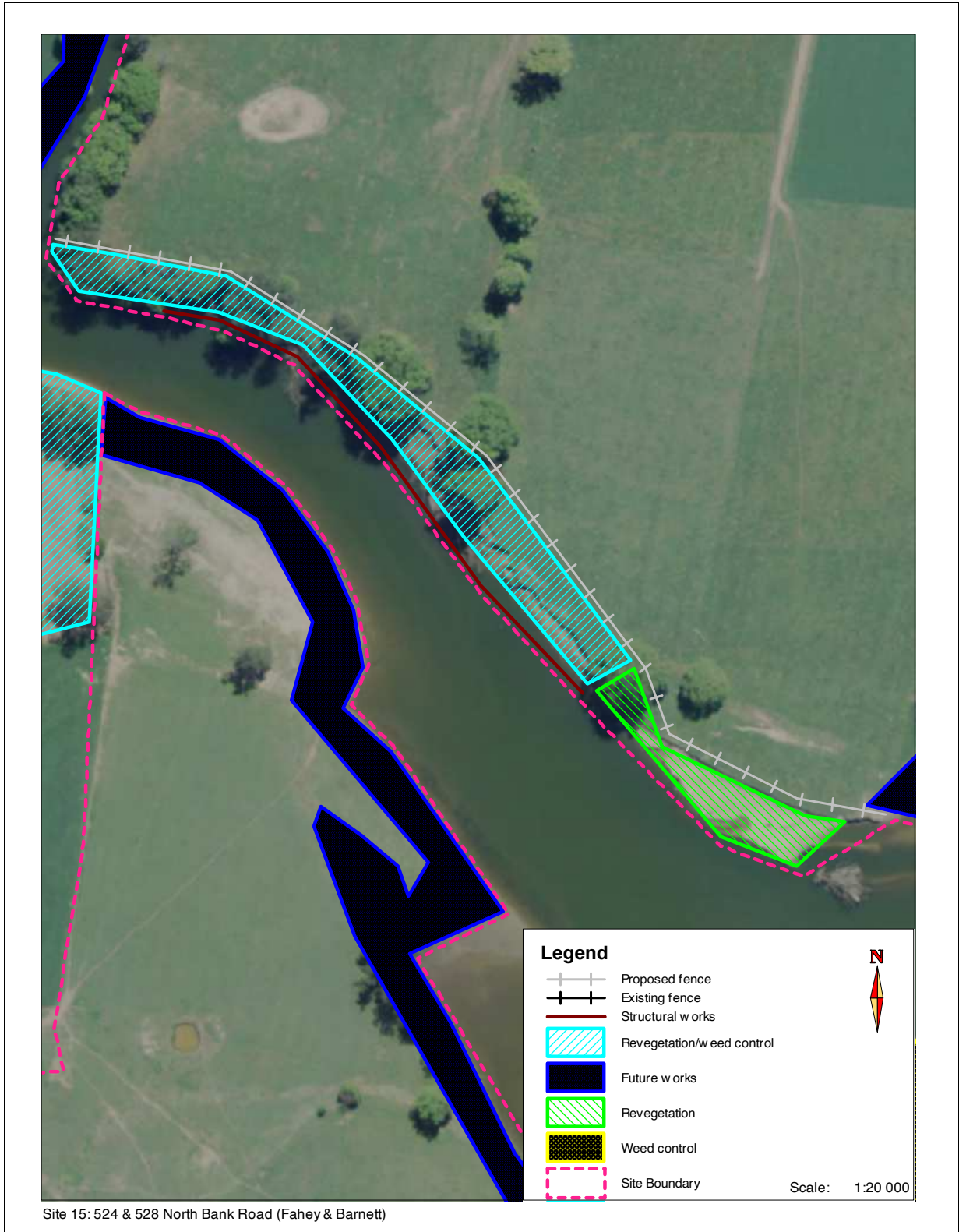


Figure 45: Property workplan map

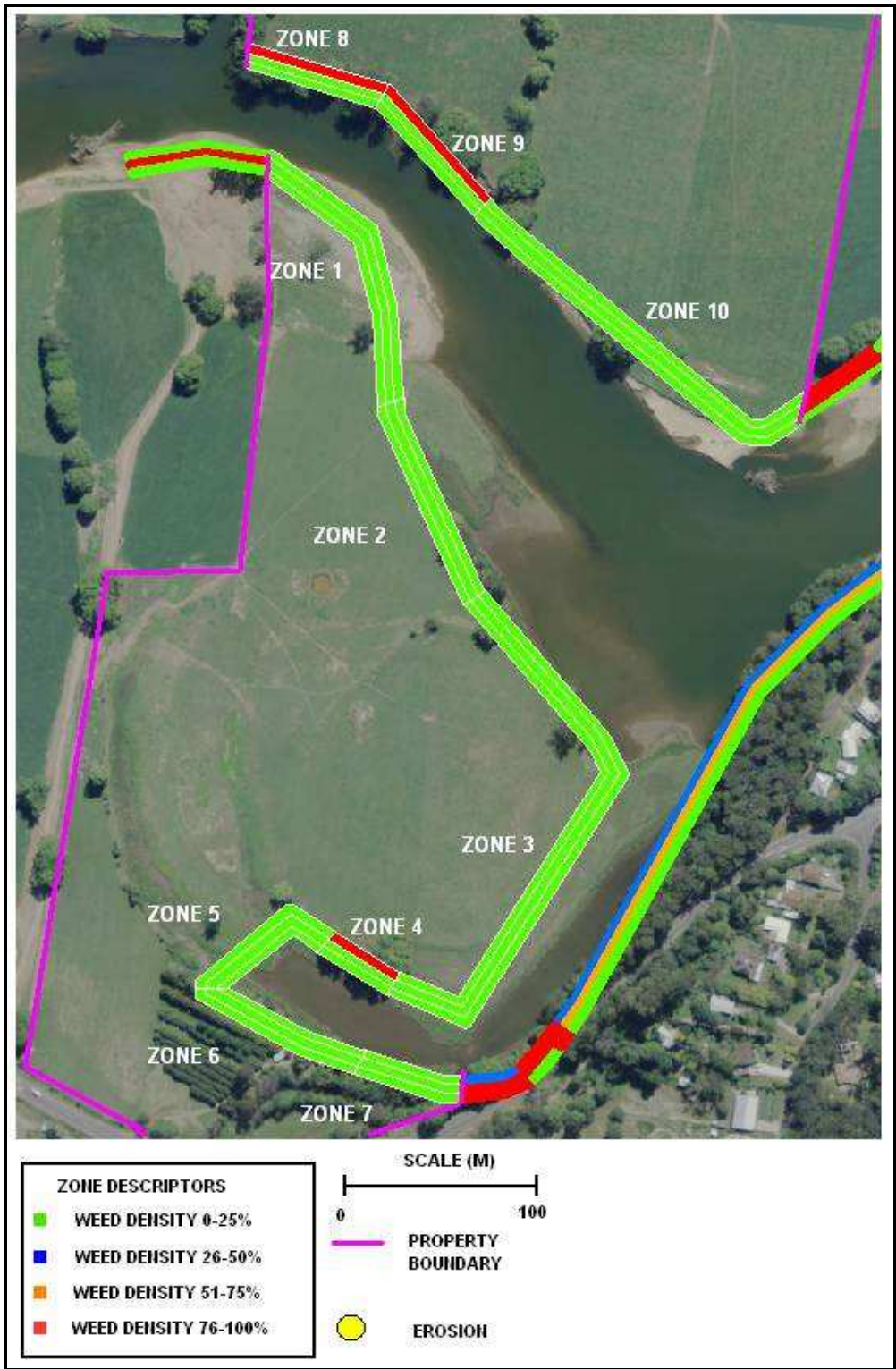


Figure 46: Riparian condition and extent

Table 36: Riparian condition summary

MGT ZONE	1	2	3	4	5	6	7	8	9	10
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	<5m	5-10m	<5m	5-10m	5-10m	10-20m	10-20m	5-10m	5-10m	<5m
CANOPY COVER	Cleared	76-100%	Cleared	26-50%	Cleared	76-100%	Cleared	76-100%	26-50%	Cleared
MIDSTOREY COVER	Cleared	<25%	Cleared	Cleared	76-100%	51-75%	76-100%	76-100%	Cleared	Cleared
GROUND COVER	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	N	N	Y	Y	N	N	N
GRAZING IMPACT	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
NATURAL REGEN	N	N	N	Y	Y	Y	Y	N	N	N
CANOPY WEED		0%		<25%		76-100%	0%	<25%	76-100%	
MIDSTOREY WEED		76-100%			0%	<25%	<25%	76-100%		
GROUND COVER WEED	pasture	pasture	pasture	pasture	pasture	pasture	pasture	26-50%	pasture	pasture
WEED 1		Camphor Laurel (Cinnamomum camphora)		Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)	Winter Senna (Senna pendula)	Small Leaf Privet (Ligustrum sinense)	Camphor Laurel (Cinnamomum camphora)	Blue Billy Goat (Ageratum houstonianum)
WEED 1 DENSITY		Few Scattered (<10%)		Few Scattered (<10%)	Few Scattered (<10%)	Dominant (>50%)	Few Scattered (<10%)	Dominant (>50%)	Dominant (>50%)	Few Scattered (<10%)
WEED 2		Cat Claw Creeper (Macfadyenian unguis-cati)					Small Leaf Privet (Ligustrum sinense)	Camphor Laurel (Cinnamomum camphora)	Passion Flower (Passiflora spp.)	Camphor Laurel (Cinnamomum camphora)

WEED 2 DENSITY	Few Scattered (<10%)											Few Scattered (<10%)		Few Scattered (<10%)
WEED 3	Small Leaf Privet (Ligustrum sinense)											Wild Tobacco (Solanum mauritianum)	Wild Tobacco (Solanum mauritianum)	Small Leaf Privet (Ligustrum sinense)
WEED 3 DENSITY	Few Scattered (<10%)											Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 4												Mistflower (Eupatorium riparium)	Blue Billy Goat (Ageratum houstonianum)	
WEED 4 DENSITY												Few Scattered (<10%)	Few Scattered (<10%)	
WEED 5												Blue Billy Goat (Ageratum houstonianum)	Mistflower (Eupatorium riparium)	
WEED 5 DENSITY												Few Scattered (<10%)	Few Scattered (<10%)	
BANK	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	North Bank

Table 37: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy			800 (In kind)	800
N/A	Publicity	Printing, educational activities, media release	Environmental Levy			80 (In kind)	80
	Weed Control	Manual weed eradication along riparian zone (40hrs @ \$30/hr)		1200 (In kind)			1200
	Fencing	Landholders to supply materials for and construct fence line to exclude stock (480m @ \$5000/km)		2400			2400
	Revegetation (4800m ²)	Planting of key species at 2m centres along top of bank and face. (landholder labour) (\$6.50/ plant incl labour x 1200 plants) (landholder labour in kind)		3600 (In kind)	4200		7800
	Structural works	Construction of rock revetment wall and batter bank face (480m @ \$350/m)			168000		168000
All	On-going Maintenance	Follow-up weed treatment and fence maintenance- quarterly (9hrs / qtr) inspections and suppression as necessary for 10 years		11400 (In kind)			11400
			TOTAL	18600	172200	880	191680

Site 16 - Bell Street-Baker Street-Main Street-Waterfall Way, Fernmount NSW 2454

Lot/DP	Lot7005DP1054523; Lot7006DP1054523; Lot7004DP1055533
Property Owners	Crown Land/Bellingen Shire Council
Catchment Details	Upper Bellinger River estuary – south bank; 710m river frontage; Area: 2.21ha
Land Use	Crown Land/Reserve/Road Reserve

Property Summary

This site can be divided into two overlapping sections. The first section (zones 1-4) spans an outside bend meander cutoff, which is now essentially a tidal backwater lagoon. This merges into a significant bedrock outcropping (Fernmount Bluff) which marks a sharp dogleg bend in the current river channel (zones 4-6). The banks are now considered to be stable throughout both these sections (Cohen & Telfer, 2010). The riparian zone contains a healthy diversity of locally native plant species natural recruitment occurring, however competition from weed species is threatening natural stands of vegetation in some areas. Problematic weed species include Camphor Laurel (*Cinnamomum camphora*), Balloon Vine (*Cardiospermum grandiflorum*), Lantana (*Lantana camara*), Small Leaf Privet (*Ligustrum sinense*), Groundsel bush (*Baccharis halimifolia*), Morning glory (*Ipomoea* spp.), Mysore Thorn (*Caesalpinia decapetala*) and Cats Claw (*Macfadyena unguis-cati*).

Previous Management Efforts

Periodic weed control has been undertaken at this site, in particular targeting Cats Claw (*Macfadyena unguis-cati*) and Mysore Thorn (*Caesalpinia decapetala*).

Rehabilitation Strategy

1. The southwestern end of this site (zone x) is suffering from a severe vine weed infestation, with a sparse native vegetation understory. Targeted weed control and accompanying revegetation should be undertaken at this site. Follow-up treatment of vine weeds and ongoing weed management will also be critical to ensure the survival and recruitment of native plants.
2. The current weed control program should be expanded to both control invasive species and facilitate better native plant recruitment along the entire river bank at this site. This will require a broad scale, intensive initial weed control program and ongoing weed control to ensure the continued survival and recruitment of native plants.



Figure 47: Property workplan map

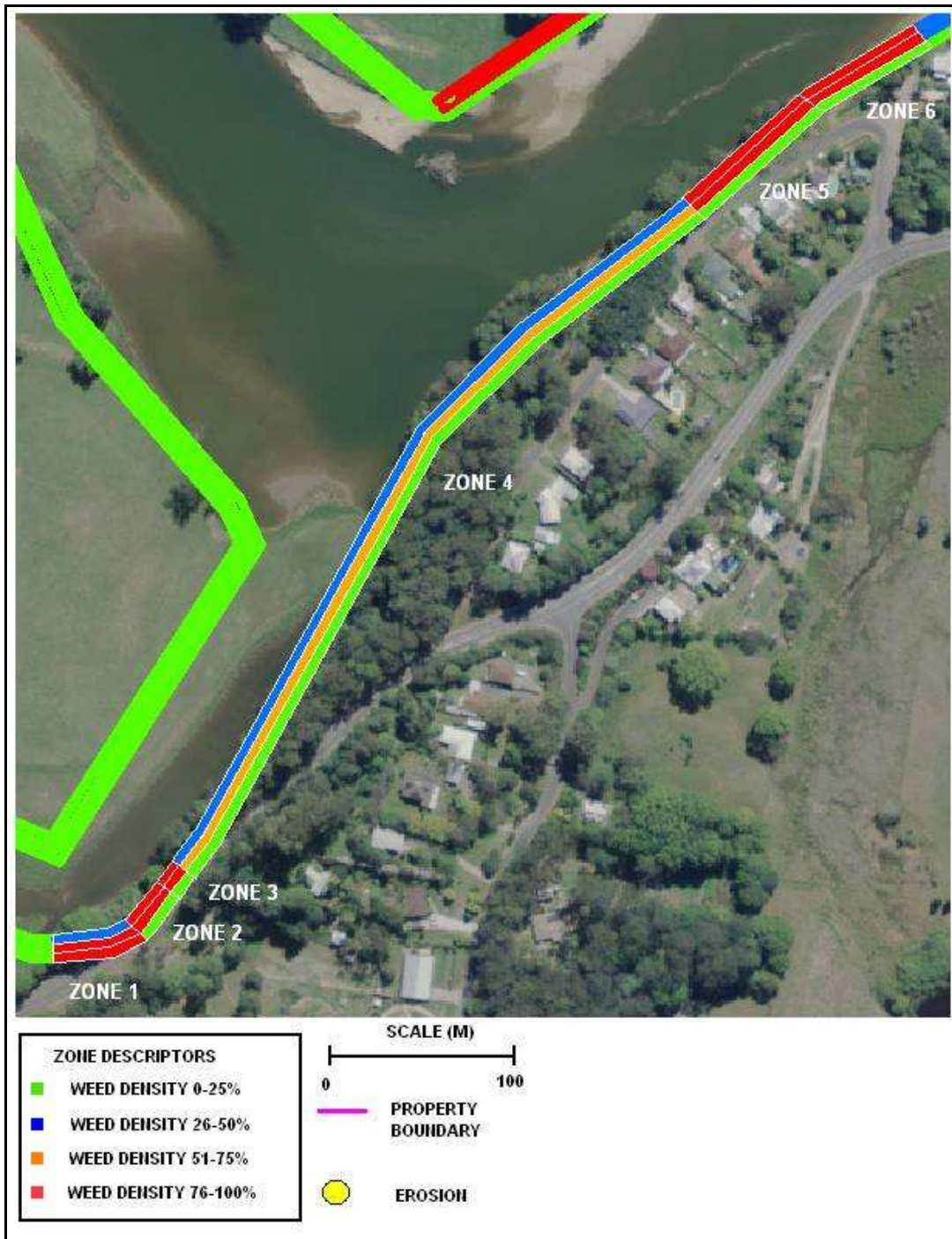


Figure 48: Riparian condition and extent

Table 38: Riparian condition summary

MGT ZONE	1	2	3	4	5	6
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	5-10m	5-10m	20-30m	5-10m	5-10m
CANOPY COVER	76-100%	Cleared	51-75%	76-100%	51-75%	Cleared
MIDSTOREY COVER	76-100%	26-50%	76-100%	76-100%	51-75%	76-100%
GROUND COVER	76-100%	76-100%	76-100%	51-75%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	Y	N	N
GRAZING IMPACT	N	N	N	N	N	N
NATURAL REGEN	Y	N	N	Y	N	N
CANOPY WEED	76-100%		76-100%	<25%	<25%	
MIDSTOREY WEED	76-100%	76-100%	76-100%	51-75%	76-100%	76-100%
GROUND COVER WEED	26-50%	76-100%	76-100%	26-50%	76-100%	76-100%
WEED 1	Camphor Laurel (Cinnamomum camphora)	Morning Glory (Ipomea spp.)	Camphor Laurel (Cinnamomum camphora)	Morning Glory (Ipomea spp.)	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)
WEED 1 DENSITY	Dominant (>50%)	Dominant (>50%)	Clumps (11-50%)	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 2	Small Leaf Privet (Ligustrum sinense)	Groundsel bush (Baccharis halimifolia)	Small Leaf Privet (Ligustrum sinense)	Winter Senna (Senna pendula)	Balloon Vine (Cardiospermum grandiflorum)	Morning Glory (Ipomea spp.)
WEED 2 DENSITY	Dominant (>50%)	Few Scattered (<10%)	Dominant (>50%)	Clumps (11-50%)	Clumps (11-50%)	Dominant (>50%)
WEED 3	Morning Glory (Ipomea spp.)	Winter Senna (Senna pendula)	Morning Glory (Ipomea spp.)	Balloon Vine (Cardiospermum grandiflorum)	Passion Flower (Passiflora spp.)	Lantana (Lantana camara)
WEED 3 DENSITY	Clumps (11-50%)	Clumps (11-50%)	Dominant (>50%)	Clumps (11-50%)	Few Scattered (<10%)	Clumps (11-50%)
WEED 4	Winter Senna (Senna pendula)	Balloon Vine (Cardiospermum grandiflorum)	Balloon Vine (Cardiospermum grandiflorum)	Camphor Laurel (Cinnamomum camphora)	Lantana (Lantana camara)	Balloon Vine (Cardiospermum grandiflorum)
WEED 4 DENSITY	Clumps (11-50%)	Few Scattered	Few Scattered	Clumps (11-50%)	Clumps (11-50%)	Few Scattered

WEED 5		(<10%)	Lantana (Lantana camara)	Lantana (Lantana camara)	WINTER Senna (Senna pendula)	Castor Oil Plant (Rinicus communis)
WEED 5 DENSITY		Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 6		WINTER Senna (Senna pendula)	Small Leaf Privet (Ligustrum sinense)		WINTER Senna (Senna pendula)	
WEED 6 DENSITY		Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 7			Cats Claw (Macfadyena unguis-cati)			Coral Tree (Erythrina sykesii)
WEED 7 DENSITY			Few Scattered (<10%)	Few Scattered (<10%)		Few Scattered (<10%)
WEED 8			Mistflower (Eupatorium riparium)			
WEED 8 DENSITY			Few Scattered (<10%)	Few Scattered (<10%)		
WEED 9			Mysore Thorn (Caesalpinia decapetala)			
WEED 9 DENSITY			Few Scattered (<10%)	Few Scattered (<10%)		
BANK	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank

Table 39: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
	Weed Control (contractor)	Vine weed eradication along riparian zone; (2 days @ \$800/day)		1600		1600	
	Revegetation (1200m ²)	Plant out gap areas along riparian zone (\$6.50/ plant incl labour x 300 plants)		1950		1950	
	Weed Control (contractor)	Broad scale weed eradication along riparian zone; (22 days @ \$800/day)		17600		17600	
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (16hrs / qtr) inspections and suppression as necessary for 10 years		22030		22030	
			TOTAL	43180	880	44060	

Site 17 - 4 Tyson Street, Fernmount NSW 2454

Lot/DP	Lot21DP858531
Property Owners	JL Newhouse & D Freuden
Catchment Details	Upper Bellinger River estuary – south bank; 218m river frontage; Area: 1.38Ha
Land Use	Residential

Property Summary

This site spans a slight outside bend section alluvial floodplain. The majority of the bank along this section appears to be relatively stable although tree root exposure is visible along the bank toe. Current erosion rates are considered minor to minor (Cohen & Telfer, 2010). Riparian vegetation includes River Oak (*Casurina cunninghammania*) and vigorous weeds including Camphor Laurel (*Cinnamomum camphora*), Small Leaf Privet (*Ligustrum sinense*), Lantana (*Lantana camara*) and Balloon Vine (*Cardiospermum grandiflorum*).

Previous Management Efforts

Funding was obtained following recent flood events to undertake bank stabilisation works along the upper extent of the property (zone 1). Specifically the toe of the bank was consolidated with gravel, pin fences constructed along the bank face and accompanying revegetation undertaken using local native plants.

Rehabilitation Strategy

A minimum riparian buffer of five metres from the crest of the bank is recommended. This area should then be vegetated with a variety of deep rooted plant species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). To minimize maintenance requirements the following succession approach is suggested. Initial weed control should be undertaken to control vine weeds and Small Leaf Privet choking the undergrowth. Vegetation should then be planted along the bank face (to fill gaps) in order to enhance resilience against erosive flood forces. Planting of an additional row of pioneer type canopy trees is recommended along the existing vegetation margin. Once the new plants are well established (ie. ~5 years), a gradual thinning of Camphor Laurel trees will promote better succession of native counterparts. This will provide a bare minimum in terms of resilience against future erosion and slumping during flood events. Continual monitoring should be undertaken to ascertain vegetation response and recovery from ensuing flood events. This buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants. Should stock be reintroduced to the site, appropriate fences will need to be erected to restrict stock access to the regeneration area.

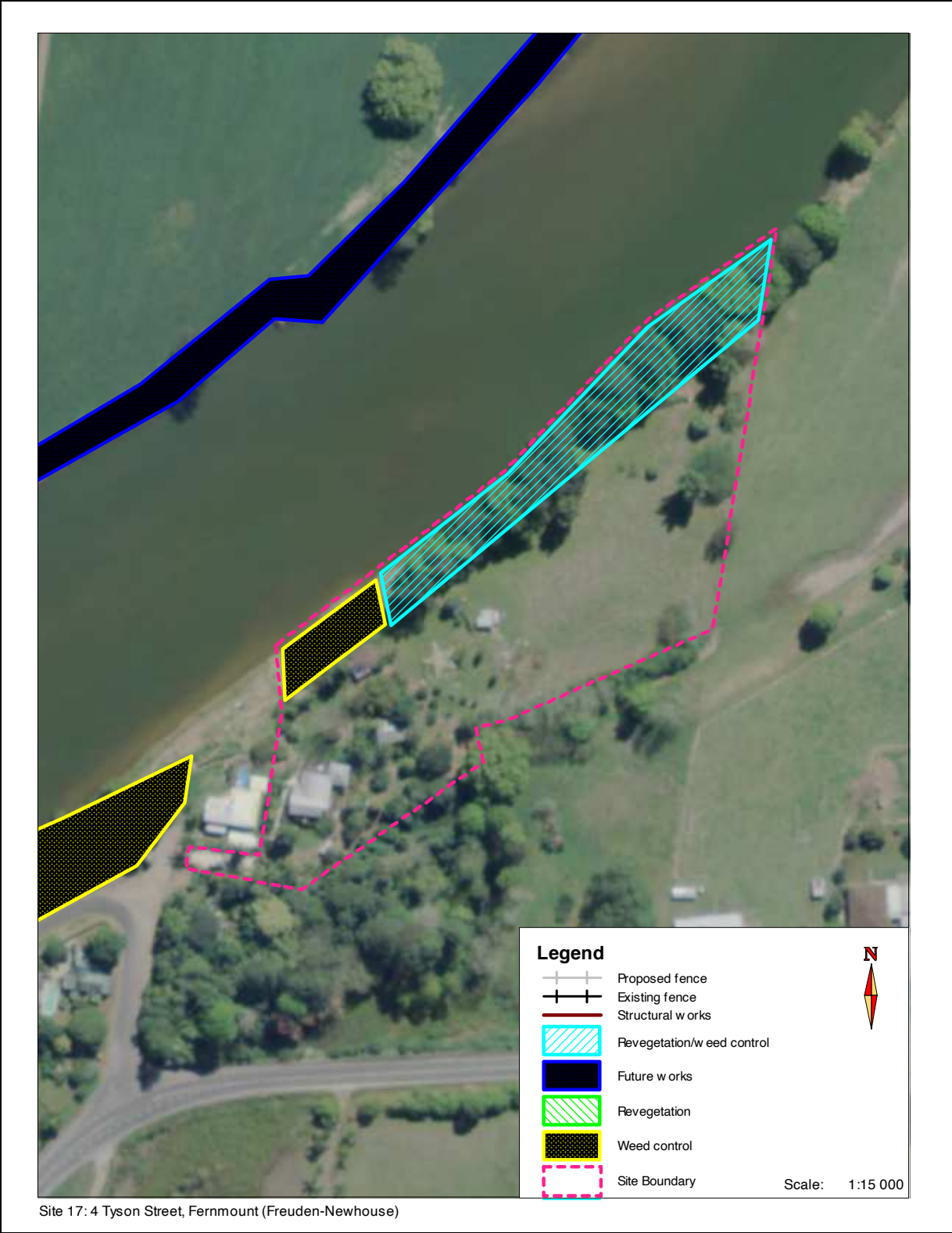


Figure 49: Property workplan map

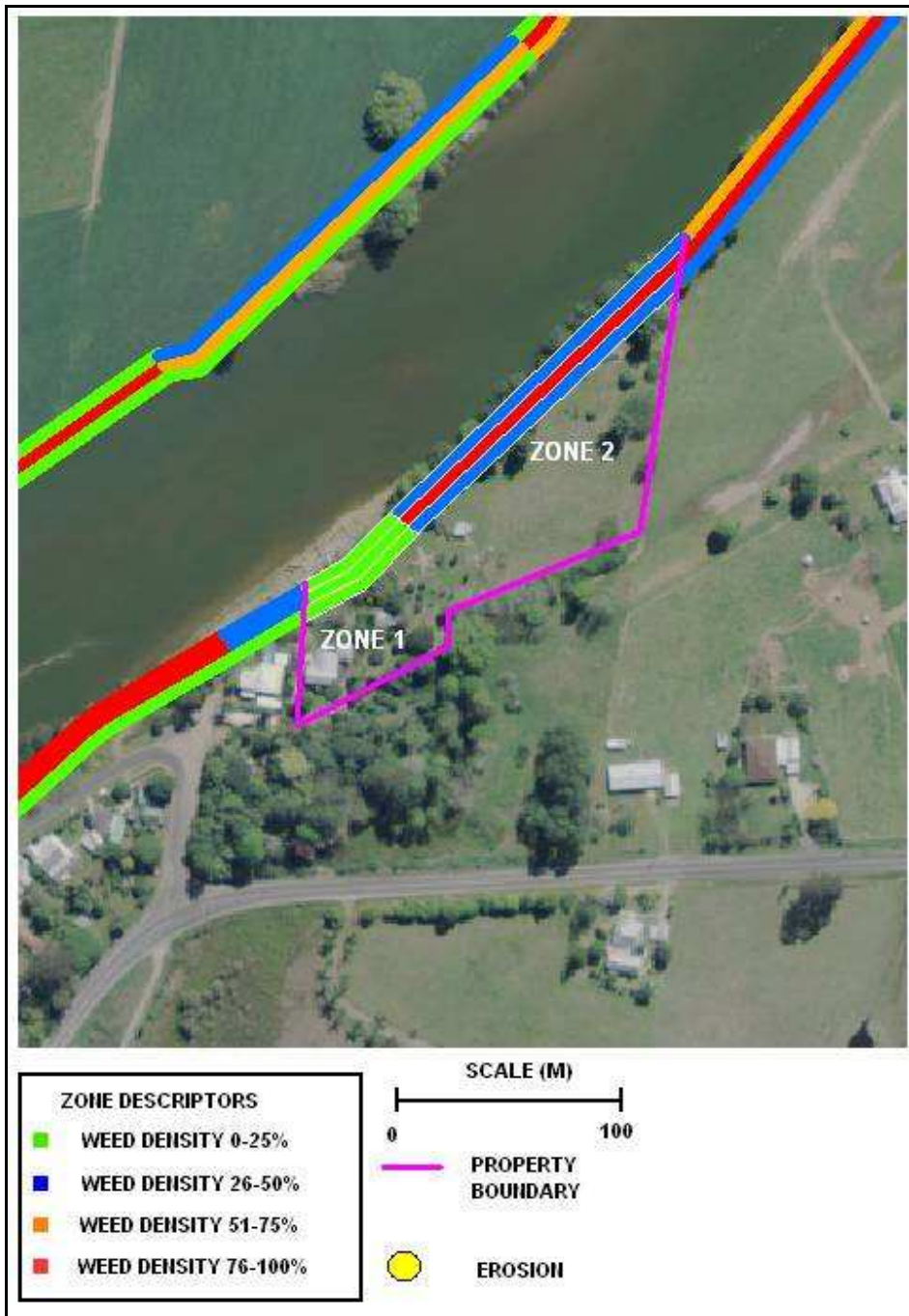


Figure 50: Riparian condition and extent

Table 40: Riparian condition summary

MGT ZONE	1	2
ASSESSOR	A. Rickert	A. Rickert
RIPARIAN WIDTH	10-20m	5-10m
CANOPY COVER	<25%	76-100%
MIDSTOREY COVER	51-75%	76-100%
GROUND COVER	76-100%	26-50%
APPROPRIATE COVER	Y	N
GRAZING IMPACT	N	Y
NATURAL REGEN	Y	N
CANOPY WEED	0%	26-50%
MIDSTORY WEED	0%	76-100%
GROUND COVER WEED	<25%	26-50%
WEED 1	Castor Oil Plant (<i>Rinicus communis</i>)	Balloon Vine (<i>Cardiospermum grandiflorum</i>)
WEED 1 DENSITY	Few Scattered (<10%)	Dominant (>50%)
WEED 2	Morning Glory (<i>Ipomea</i> spp.)	Morning Glory (<i>Ipomea</i> spp.)
WEED 2 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)
WEED 3	Blue Billy Goat (<i>Ageratum houstonianum</i>)	Lantana (<i>Lantana camara</i>)
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)
WEED 4		Small Leaf Privet (<i>Ligustrum sinense</i>)
WEED 4 DENSITY		Dominant (>50%)
WEED 5		Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 5 DENSITY		Few Scattered (<10%)
BANK	South Bank	South Bank

Table 41: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)				
				Landholder	NRCMA or Other	Contributions		Total Budget
						Bellingen Shire Council		
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy			800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy			80 (In kind)	80	
2	Weed Control (contractor)	Manual weed eradication along riparian zone (3 days @ \$800/day)			2400		2400	
2	Revegetation (3000m ²)	Planting of key species at ~5m centres along top of bank and face. (landholder labour in kind) (\$6.50/ plant incl labour x 100 plants)		300 (In kind)	350		650	
All	On-going Maintenance	Follow-up weed treatment and fence maintenance- quarterly (12hrs / yr) inspections and suppression as necessary for 10 years		3930 (In kind)			3930	
			TOTAL	4230	2750	880	7860	

Site 18 - 528 & 606 North Bank Road, Bellingen NSW 2454

Lot/DP	Lot2DP1136869; Lot1DP558359
Property Owners	PO & BD Barnett; WJ Tyson
Catchment Details	Upper Bellingen River estuary – north bank; 283m river frontage; Area: 4.33Ha
Land Use	Rural/Residential – Cattle

Property Summary

This site incorporates two adjoining properties along a straight section through upper outside bend alluvial floodplain. The majority of the bank along this section appears to be affected by flood scour and mass failure (including undercutting, slump and tree fall). Current erosion rates are considered minor to moderate (Cohen & Telfer, 2010). Riparian vegetation is sparse, consisting mainly of weeds including Camphor Laurel (*Cinnamomum camphora*), Small Leaf Privet (*Ligustrum sinense*) and Lantana (*Lantana camara*).

Previous Management Efforts

N/A

Rehabilitation Strategy

A minimum fence line setback of ten metres from the crest of the bank is recommended. This area should then be vegetated with a variety of deep rooted plant species as outlined in the Bellingen River Estuary Revegetation Guide (BSC/Bellingen Landcare). Battering of the bank crest prior to revegetation may be advantageous in terms of minimizing the potential for further mass failure at the shear bank face; however the cost of this exercise may outweigh the long term benefits. Accompanying vegetation should be planted along the bank face and toe (where possible) in order to create root complexes to buffer against erosive flood forces. This will provide a bare minimum in terms of resilience against future erosion and slumping during flood events. Continual monitoring should be undertaken to ascertain vegetation response and recovery from ensuing flood events. This buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

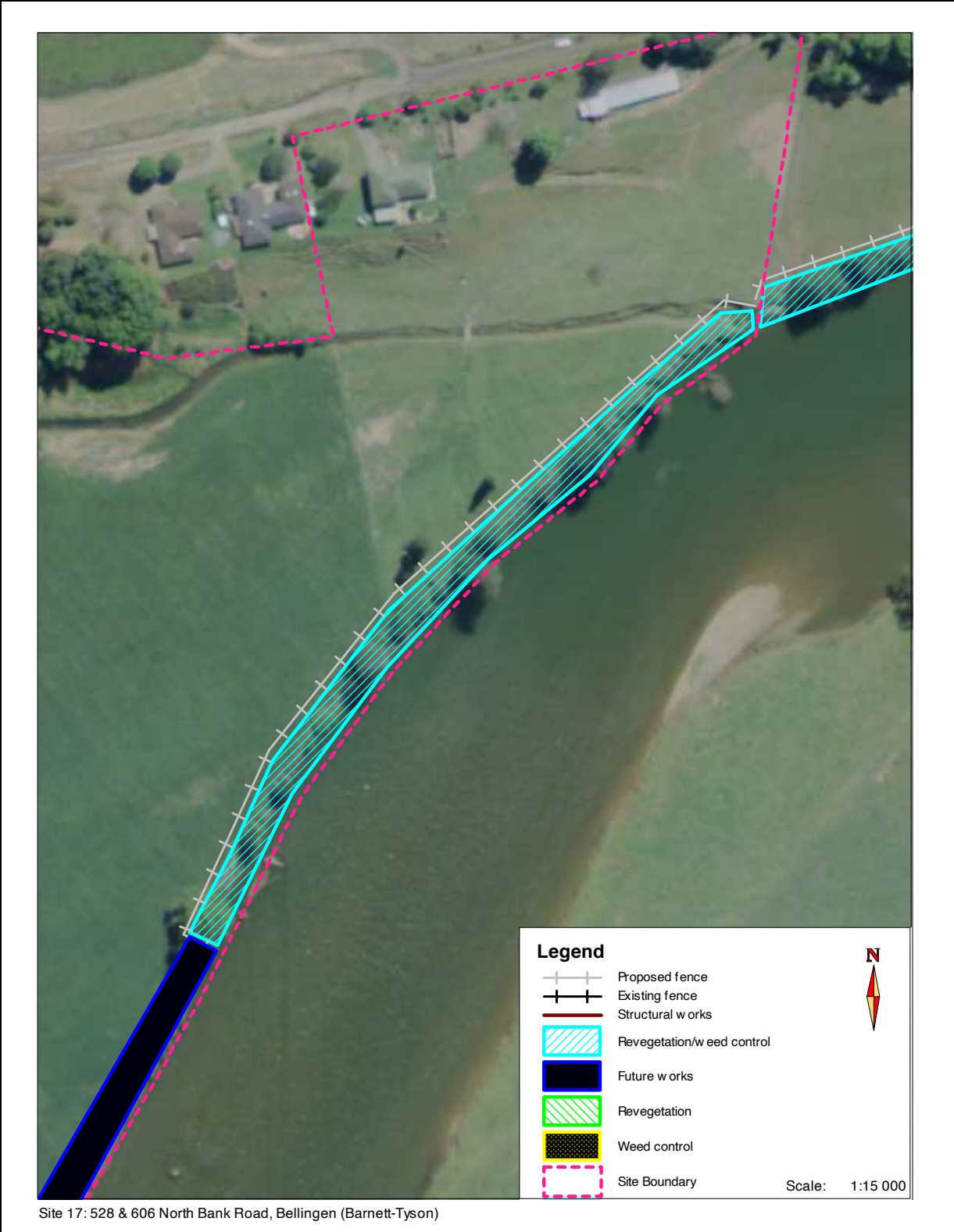


Figure 51: Property workplan map

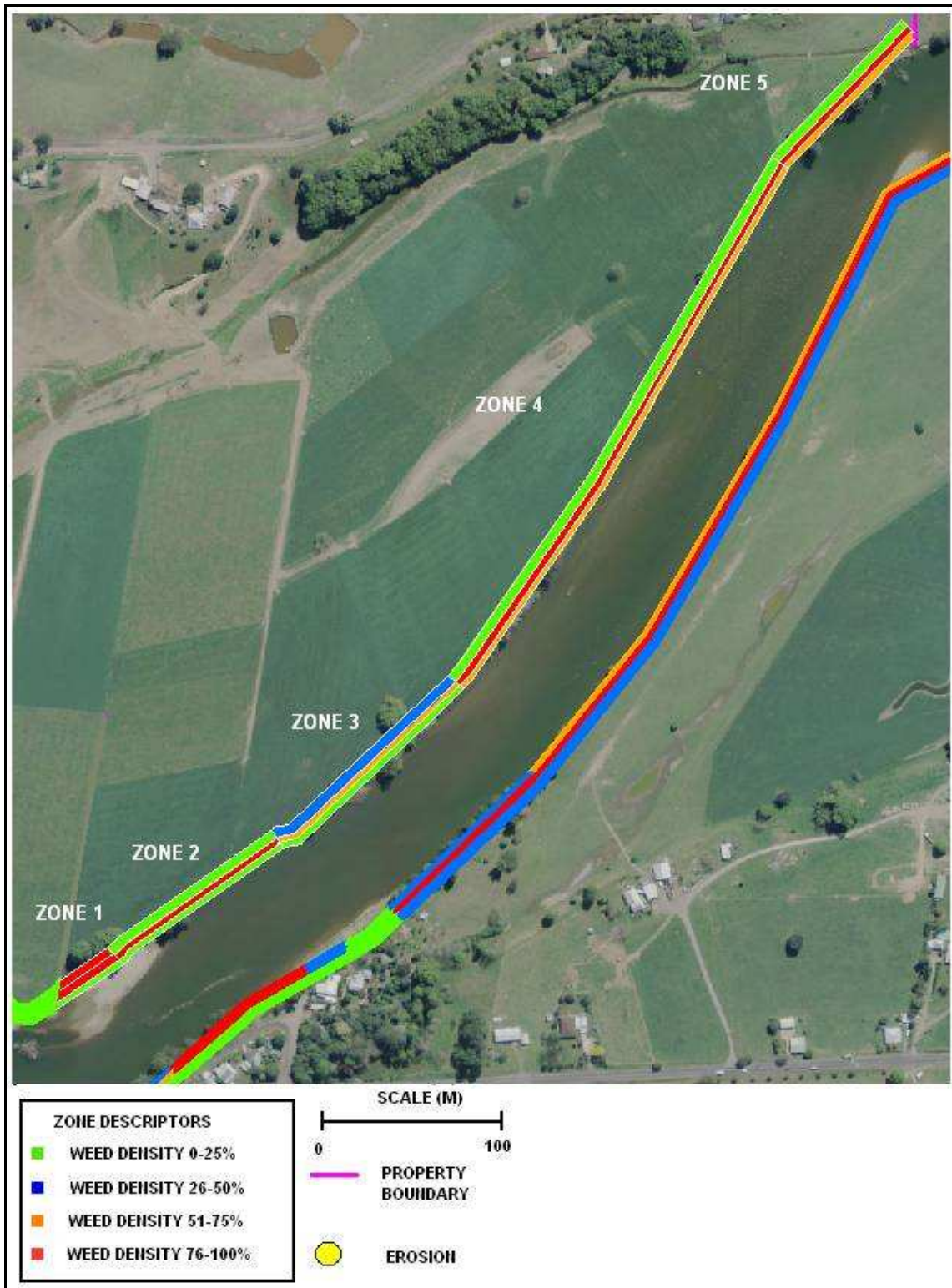


Figure 52: Riparian condition and extent

Table 42: Riparian condition summary

MGT ZONE	1	2	3	4	5
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m		<5m	5-10m	<5m
CANOPY COVER	51-75%	Cleared	<25%	76-100%	<25%
MIDSTOREY COVER	<25%	<25%	<25%	76-100%	76-100%
GROUND COVER	76-100%	76-100%	76-100%	51-75%	26-50%
APPROPRIATE COVER	N	N	N	N	N
GRAZING IMPACT		Y	Y	Y	Y
NATURAL REGEN		N	N	N	N
CANOPY WEED	76-100%		26-50%	26-50%	<25%
MIDSTORY WEED	76-100%	76-100%	51-75%	76-100%	76-100%
GROUND COVER WEED	pasture	pasture	pasture	76-100%	51-75%
WEED 1	Camphor Laurel (Cinnamomum camphora)	Small Leaf Privet (Ligustrum sinense)	Small Leaf Privet (Ligustrum sinense)	Balloon Vine (Cardiospermum grandiflorum)	Small Leaf Privet (Ligustrum sinense)
WEED 1 DENSITY	Clumps (11-50%)	Few Scattered (<10%)	Clumps (11-50%)	Dominant (>50%)	Clumps (11-50%)
WEED 2	Small Leaf Privet (Ligustrum sinense)	Exotic grass	Blue Billy Goat (Ageratum houstonianum)	Small Leaf Privet (Ligustrum sinense)	Balloon Vine (Cardiospermum grandiflorum)
WEED 2 DENSITY	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Dominant (>50%)
WEED 3	Castor Oil Plant (Rinicus communis)	Castor Oil Plant (Rinicus communis)	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)
WEED 4	Blue Billy Goat (Ageratum houstonianum)			Morning Glory (Ipomea spp.)	Lantana (Lantana camara)
WEED 4 DENSITY	Few Scattered (<10%)			Few Scattered (<10%)	Few Scattered (<10%)
WEED 5	Balloon Vine (Cardiospermum grandiflorum)			Wild Tobacco (Solanum mauritianum)	Coral Tree (Erythrina sykesii)
WEED 5 DENSITY	Few Scattered (<10%)			Few Scattered (<10%)	Few Scattered (<10%)

WEED 6					Winter Senna (Senna pendula)	Morning Glory (Ipomea spp.)
WEED 6 DENSITY					Few Scattered (<10%)	Few Scattered (<10%)
BANK		North Bank	North Bank	North Bank	North Bank	North Bank

Table 43: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	NRCMA or Other	Bellingen Shire Council	Total Budget
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy			800 (In kind)	800
N/A	Publicity	Printing, educational activities, media release	Environmental Levy			80 (In kind)	80
	Weed Control contractor	Manual weed eradication along riparian zone (3 days @ \$800/day)			2400		2400
	Fencing	Landholders to supply materials for and construct fence line to exclude stock (280m @ \$5000/km)		1400			1400
	Revegetation (2800m ²)	Planting of key species at 2m centres along top of bank and face. (landholder labour) (\$6.50/ plant incl labour x 700 plants)			4550		4550
	Batter shear bank	Batter crest of shear bank face to facilitate better plant establishment (14hrs @ \$150/hr)			1050		1050
All	On-going Maintenance	Follow-up weed treatment and fence maintenance- quarterly (8hrs / qtr) inspections and suppression as necessary for 10 years		9400 (In kind)			9400
			TOTAL	10800	8000	880	19680

Part 2: Mid Bellinger Estuary – Reach Plan

Site 1a - 638 North Bank Road, Raleigh NSW 2454

Lot/DP	Lot211DP1119824
Property Owners	PJ Ellis, JA Gothe & M Gothe-Ellis
Catchment Details	Mid Bellinger River estuary – north bank; 341m river frontage; Area: 17.0Ha
Land Use	Rural/Residential – Cattle

Property Summary

This section spans the upper-mod extent of an outside bend alluvial floodplain. The majority of the bank along this section is shear, resulting primarily from flood scour with signs of block type mass failures and tree fall. Erosion has occurred along this section since European settlement, although the channel appears to have modified to a more stable equilibrium in recent times. No photogrammetric data exists for this bend, however overall active erosion has been assessed as moderate (Cohen & Telfer, 2010). Riparian vegetation is sparse consisting mainly of weeds including Small Leaf Privet (*Ligustrum sinense*), Camphor Laurel (*Cinnamomum camphora*), Coral Tree (*Erythrina sykesii*), Lantana (*Lantana camara*) and Wild Tobacco (*Solanum mauritianum*).

Previous Management Efforts

Riparian fence lines have been established here in the past, however appear to have been rendered dysfunctional (most likely during flood events).

Rehabilitation Strategy

Two options exist for this site:

- a. A minimum fence line setback of ten metres from the crest of the bank is recommended. This area should then be vegetated with a variety of deep rooted plant species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Battering of the bank crest prior to revegetation may be advantageous in terms of minimizing the potential for further mass failure at the shear bank face; however the cost of this exercise may outweigh the long term benefits. Accompanying vegetation should be planted along the bank face and toe (where possible) in order to create root complexes to buffer against erosive flood forces. This will provide a bare minimum in terms of resilience against future erosion and slumping during flood events. Continual monitoring should be undertaken to ascertain vegetation response and recovery from ensuing flood events. This buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants. Should this approach be undertaken it is

recommended that the revegetation project be undertaken in several stages working in a downstream direction.

- b. The placement of a rock revetment wall is recommended along the lower third of the bank. Battering of the bank (where possible) will facilitate better ongoing management. Construction of a fence line with a minimum setback of ten metres from the crest of the bank is recommended. Within this area accompanying revegetation using species outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare) will be critical to ensuring flood resilience over the long term. Root complexes provided by the vegetation strip will bind the mid-upper bank and minimise the potential for outflanking behind the revetment structure during floods. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

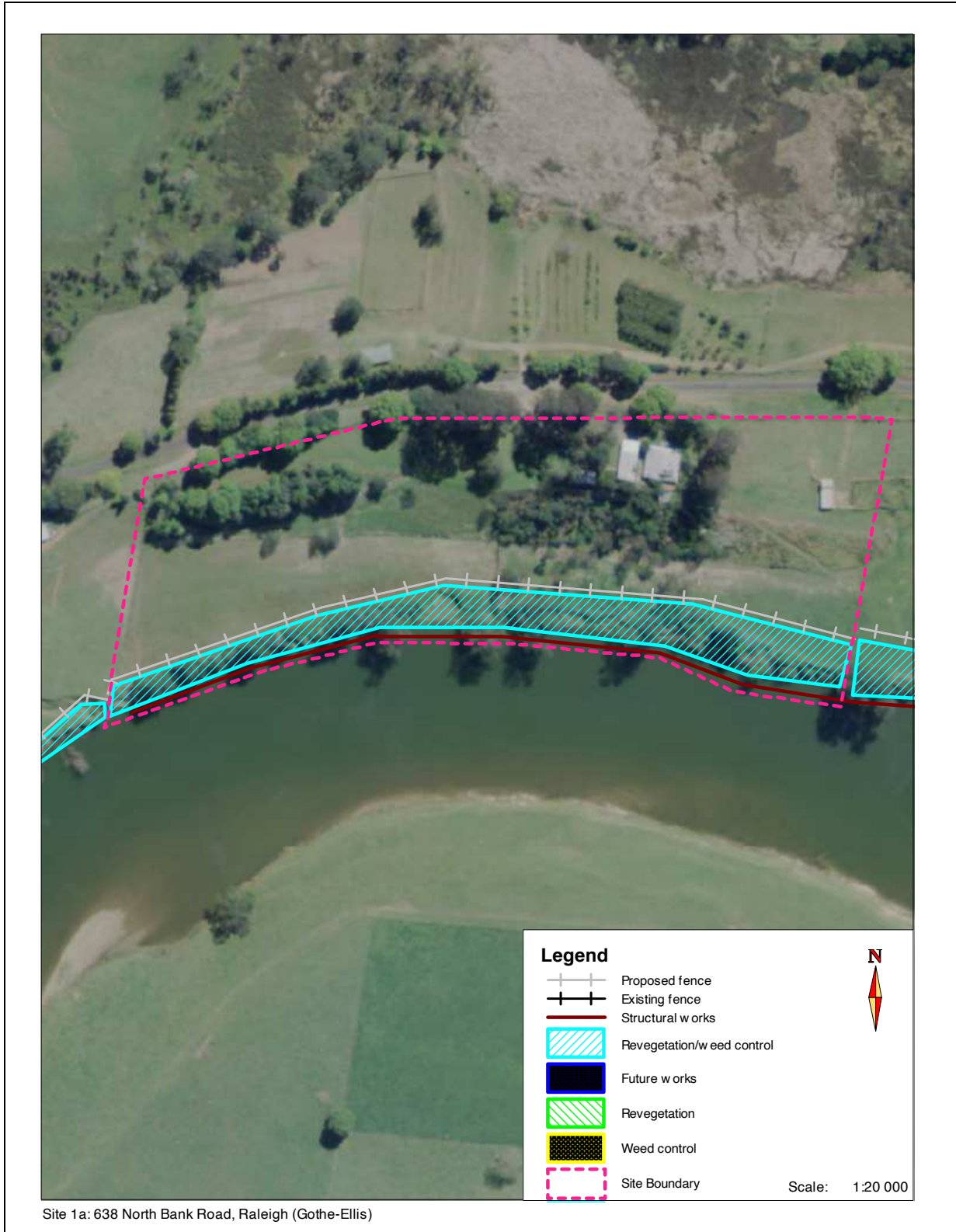


Figure 53: Property workplan map

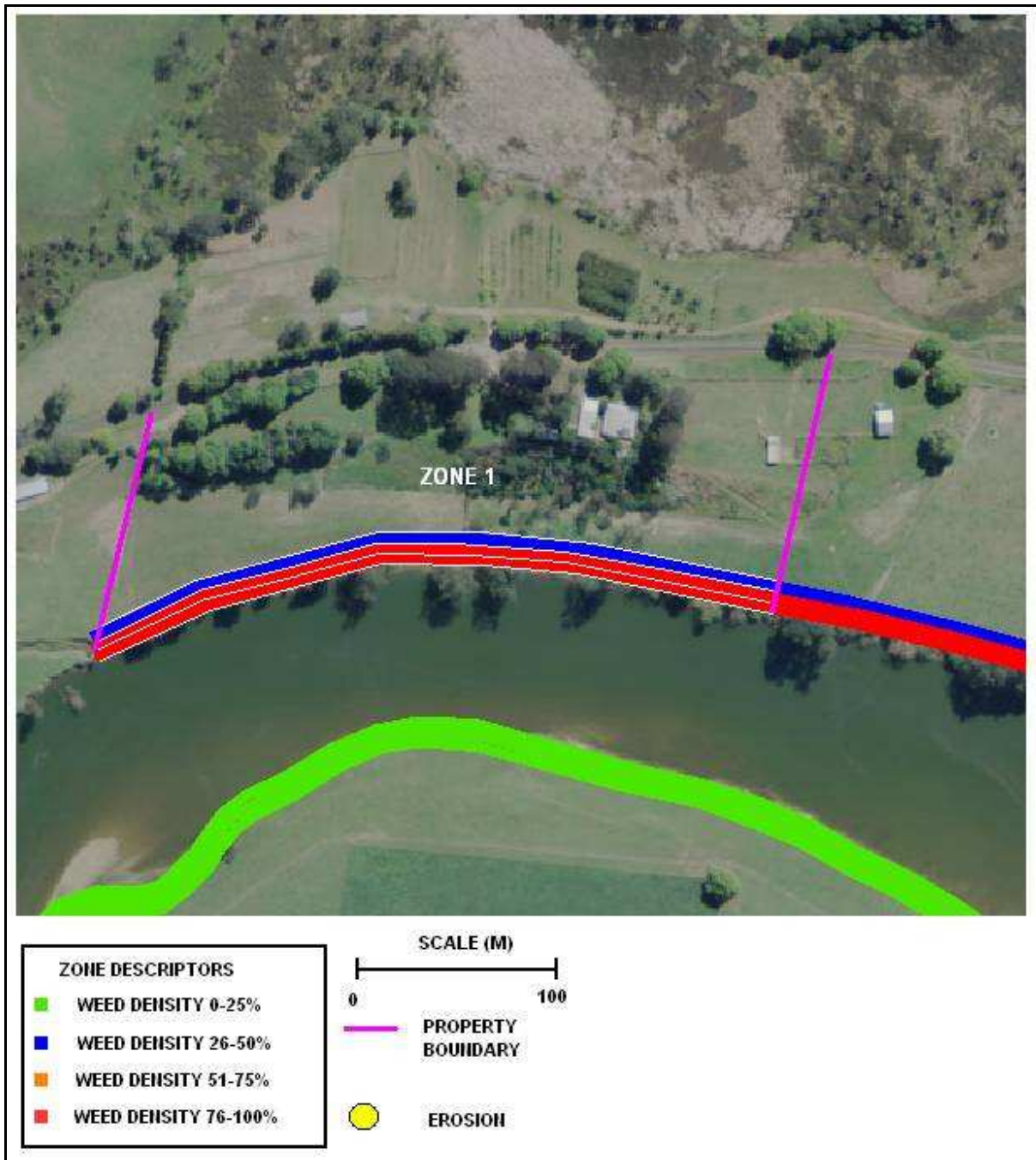


Figure 54: Riparian condition and extent

Table 44: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	5-10m
CANOPY COVER	51-75%
MIDSTOREY COVER	51-75%
GROUND COVER	51-75%
APPROPRIATE COVER	N
GRAZING IMPACT	Y
NATURAL REGEN	Y
CANOPY WEED	26-50%
MIDSTORY WEED	76-100%
GROUND COVER WEED	76-100%
WEED 1	Coral Tree (<i>Erythrina sykesii</i>)
WEED 1 DENSITY	Clumps (11-50%)
WEED 2	Balloon Vine (<i>Cardiospermum grandiflorum</i>)
WEED 2 DENSITY	Clumps (11-50%)
WEED 3	Small Leaf Privet (<i>Ligustrum sinense</i>)
WEED 3 DENSITY	Clumps (11-50%)
WEED 4	Wild Tobacco (<i>Solanum mauritianum</i>)
WEED 4 DENSITY	Clumps (11-50%)
WEED 5	Castor Oil Plant (<i>Rinicus communis</i>)
WEED 5 DENSITY	Clumps (11-50%)
BANK	North Bank

Table 45: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)		
				Contributions		
				Landholder	NRCMA or Other	Bellingen Shire Council
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80
	Batter shear bank (optional a)	Batter crest of shear bank face to facilitate better plant establishment (14hrs @ \$150/hr)		2100		2100
	Structural works (optional b)	Construction of rock revetment wall and batter bank face (340m @ \$500/m)		170000		170000
	Weed Control (contractor)	Manual weed eradication along riparian zone (4 days @ \$800/day)		3200		3200
	Fencing	Landholder to supply materials for and construct fence line to exclude stock (340m @ \$5000/km)		1700		1700
	Revegetation (3400m ²)	Planting of key species at 2m centres along top of bank and face. (landholder labour) (\$6.50/ plant incl labour x 850 plants)		5525		5525
All	On-going Maintenance	Follow-up weed treatment and fence maintenance- quarterly (8hrs / qtr) inspections and suppression as necessary for 10 years		11425 (In kind)		11425
			TOTAL	13125	180825	194830

Site 1 - 700 & 754 North Bank Road, Raleigh NSW 2454

Lot/DP	Lot212 DP1119824; Lot101 DP633850
Property Owners	JM & BJ Gothe
Catchment Details	Mid Bellinger River estuary – north bank; 1090m river frontage; Area: 35.34Ha
Land Use	Rural/Residential – Dairy Cattle

Property Summary

This site can be divided into two geomorphologically distinct sections:

1. The first section spans the lower extent of an outside bend alluvial floodplain (zones 1-3).
The majority of the bank along this section is shear, resulting primarily from flood scour with signs of block type mass failures. Severe erosion has occurred along this section since European settlement, although the channel appears to have modified to a more stable equilibrium in recent times. No photogrammetric data exists for this bend, however overall active erosion has been assessed as severe (Cohen & Telfer, 2010). Riparian vegetation is sparse consisting mainly of weeds including Small Leaf Privet (*Ligustrum sinense*), Camphor Laurel (*Cinnamomum camphora*), Coral Tree (*Erythrina sykesii*), Lantana (*Lantana camara*) and Wild Tobacco (*Solanum mauritianum*).
2. The second section spans an inside bend where alluvial material is depositing along a low floodplain bench (zones 4-6). This section is considered stable according to Cohen & Telfer (2010). The riparian vegetation buffer is quite wide here, although dominated by weed species including Small Leaf Privet (*Ligustrum sinense*), Camphor Laurel (*Cinnamomum camphora*), Coral Tree (*Erythrina sykesii*), Lantana (*Lantana camara*), Wild Tobacco (*Solanum mauritianum*) and Mistflower (*Eupatorium riparium*).

Previous Management Efforts

Riparian fence lines have been established here in the past, however appear to have been rendered dysfunctional (most likely during flood events).

Rehabilitation Strategy

2. Two options are proposed for this bend:
 - a. A minimum fence line setback of ten metres from the crest of the bank is recommended. This area should then be vegetated with a variety of deep rooted plant species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Battering of the bank crest prior to revegetation may be advantageous in terms of minimizing the potential for further mass failure at the shear bank face; however the cost of this exercise may outweigh the long term benefits. Accompanying vegetation should be planted along the bank face and toe (where possible) in order to create root complexes to buffer against erosive flood forces. This will provide a bare minimum in terms of resilience against future erosion and slumping during flood events. Continual monitoring should be undertaken to ascertain vegetation response and recovery from ensuing flood events. This buffer may need to be re-established and/or

expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants. Should this approach be undertaken it is recommended that the revegetation project be undertaken in several stages working back from the stable bench at the inside bend (section 2).

- b. This option involves the installation of a rock revetment wall along the toe of the bank, battering of the bank slope and subsequent revegetation using species outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). A similar fence line setback (approx 10m from current bank crest) would be necessary to create a suitable batter angle and allow establishment of plants along the bank face. This will provide a higher degree of resilience against erosion from flooding and boat wash (than 1.1), however the cost would limit the potential for funding contributions from external parties.

2. Rehabilitation efforts at this site should focus primarily on weed control of the aforementioned species. This can be accompanied by revegetation in areas left bare after weeds have been eliminated. It is imperative that fence lines also be re-established prior to any revegetation work to prevent stock damage. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

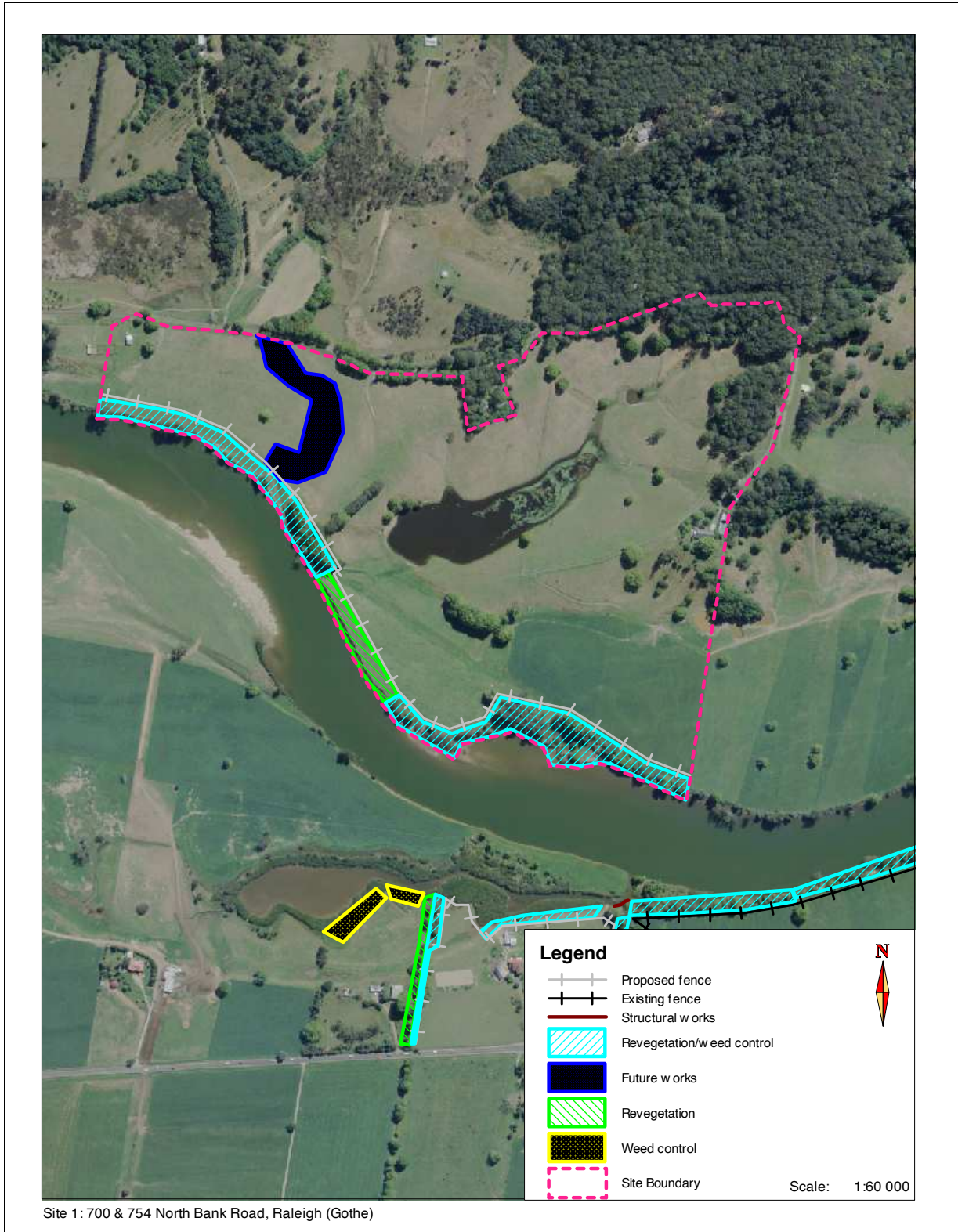


Figure 55: Property workplan map

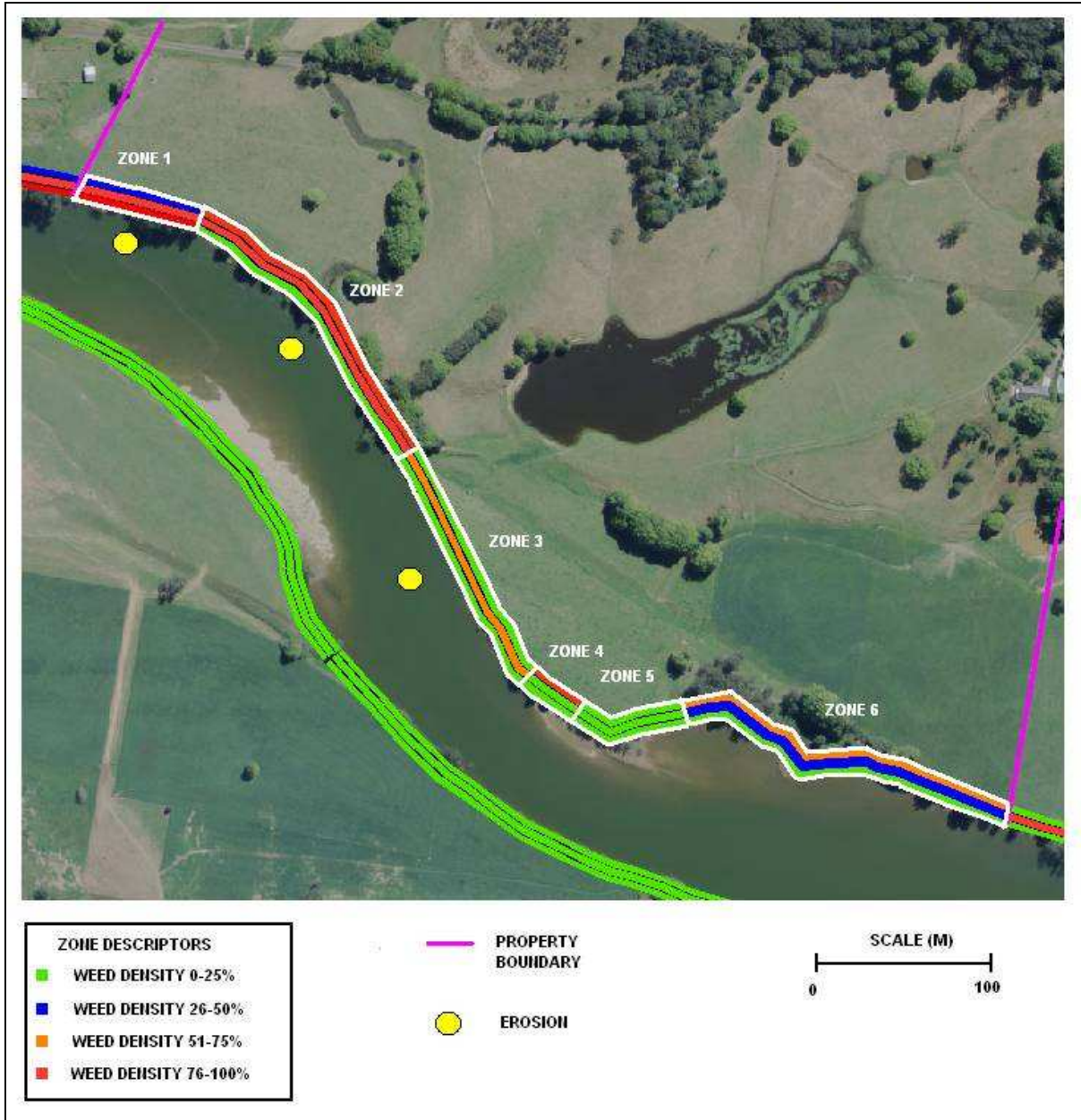


Figure 56: Riparian condition and extent

Table 46: Riparian condition summary

MGT ZONE	1	2	3	4	5	6
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	<5m	0m	5-10m	10-20m	20-30m
CANOPY COVER	51-75%	26-50%	Cleared	76-100%	76-100%	76-100%
MIDSTOREY COVER	51-75%	<25%	<25%	Cleared	<25%	76-100%
GROUND COVER	51-75%	76-100%	76-100%	26-50%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	N	Y	Y
GRAZING IMPACT	Y	Y	Y	Y		N
NATURAL REGEN	Y	N	N	N	Y	Y
CANOPY WEED	26-50%	76-100%	0%	76-100%	0%	51-75%
MIDSTOREY WEED	76-100%	76-100%	51-75%	0%	<25%	26-50%
GROUND COVER WEED	76-100%	0%	<25%	0%	0%	<25%
WEED 1	Coral Tree (Erythrina sykesii)	Coral Tree (Erythrina sykesii)	Mistflower (Eupatorium riparium)	Camphor Laurel (Cinnamomum camphora)	Lantana (Lantana camara)	Paddy Lucerne
WEED 1 DENSITY	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)
WEED 2	Balloon Vine (Cardiospermum grandiflorum)	Camphor Laurel (Cinnamomum camphora)	Blue Billy Goat (Ageratum houstonianum)	Coral Tree (Erythrina sykesii)		Lantana (Lantana camara)
WEED 2 DENSITY	Clumps (11-50%)	Dominant (>50%)	Few Scattered (<10%)	Clumps (11-50%)		Clumps (11-50%)
WEED 3	Small Leaf Privet (Ligustrum sinense)	Small Leaf Privet (Ligustrum sinense)	Lantana (Lantana camara)	Small Leaf Privet (Ligustrum sinense)		Camphor Laurel (Cinnamomum camphora)
WEED 3 DENSITY	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)		Dominant (>50%)
WEED 4	Wild Tobacco (Solanum mauritianum)					Mistflower (Eupatorium riparium)
WEED 4 DENSITY	Clumps (11-50%)					Clumps (11-50%)
WEED 5	Castor Oil Plant (Rinicus communis)					Wild Tobacco (Solanum mauritianum)
WEED 5 DENSITY	Clumps (11-50%)					Few Scattered (<10%)
BANK	North Bank	North Bank	North Bank	North Bank	North Bank	North Bank

Table 47: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)		
				Landholder	Contributions	
					NRCMA or Other	Bellingen Shire Council
All	Project Coordination	Technical, administrative & practical support (8 hrs @ \$50/hr)	Environmental Levy		400 (In kind)	400
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80
1-2	Weed Control (contractor)	Manual weed eradication along riparian zone (2 days @ \$760/day)				1520
1-3	Fencing	Landholder to supply materials for and construct fence line to exclude stock (580m @ \$5000/km)				2900
1-3	Revegetation (5800m ²)	Planting of key species at 2m centres along top of bank and face. (landholder labour) (\$6.50/ plant incl labour x 1450 plants) (landholder labour in kind)				9425
1-3	Batter shear bank (optional a)	Batter crest of shear bank face to facilitate better plant establishment (14hrs @ \$150/hr)				2100
1-3	Structural works (optional b)	Construction of rock revetment wall and batter bank face (580m @ \$500/m)				290000
4-6	Weed Control (contractor)	Manual weed eradication along riparian zone (6 days @ \$760/day)				4560
4-6	Fencing	Landholder to supply materials for and construct fence line to exclude stock (480m @ \$5000/km)				2400
4-6	Revegetation (13460m ²)	Planting of key species at 4m centres along top of bank and face.				5467

		(\$6.50/ plant incl labour x 841 plants) (landholder labour in kind)								
All	On-going Maintenance	Follow-up weed treatment and fence maintenance- quarterly (18hrs / qtr) inspections and suppression as necessary for 10 years	25472 (In kind)						25472	
			TOTAL						341424	

Site 2 - 534 Waterfall Way, Fernmount NSW 2454

Lot/DP	Lot112 DP624576
Property Owners	NR & LC Chapman
Catchment Details	Mid Bellinger River estuary – south bank; 410m stream frontage; Area: 2.76Ha
Land Use	Residential

Property Summary

The northern boundary of the property is enclosed by a significant estuarine wetland which links to the Bellinger River (on adjacent property – site 2). The eastern boundary of the property also borders an artificial drainage line which drains grazing land on the alluvial floodplain to the estuarine wetland. Due to the nature of the excavated drainage line (vertical banks, straight planform and insufficient riparian vegetation), bank scour and slump are evident. Additionally there is evidence of acid sulfate soil exposure in the bed of the drain. This has multiple negative effects on the immediate and downstream environment. Significant weed incursions include Small Leaf Privet (*Ligustrum sinense*), Camphor Laurel (*Cinnamomum camphora*) and Morning Glory (*Ipomea indica*). In particular the Morning Glory (*Ipomea indica*) threatens the mangrove habitat along the fringe of the estuarine wetland.

Previous Management Efforts

Significant native revegetation has already been undertaken by the landholder along the margin of the artificial drainage line.

Rehabilitation Strategy

Rehabilitation at this site will focus improving drain bank stability and extending the riparian corridor through revegetation:

1. Additional deep rooted plant species should be planted amongst the existing native vegetation to improve riparian structural diversity (refer to Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare)).
2. Further testing is recommended to ascertain the presence of active acid sulfate soil oxidation. Installation of a weir/bed control type structure may be necessary to maintain sufficient base flow water levels to inundate this oxidizing layer.
3. Continued weed control is also required to facilitate the regeneration process. In particular, control of Morning Glory (*Ipomea indica*) should be a key focus, allowing River Mangrove (*Aegiceras corniculatum*) and Common Reed (*Phragmites australis*) to proliferate.

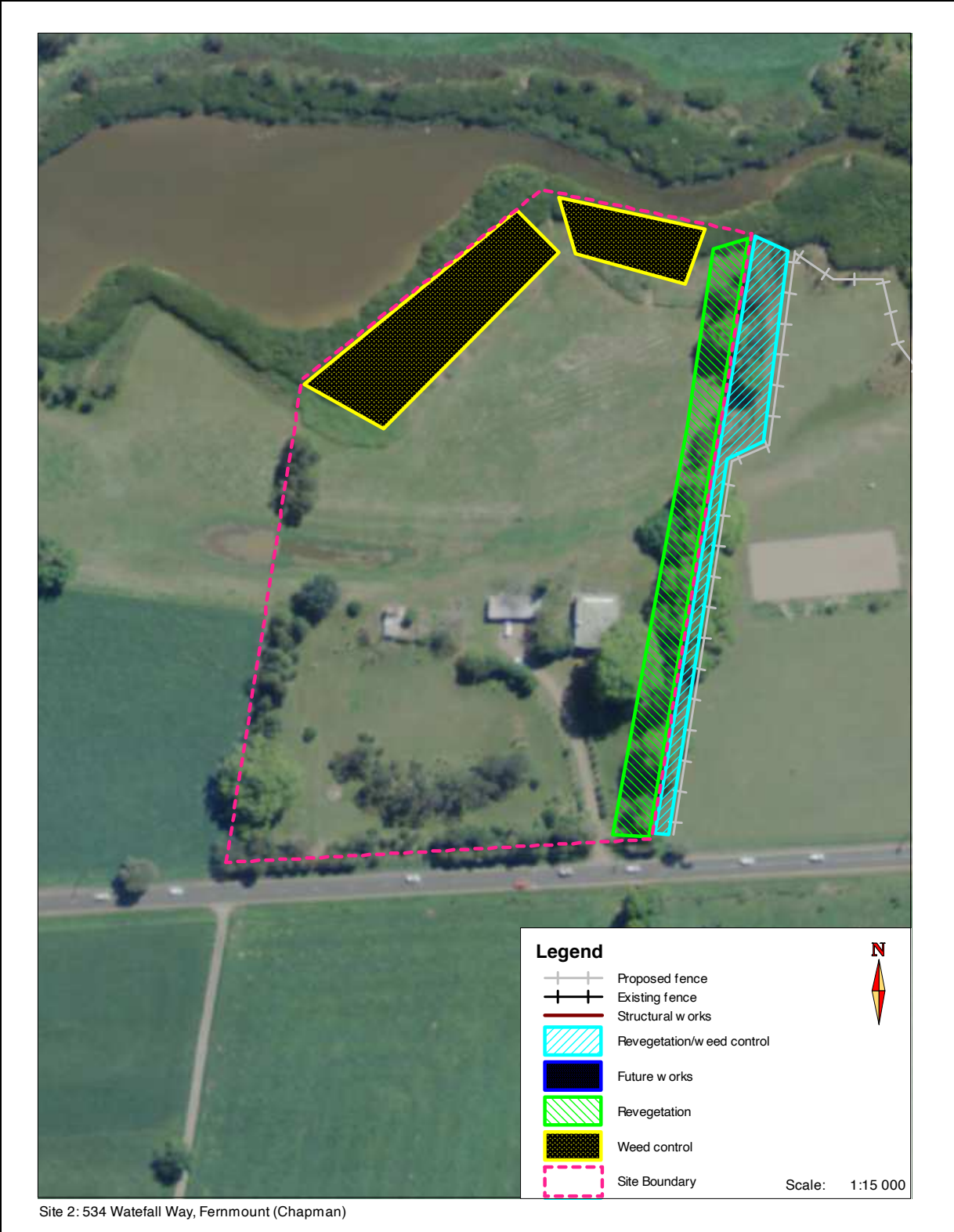


Figure 57: Property workplan map



Figure 58: Riparian condition and extent

Table 48: Riparian condition summary

MGT ZONE	1
ASSESSOR	S. Morris
RIPARIAN WIDTH	20-30m
CANOPY COVER	0%
MIDSTOREY COVER	76-100%
GROUND COVER	76-100%
APPROPRIATE COVER	Y
GRAZING IMPACT	N
NATURAL REGEN	N
CANOPY WEED	0%
MIDSTORY WEED	0%
GROUND COVER WEED	76-100%
WEED 1	Morning Glory (Ipomea sp)
WEED 1 DENSITY	Dominant (>50%)
BANK	North Bank

Table 49: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Contributions			
				Landholder	NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (2 hrs @ \$50/hr)	Environmental Levy		100 (In kind)	100	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
	Revegetation (1260m ²) (contractor)	Planting of key species at 2m centres to stabilise bank along drainage line (\$6.50/ plant incl labour x 300 plants)		1950			1950
	Weed control (4000m ²)	Supply of herbicide; Landholder to undertake weed management (40hrs @ \$35/hr) (landholder labour in kind)		1400 (In kind)	150		1550
	Maintenance Support	Wetland Care Australia to assist with aspects of site maintenance (36hrs @ \$50/hr)			1800 (In kind)		1800
	On-going Maintenance	Follow-up weed treatment- quarterly (4hrs / qtr) inspections and suppression as necessary for 10 years		5300 (In kind)			5300
			TOTAL	6700	3900	180	10780

Site 3 - 516 Waterfall Way, Fernmount NSW 2454

Lot/DP	Lot400 DP1042652
Property Owners	KJ Hood & AJ Hyndman
Catchment Details	Mid Bellinger River estuary – south bank; 710m stream frontage; Area: 5.175ha
Land Use	Rural/Residential – Horse property

Property Summary

This property is a section of alluvial floodplain that is nestled between a significant estuarine wetland (northern boundary), an artificial drainage line (western boundary, bordering site 1) and a modified natural drainage line (eastern boundary, bordering site 3). The modified drainage line on the eastern boundary meets the entrance to the estuarine wetland at their confluence with the Bellinger River. Minor bank erosion and channel siltation has also been observed at the estuarine wetland entrance. Due to the nature of the artificial drainage line (vertical banks, straight planform and insufficient riparian vegetation), bank scour and slump are evident. Additionally there is evidence of acid sulfate soil exposure in the bed of the drain. This has multiple negative effects on the immediate and downstream environment. An absence of riparian plants is also evident behind the mangrove colonies fringing the estuarine wetland. Weed infestations are an issue along the margins of both drainage lines including Small Leaf Privet (*Ligustrum sinense*) and Camphor Laurel (*Cinnamomum camphora*).

Previous Management Efforts

The modified drainage line has been fenced to restrict stock access along the riparian zone. The lower margin of the artificial drainage line (adjacent to the estuarine wetland) has also been fenced to exclude stock.

Rehabilitation Strategy

Improvements to both riparian and wetland condition can be achieved with the following approach:

1. Installation of 6 single pin sets (refer to site plan) to deflect flow away from right hand bank of backwater channel. Pins will also provide slack water habitats that will encourage the recruitment of mangrove seedlings. A preference for the use of turpentine timber is preferred however sufficient longevity will be achieved with normal hardwood timber species.
2. Re-establishment of a riparian corridor on the bank slope between the high bank edge and the mangrove community fringing the estuarine wetland. Consolidating the bank face through deep rooted species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare) would create long term stability. Accompanying fence lines will need to be established to exclude stock from the regeneration area.
3. Enhancement of the riparian corridors along the eastern and western boundaries. This will involve initial planting of native species, with gradual removal of Camphor Laurel (*Cinnamomum camphora*) to facilitate native regeneration. Accompanying fence lines will

need to be established to exclude stock from the regeneration area. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

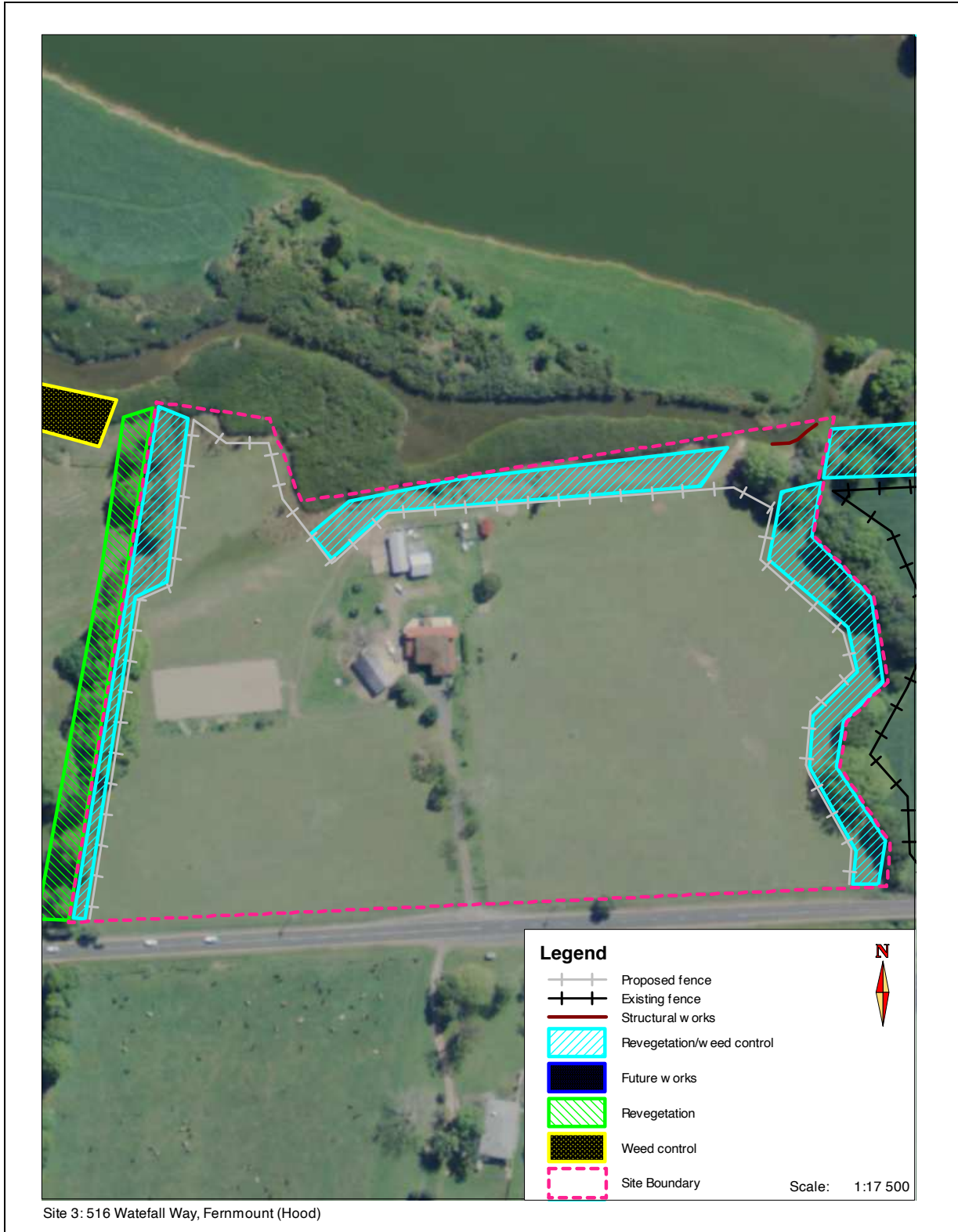


Figure 59: Property workplan map

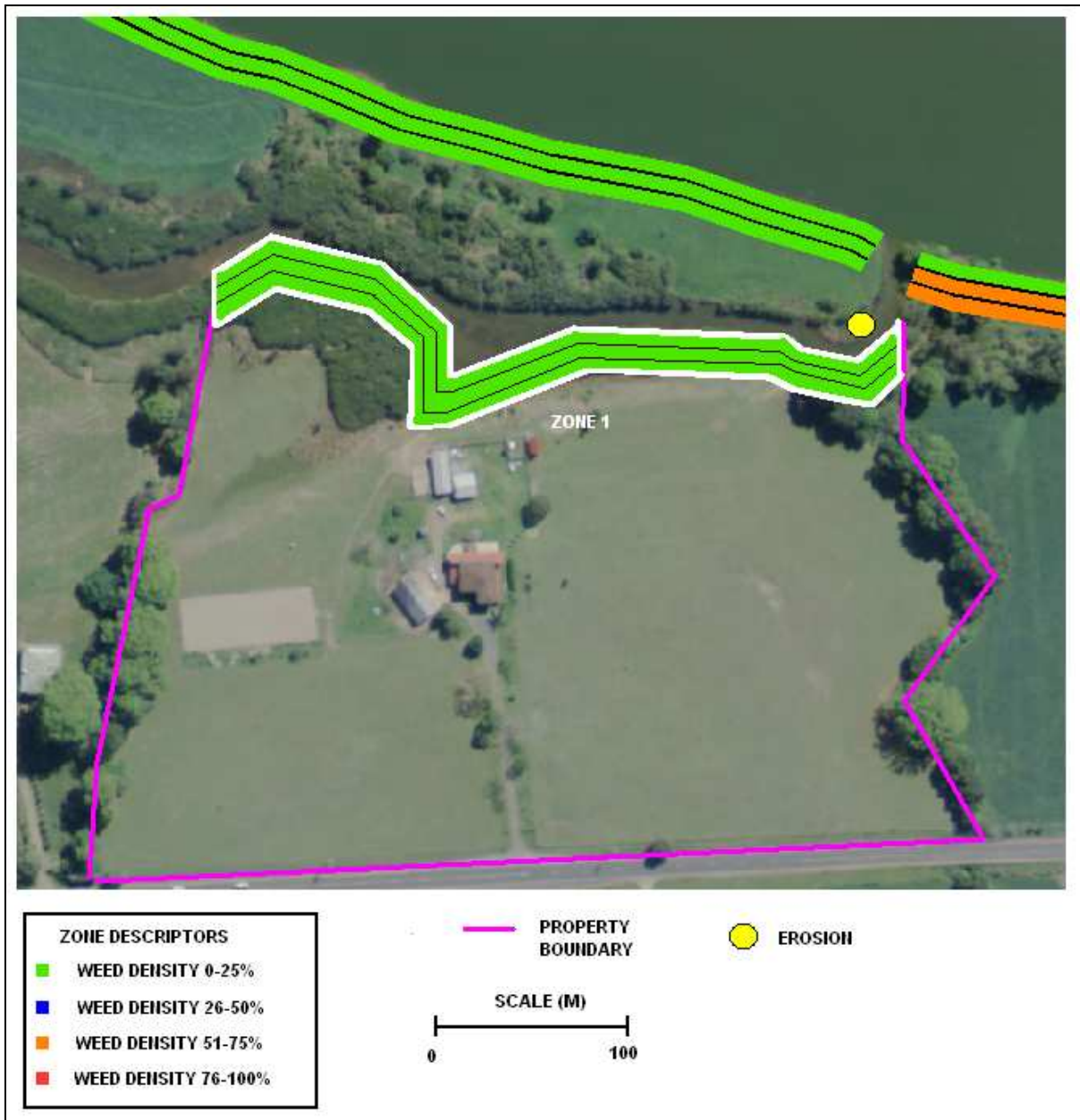


Figure 60: Riparian condition and extent

Table 50: Riparian condition summary

MGT ZONE	1
ASSESSOR	S. Morris
RIPARIAN WIDTH	20-30m
CANOPY COVER	0%
MIDSTOREY COVER	76-100%
GROUNDCOVER	76-100%
APPROPRIATE COVER	Y
GRAZING IMPACT	N
NATURAL REGEN	N
CANOPY WEED	0%
MIDSTORY WEED	0%
GROUNDCOVER WEED	0%
BANK	right

Table 51: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (10 hrs @ \$50/hr)	Environmental Levy		500 (In kind)	500	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
	Fencing	Landholder to supply materials for and construct fence line to exclude stock (220m @ \$3000/km)		660 (In kind)		660	
	Structural works	Realign existing debris (ie fallen trees) and construct pin groynes			1820	1820	
	Timber pins	Landholder to provide timber pins for groyne construction (24 hardwood posts @ \$37.50ea)		900 (In kind)		900	
	Weed control (1400m ²) (contractor)	Manual weed eradication along riparian zone and targeted thinning of Camphor (1 day @ \$760/day)			760	760	
	Revegetation (1400m ²)	Planting of key species at 2m centres to stabilise bank along drainage line (\$6.50/ plant incl labour x 350 plants) (landholder labour in kind)		1050 (In kind)	1225	2275	
	Fencing	Landholder to supply materials for and construct fence line to exclude stock (220m @ \$3000/km)		660 (In kind)		660	
	Weed control (1400m ²)	Manual weed eradication along riparian zone and targeted thinning of Camphor (1 day @ \$760/day)			760	760	

	Revegetation (1400m ²)	Planting of key species at 2m centres to stabilise bank along drainage line (\$6.50/ plant incl labour x 350 plants) (landholder labour in kind)		1050 (In kind)	1225		2275
	Fencing	Landholder to supply materials for and construct fence line to exclude stock (220m @ \$3000/km)		660 (In kind)			660
	Revegetation (1875m ²)	Planting of key species at 2m centres to stabilise bank face on northern boundary (\$6.50/ plant incl labour x 470 plants) (landholder labour in kind)		1410 (In kind)	1645		3055
	Fencing	Landholder to supply materials for and construct fence line to exclude stock (190m @ \$3000/km)		570 (In kind)			570
	On-going Maintenance	Follow-up weed treatment and fence maintenance- quarterly (4hrs / qtr) inspections and suppression as necessary for 10 years		14395 (In kind)			
			TOTAL	21355	7435	580	29370

Site 4 - 461 Waterfall Way, Fernmount NSW 2454

Lot/DP	Lot401 DP1042651
Property Owners	DS & SA Pryor
Catchment Details	Mid Bellinger River estuary – south bank; 930m river frontage; Area: 94.37ha
Land Use	Rural – Dairy Cattle

Property Summary

The bank at this site spans an outside bend section alluvial floodplain. A modified drainage line borders the property along its western flank (zone 1; adjacent to site 3). The upstream extent of the riparian zone along the main river channel is relatively stable (zones 1-3), gradually becoming more degraded towards the downstream extent (zones 4-5). This is consistent with the geomorphic character of the outside bend and associated erosive forces on the bank. Overall active erosion is considered moderate at this site (Cohen & Telfer, 2010). The modified drainage line is relatively stable with some minor weed problems. Notable weed species at this site include Small Leaf Privet (*Ligustrum sinense*), Camphor Laurel (*Cinnamomum camphora*), Balloon Vine (*Cardiospermum grandiflorum*), Lantana (*Lantana camara*) and Mistflower (*Eupatorium riparium*).

Previous Management Efforts

Riparian fencing has been established along the margins of the two paddocks at the upstream end of the site. The landholder indicated an intention to extend this fencing along the entire riparian corridor.

Rehabilitation Strategy

Target condition at this site can be achieved through a systematic, staged riparian fencing and revegetation program. This approach should focus on working out from the stable well vegetated section of river bank at the upstream extent of the property. A minimum fence line setback of five metres from the crest of the bank is recommended. This area should then be vegetated with a variety of deep rooted plant species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Accompanying vegetation should be planted along the bank face and toe (where possible) in order to create root complexes to buffer against erosive flood forces. This will provide a bare minimum in terms of resilience against future erosion and slumping during flood events. This buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

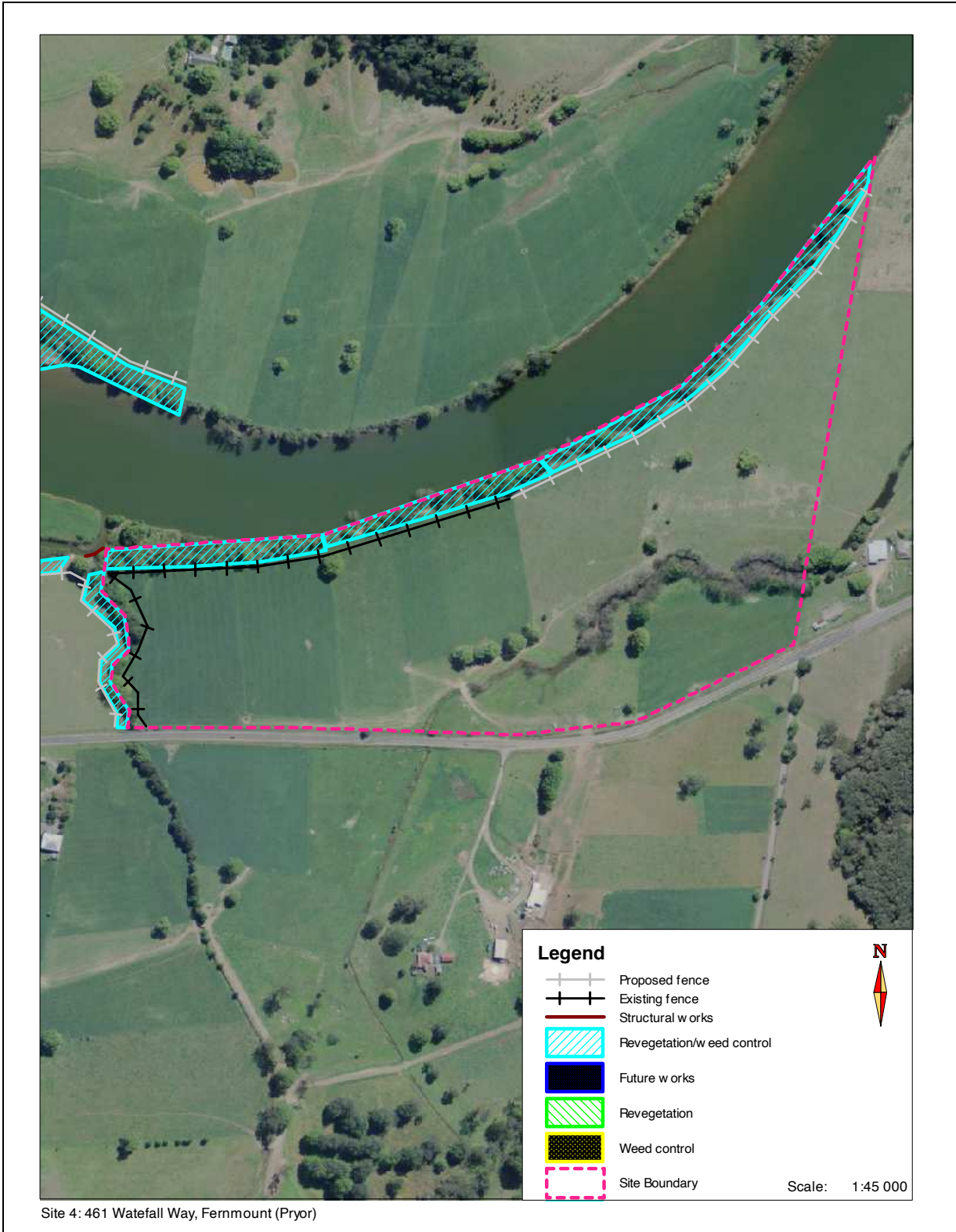


Figure 61: Property workplan map

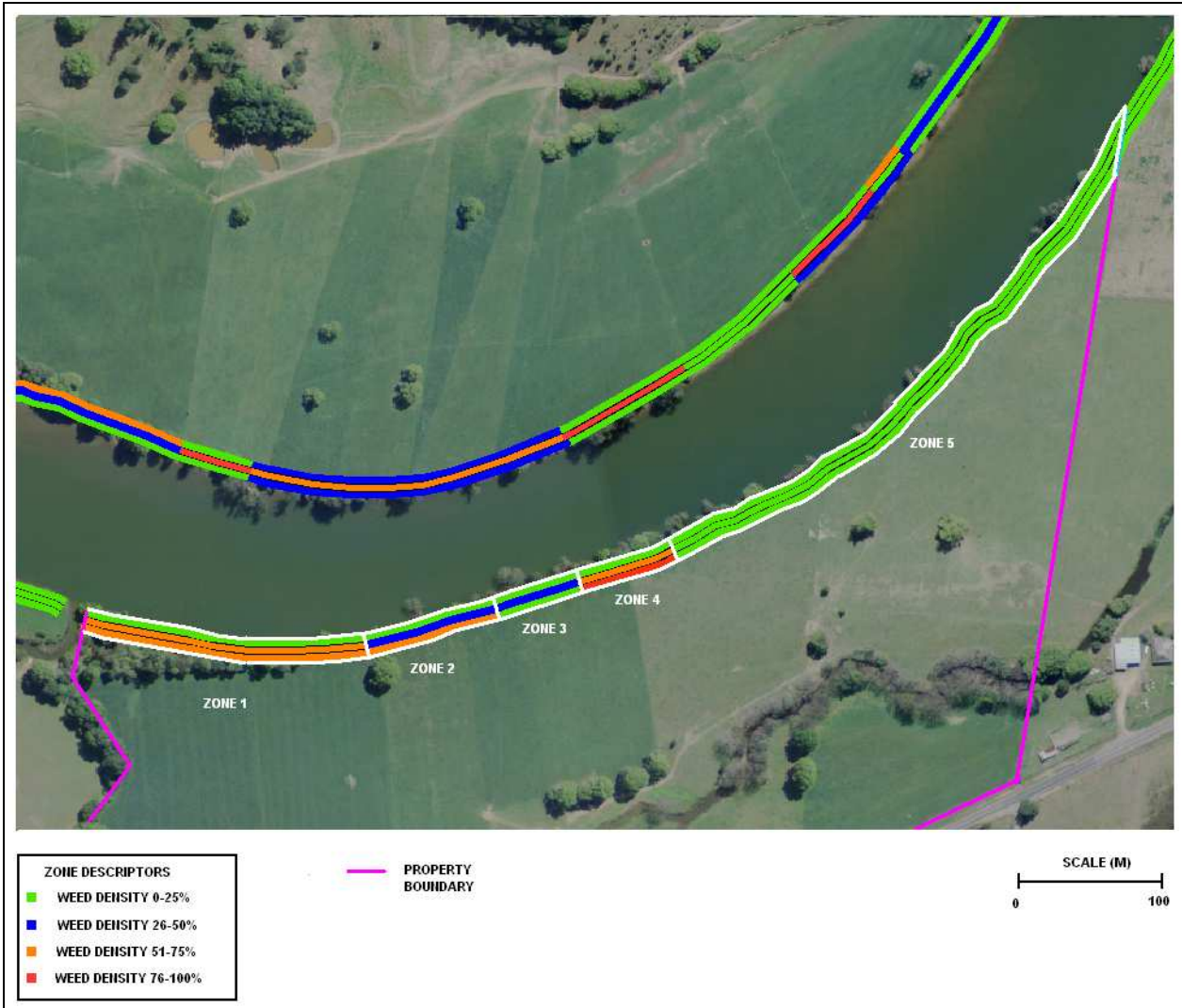


Figure 62: Riparian condition and extent

Table 52: Riparian condition summary

MGT ZONE	1	2	3	4	5
ASSESSOR	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris
RIPARIAN WIDTH	5-10m	<5m	<5m	5-10m	<5m
CANOPY COVER	76-100%	26-50%	<25%	76-100%	<25%
MIDSTOREY COVER	51-75%	26-50%	<25%	<25%	<25%
GROUND COVER	76-100%	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	N	N
GRAZING IMPACT	Y	Y	Y	Y	Y
NATURAL REGEN	N	N	N	N	Y
CANOPY WEED	51-75%	51-75%	0%	76-100%	<25%
MIDSTOREY WEED	51-75%	26-50%	26-50%	51-75%	0%
GROUND COVER WEED	0%	<25%	<25%	<25%	0%
WEED 1	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)	Small Leaf Privet (Ligustrum sinense)	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)
WEED 1 DENSITY	Dominant (>50%)	Dominant (>50%)	Few Scattered (<10%)	Dominant (>50%)	Few Scattered (<10%)
WEED 2	Lantana (Lantana camara)	Lantana (Lantana camara)	Lantana (Lantana camara)	Lantana (Lantana camara)	
WEED 2 DENSITY	Dominant (>50%)	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	
WEED 3	Balloon Vine (Cardiospermum grandiflorum)	Mistflower (Eupatorium riparium)	Mistflower (Eupatorium riparium)	Mistflower (Eupatorium riparium)	
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	
WEED 4	Small Leaf Privet (Ligustrum sinense)				
WEED 4 DENSITY	Few Scattered (<10%)				
BANK	South Bank	South Bank	South Bank	South Bank	South Bank

Table 53: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)		
				Landholder	Contributions	
					NRCMA or Other	Bellingen Shire Council
All	Project Coordination	Technical, administrative & practical support (14 hrs @ \$50/hr)	Environmental Levy		700 (In kind)	700
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80
1	Weed Control (contractor)	Manual weed eradication along riparian zone (2 days @ \$760/day)		1520		1520
1	Revegetation (7500m ²)	Planting of key species at 4m centres along riparian zone (\$6.50/ plant incl labour x 470 plants) (landholder labour in kind)		3055		3055
2-4	Fencing	Landholder to supply materials for and construct fence line to exclude stock (240m @ \$5000/km)		1200 (In kind)		1200
2-4	Weed Control (contractor)	Manual weed eradication along riparian zone (2.5 days @ \$760/day)		1900		1900
2-4	Revegetation (1680m ²)	Planting of key species at 2m centres along top of bank and face. (\$6.50/ plant incl labour x 420 plants) (landholder labour in kind)		2730		2730
5	Fencing	Landholder to supply materials for and construct fence line to exclude stock (480m @ \$5000/km)		2400 (In kind)		2400
5	Weed Control (contractor)	Manual weed eradication along riparian zone (2 days @ \$760/day)		1520		1520
5	Revegetation	Planting of key species at 2m centres along		3900		3900

	(2400m ²)	top of bank and face. (\$6.50/ plant incl labour x 600 plants) (landholder labour in kind)							
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (13hrs / qtr) inspections and suppression as necessary for 10 years		18255 (In kind)					18255
			TOTAL	21855	14625	780			37260

Site 5 - 935 North Bank Road, Raleigh NSW 2454

Lot/DP	Lot3 DP755553
Property Owners	CC & JF Saeck
Catchment Details	Mid Bellinger River estuary – north bank; 520m river frontage; Area: 58.58ha
Land Use	Rural – Dairy Cattle

Property Summary

This property fronts the Bellinger River on an alluvial flood plain outside bend section. A modified drainage line (Connors Creek) also intersects the property, delivering water from wetland areas further to the north. The upstream extent of the riparian zone along the main river channel is relatively stable (zone 1), gradually becoming more degraded towards the downstream extent (zones 2-3). Significant mass failure has occurred along downstream sections of the bank at this site, attributed to bank scour and hydraulic drawdown in the flood events of 2009. Overall active erosion is considered to be minor in severity (Cohen & Telfer, 2010). Vegetation at this site is dominated by weed species including Small Leaf Privet (*Ligustrum sinense*), Camphor Laurel (*Cinnamomum camphora*), Balloon Vine (*Cardiospermum grandiflorum*), Lantana (*Lantana camara*), Blue Billy Goat (*Ageratum houstonianum*) and newly regenerating natives such as River Oak (*Casurina cunninghamiana*) and Wattle (*Acacia* sp). Several large Camphor Laurel (*Cinnamomum camphora*) trees are overhanging the bank and at risk of toppling into the river and causing further damage to the bank.

Previous Management Efforts

The drainage line that intersects this property has recently been excavated to facilitate better drainage across the alluvial floodplain. Several large Camphor Laurel (*Cinnamomum camphora*) trees have also been lopped along this drainage line.

Rehabilitation Strategy

In order to address these issues it is suggested that a combination of actions be employed to retard further bank failure and create the necessary riparian complexity that will result in long term bank stability:

1. A series of pin sets (refer to figure x) be installed at sites of scour erosion. Pin sets should be placed to both deflect flows away from steep banks and aggrade bed material along the toe.
2. A minimum fence line setback of five metres from the crest of the bank is recommended. This area should then be vegetated with a variety of deep rooted plant species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Accompanying vegetation should be planted along the bank face and toe (where possible) in order to create root complexes to buffer against erosive flood forces. Particular attention should be paid to heavily vegetating benches and bank toes where slumping or scour has occurred. This will provide a bare minimum in terms of resilience against future erosion and slumping during flood events. This buffer may need to be re-established and/or expanded in the advent of

damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants. This will include gradual removal of Camphor Laurel (*Cinnamomum camphora*) and manual lopping of trunks at knee-waist height where their collapse is imminent.

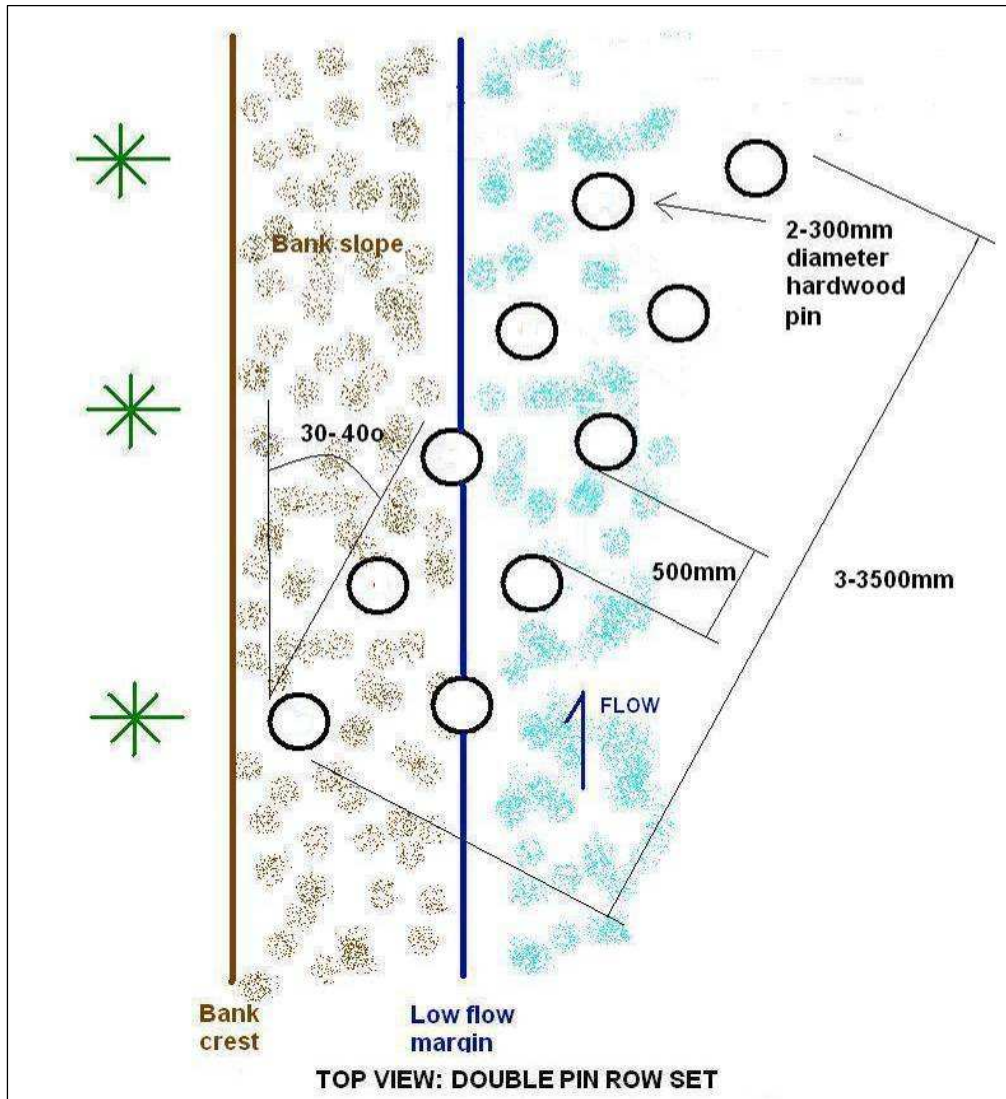


Figure 63: structural works design specifications

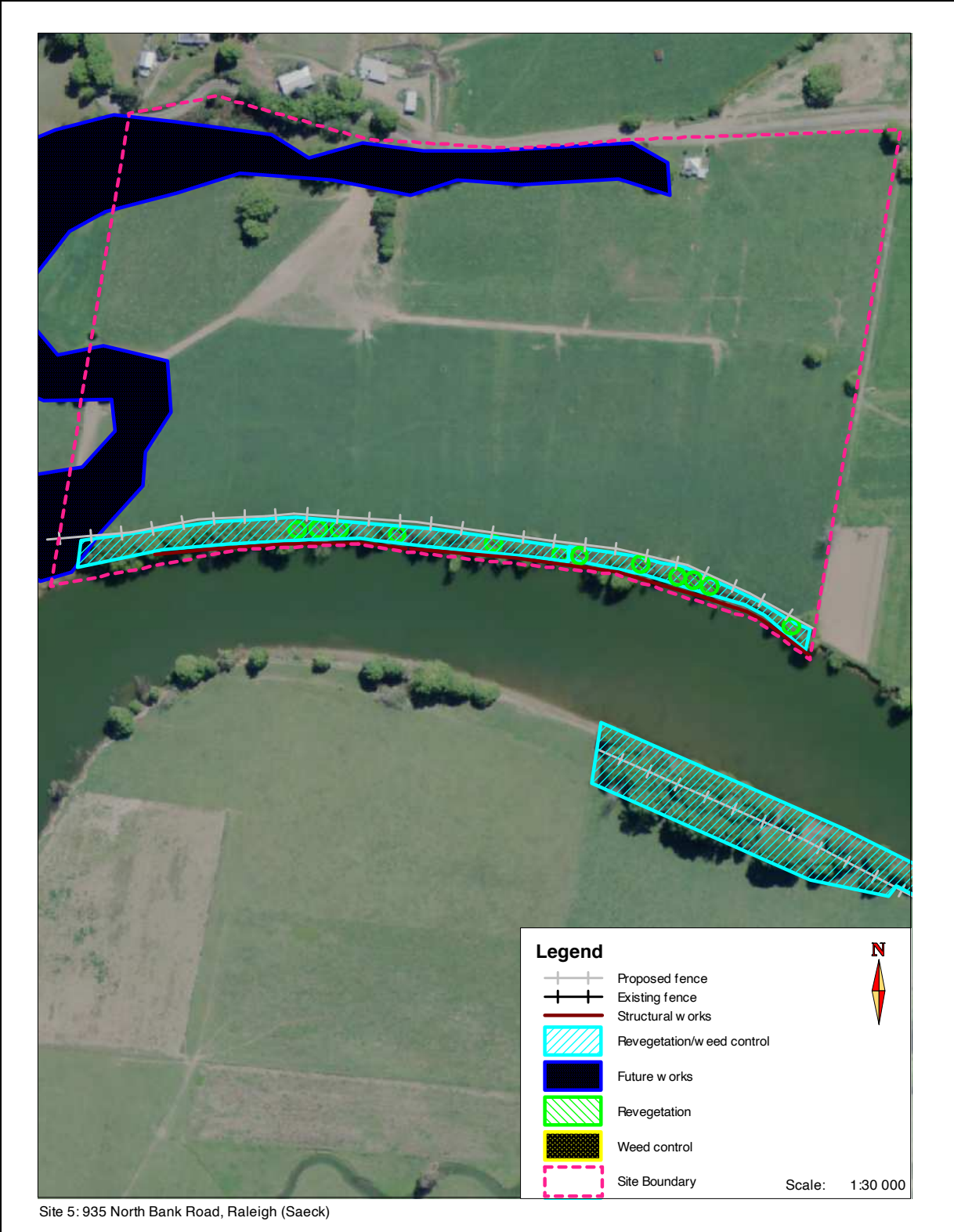


Figure 64: Property workplan map

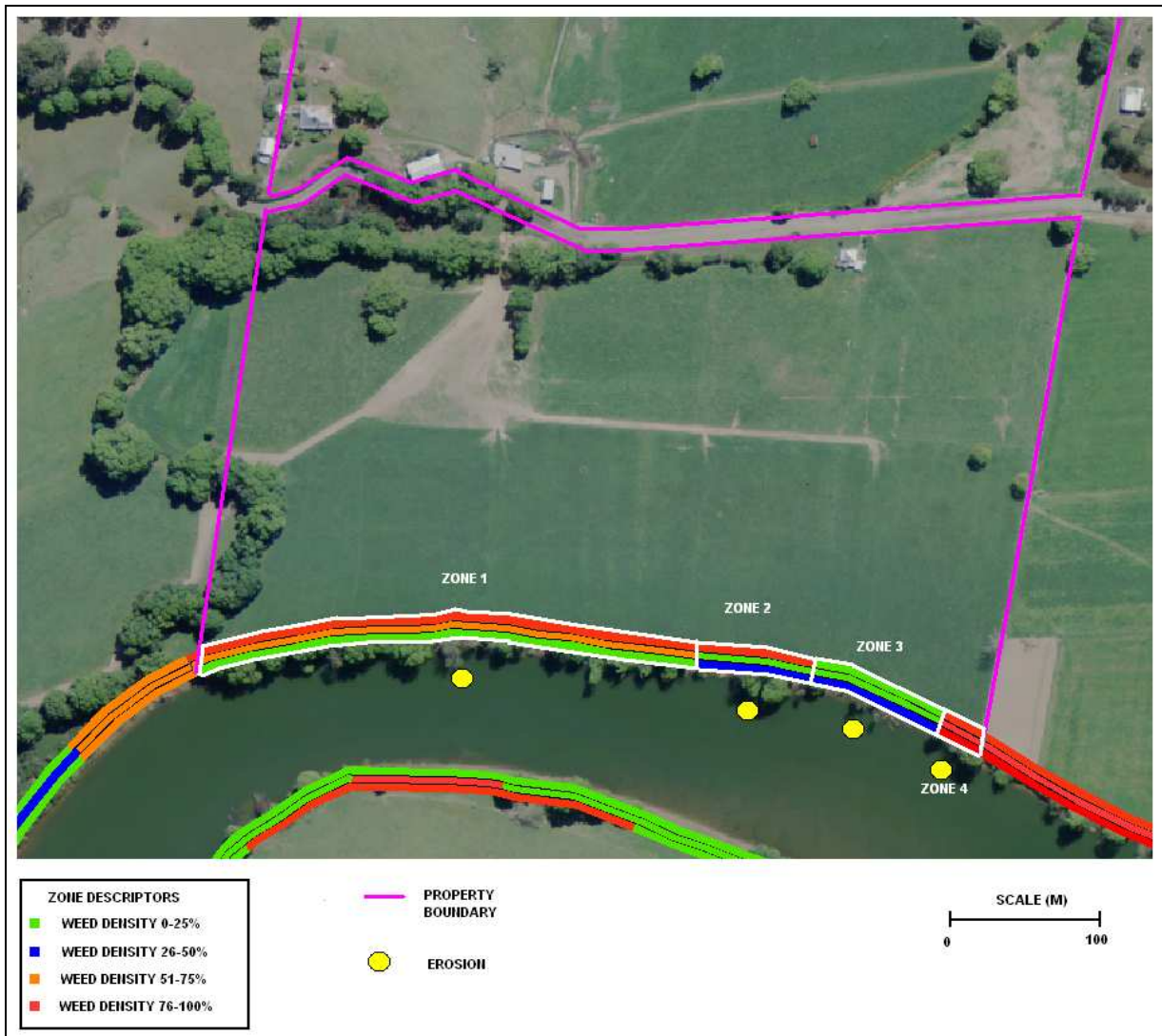


Figure 65: Riparian condition and extent

Table 54: Riparian condition summary

MGT ZONE	1	2	3	4
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	<5m	<5m	<5m
CANOPY COVER	76-100%	<25%	Cleared	<25%
MIDSTOREY COVER	26-50%	<25%	26-50%	26-50%
GROUND COVER	51-75%	76-100%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	N
GRAZING IMPACT	Y	Y	Y	Y
NATURAL REGEN	Y	Y	Y	N
CANOPY WEED	76-100%	76-100%	0%	76-100%
MIDSTOREY WEED	51-75%	0%	<25%	76-100%
GROUND COVER WEED	0%	26-50%	26-50%	76-100%
WEED 1	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)	Blue Billy Goat (Ageratum houstonianum)	Camphor Laurel (Cinnamomum camphora)
WEED 1 DENSITY	Dominant (>50%)	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)
WEED 2	Lantana (Lantana camara)	Lantana (Lantana camara)	Camphor Laurel (Cinnamomum camphora)	Coral Tree (Erythrina sykesii)
WEED 2 DENSITY	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 3	Coral Tree (Erythrina sykesii)	Wild Tobacco (Solanum mauritianum)		Mistflower (Eupatorium riparium)
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)		Clumps (11-50%)
WEED 4	Small Leaf Privet (Ligustrum sinense)	Blue Billy Goat (Ageratum houstonianum)		Balloon Vine (Cardiospermum grandiflorum)
WEED 4 DENSITY	Few Scattered (<10%)	Clumps (11-50%)		Few Scattered (<10%)
WEED 5	Balloon Vine (Cardiospermum grandiflorum)			Small Leaf Privet (Ligustrum sinense)
WEED 5 DENSITY	Few Scattered (<10%)			Few Scattered (<10%)
BANK	North Bank	North Bank	North Bank	North Bank

Table 55: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (14 hrs @ \$50/hr)	Environmental Levy		700 (In kind)	700	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
1	Fencing	Landholder to supply materials for and construct fence line to exclude stock (330m @ \$5000/km)		1650		1650	
1	Weed Control (contractor)	Manual weed eradication along riparian zone (3.5 days @ \$760/day)		2660		2660	
1	Revegetation (3300m ²)	Planting of key species at 2m centres along riparian zone (\$6.50/ plant incl labour x 825 plants) (landholder labour in kind)		2475 (In kind)	2888	5362	
2-3	Fencing	Landholder to supply materials for and construct fence line to exclude stock (190m @ \$5000/km)			950	950	
2-3	Weed Control (contractor)	Manual weed eradication along riparian zone (2 days @ \$760/day)			1520	1520	
2-3	Revegetation (1900m ²)	Planting of key species at 2m centres along top of bank and face. (\$6.50/ plant incl labour x 475 plants) (landholder labour in kind)		1425 (In kind)	1663	3088	
1-3	Structural works	Excavator driving pin sets into scour and slumping sites (refer to CMA site plan)			20030	20030	
All	On-going	Follow-up weed treatment & fence		32786		32786	

Maintenance	maintenance- quarterly (23hrs / qtr) inspections and suppression as necessary for 10 years		(In kind)				
		TOTAL	36686	31361	780	68827	

Site 6 - 383 Waterfall Way, Fernmount NSW 2454

Lot/DP	LotPTA DP184353
Property Owners	Anne Lynette Perry
Catchment Details	Mid Bellinger River estuary – south bank; 360m river frontage; Area: 68.15ha
Land Use	Rural– Dairy Cattle

Property Summary

The site spans a straight section alluvial floodplain (zone 1) with an estuarine inlet/wetland laterally meandering through the property (zone 2). The bank section along the main river channel is a deposition zone, although some minor bank instability and damage to River Mangrove (*Aegiceras corniculatum*) is evident due to unrestricted cattle access. Overall erosion severity is considered stable for this site (Cohen & Telfer, 2010). Camphor Laurel (*Cinnamomum camphora*) dominate the riparian zone at this site and in combination with cattle browsing, are suppressing the establishment of new plant recruits in the riparian zone.

Previous Management Efforts

N/A

Rehabilitation Strategy

Rehabilitation at this site should focus on restricting cattle access to the immediate bank face and low bench. This will allow the recruitment and establishment of mangroves which will improve bank stability. In particular, boat wash may threaten bank stability at this site and mangroves will play a key role in mitigating this issue. Further action is recommended to implement a program to gradually replace the Camphor Laurel (*Cinnamomum camphora*) trees with deep rooted native species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). This will create a healthy riparian corridor and assist in long term resilience of the site against potential flood damage. It is imperative that cattle are restricted from the revegetation area during initial establishment as they will destroy small plants through browsing and trampling. Upon establishment (5-10years) however, this area will provide much greater grazing potential than is currently attainable with the Camphor Laurel (*Cinnamomum camphora*) trees which omit chemicals to suppress pasture establishment beneath.

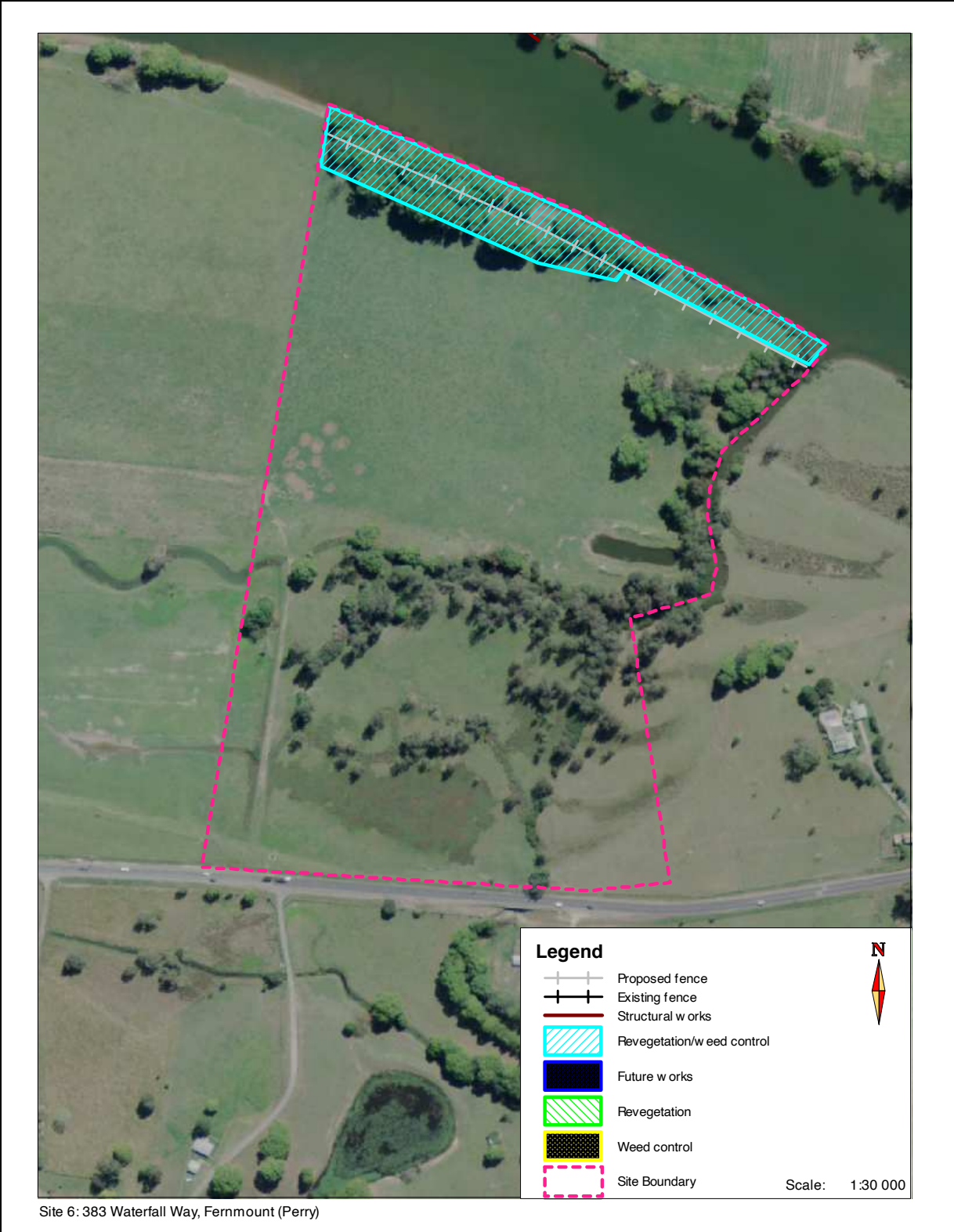


Figure 66: Property workplan map

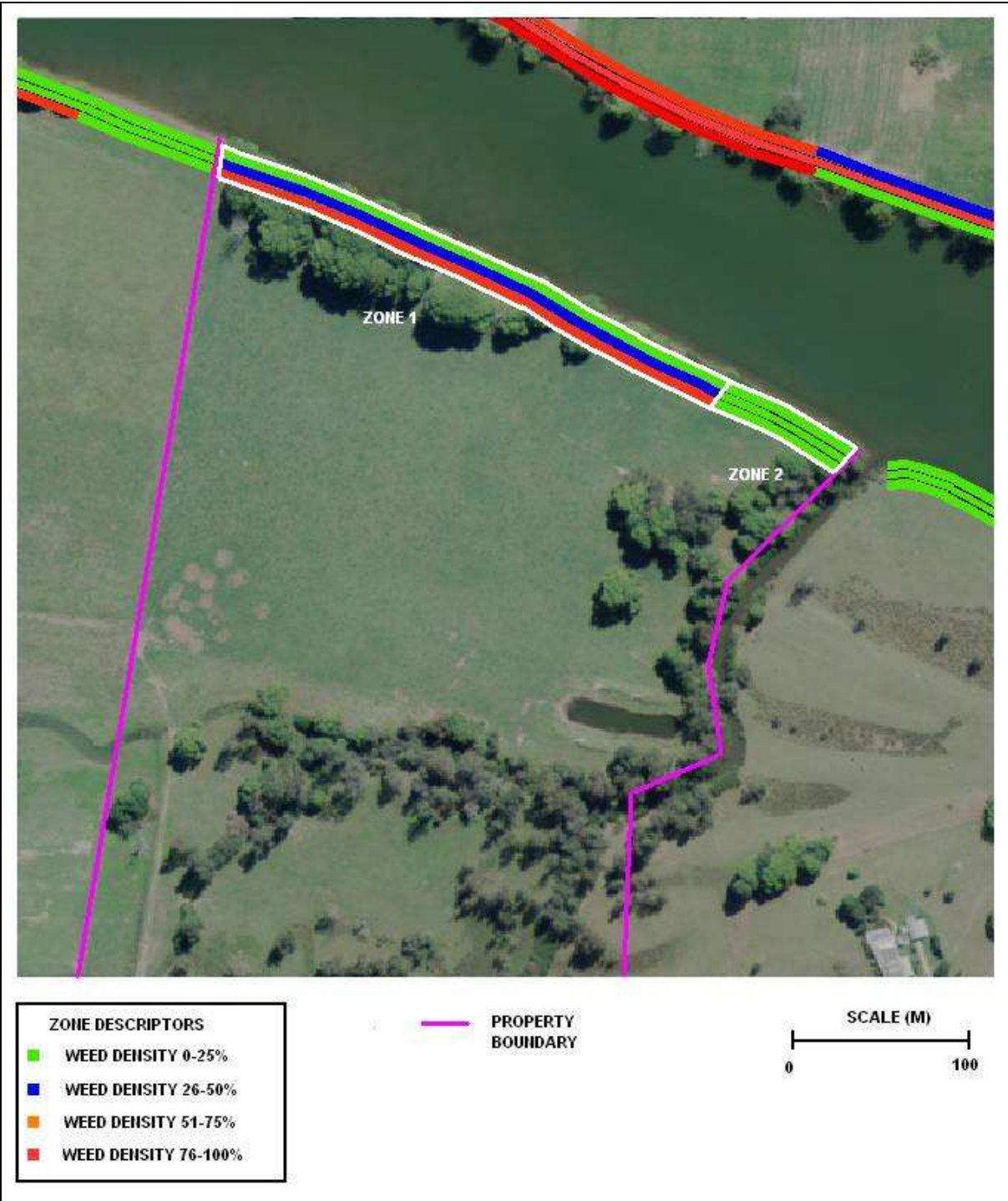


Figure 67: Riparian condition and extent

Table 56: Riparian condition summary

MGT ZONE	1	2
ASSESSOR	S. Morris	S. Morris
RIPARIAN WIDTH	5-10m	5-10m
CANOPY COVER	76-100%	<25%
MIDSTOREY COVER	<25%	51-75%
GROUND COVER	51-75%	76-100%
APPROPRIATE COVER	N	N
GRAZING IMPACT	Y	Y
NATURAL REGEN	N	N
CANOPY WEED	76-100%	<25%
MIDSTORY WEED	26-50%	0%
GROUND COVER WEED	0%	0%
WEED 1	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)
WEED 1 DENSITY	Dominant (>50%)	Few Scattered (<10%)
WEED 2	Lantana (Lantana camara)	
WEED 2 DENSITY	Few Scattered (<10%)	
BANK	South Bank	South Bank

Table 57: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (4 hrs @ \$50/hr)	Environmental Levy		200 (In kind)	200	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Fencing	Supply materials for landholder to construct fence line to exclude stock (360m @ \$5000/km) (landholder labour in kind)		1080 (In kind)	720	1800	
1	Weed Control (contractor)	Targeted poisoning of Camphors in stages (30 stems @ \$6.50ea incl. herbicide)			195	195	
All	Revegetation (7200m ²)	Re-establishment of native canopy trees among Camphor gaps (approx 6m centres) (\$6.50/ plant incl labour x 200 plants) (landholder labour in kind)			1300	1300	
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (2.5hrs / qtr) inspections and suppression as necessary for 10 years		3295 (In kind)		3295	
			TOTAL	4375	2215	6870	280

Site 7 - 282 Waterfall Way, Fernmount NSW 2454

Lot/DP	Lot12 DP855011
Property Owners	AM & SM Gilmore
Catchment Details	Mid Bellinger River estuary – south bank; 40m river frontage; Area: 1.55Ha
Land Use	Rural/Residential – Beef Cattle

Property Summary

This property spans a small alluvial floodplain high bank section on an outside bend. There is a narrow tidally submerged bench extending approximately four metres from the toe of the immediate bank face. Undercutting is evident along the toe of the bank. This is deemed to be a combination of boat wash fretting and flood scour (A. Gilmore, pers comm). Overall active erosion is considered to be minor (Cohen & Telfer, 2010). Bank vegetation consists of several large trees including Camphor Laurel (*Cinnamomum camphora*) and River Oak (*Casurina cunninghamiana*), with understory species such as Wattle (*Acacia* sp), Guoia (*Guoia semiglauca*) and Lanatana (*Lantana camara*).

Previous Management Efforts

The riparian zone has been fenced to a distance approximately 7 metres back from the bank crest. Limited regeneration is occurring due to competition from weed species and lack of existing seed stock. The bank toe has been protected using sand bags, however the permanence of this measure is uncertain. Several fallen logs (due to bank collapse) have also been re-aligned and/or lopped to reduce further damage to the bank.

Rehabilitation Strategy

The rehabilitation strategy for this site should build on the current management efforts with a focus on improving bank stability through riparian revegetation and bank toe protection measures:

1. A series of rock fillets (figure x) be placed along the low tide bench in order to facilitate the regeneration of mangroves and deflect damaging boat wash and flood scour. Should this option be undertaken, works would need to take place prior to any revegetation works suggest below.
2. The riparian area that is already fenced should be revegetated with deep rooted plant species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). This will need to take place in conjunction with weed control work, in particular the Camphor Laurel (*Cinnamomum camphora*) trees will need to be removed in order to facilitate successful establishment of alternative native plants.

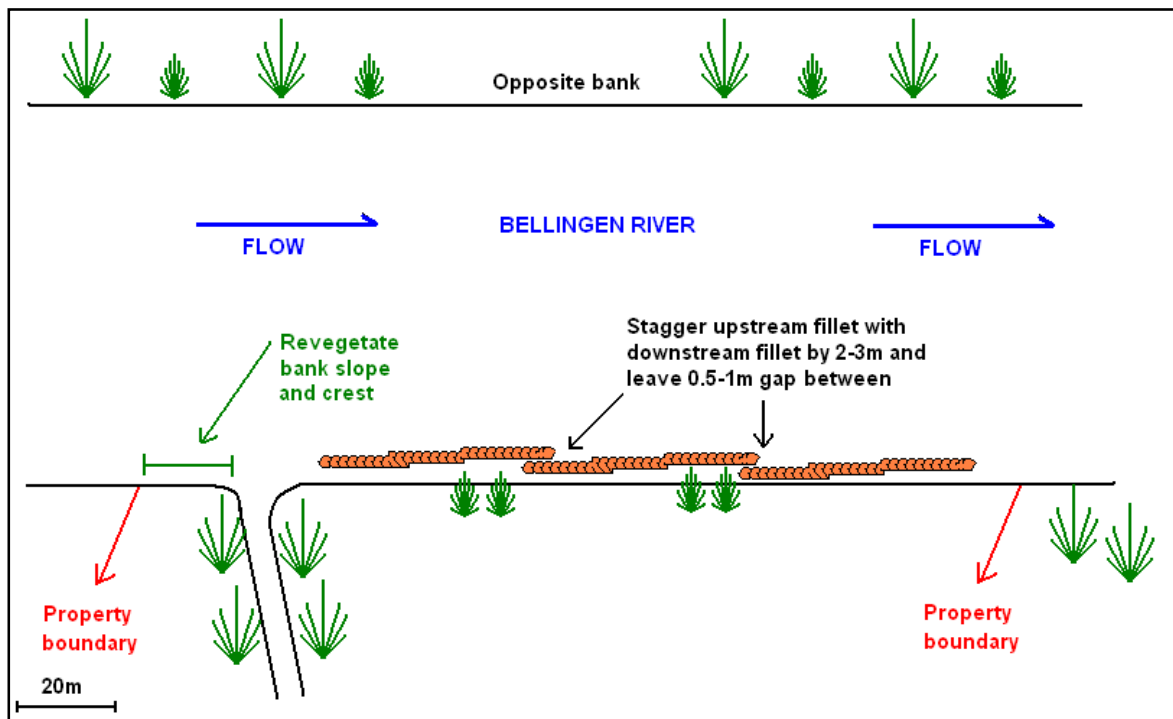


Figure 68: Design layout for structural works



Figure 69: Property workplan map

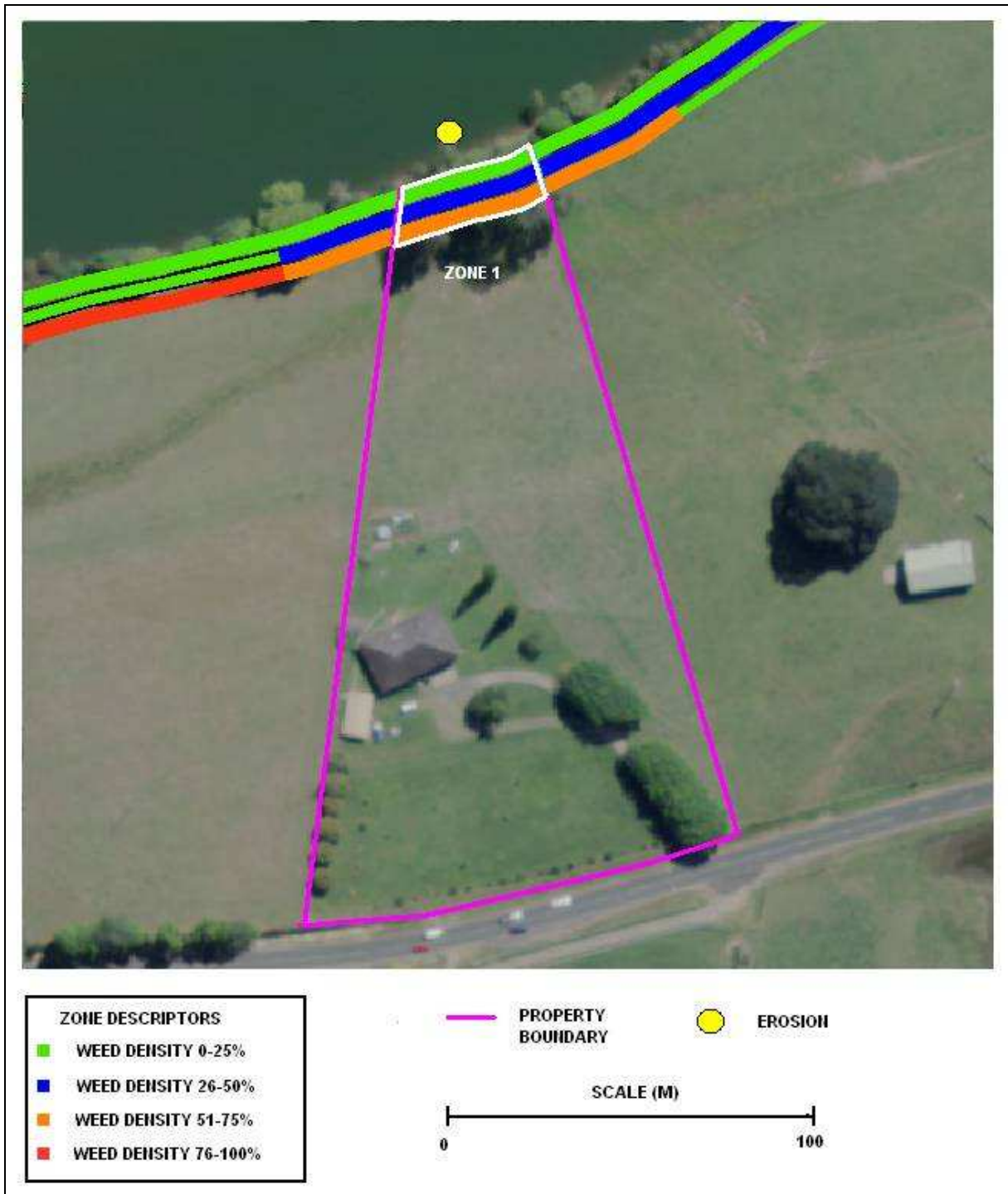


Figure 70: Riparian condition and extent

Table 58: Riparian condition summary

MGT ZONE	1
ASSESSOR	S. Morris
RIPARIAN WIDTH	<5m
CANOPY COVER	26-50%
MIDSTOREY COVER	26-50%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	Y
NATURAL REGEN	Y
CANOPY WEED	<25%
MIDSTORY WEED	0%
GROUND COVER WEED	<25%
WEED 1	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 1 DENSITY	Few Scattered (<10%)
WEED 2	Lantana (<i>Lantana camara</i>)
WEED 2 DENSITY	Few Scattered (<10%)
WEED 3	Morning Glory (<i>Ipomea</i> sp)
WEED 3 DENSITY	Few Scattered (<10%)
BANK	South Bank

Table 59: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (6 hrs @ \$50/hr)	Environmental Levy		300 (In kind)	300	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Weed Control (contractor)	General weed control along riparian zone and stem inject Camphors (0.5 days @ \$760/day)		380		380	
All	Revegetation (280m ²)	Planting of key species at 2m centres along top of bank and face. (\$6.50/ plant incl labour x 70 plants) (landholder labour in kind)		210 (In kind)	241	455	
All	Structural works (optional)	Excavator to place two rock fillets along margin of low tide bench (1 x 40m fillets @ \$100/m)			4000	4000	
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (6hrs / qtr) inspections and suppression as necessary for 10 years		8035 (In kind)		8035	
			TOTAL	8245	4621	13250	

Site 8 - 182 Waterfall Way; 1018 North Bank Road Raliegh NSW 2454

Lot/DP	Lot10 DP836002; Lot26 DP619527
Property Owners	Charles Henry Taylor
Catchment Details	Mid Bellinger River estuary – south & north bank; 1810m river frontage; Area: 76.7ha
Land Use	Rural – Dairy Cattle

Property Summary

This site comprises of four geomorphologically distinct sections:

1. Outside bend alluvial floodplain on south bank (zone 1). According to photogrammetrically derived high bank estimates this bend has eroded approximately 35 metres since 1942 (0.3-0.5m/yr). There is a sheer bank face dropping into deep water approximately 3-4 metres above mean high tide mark. Scour and fretting of the bank toe and subsequent mass failure are evident in recent times. Two flood chutes also cut laterally across the flood plain however the entry points are on properties upstream. Overall active erosion severity is considered severe on this bend (Cohen & Telfer, 2010). Vegetation is almost non-existent with a few Wattle (*Acacia* sp) and River Oak (*Casurina cunninghamiana*) establishing along the bank face. Weed species including small Camphor Laurel (*Cinnamomum camphora*) and Lantana (*Lanatana camara*) also appear sporadically.
2. Outside bend alluvial floodplain on north bank (zones 6-9). Photogrammetric high bank locations suggest a similar rate of retreat for this bend (0.3-0.5m/yr). Photogrammetric cross-sections for both bends should be treated conservatively given the large proportion of cross sectional area beneath the water surface in these instances. Overall active erosion severity is considered severe on this bend (Cohen & Telfer, 2010). Vegetation along this bend is dominated by pasture with a few weed species including Camphor Laurel (*Cinnamomum camphora*) Wild Tobacco (*Solanum mauritianum*), Balloon Vine (*Cardiospermum grandiflorum*), Small Leaf Privet (*Ligustrum sinense*) and Blue Billy Goat (*Ageratum houstonianum*).
3. Inside bend alluvial flood plain and depositional bench (zones 2-3). According to photogrammetric evidence, this site has eroded and aggraded similar amounts of material on either side of the bend. Active erosion severity grades from severe to stable through this bend (Cohen & Telfer, 2010). Notable vegetation at this bend includes Common Reed (*Phragmites australis*), River Oak (*Casurina cunninghamiana*) and Camphor Laurel (*Cinnamomum camphora*), Lantana (*Lanatana camara*) and Wild Tobacco (*Solanum mauritianum*).
4. Straight section through slight outside bend (zones 3-5), alluvial floodplain with small estuarine inlet meandering laterally across floodplain (zone 4). There is some minor erosion evident towards the downstream extent of this section (zone 4-5). This is reflected in Cohen & Telfer (2010) where active erosion grades from stable to minor towards the slight outside bend. River Mangrove (*Aegicercus corniculatum*) is interspersed along this section of bank and has established in thickets around the mouth of the creek inlet. Other significant vegetation includes Common Reed (*Phragmites australis*), River Oak (*Casurina cunninghamiana*)

and weeds including Coral Tree (*Erythrina sykesii*), Camphor Laurel (*Cinnamomum camphora*), Morning Glory (*Ipomea* sp) and Lantana (*Lantana camara*).

Previous Management Efforts

Riparian fencing has been constructed along sections of the property, although no attempt has been made to revegetate and natural regeneration is limited.

Rehabilitation Strategy

The rehabilitation strategy for this site will be addressed according to the four distinct units mentioned previously:

1. Two options are proposed for this bend:
 - 1.1. A minimum fence line setback of ten metres from the crest of the bank is recommended. This area should then be vegetated with a variety of deep rooted plant species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Battering of the bank crest prior to revegetation may be advantageous in terms of minimizing the potential for further mass failure at the shear bank face; however the cost of this exercise may outweigh the long term benefits. Accompanying vegetation should be planted along the bank face and toe (where possible) in order to create root complexes to buffer against erosive flood forces. This will provide a bare minimum in terms of resilience against future erosion and slumping during flood events. This buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants. Should this approach be undertaken it is recommended that the revegetation project be undertaken in several stages working back from the stable bench at the inside bend (section 2). Continual monitoring should be undertaken to ascertain vegetation response and recovery from ensuing flood events.
 - 1.2. This option involves the installation of a rock revetment wall along the toe of the bank, battering of the bank slope and subsequent revegetation using species outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). A similar fence line setback (approx 10m from current bank crest) would be necessary to create a suitable batter angle and allow establishment of plants along the bank face. This will provide a higher degree of resilience against erosion from flooding and boat wash (than 1.1), however the cost would limit the potential for funding contributions from external parties.
2. The same options (as in 1.) are proposed for this bend.
3. This area should then be vegetated with a variety of deep rooted plant species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Particular attention should be paid to the unconsolidated bench at the apex of the inside bend where active erosion is still severe. Accompanying fence lines will need to be established to exclude stock from the regeneration area. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.
4. Although this section of the bank is relatively stable, there is significant potential to improve riparian condition. Rehabilitation at this site should focus on restricting cattle access to the

immediate bank face and low bench. This will improve survival and establishment of mangroves which protect the bank toe. In particular, boat wash may threaten bank stability at this site and mangroves will play a key role in mitigating this issue. Further action is recommended to implement a program to gradually replace the Camphor Laurel (*Cinnamomum camphora*) trees with deep rooted native species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). This will create a healthy riparian corridor and assist in long term resilience of the site against potential flood damage. It is imperative that cattle are restricted from the revegetation area during initial establishment as they will destroy small plants through browsing and trampling. Upon establishment (5-10 years) however, this area will provide much greater grazing potential than is currently attainable with the Camphor Laurel (*Cinnamomum camphora*) trees which omit chemicals to suppress pasture establishment beneath.

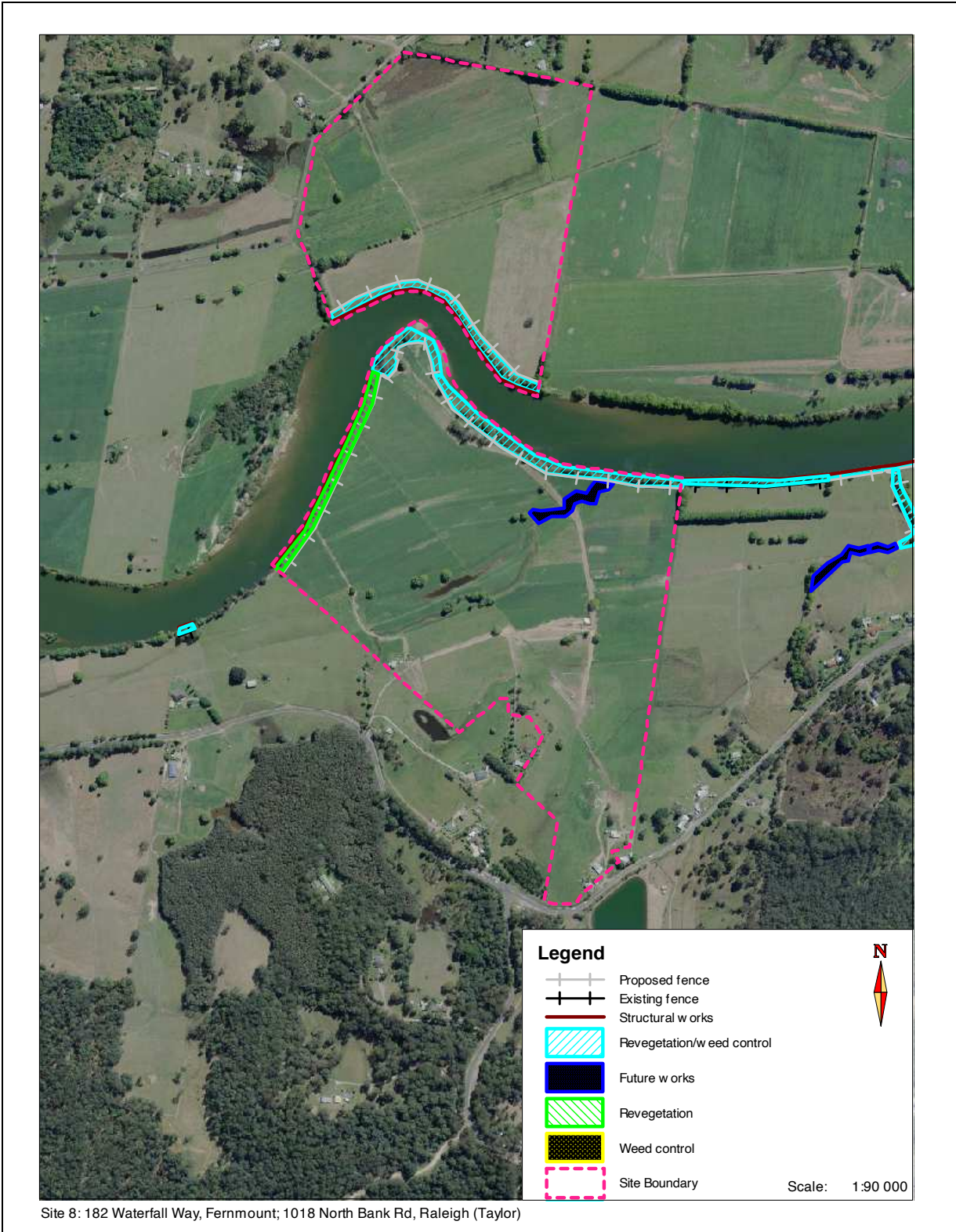


Figure 71: Property workplan map

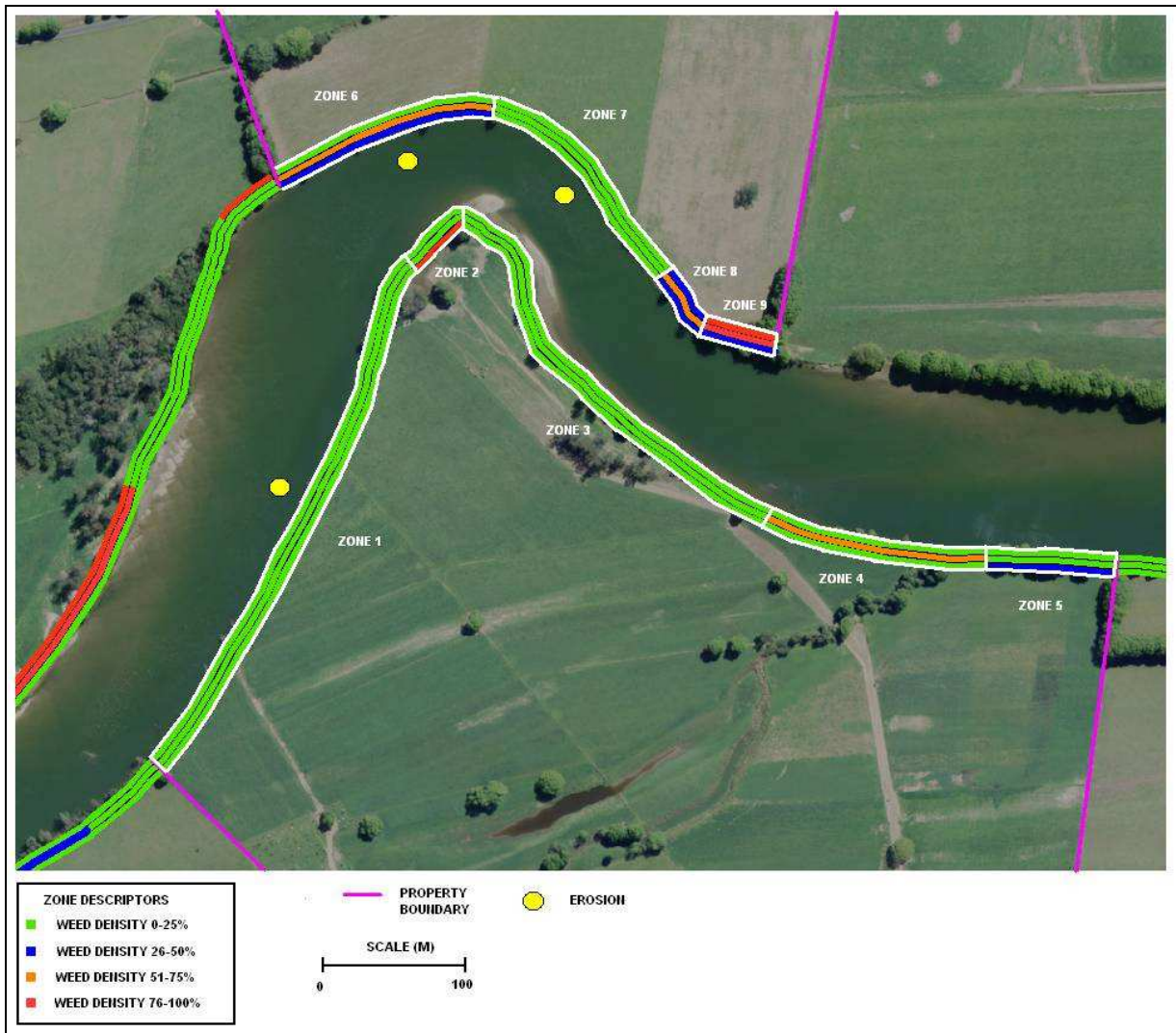


Figure 72: Riparian condition and extent

Table 60: Riparian condition summary

MGT ZONE	1	2	3	4	5	6	7	8	9
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris
RIPARIAN WIDTH	<5m	0m	<5m	5-10m	5-10m	5-10m	5-10m	<5m	5-10m
CANOPY COVER	<25%	Cleared	<25%	76-100%	26-50%	26-50%	<25%	<25%	51-75%
MIDSTOREY COVER	26-50%	Cleared	26-50%	26-50%	<25%	<25%	76-100%	<25%	26-50%
GROUND COVER	26-50%	76-100%	76-100%	<25%	76-100%	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	N	N	N	N	N	N
GRAZING IMPACT	N	N	N	N	Y	Y	Y	Y	Y
NATURAL REGEN	N	N	Y	N	N	N	N	N	N
CANOPY WEED	<25%	0%	26-50%	76-100%	0%	76-100%	<25%	<25%	26-50%
MIDSTOREY WEED	51-75%	0%	51-75%	76-100%	0%	<25%	<25%	51-75%	<25%
GROUND COVER WEED	26-50%	<25%	26-50%	26-50%	0%	0%	<25%	<25%	<25%
WEED 1	Small Leaf Privet (Ligustrum sinense)	Blue Billy Goat (Ageratum houstonianum)	Small Leaf Privet (Ligustrum sinense)	Camphor Laurel (Cinnamomum camphora)		Camphor Laurel (Cinnamomum camphora)	Lantana (Lantana camara)	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)
WEED 1 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Dominant (>50%)		Dominant (>50%)	Few Scattered (<10%)	Few Scattered (<10%)	Dominant (>50%)
WEED 2	Wild Tobacco (Solanum mauritianum)		Lantana (Lantana camara)	Small Leaf Privet (Ligustrum sinense)		Lantana (Lantana camara)	Coral Tree (Erythrina sykesii)	Lantana (Lantana camara)	Lantana (Lantana camara)
WEED 2 DENSITY	Clumps (11-50%)		Clumps (11-50%)	Clumps (11-50%)		Few Scattered	Few Scattered	Few Scattered	Few Scattered

WEED 3	Lantana (Lantana camara)	Blue Billy Goat (Ageratum houstonianum)	Mistflower (Eupatorium riparium)			Wild Tobacco (Solanum mauritianum)	Morning Glory (Ipomea sp)	Morning Glory (Ipomea sp)		
WEED 3 DENSITY	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)			Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)		
WEED 4	Mistflower (Eupatorium riparium)	Wild Tobacco (Solanum mauritianum)								
WEED 4 DENSITY	Clumps (11-50%)	Few Scattered (<10%)						Few Scattered (<10%)		
WEED 5	Coral Tree (Erythrina sykesii)	Balloon Vine (Cardiospermum grandiflorum)								
WEED 5 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)								
BANK	South Bank	South Bank	South Bank	South Bank	South Bank	North Bank	North Bank	North Bank	North Bank	North Bank

Table 61: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)		
				Landholder	Contributions	
					NRCMA or Other	Bellingen Shire Council
All	Project Coordination	Technical, administrative & practical support (21 hrs @ \$50/hr)	Environmental Levy		1050 (In kind)	1050
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80
1	Fencing	Landholder to supply materials for and construct fence line to exclude stock (460m @ \$5000/km)		2300 (In kind)		2300
1	Structural works (optional)	Construction of rock revetment wall and batter bank face (460m @ \$900/m)			414000	414000
1	Revegetation (4600m ²)	Planting of key species at 2m centres along riparian zone (\$6.50/ plant incl labour x 1150 plants) (landholder labour in kind)		3450 (In kind)	4025	7475
6-9	Fencing	Landholder to supply materials for and construct fence line to exclude stock (520m @ \$5000/km)		2600 (In kind)		2600
6-7	Structural works (optional)	Construction of rock revetment wall and batter bank face (520m @ \$900/m)			468000	468000
6,8,9	Weed Control (contractor)	Manual weed eradication along riparian zone (2 days @ \$760/day)			1520	1520
6-9	Revegetation (5200m ²)	Planting of key species at 2m centres along riparian zone (\$6.50/ plant incl labour x 1300 plants) (landholder labour in kind)		3900 (In kind)	4550	8450
2-3	Fencing	Landholder to supply materials for and		1000		1000

		construct fence line to exclude stock (200m @ \$5000/km)			(In kind)			
2	Weed Control (contractor)	Manual weed eradication along riparian zone; stem inject Camphors (0.5 days @ \$760/day)				380		380
2-3	Revegetation (2500m ²)	Planting of key species at 2m centres along top of bank and face. (\$6.50/ plant incl labour x 625 plants) (landholder labour in kind)			1875 (In kind)	2188		4063
3-5	Fencing	Landholder to supply materials for and construct fence line to exclude stock (570m @ \$5000/km)			2850 (In kind)			2850
3-5	Weed Control (contractor)	Manual weed eradication along riparian zone; stem inject Camphors (1.5 days @ \$760/day)				1140		1140
3-5	Revegetation (5700m ²) (contractor)	Re-establishment of native trees among Camphor gaps (approx 6m centres) (\$6.50/ plant incl labour x 160 plants)				1040		1040
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (22hrs / qtr) inspections and suppression as necessary for 10 years			32818 (In kind)			32818
			TOTAL		50793	896843	1130	948766

Site 8b - North Bank Road, Raleigh, NSW 2454

Lot/DP	Lot 16DP112142; Lot17DP112142; Lot422DP884324; Lot11DP839900
Property Owners	Raleigh Dairy Holdings
Catchment Details	Mid Bellinger River estuary – south bank; 1440m river frontage; Area: 113.7ha
Land Use	Rural – Dairy Cattle

Property Summary

This site incorporates a straight section-slight inside bend alluvial floodplain. Undercutting is evident along the bank toe (most likely a combination of fretting from boat wash and scour during floods). There is a wide tidally submerged bench extending approximately 6-8 metres from the toe of the immediate bank face. Overall active bank erosion is considered to be minor (Cohen & Telfer, 2010). The riparian zone some native plant species however natural recruitment is currently limited due to cattle browsing along the bank. Some minor weed problems exist with species such as Camphor Laurel (*Cinnamomum camphora*), Morning Glory (*Ipomea* spp.), Lantana (*Lantana camara*) and Small Leaf Privet (*Ligustrum sinense*).

Previous Management Efforts

N/A

Rehabilitation Strategy

1. Rehabilitation at this site should focus on removing problematic weed species as mentioned above. Following weed treatment, these areas should be revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare).
2. It is advisable that a wider riparian buffer also be established to a minimum distance of 5-7m back from the bank crest. Continual monitoring should be undertaken to ascertain vegetation response and recovery from ensuing flood events. This buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.
3. Should undercut at the toe continue to cause bank retreat, installation of rock fillets (refer to figure 73) would provide a higher degree of resilience against erosion from flooding and boat/wind wave wash, and provide valuable habitat for estuarine animals (fish, crustaceans, etc) and plants (mangroves, seagrass). However the cost would limit the potential for funding contributions from external parties.
4. The landholder has indicated intent to fence off all drains and creek lines across the property (see figure 74). This action is strongly supported under the reach plan although cost estimates not detailed in the work plan (table 63). Periodic drain cleaning (relevant approvals must be sought) and on-going weed control will be an integral part of managing these drainage systems. The establishment of tree/shade belts along one side of the drain margins is recommended as it will reduce maintenance requirements and weed problems in the drains.

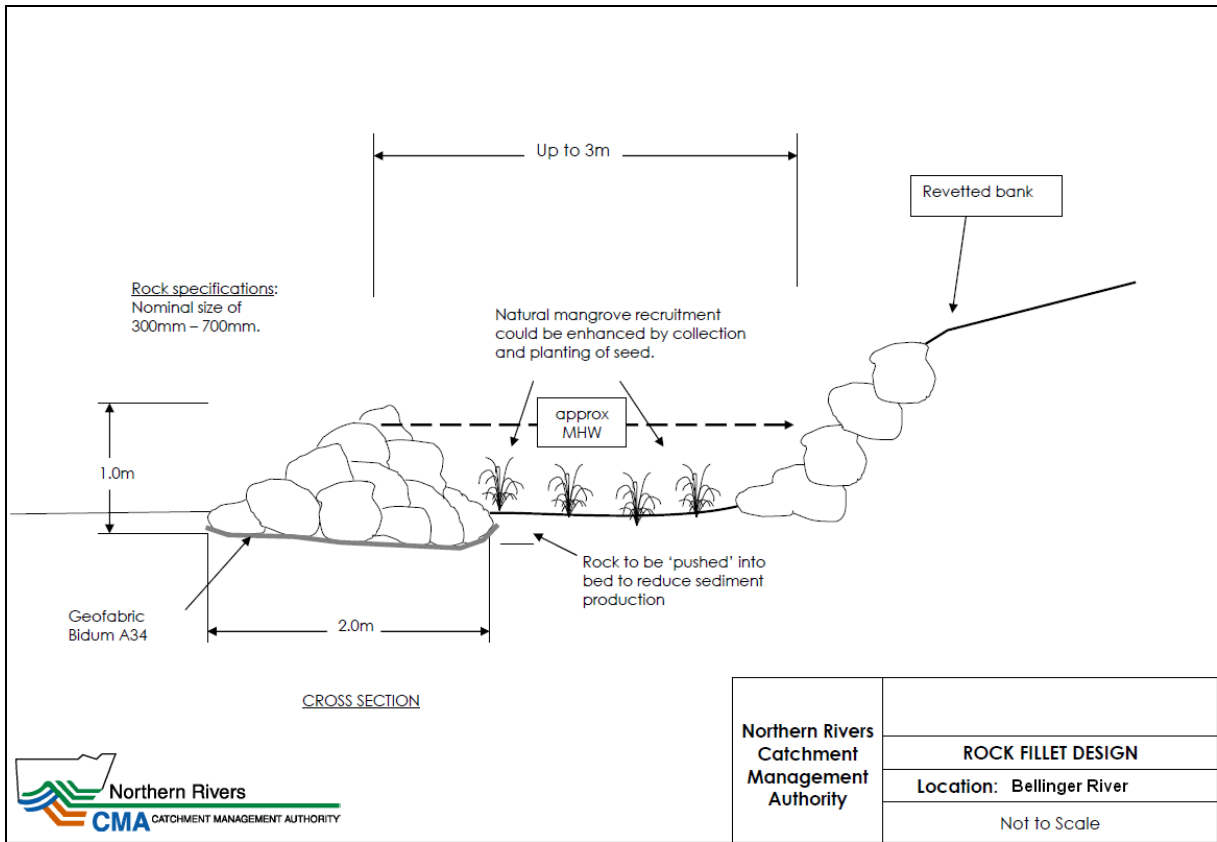


Figure 73: Design layout for structural works

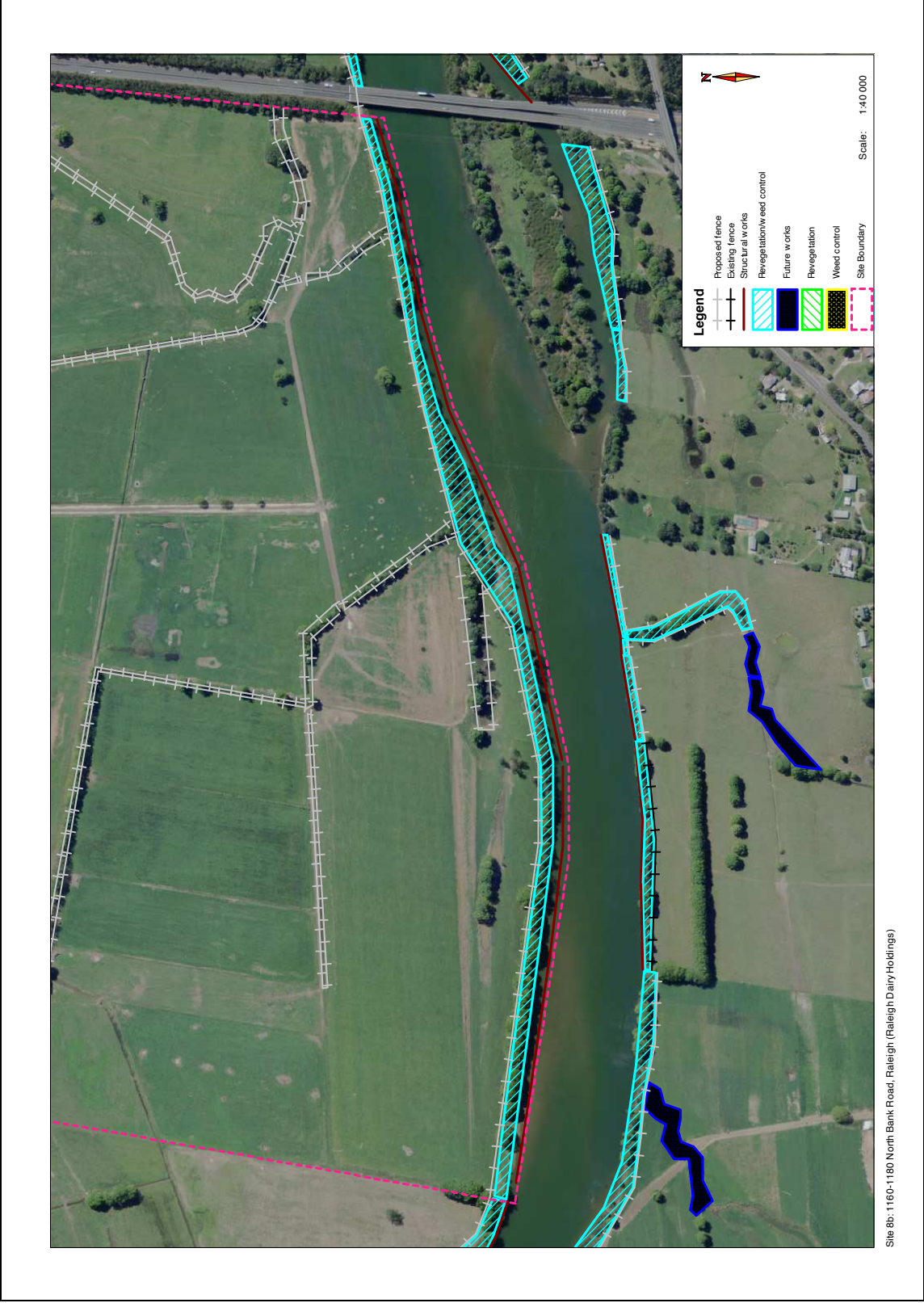


Figure 74: Property workplan map

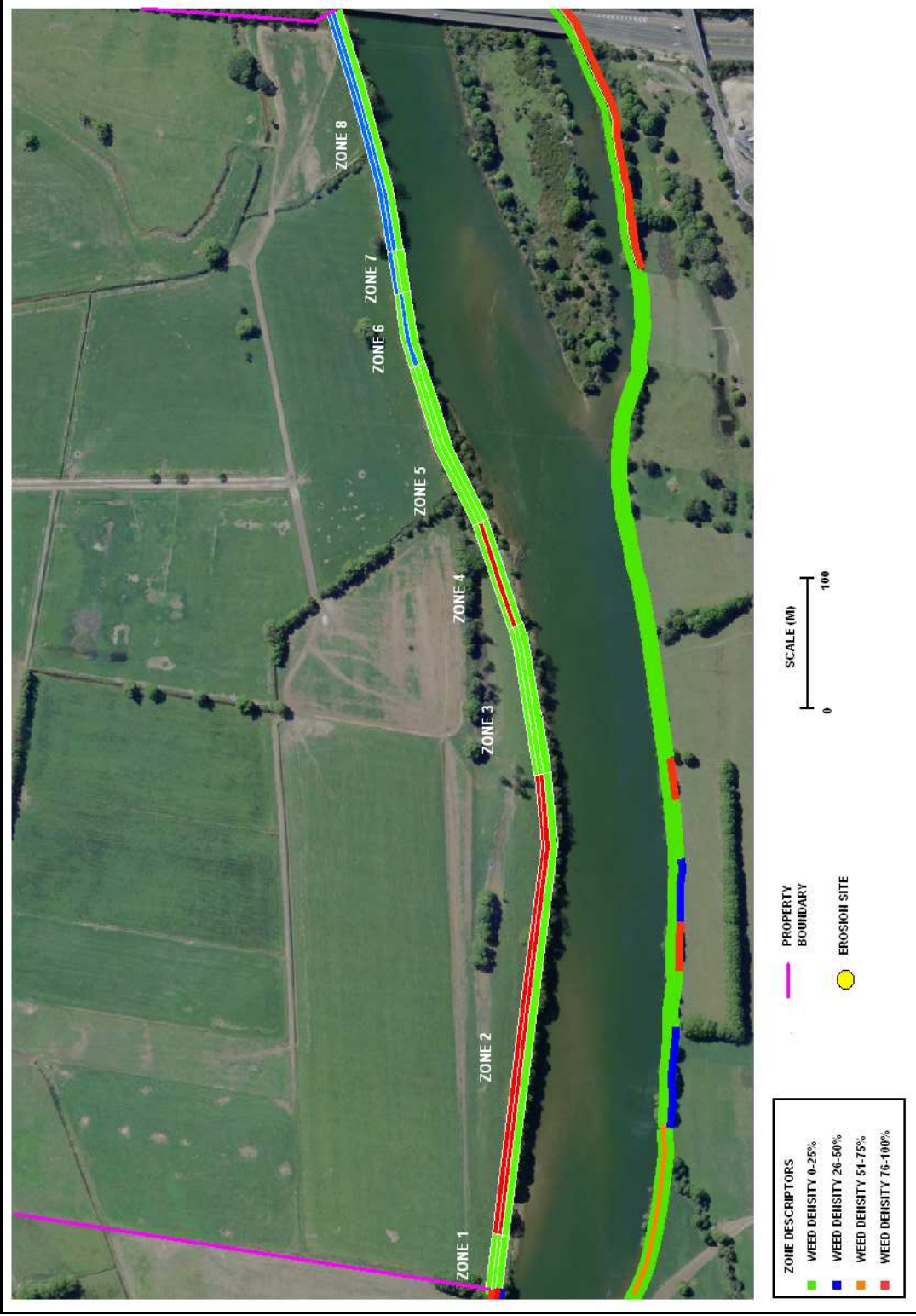


Figure 75: Riparian condition and extent

Table 62: Riparian condition summary

MGT ZONE	1	2	3	4	5	6	7	8
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	0m	<5m	<5m	<5m	10-20m	5-10m	<5m	<5m
CANOPY COVER	<25%	76-100%	76-100%	<25%	51-75%	76-100%	<25%	51-75%
MIDSTOREY COVER	<25%	<25%	<25%	26-50%	76-100%	51-75%	26-50%	76-100%
GROUNDCOVER	76-100%	<25%	26-50%	76-100%	<25%	<25%	51-75%	76-100%
APPROPRIATE COVER	N	N	N	N	Y	N	N	N
GRAZING IMPACT	Y	Y	Y	Y	Y	Y	Y	Y
NATURAL REGEN	N	N	N	Y	Y	N	N	N
CANOPY WEED	0%	76-100%	<25%	0%	<25%	<25%	26-50%	26-50%
MIDSTOREY WEED	0%	76-100%	<25%	76-100%	<25%	26-50%	0%	26-50%
GROUNDCOVER WEED	pasture	pasture	pasture	pasture	<25%	pasture	<25%	<25%
WEED 1	Blue Billy Goat (Ageratum houstonianum)	Small Leaf Privet (Ligustrum sinense)	Camphor Laurel (Cinnamomum camphora)	Lantana (Lantana camara)	Camphor Laurel (Cinnamomum camphora)	Small Leaf Privet (Ligustrum sinense)	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)
WEED 1 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)
WEED 2		Camphor Laurel (Cinnamomum camphora)	Wild Tobacco (Solanum mauritianum)	Camphor Laurel (Cinnamomum camphora)	Morning Glory (Ipomea spp.)	Camphor Laurel (Cinnamomum camphora)		Lantana (Lantana camara)
WEED 2 DENSITY		Dominant (>50%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)		Few Scattered (<10%)
WEED 3		Morning Glory (Ipomea)	Lantana (Lantana)	Wild Tobacco (Solanum)				Wild Tobacco (Solanum)

			spp.)	camara)	mauritianum)				mauritianum)
WEED 3 DENSITY			Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11- 50%)				Few Scattered (<10%)
WEED 4			Wild Tobacco (Solanum mauritianum)	Morning Glory (Ipomea spp.)					Morning Glory (Ipomea spp.)
WEED 4 DENSITY			Few Scattered (<10%)	Few Scattered (<10%)					Few Scattered (<10%)
BANK	North Bank	North Bank	North Bank	North Bank	North Bank	North Bank	North Bank	North Bank	North Bank

Table 63: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Weed Control (contractor)	Manual weed eradication along riparian zone; and stem inject Camphors (14 days @ \$800/day)		11200		11200	
All	Revegetation (5000m ²)	Plant out gap areas along riparian zone (\$6.50/ plant incl labour x 1750 plants) (landholder labour in kind)		6125	5250 (In kind)	11375	
All	Structural works (optional)	Excavator to place two rock fillets along margin of low tide bench (28 x 50m fillets @ \$275/m)		385000		385000	
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (17hrs / qtr) inspections and suppression as necessary for 10 years			23455 (In kind)	23455	
			TOTAL	402325	28705	431910	

Site 9 - 160 Waterfall Way, Raleigh NSW 2454

Lot/DP	Lot32 DP805343
Property Owners	William John Maxwell Hodgson
Catchment Details	Mid Bellinger River estuary – south bank; 300m river frontage; Area: 16.64ha
Land Use	Rural – Beef Cattle

Property Summary

This site incorporates a straight section alluvial floodplain. Undercutting is evident along the bank toe (most likely a combination of fretting from boat wash and scour during floods). There is a narrow tidally submerged bench extending approximately 2-3 metres from the toe of the immediate bank face. Overall active bank erosion is considered to be minor (Cohen & Telfer, 2010). The riparian zone contains a diversity of locally native plant species with healthy natural recruitment occurring. Some minor weed problems exist with species such as Camphor Laurel (*Cinnamomum camphora*), Balloon Vine (*Cardiospermum grandiflorum*), Lantana (*Lantana camara*) and Small Leaf Privet (*Ligustrum sinense*).

Previous Management Efforts

A fence has been erected along the riparian fringe approximately 3-5 metres back from the bank crest. This replaced the previous fence which was dysfunctional due to the undermining and collapse of the immediate bank. Periodic, targeted weed control has been administered to suppress the establishment of the aforementioned weed species.

Rehabilitation Strategy

1. Rehabilitation at this site should focus on removing problematic weed species as mentioned above. Following weed treatment, these areas should be revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare).
2. It is advisable that a wider riparian buffer also be established to a minimum distance of 5-7m back from the bank crest. Continual monitoring should be undertaken to ascertain vegetation response and recovery from ensuing flood events. This buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.
3. Should undercut at the toe continue to cause bank retreat, installation of rock fillets (refer to figure x) would provide a higher degree of resilience against erosion from flooding and boat wash, however the cost would limit the potential for funding contributions from external parties.

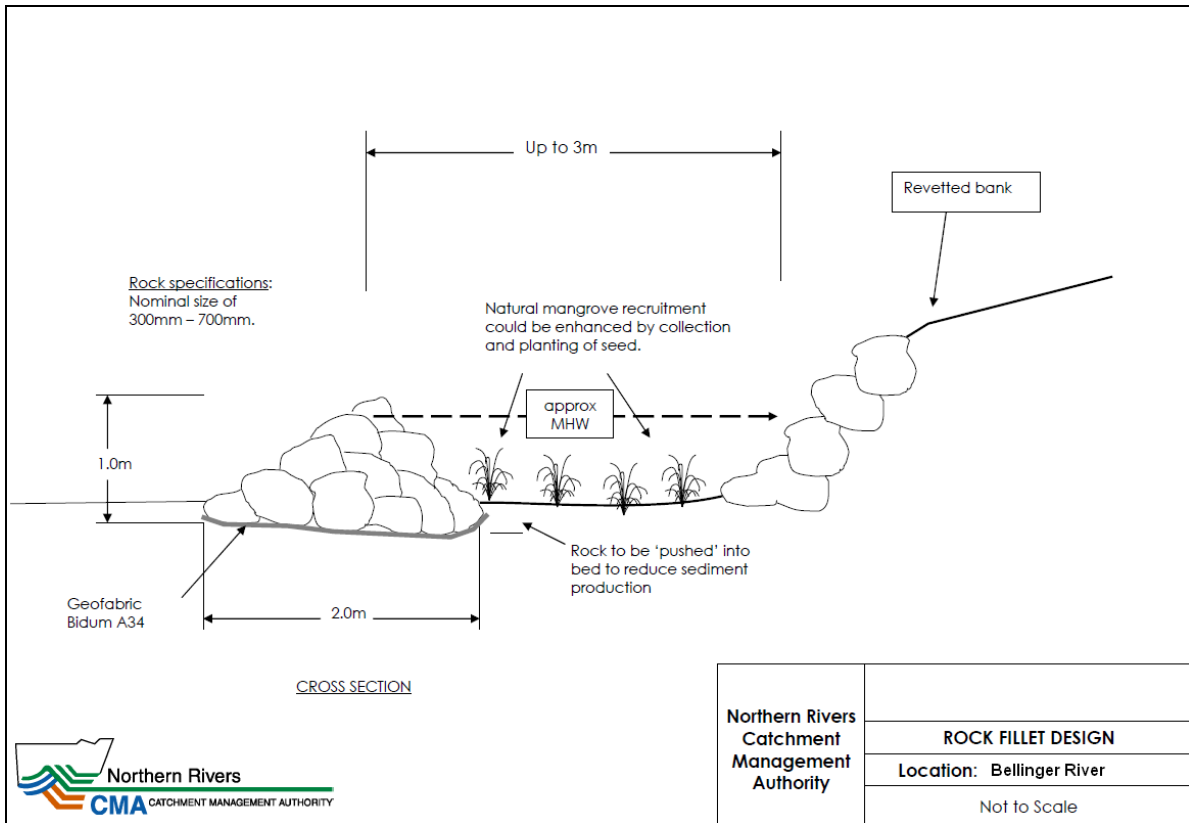


Figure 76: Design layout for structural works

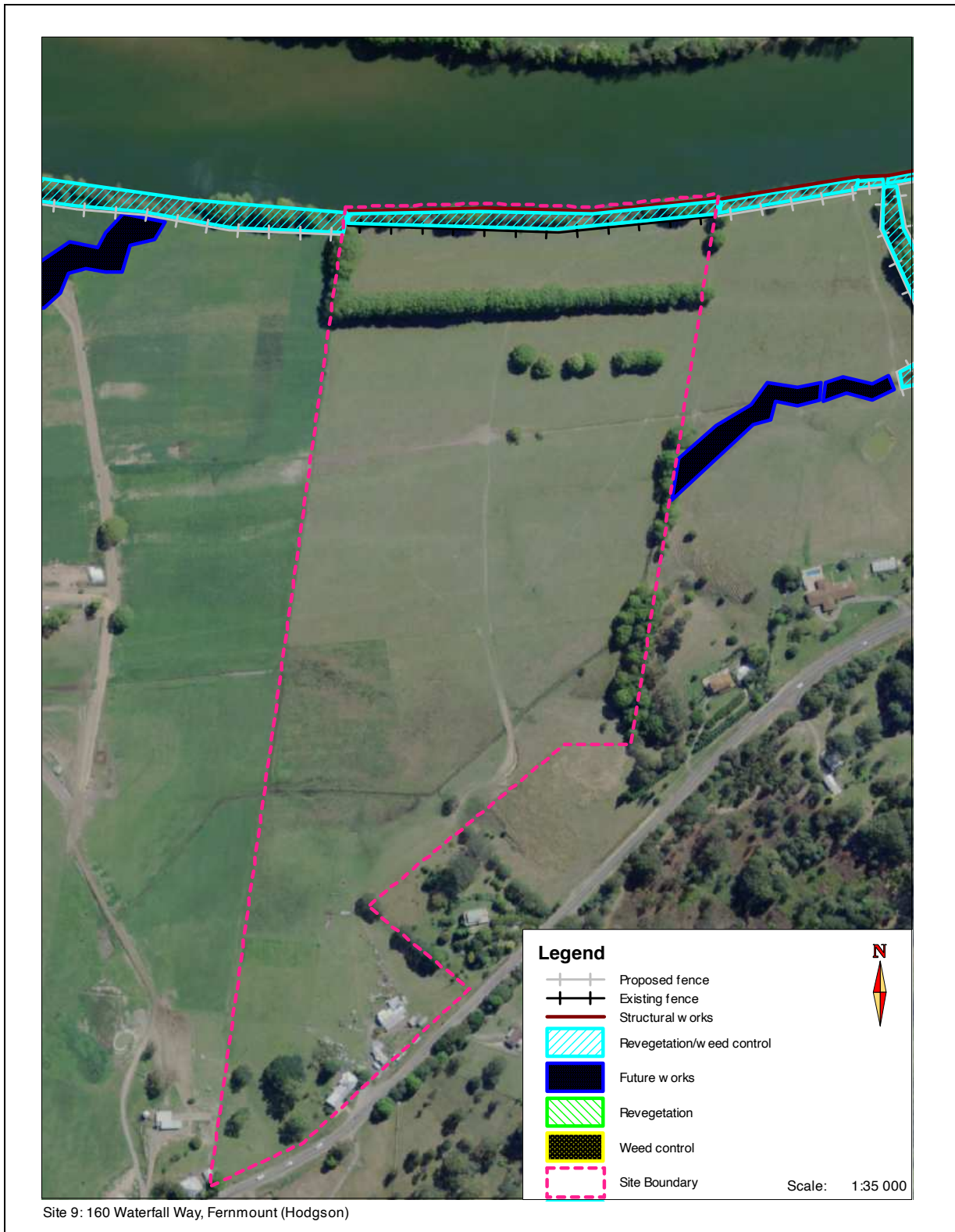


Figure 77: Property workplan map Riparian Condition Assessment

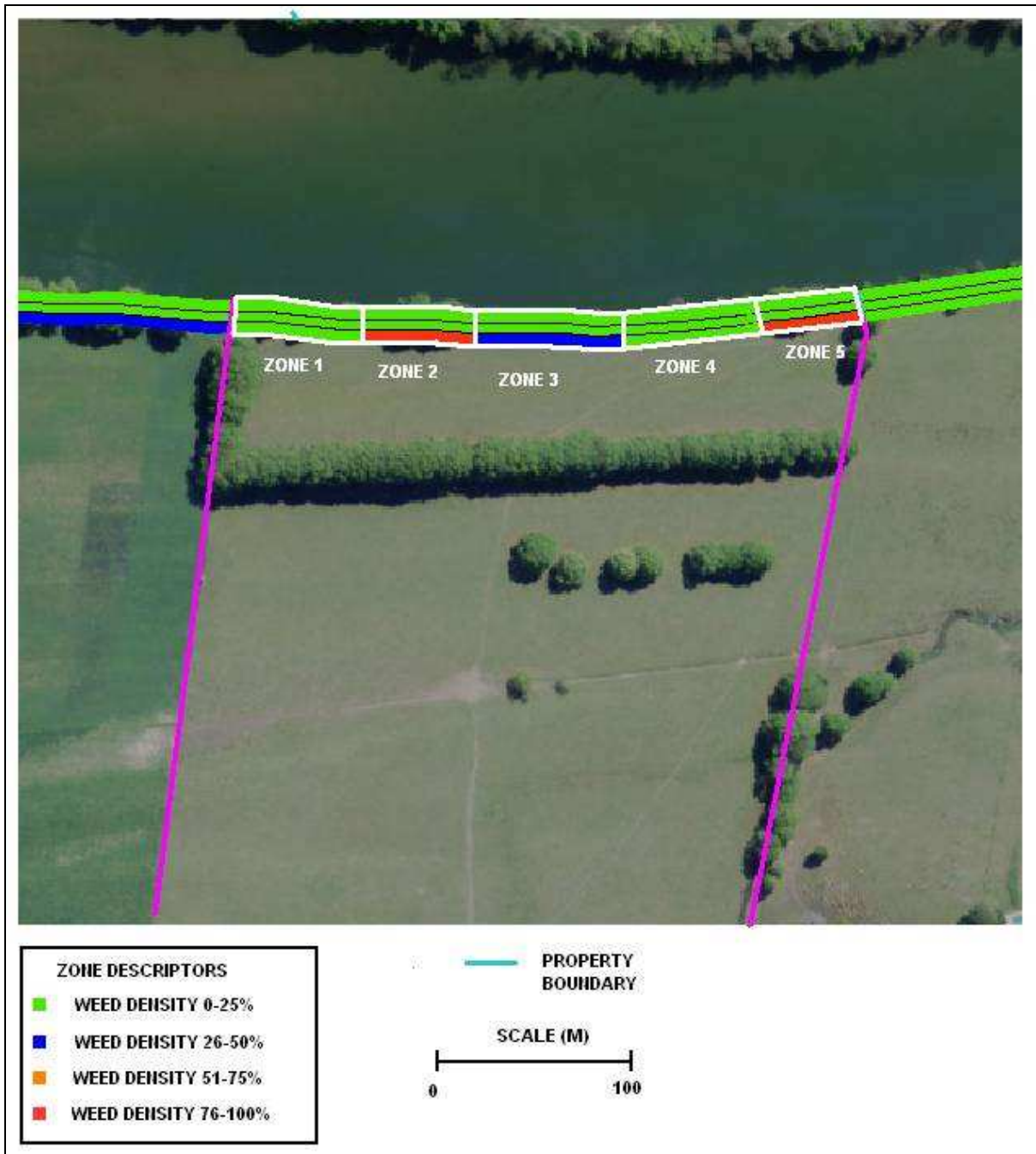


Figure 78: Riparian condition and extent

Table 64: Riparian condition summary

MGT ZONE	1	2	3	4	5
ASSESSOR	S. Morris	S. Morris	S. Morris	S. Morris	S. Morris
RIPARIAN WIDTH	5-10m	5-10m	5-10m	5-10m	5-10m
CANOPY COVER	26-50%	76-100%	51-75%	<25%	76-100%
MIDSTOREY COVER	51-75%	<25%	<25%	<25%	<25%
GROUND COVER	76-100%	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	N	N
GRAZING IMPACT	Y	Y	Y	Y	Y
NATURAL REGEN	Y	N	N	N	N
CANOPY WEED	<25%	76-100%	26-50%	<25%	76-100%
MIDSTOREY WEED	<25%	0%	0%	<25%	0%
GROUND COVER WEED	0%	0%	0%	<25%	0%
WEED 1	Lantana (Lantana camara)	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)	Broad Leaf Privet(B)	Camphor Laurel (Cinnamomum camphora)
WEED 1 DENSITY	Few Scattered (<10%)	Dominant (>50%)	Clumps (11-50%)	Few Scattered (<10%)	Dominant (>50%)
WEED 2	Camphor Laurel (Cinnamomum camphora)		Lantana (Lantana camara)	Camphor Laurel (Cinnamomum camphora)	
WEED 2 DENSITY	Few Scattered (<10%)		Few Scattered (<10%)	Few Scattered (<10%)	
WEED 3				Morning Glory (Ipomea sp)	
WEED 3 DENSITY				Few Scattered (<10%)	
BANK	South Bank	South Bank	South Bank	South Bank	South Bank

Table 65: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (2 hrs @ \$50/hr)	Environmental Levy		100 (In kind)	100	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Weed Control (contractor)	Manual weed eradication along riparian zone; stem inject Camphors (3 days @ \$760/day)		2280		2280	
All	Revegetation (1500m ²)	Plant out gap areas along riparian zone (\$6.50/ plant incl labour x 150 plants) (landholder labour in kind)		450 (In kind)	630	975	
All	Structural works (optional)	Excavator to place two rock fillets along margin of low tide bench (6 x 50m fillets @ \$100/m)			30000	30000	
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (2hrs / qtr) inspections and suppression as necessary for 10 years		3255 (In kind)		3255	
			TOTAL	3705	32910	36690	

Site 10 - 124 Waterfall Way, Raleigh NSW 2454

Lot/DP	Lot1 DP807871
Property Owners	Barbara Helen Benyon
Catchment Details	Mid Bellinger River estuary – south bank; 110m river frontage; Area: 4.65ha
Land Use	Rural – Beef Cattle

Property Summary

This site incorporates a straight section alluvial floodplain. A small, partly vegetated drainage line also runs parallel to the main river channel through the middle of the property. Undercutting is evident along the bank toe (most likely a combination of fretting from boat wash and scour during floods). There is a narrow tidally submerged bench extending approximately 2-3 metres from the toe of the immediate bank face. Overall active bank erosion is considered to be minor (Cohen & Telfer, 2010). Riparian vegetation is sparse with species such as Wattle (*Acacia* sp), Bottlebrush (*Callistemon* sp), Common Reed (*Phragmites australis*), River Oak (*Casurina cunninghamiana*). Weeds including Camphor Laurel (*Cinnamomum camphora*), Wild Tobacco (*Solanum mauritianum*), Morning Glory (*Ipomea* sp) and Lantana (*Lantana camara*) are also interspersed along the bank face and immediate crest.

Previous Management Efforts

N/A

Rehabilitation Strategy

1. A minimum fence line setback of 5-7 metres from the crest of the bank is recommended. This area should then be vegetated with a variety of deep rooted plant species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Accompanying vegetation should be planted along the bank face and toe (where possible) in order to create root complexes to buffer against erosive forces. This will provide a bare minimum in terms of resilience against future erosion and slumping. Continual monitoring should be undertaken to ascertain vegetation response and recovery from ensuing flood events. The buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.
2. Should undercut at the toe continue to cause bank retreat, installation of rock fillets (refer to figure x) would provide a higher degree of resilience against erosion from flooding and boat wash, however the cost would limit the potential for funding contributions from external parties.

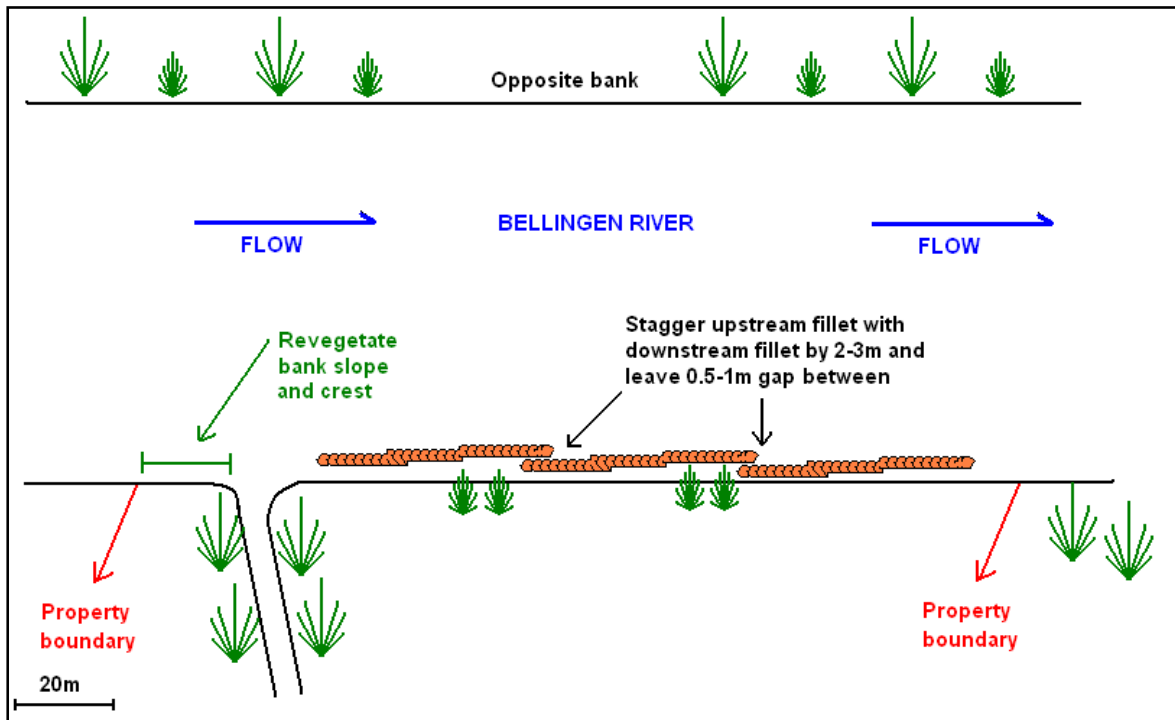


Figure 79: structural works diagram

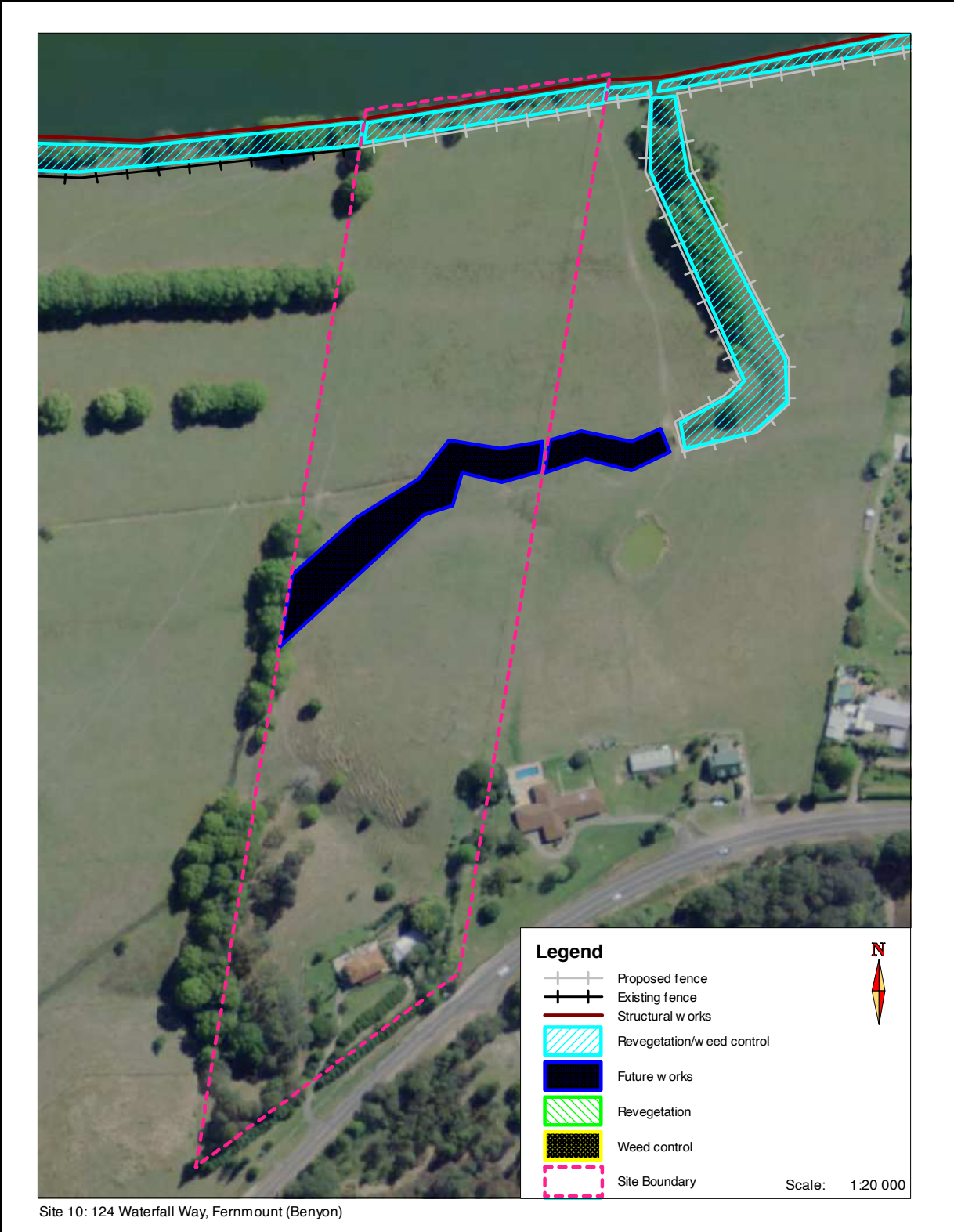


Figure 80: Property workplan map

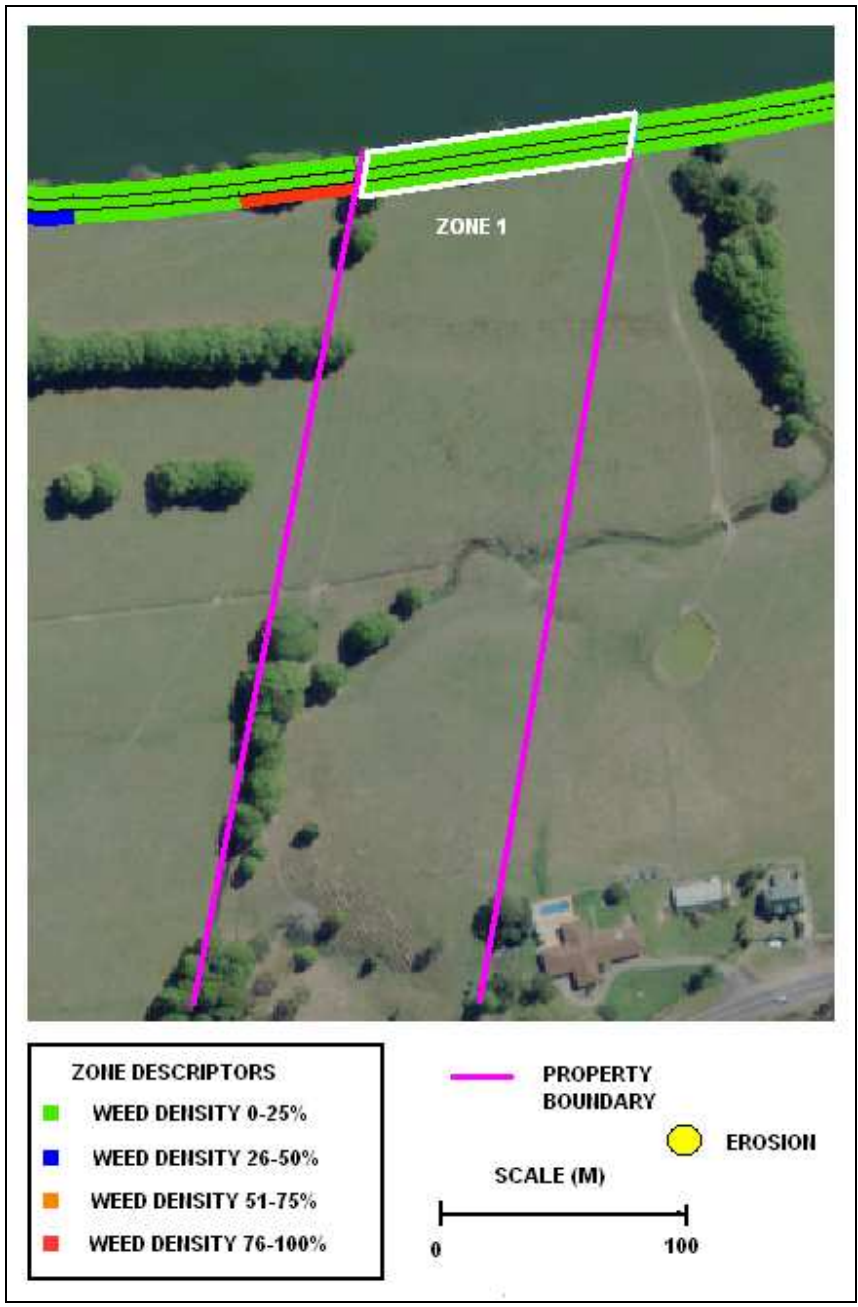


Figure 81: Riparian condition and extent

Table 66: Riparian condition summary

MGT ZONE	1
ASSESSOR	S. Morris
RIPARIAN WIDTH	<5m
CANOPY COVER	26-50%
MIDSTOREY COVER	26-50%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	Y
NATURAL REGEN	Y
CANOPY WEED	<25%
MIDSTORY WEED	0%
GROUND COVER WEED	<25%
WEED 1	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 1 DENSITY	Few Scattered (<10%)
WEED 2	Lantana (<i>Lantana camara</i>)
WEED 2 DENSITY	Few Scattered (<10%)
WEED 3	Morning Glory (<i>Ipomea</i> sp)
WEED 3 DENSITY	Few Scattered (<10%)
BANK	South Bank

Table 67: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (2 hrs @ \$50/hr)	Environmental Levy		100 (In kind)	100	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Fencing	Landholder to supply materials for and construct fence line to exclude stock (110m @ \$9000/km)		990 (In kind)		990	
All	Weed Control (contractor)	General weed control along riparian zone (0.5 days @ \$760/day)			380	380	
All	Revegetation (770m ²) (contractor)	Planting of key species at 2m centres along top of bank and face. (\$6.50/ plant incl labour x 200 plants)			1300	1300	
All	Structural works (optional)	Excavator to place two rock fillets along margin of low tide bench (2 x 50m fillets @ \$100/m)			10000	10000	
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (1.5hrs / qtr) inspections and suppression as necessary for 10 years		2230 (In kind)		2230	
			TOTAL	3220	11680	15080	

Site 11 - 100 Waterfall Way, Raleigh NSW 2454

Lot/DP	Lot2 DP807871
Property Owners	RB & MH Gilmore
Catchment Details	Mid Bellinger River estuary – south bank; 160m river frontage; Area: 5.53ha
Land Use	Rural – Beef Cattle

Property Summary

This site incorporates a straight section alluvial floodplain with a tidal creek inlet laterally intersecting and meandering across the middle of the property. Undercutting is evident along the bank toe of the main channel and creek entrance (most likely a combination of fretting from boat wash and scour during floods). There is a narrow tidally submerged bench extending approximately 2-3 metres from the toe of the immediate bank face. Overall active bank erosion is considered to be minor (Cohen & Telfer, 2010). Riparian vegetation is sparse with species such as Wattle (*Acacia* sp), Bottlebrush (*Callistemon* sp), Common Reed (*Phragmites australis*), River Oak (*Casurina cunninghamiana*). Weeds including Camphor Laurel (*Cinnamomum camphora*), Wild Tobacco (*Solanum mauritianum*), Mornings Glory (*Ipomea* sp) and Lantana (*Lantana camara*) are also interspersed along the bank face and immediate crest.

Previous Management Efforts

N/A

Rehabilitation Strategy

The target condition will be considered for the main channel riparian zone and tributary independently:

- 1.1 A minimum fence line setback of 5-7 metres from the crest of the bank is recommended for the main channel. This area should then be vegetated with a variety of deep rooted plant species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Accompanying vegetation should be planted along the bank face and toe (where possible) in order to create root complexes to buffer against erosive forces. This will provide a bare minimum in terms of resilience against future erosion and slumping. Continual monitoring should be undertaken to ascertain vegetation response and recovery from ensuing flood events. The buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.
- 1.2 Should undercut at the toe continue to cause bank retreat along the main channel, installation of rock fillets (refer to figure x) would provide a higher degree of resilience against erosion from flooding and boat wash, however the cost would limit the potential for funding contributions from external parties.
2. Rehabilitation along the tributary should focus on fencing the riparian zone (approx. 3m back from the bank crest) and revegetation using a range of species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Particular attention

should be paid to creating a more complex understory. Gradual removal of Camphor Laurel (*Cinnamomum camphora*), should accompany this work.

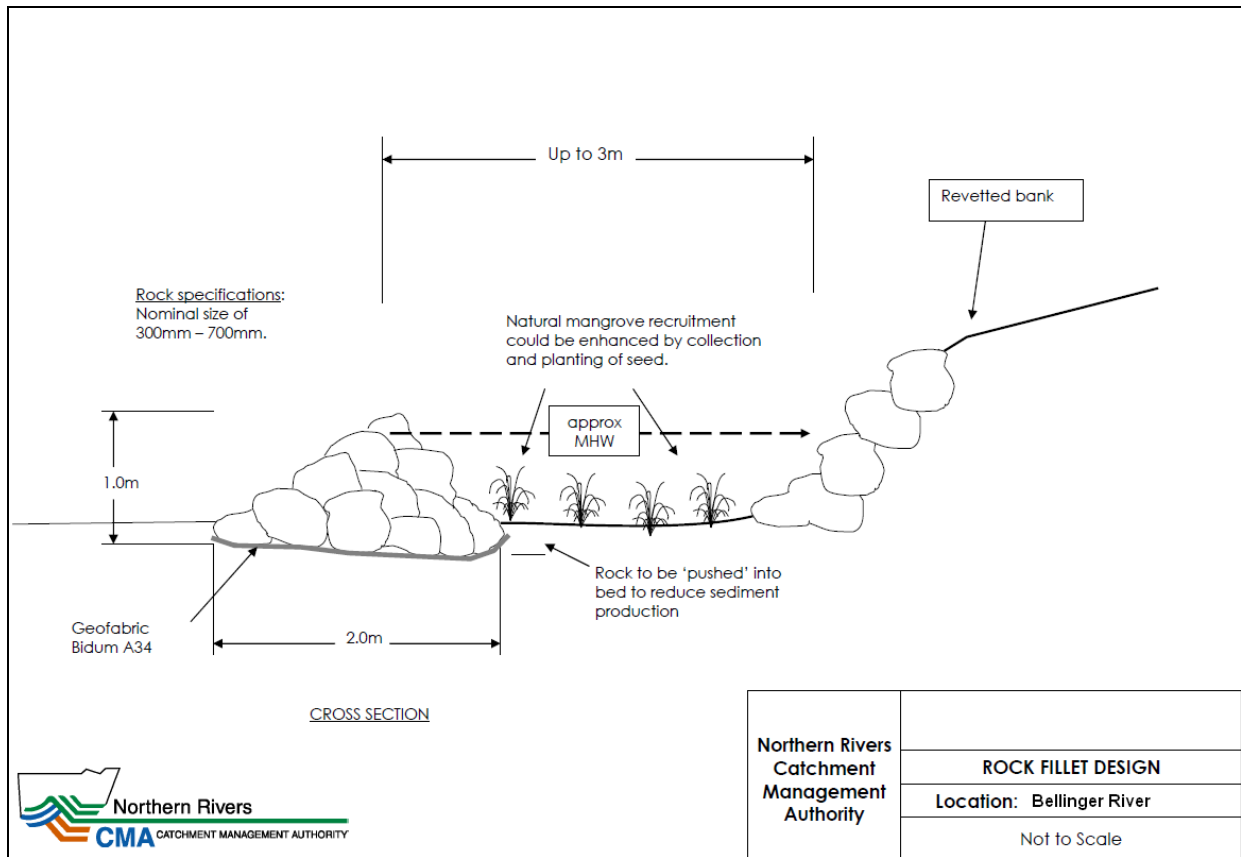


Figure 82: structural works diagram

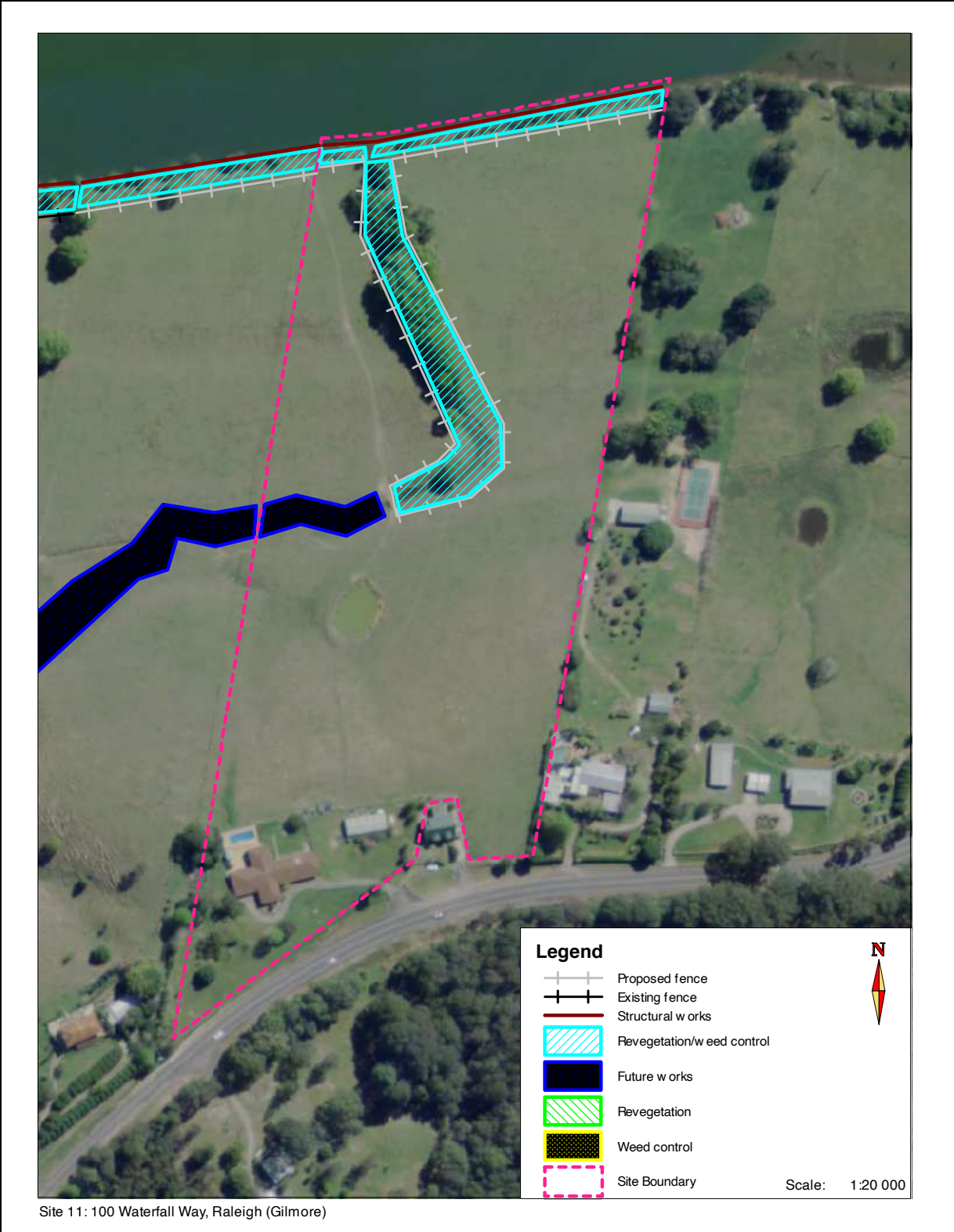


Figure 83: Property workplan map

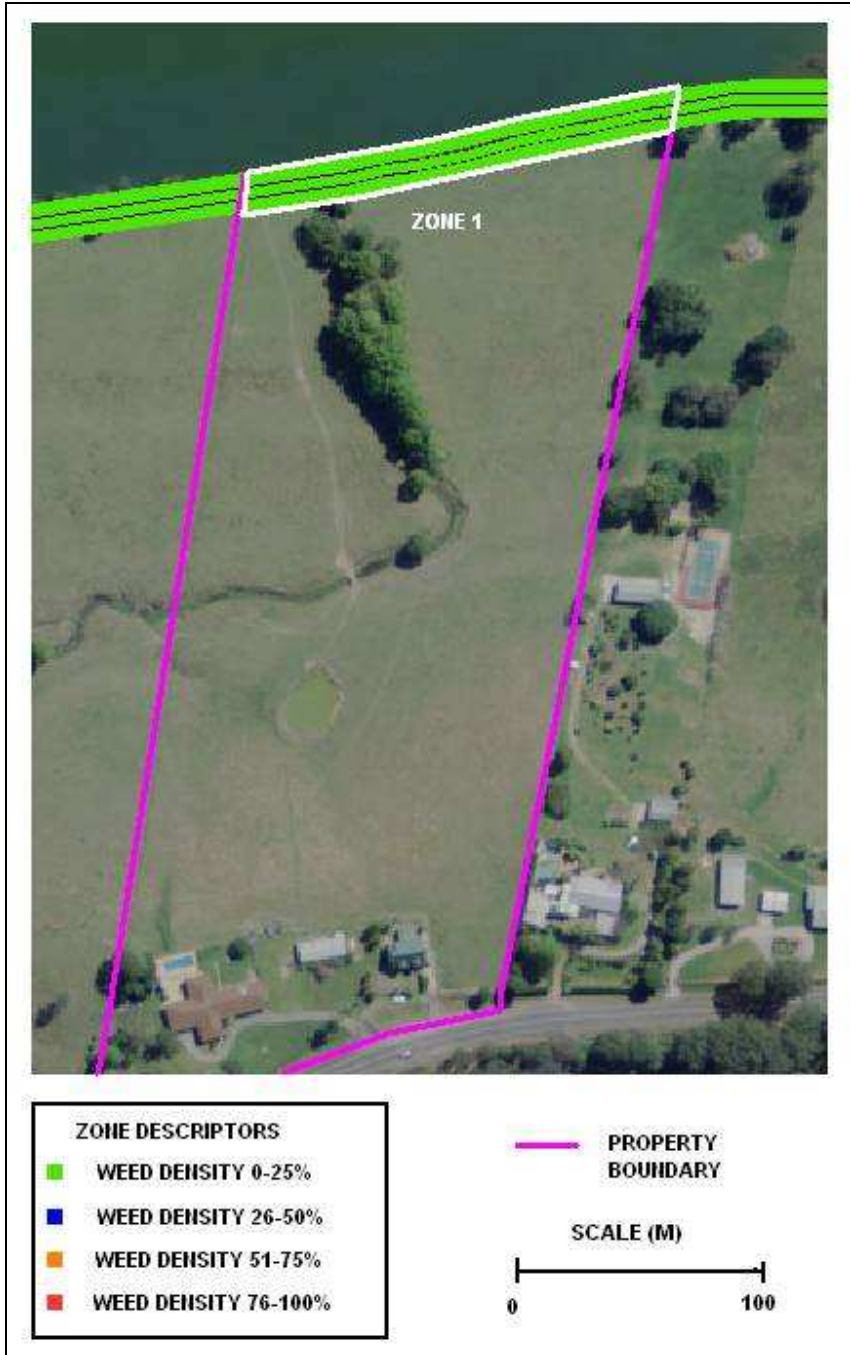


Figure 84: Riparian condition and extent

Table 68: Riparian condition summary

MGT ZONE	1
ASSESSOR	S. Morris
RIPARIAN WIDTH	<5m
CANOPY COVER	26-50%
MIDSTOREY COVER	26-50%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	Y
NATURAL REGEN	Y
CANOPY WEED	<25%
MIDSTORY WEED	0%
GROUND COVER WEED	<25%
WEED 1	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 1 DENSITY	Few Scattered (<10%)
WEED 2	Lantana (<i>Lantana camara</i>)
WEED 2 DENSITY	Few Scattered (<10%)
WEED 3	Morning Glory (<i>Ipomea</i> sp)
WEED 3 DENSITY	Few Scattered (<10%)
BANK	South Bank

Table 69: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (2 hrs @ \$50/hr)	Environmental Levy			100 (In kind)	100
N/A	Publicity	Printing, educational activities, media release	Environmental Levy			80 (In kind)	80
1	Fencing	Fencing contractor to erect fence to exclude stock (160m @ \$9000/km)		1440			1440
1	Weed Control	General weed control along riparian zone (0.5 days @ \$760/day)			380		380
1	Revegetation (1120m ²) (contractor)	Planting of key species at 2m centres along top of bank and face. (\$6.50/ plant incl labour x 280 plants)			1820		1820
1	Structural works (optional)	Excavator to place three rock fillets along margin of low tide bench (3 x 50m fillets @ \$100/m)			15375		15375
Trib	Fencing	Fencing contractor to erect fence to exclude stock (400m @ \$9000/km)		3600			3600
Trib	Weed Control (contractor)	Targeted poisoning of Camphors in stages (20 stems @ \$6.50ea incl. herbicide)			130		130
Trib	Revegetation (2000m ²) (contractor)	Planting of key species at 4m centres along top of bank and face. (\$6.50/ plant incl labour x 125 plants)			813		813
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (4hrs / qtr) inspections and suppression as necessary for		5943 (In kind)			5943

	10 years								
		TOTAL	10983	18518	180				29681

Site 12 - 62 Waterfall Way, Raleigh NSW 2454

Lot/DP	Lot4 DP807871
Property Owners	Errol William Cooper
Catchment Details	Mid Bellinger River estuary – south bank; 90m river frontage; Area: 2.53ha
Land Use	Rural – Beef Cattle

Property Summary

This site spans a straight section alluvial floodplain on the back channel where the River anabranches around McGeary's Island. Undercutting is evident along the bank toe (most likely from scour during floods). Overall active bank erosion is considered to be minor (Cohen & Telfer, 2010). Bank vegetation is dominated by weed species including Wild Tobacco (*Solanum mauritanum*), Cassia (*Senna pendula*), Camphor Laurel (*Cinnamomum camphora*), Balloon Vine (*Cardiospermum grandiflorum*) and Lantana (*Lantana camara*). A few native Wattle (*Acacia* sp) and Oak (*Casurina cunninghamiana*) are also present.

Previous Management Efforts

The riparian zone has been fenced at the immediate bank crest, however due to its age the fence is dysfunctional.

Rehabilitation Strategy

A minimum fence line setback of 5-7 metres from the crest of the bank is recommended. Problematic weeds (as outlined above) should be controlled and the entire riparian area should then be vegetated with a variety of deep rooted plant species as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Accompanying vegetation should be planted along the bank face and toe (where possible) in order to create root complexes to buffer against erosive forces. This will provide a bare minimum in terms of resilience against future erosion and slumping. Continual monitoring should be undertaken to ascertain vegetation response and recovery from ensuing flood events. The buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

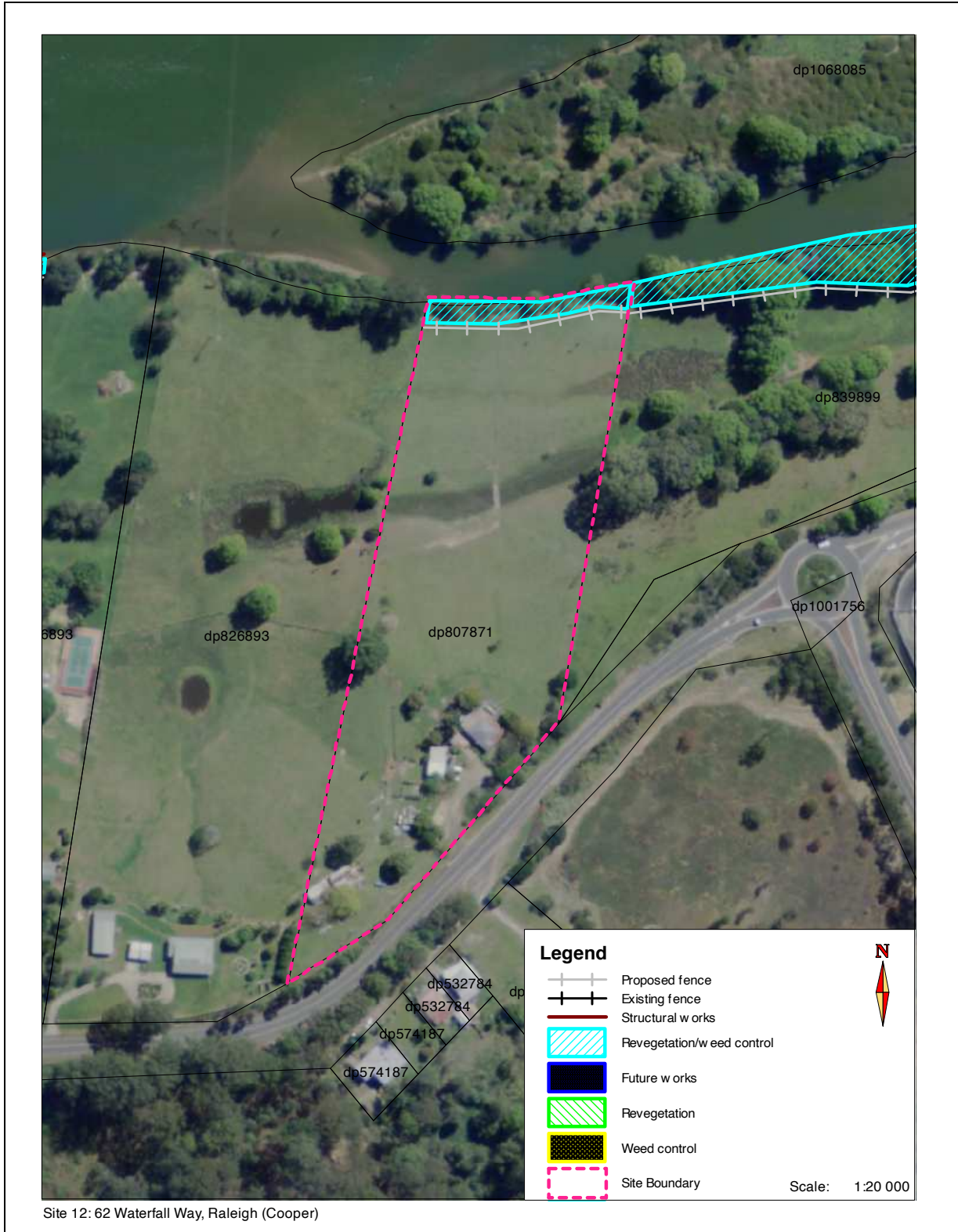


Figure 85: Property workplan map

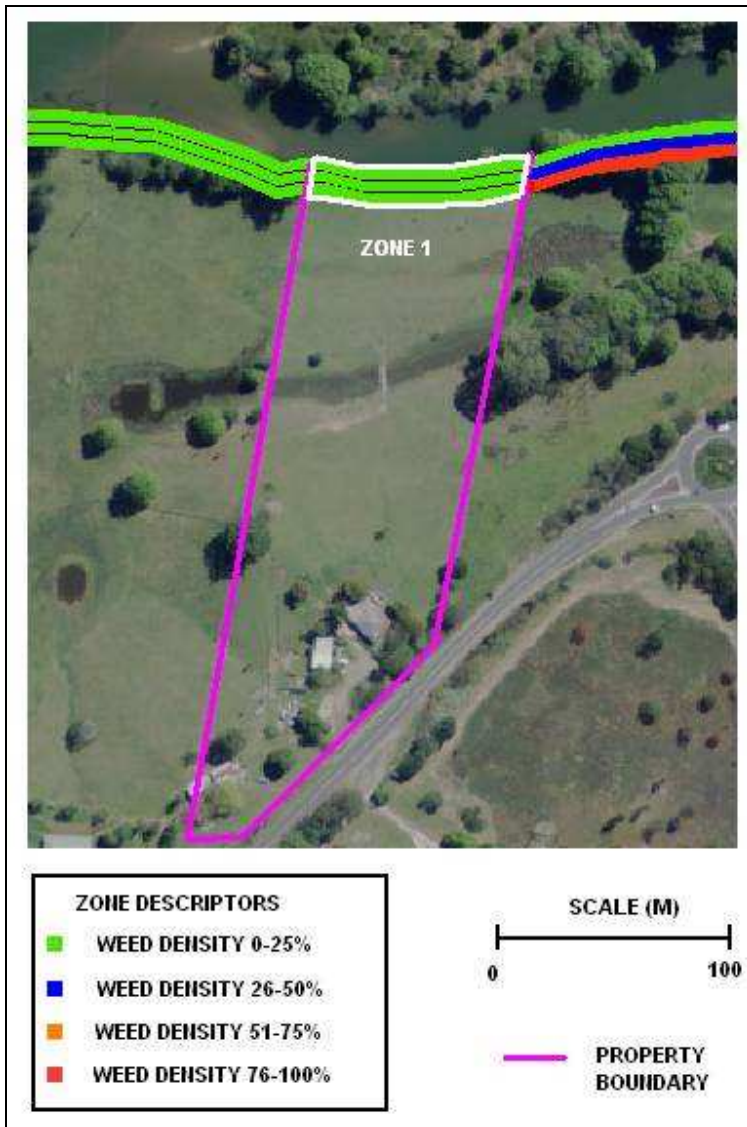


Figure 86: Riparian condition and extent

Table 70: Riparian condition summary

MGT ZONE	1
ASSESSOR	S. Morris
RIPARIAN WIDTH	<5m
CANOPY COVER	26-50%
MIDSTOREY COVER	26-50%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	Y
NATURAL REGEN	Y
CANOPY WEED	<25%
MIDSTORY WEED	0%
GROUND COVER WEED	<25%
WEED 1	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 1 DENSITY	Few Scattered (<10%)
WEED 2	Lantana (<i>Lantana camara</i>)
WEED 2 DENSITY	Few Scattered (<10%)
WEED 3	Morning Glory (<i>Ipomea</i> sp)
WEED 3 DENSITY	Few Scattered (<10%)
BANK	South Bank

Table 71: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (2 hrs @ \$50/hr)	Environmental Levy		100 (In kind)	100	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
	Fencing	Landholder to supply materials for and construct fence line to exclude stock (90m @ \$9000/km)		810 (In kind)		810	
	Weed Control (contractor)	General weed control along riparian zone (1 days @ \$760/day)		760		760	
	Revegetation (630m ²) (contractor)	Planting of key species at 2m centres along top of bank and face. (\$6.50/ plant incl labour x 160 plants)		1040		1040	
	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (2hrs / qtr) inspections and suppression as necessary for 5 years		1305 (In kind)		1305	
			TOTAL	2115	1800	4095	

Site 13 - 44 Waterfall Way, Raleigh NSW 2454

Lot/DP	Lot16 DP839899
Property Owners	Archibold Industries Pty Ltd
Catchment Details	Mid Bellinger River estuary – south bank; 460m river frontage; Area: 5.17ha
Land Use	Rural – Beef Cattle

Property Summary

This site can be divided into two sections, upstream and downstream of the Pacific Highway Bridge:

1. The upstream section is a straight section alluvial floodplain that lies on the back channel where the River anabranches around McGeary's Island. This section of bank is considered stable (Cohen & Telfer, 2010). Competition from weed species including Wild Tobacco (*Solanum mauritanum*), Cassia (*Senna pendula*), Camphor Laurel (*Cinnamomum camphora*), Balloon Vine (*Cardiospermum grandiflorum*), Morning Glory (*Ipomea* sp) and Lantana (*Lantana camara*) are compromising the long term integrity and health of this riparian zone. Unrestricted cattle access to the river bank is also causing degradation to the riparian zone. Stock are crossing the back channel and causing erosion along the opposing bank on McGeary's Island.
2. The section below the bridge incorporates a small section of bedrock outcropping (immediately downstream of bridge rip rap), followed by a narrow discontinuous floodplain which is cutoff by more bedrock material at the Old Pacific Highway Bridge. It is apparent that mid-level flood flows are being deflected off the Pacific Highway Bridge pylon footing and causing scour and mass failure along the adjacent bank. Several trees have or are on the verge of collapse along this section of bank. The fence line running perpendicularly away from the bank is also being damaged due to undercutting and collapse. This is contradictory to the active bank erosion assessment of stable given by Cohen & Telfer (2010). Significant River Mangrove (*Aegiceras corniculatum*) colonies exist along the downstream extent of this section. Otherwise the riparian zone is dominated by weed species including Cassia (*Senna pendula*), Camphor Laurel (*Cinnamomum camphora*), Morning Glory (*Ipomea* sp) and Lantana (*Lantana camara*).

Previous Management Efforts

The riparian zone has been fenced approximately 3-5 metres back from the crest of the bank, however due to a dominance of large Camphor Laurel (*Cinnamomum camphora*) trees, natural regeneration is severely suppressed.

Rehabilitation Strategy

1. A fence line should be established a minimum of five metres back from the crest of the bank to exclude cattle from this sensitive riparian zone. A systematic weed control program should be undertaken to eliminate problematic weed species (mentioned above) and subsequent gaps should be revegetated with a variety of riparian plants as outlined in the

Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Continual monitoring should be undertaken to ascertain vegetation response and recovery from ensuing flood events. The buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

2. Pending on contributions from the NSW Road & Traffic Authority, a rock revetment wall or rock fillet structures are recommended from the existing bedrock outcrop to the downstream extent of bank scour (from deflected bridge flows). In the interim it is recommended that program is undertaken to gradually replace Camphor Laurel (*Cinnamomum camphora*) with deep rooted native trees as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Following the placement of structural works the regenerating riparian zone can be further vegetated with additional native understory and groundcover species. Accompanying fence lines will need to be established to exclude cattle from the regeneration areas. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

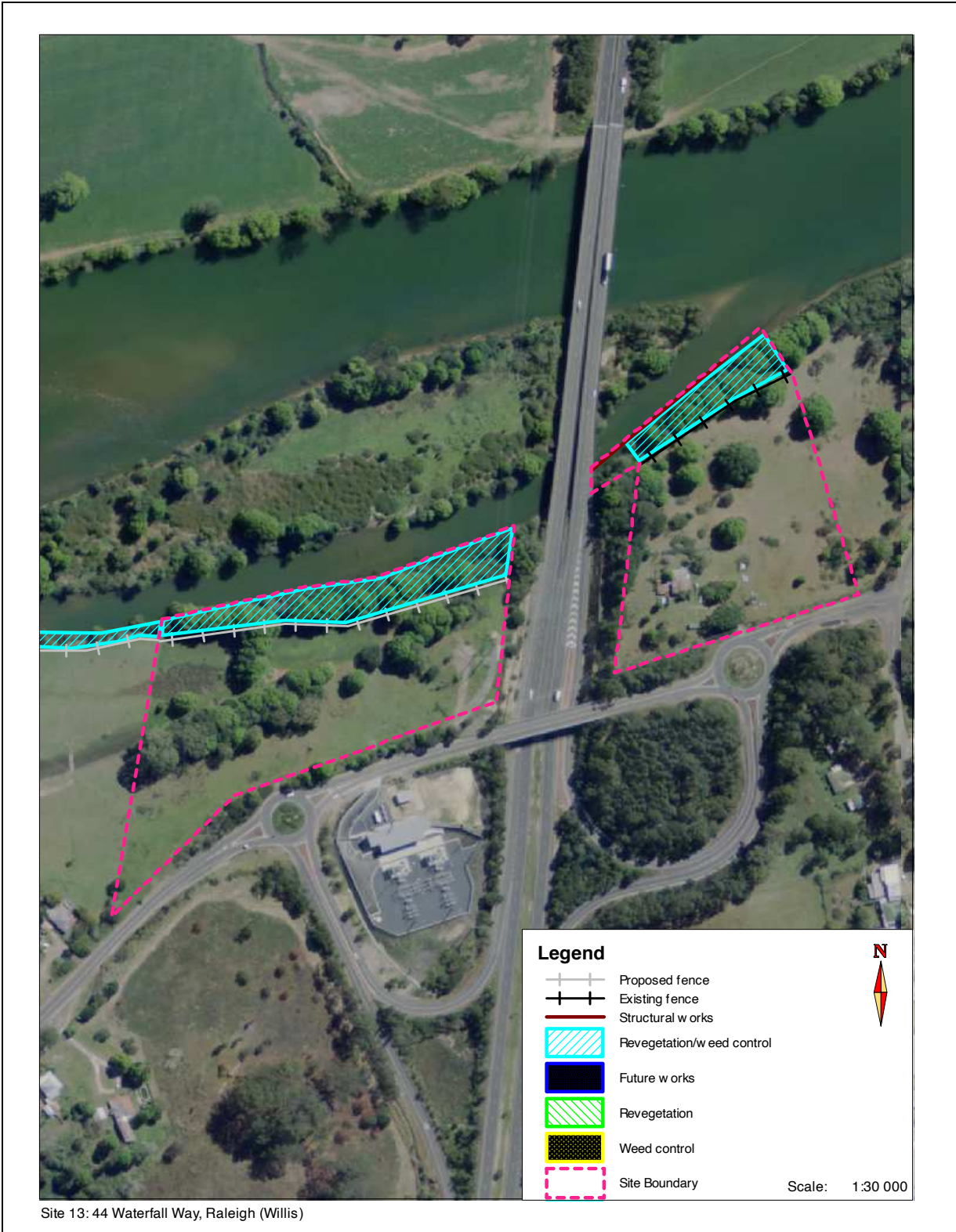


Figure 87: Property workplan map

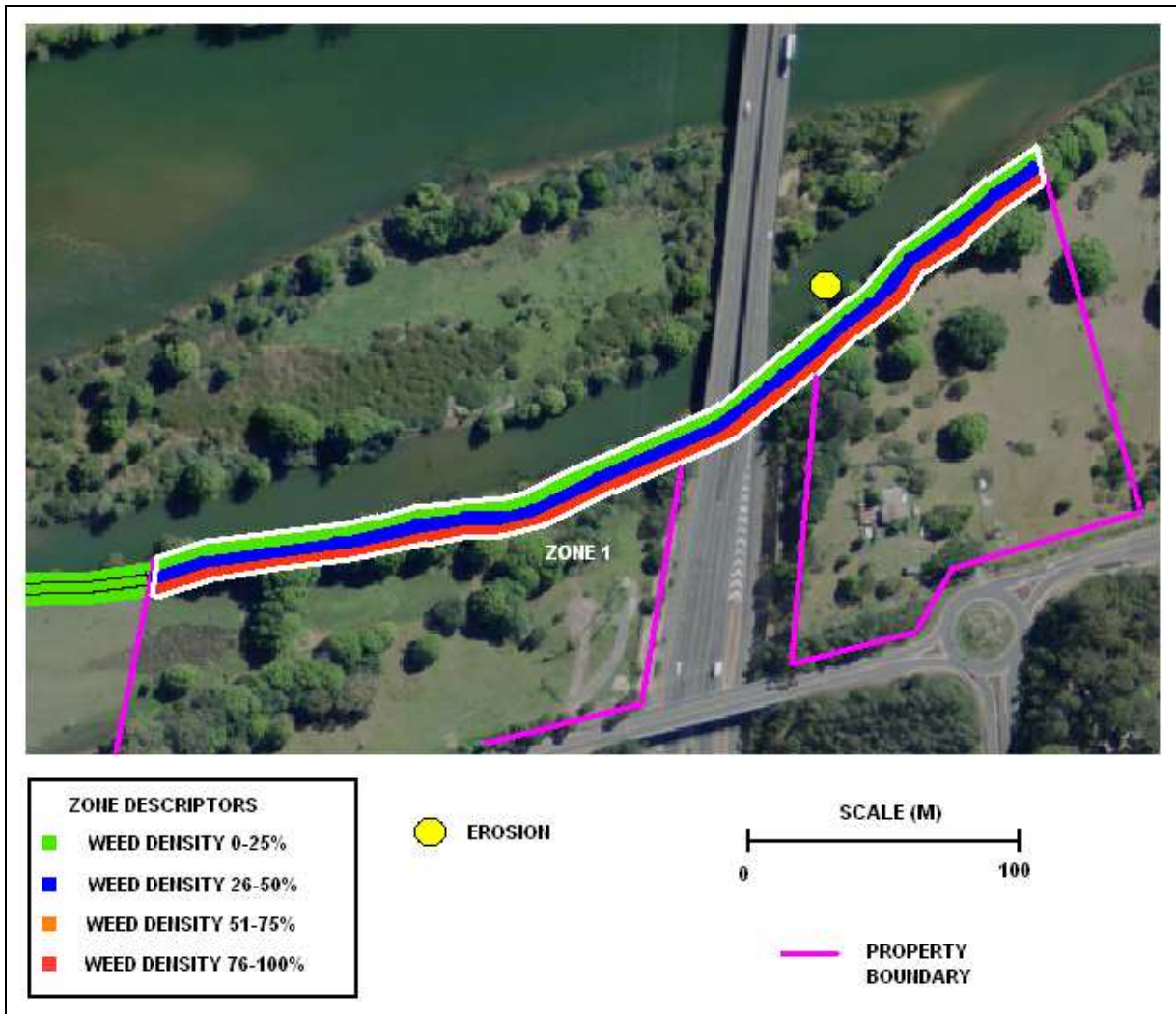


Figure 88: Riparian condition and extent

Table 72: Riparian condition summary

MGT ZONE	1
ASSESSOR	S. Morris
RIPARIAN WIDTH	10-20m
CANOPY COVER	76-100%
MIDSTOREY COVER	76-100%
GROUNDCOVER	26-50%
APPROPRIATE COVER	Y
GRAZING IMPACT	Y
NATURAL REGEN	N
CANOPY WEED	76-100%
MIDSTORY WEED	
GROUNDCOVER WEED	<25%
WEED 1	Lantana (<i>Lantana camara</i>)
WEED 1 DENSITY	Clumps (11-50%)
WEED 2	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 2 DENSITY	Dominant (>50%)
WEED 3	Morning Glory (<i>Ipomea</i> sp)
WEED 3 DENSITY	Few Scattered (<10%)
WEED 4	Easter Cassia (<i>Senna pendula</i>)
WEED 4 DENSITY	Clumps (11-50%)
BANK	South Bank

Table 73: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)		
				Landholder	Contributions	
					NRCMA or Other	Bellingen Shire Council
1	Project Coordination	Technical, administrative & practical support (6 hrs @ \$50/hr)	Environmental Levy		300 (In kind)	300
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80
1	Fencing	Landholder to supply materials for and construct fence line to exclude stock (240m @ \$9000/km)		2160 (In kind)		2160
1	Weed Control (contractor)	General weed control along riparian zone; stem inject camphors (2.5 days @ \$760/day)			1900	1900
1	Revegetation (1200m ²) (contractor)	Planting of key species at 2m centres along top of bank and face. (\$6.50/ plant incl labour x 300 plants)		900 (In kind)	1050	1950
1	Structural works (optional)	Excavator to place two rock fillets along margin of low tide bench (2 x 50m fillets @ \$100/m)			10000	10000
1	Weed Control (contractor)	Targeted poisoning of Camphors in stages (20 stems @ \$6.50ea incl. herbicide)			130	130
1	Revegetation (910m ²) (contractor)	Planting of key species at 4m centres along top of bank and face. (\$6.50/ plant incl labour x 50 plants)		150 (In kind)	175	325
1	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (4.5hrs / qtr) inspections and suppression as necessary for 10 years		6465 (In kind)		6465

			TOTAL	9675	13255	380	23310

Part 3: Lower Bellinger Estuary – Reach Plan

Site 1 - 1180 North Bank Road, Raleigh NSW 2454

Lot/DP	Lot11DP839900
Property Owners	Raleigh Dairy Holdings
Catchment Details	Lower Bellinger River estuary – north bank; 900m river frontage; Area: 19.16ha
Land Use	Rural – Dairy Cattle

Property Summary

This site incorporates an inside bend alluvial floodplain. Undercutting is evident along the bank toe (most likely fretting from boat and wind wave wash). There is a tidally submerged bench extending approximately 3-4 metres from the toe of the immediate bank face. Overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). The riparian zone contains some locally native plant species limited natural recruitment occurring due to competition from weed species. Some minor weed problems exist with species such as Camphor Laurel (*Cinnamomum camphora*), Morning Glory (*Ipomea* spp.) and Lantana (*Lantana camara*).

Previous Management Efforts

A fence has recently been erected along the riparian fringe approximately 5 metres back from the bank crest.

Rehabilitation Strategy

1. Rehabilitation at this site should focus on removing problematic weed species as mentioned above. Following weed treatment, these areas should be revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). The riparian buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.
2. The landholder has indicated intent to fence off all drains and creek lines across the property (see figure 89). This action is strongly supported under the reach plan although cost estimates are not detailed in the work plan (table 75). Periodic drain cleaning (relevant approvals must be sought) and on-going weed control will be an integral part of managing these drainage systems. The establishment of tree/shade belts along one side of the drain margins is recommended as it will reduce maintenance requirements and weed problems in the drains.



Figure 89: Property workplan map

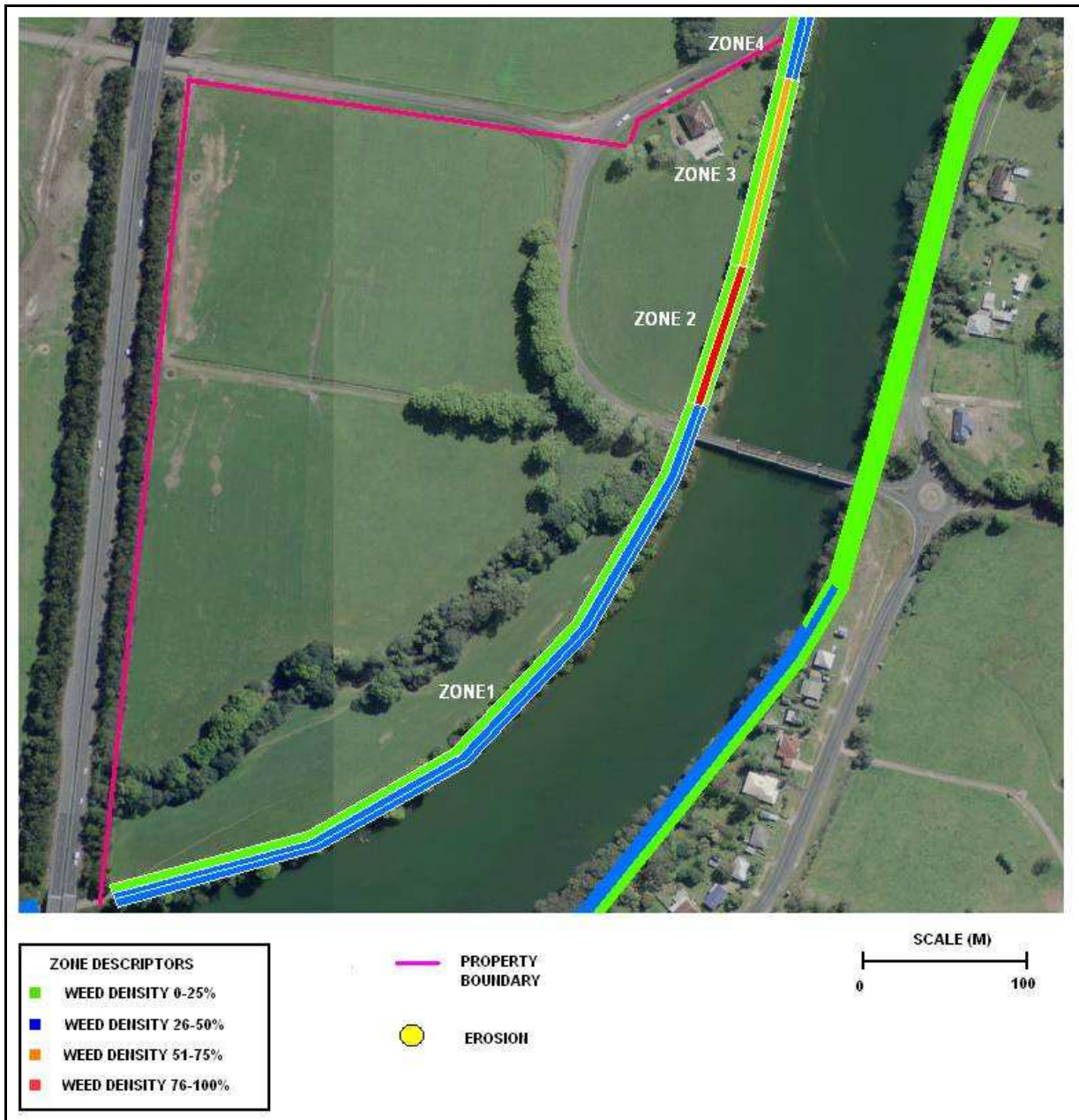


Figure 90: Riparian condition and extent

Table 74: Riparian condition summary

MGT ZONE	1	2	3	4
ASSESSOR	A.Ricket	A.Ricket	A.Ricket	A.Ricket
RIPARIAN WIDTH	<5m	5-10m	5-10m	5-10m
CANOPY COVER	51-75%	76-100%	<25%	<25%
MIDSTOREY COVER	51-75%	26-50%	76-100%	76-100%
GROUND COVER	76-100%	76-100%	51-75%	51-75%
APPROPRIATE COVER	N	Y	N	N
GRAZING IMPACT	N	N	N	N
NATURAL REGEN	Y	Y	Y	Y
CANOPY WEED	26-50%	<25%	0%	0%
MIDSTOREY WEED	<25%	76-100%	51-75%	51-75%
GROUND COVER WEED	pasture	pasture	pasture	pasture
WEED 1	Camphor Laurel(B)	Camphor Laurel(B)	Morning glory (Ipomoea spp.)(A)	Morning glory (Ipomoea spp.)(A)
WEED 1 DENSITY	Few Scattered (<10%)	Clumps (11-50%)	Clumps (11-50%)	Clumps (11-50%)
WEED 2	Lantana(B)	Lantana(B)	Lantana(B)	Lantana(B)
WEED 2 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Clumps (11-50%)
WEED 3	Morning glory (Ipomoea spp.)(A)	Narrow Leaf Privet(A)	Wild Tabacco Bush	Wild Tabacco Bush
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 4		Wild Tabacco Bush	Winter Senna(C)	Winter Senna(C)
WEED 4 DENSITY		Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 4		Morning glory (Ipomoea spp.)(A)		
WEED 4 DENSITY		Few Scattered (<10%)		
BANK	North	North	North	North

Table 75: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)				
				Landholder	NRCMA or Other	Contributions		Total Budget
						Bellingen Shire Council		
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy			800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy			80 (In kind)	80	
All	Weed Control (contractor)	Manual weed eradication along riparian zone; stem inject Camphors (9 days @ \$800/day)			7200		7200	
All	Revegetation (4500m ²)	Plant out riparian zone gaps (2m centres) (\$6.50/ plant incl labour x 1125 plants) (landholder labour in kind)		3375 (In kind)	3938		7313	
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (11hrs / qtr) inspections and suppression as necessary for 10 years		15393 (In kind)			15393	
			TOTAL	18768	11138	880	30768	

Site 2 - Queen Street, Raleigh NSW 2454

Lot/DP	BSC LotID 9922
Property Owners	Bellingen Shire Council
Catchment Details	Lower Bellinger River estuary – south bank; 740m river frontage; Area: 1.26ha
Land Use	Road Reserve

Property Summary

This site marks the beginning of the fluvial transition zone where marine influence becomes pronounced. Here major widening of the estuary (Raleigh shoal) occurs, with adjacent low and wide flood plains allowing significant dissipation of flood flow energy. Some bedrock outcropping exists along the upper length of this site (zone1). The remainder of the site is alluvial; however banks are considered stable (Cohen & Telfer, 2010). The riparian zone contains a diversity of locally native plant species with natural recruitment occurring, however competition from weeds is hampering successful establishment towards the site's lower extent (zone 2) due to competition from weed species. Weed problems include species such as Camphor Laurel (*Cinnamomum camphora*), Morning Glory (*Ipomea* spp.), Winter senna (*Senna pendula*) and Lantana (*Lantana camara*).

Previous Management Efforts

Regular mowing is undertaken along the road verge which limits the width of the riparian zone and natural plant recruitment at this site.

Rehabilitation Strategy

Initial weed treatment should be undertaken along the entire length of this site with a particular to be focussed on the lower extent where weeds are more rampant (zone 2). Following weed treatment, gap areas should be revegetated with plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellingen Landcare). The riparian buffer may be expanded in some areas which will reduce the mowing requirements along the road verge. Appropriate widths should be negotiated with Council's Operations & Maintenance team prior to undertaking any work. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

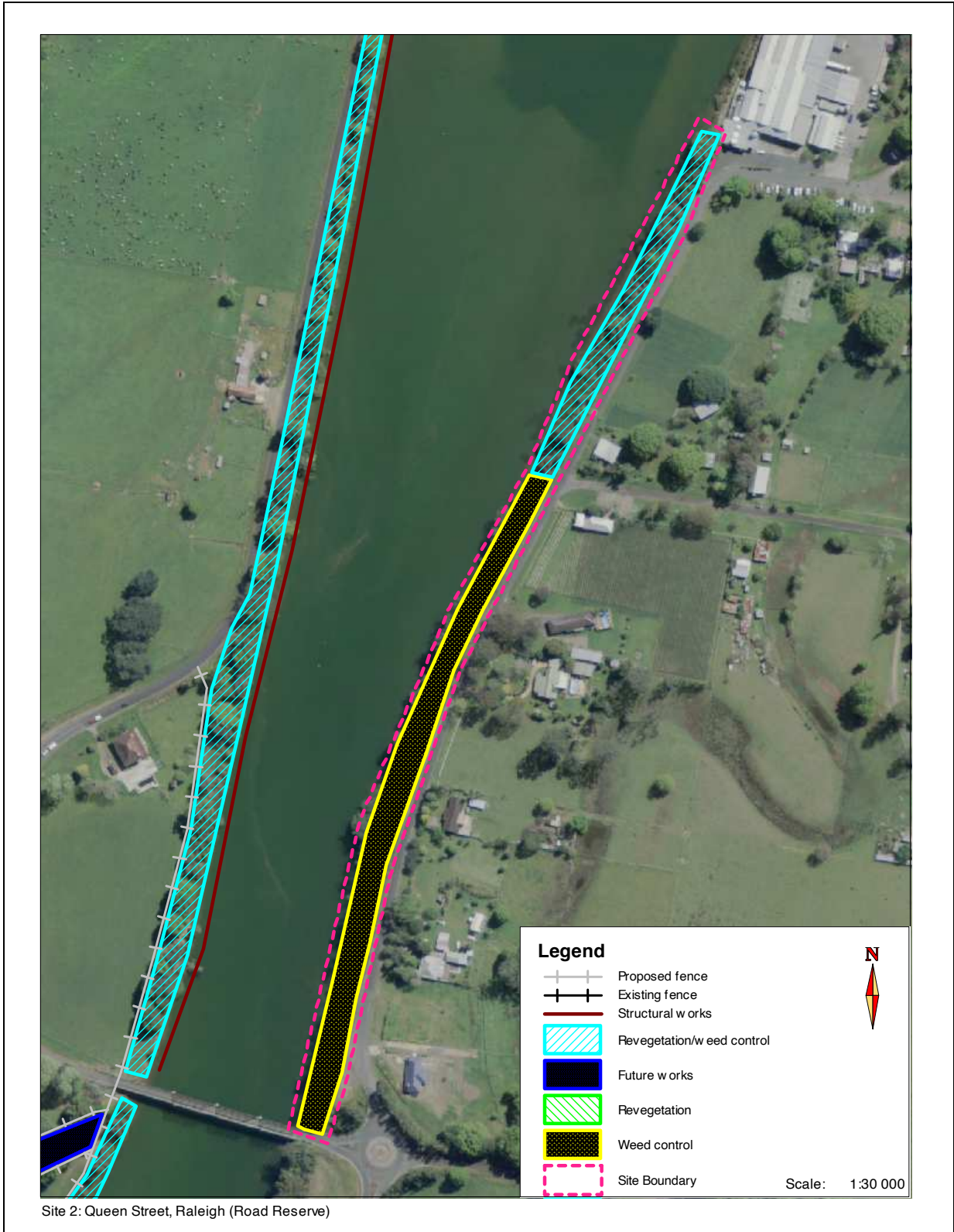


Figure 91: Property workplan map

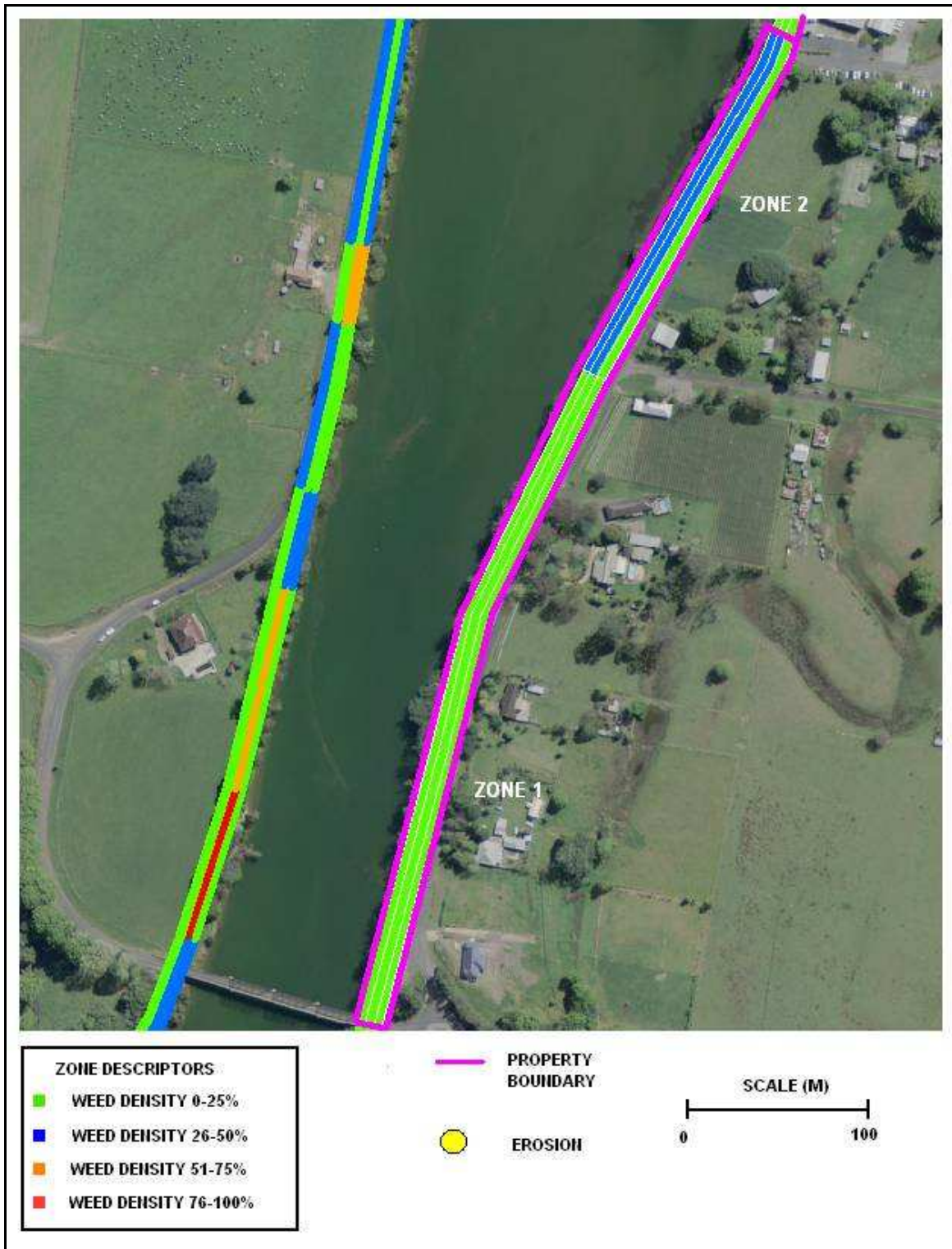


Figure 92: Riparian condition and extent

Table 76: Riparian condition summary

MGT ZONE	1	2
ASSESSOR	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	5-10m
CANOPY COVER	51-75%	26-50%
MIDSTOREY COVER	76-100%	76-100%
GROUND COVER	76-100%	51-75%
APPROPRIATE COVER	Y	Y
GRAZING IMPACT	N	N
NATURAL REGEN	Y	Y
CANOPY WEED	0%	0%
MIDSTORY WEED	<25%	26-50%
GROUND COVER WEED	<25%	26-50%
WEED 1	Winter Senna (<i>Senna pendula</i>)	Morning Glory (<i>Ipomea</i> spp.)
WEED 1 DENSITY	Few Scattered (<10%)	Clumps (11-50%)
WEED 2	Lantana (<i>Lantana camara</i>)	Coral Tree (<i>Erythrina sykesii</i>)
WEED 2 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)
WEED 3	Morning Glory (<i>Ipomea</i> spp.)	Lantana (<i>Lantana camara</i>)
WEED 3 DENSITY	Few Scattered (<10%)	Clumps (11-50%)
WEED 4		Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 4 DENSITY		Few Scattered (<10%)
BANK	South Bank	South Bank

Table 77: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Weed Control (contractor)	Manual weed eradication along riparian zone (10 days @ \$800/day)		8000		8000	
All	Revegetation (4000m ²)	Plant out riparian zone gaps (~3m centres) (\$6.50/ plant incl labour x 500 plants)		3250		3250	
All	On-going Maintenance	Follow-up weed treatment & maintenance- quarterly (8hrs / qtr) inspections and suppression as necessary for 10 years		12130		12130	
			TOTAL	23380	880	24260	

Site 3 - Keevers Drive, Raleigh NSW 2454

Lot/DP	Plan 49 – 1714 (BSC LotID 9838)
Property Owners	Bellingen Shire Council
Catchment Details	Lower Bellinger River estuary – north bank; 910m river frontage; Area: 0.79ha
Land Use	Road Reserve

Property Summary

This site marks the beginning of the fluvial transition zone where marine influence becomes pronounced. Here major widening of the estuary (Raleigh shoal) occurs, with adjacent low and wide flood plains allowing significant dissipation of flood flow energy. Undercutting is evident along the bank toe (most likely fretting from boat and wind wave wash), however banks are considered stable (Cohen & Telfer, 2010). There is a tidally submerged bench extending approximately 3-4 metres from the toe of the immediate bank face. The riparian zone contains some locally native plant species limited natural recruitment occurring due to competition from weed species. Weed problems exist with species such as Camphor Laurel (*Cinnamomum camphora*), Morning Glory (*Ipomea* spp.), Winter senna (*Senna pendula*), Small Leaf Privet (*Ligustrum sinense*) and Lantana (*Lantana camara*).

Previous Management Efforts

N/A

Rehabilitation Strategy

1. Rehabilitation at this site should focus on removing problematic weed species as mentioned above. Following weed treatment, these areas should be revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.
2. Should undercut at the toe begin to threaten the road, installation of rock fillets (refer to figure 93) would provide a higher degree of resilience against erosion from flooding and boat/wind wave wash. Rock fillets also create estuarine habitat, facilitating the mangrove establishment and fish recruitment. However due to the nature of the site, installation would need to be executed from the water via barge and the cost of these structures on such a broad scale would limit the potential for funding contributions from external parties.

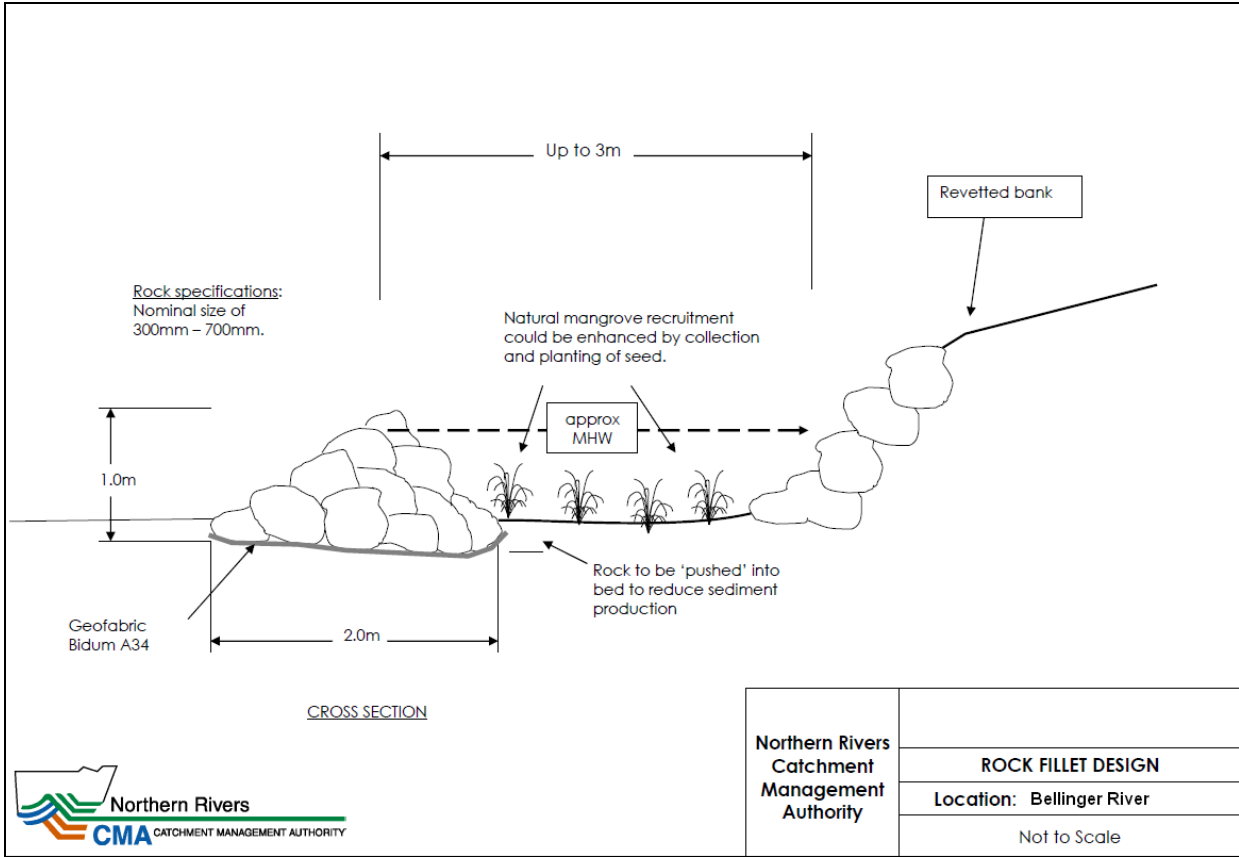


Figure 93: Design layout for structural works

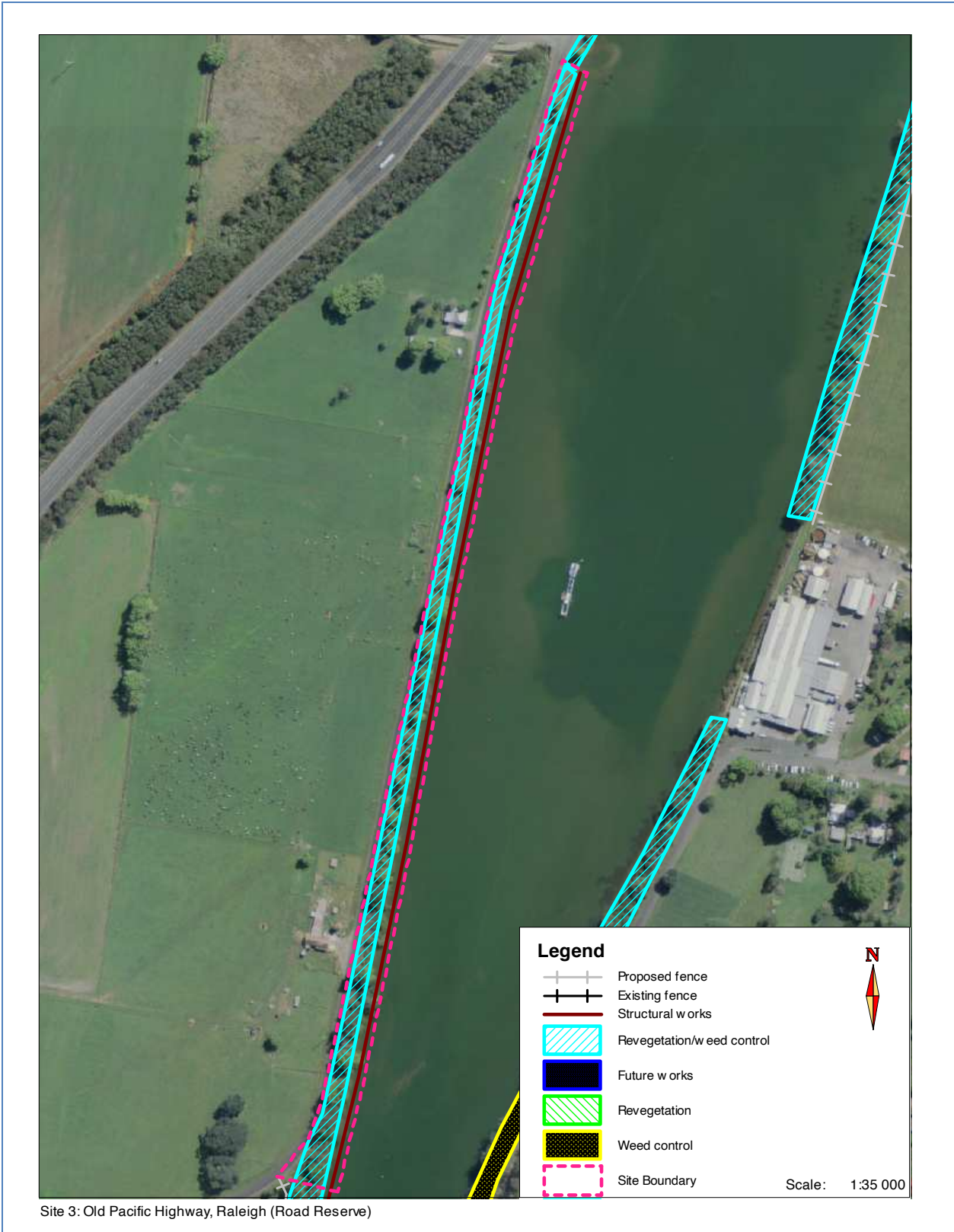


Figure 94: Property workplan map

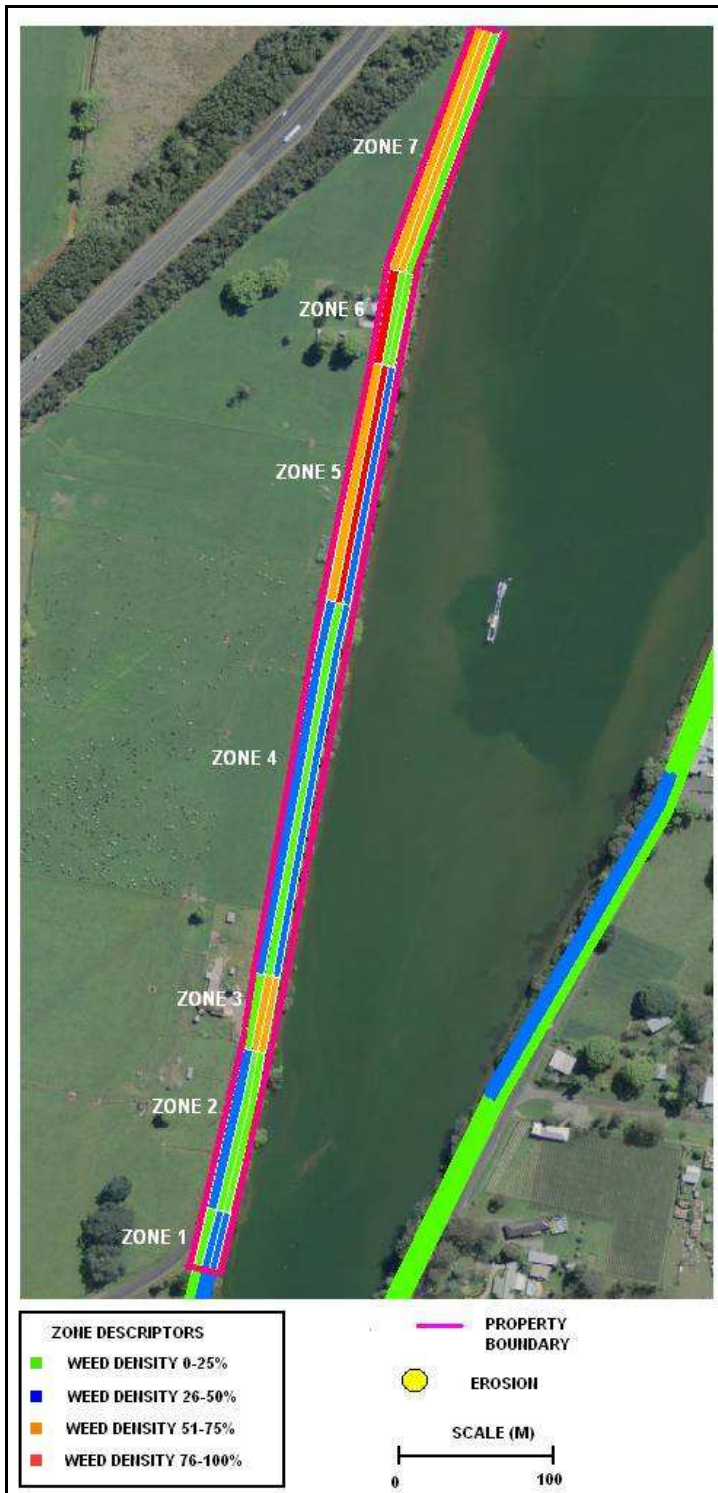


Figure 95: Riparian condition and extent

Table 78: Riparian condition summary

MGT ZONE	1	2	3	4	5	6	7
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	<5m	<5m	<5m	<5m	<5m	<5m
CANOPY COVER	76-100%	51-75%	<25%	26-50%	<25%	<25%	<25%
MIDSTOREY COVER	76-100%	51-75%	26-50%	76-100%	76-100%	51-75%	76-100%
GROUNDCOVER	51-75%	76-100%	76-100%	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	N	N	N	N
GRAZING IMPACT	N	N	N	N	N	N	N
NATURAL REGEN	Y	Y	Y	Y	Y	Y	N
CANOPY WEED	<25%	26-50%	0%	26-50%	51-75%	76-100%	51-75%
MIDSTOREY WEED	26-50%	<25%	51-75%	<25%	76-100%	0%	51-75%
GROUNDCOVER WEED	26-50%	pasture	51-75%	26-50%	26-50%	pasture	<25%
WEED 1	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)	Lantana (Lantana camara)	Morning Glory (Ipomea spp.)	Camphor Laurel (Cinnamomum camphora)	Morning Glory (Ipomea spp.)	Lantana (Lantana camara)
WEED 1 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Dominant (>50%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)
WEED 2	Lantana (Lantana camara)	Lantana (Lantana camara)	Morning Glory (Ipomea spp.)	Lantana (Lantana camara)	Morning Glory (Ipomea spp.)		Morning Glory (Ipomea spp.)
WEED 2 DENSITY	Clumps (11-50%)	Few Scattered	Clumps (11-50%)	Clumps (11-50%)	Few Scattered	Few Scattered	Few Scattered

WEED 3	Morning Glory (Ipomea spp.)	(<10%)	Small Leaf Privet (Ligustrum sinense)	Camphor Laurel (Cinnamomum camphora)	Lantana (Lantana camara)	Camphor Laurel (Cinnamomum camphora)	(<10%)
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Dominant (>50%)	Few Scattered (<10%)	
WEED 4	Winter Senna (Senna pendula)				Winter Senna (Senna pendula)		
WEED 4 DENSITY	Few Scattered (<10%)				Few Scattered (<10%)		
WEED 5							
WEED 5 DENSITY							
BANK	North Bank	North Bank	North Bank	North Bank	North Bank	North Bank	North Bank

Table 79: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Weed Control (contractor)	Manual weed eradication along riparian zone (9 days @ \$800/day)		7200		7200	
All	Revegetation (7900m ²)	Plant out riparian zone gaps (2.25m centres) (\$6.50/ plant incl labour x 1500 plants)		9750		9750	
4-9	Structural Works (optional)	Supply, delivery of materials, machinery and labour for installation of rock fillets (18 x 50m fillets @ \$270/m)		243000		243000	
All	On-going Maintenance	Follow-up weed treatment & maintenance- quarterly (13hrs / qtr) inspections and suppression as necessary for 10 years		17830		17830	
			TOTAL	277780	880	278860	

Site 4 - Old Ferry Road, Raleigh NSW 2454

Lot/DP	Lot1DP1102732; Lot2DP1102732; Lot102DP755557; Lot103DP755557
Property Owners	Raleigh Dairy Holdings
Catchment Details	Lower Bellinger River estuary – south bank; 1110m river frontage; Area: 26.95ha
Land Use	Rural – Dairy Cattle

Property Summary

This site incorporates a straight section through inside bend alluvial floodplain. Along the straight section (zone 1), there is a tidally submerged bench gradually dropping away into deeper water from the toe of the immediate bank face. Along the inside bend section (zone 2-3), the bank gradient slopes gently into a mangrove colonised tidal bench, then into shallow water. Overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). The riparian zone contains some locally native plant species limited natural recruitment occurring due to competition from weed species. Major weed infestations exist mainly along the inside bend section, with species such as Camphor Laurel (*Cinnamomum camphora*), Morning Glory (*Ipomea* spp.) and Lantana (*Lantana camara*)

Previous Management Efforts

N/A

Rehabilitation Strategy

1. Rehabilitation at this site should focus on removing problematic weed species and subsequent revegetation. This should be a staged approach with particular attention to be focused on the major weed infestation currently extending along the majority of the inside bend (zone 2 and 3). Multiple applications of herbicide will be necessary in the first instance. Following weed treatment, these areas should be revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Accompanying fence lines will be necessary to exclude cattle during plant establishment for at least 5 years. Ongoing, regular weed management will also be critical to ensure the survival and recruitment of native plants.
2. The landholder has indicated intent to fence off all drains and creek lines across the property (see figure 96). This action is strongly supported under the reach plan although cost estimates not detailed in the work plan (table x). Periodic drain cleaning (relevant approvals must be sought) and on-going weed control will be an integral part of managing these drainage systems. The establishment of tree/shade belts along one side of the drain margins is recommended as it will reduce maintenance requirements and weed problems in the drains.

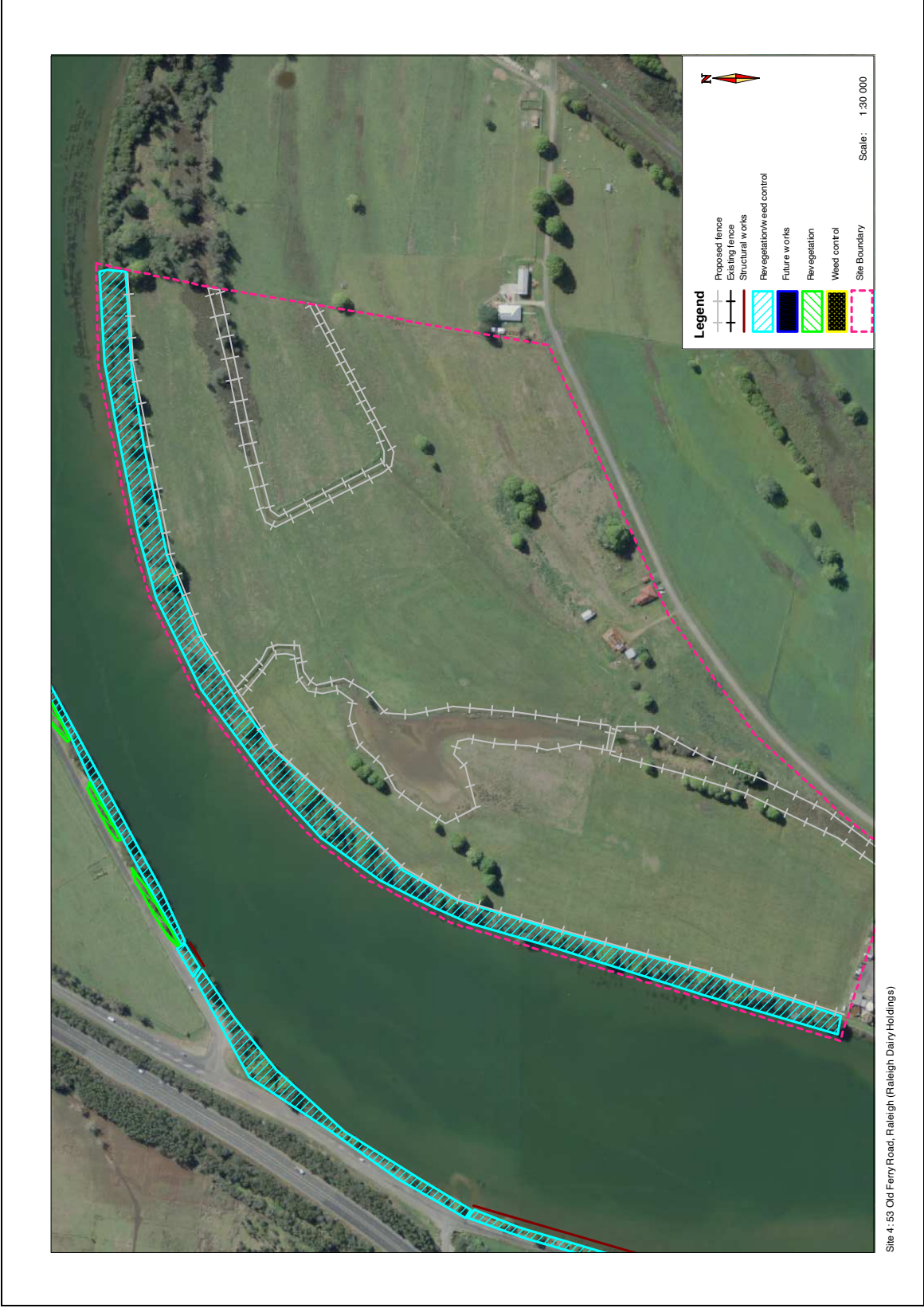


Figure 96: Property workplan map

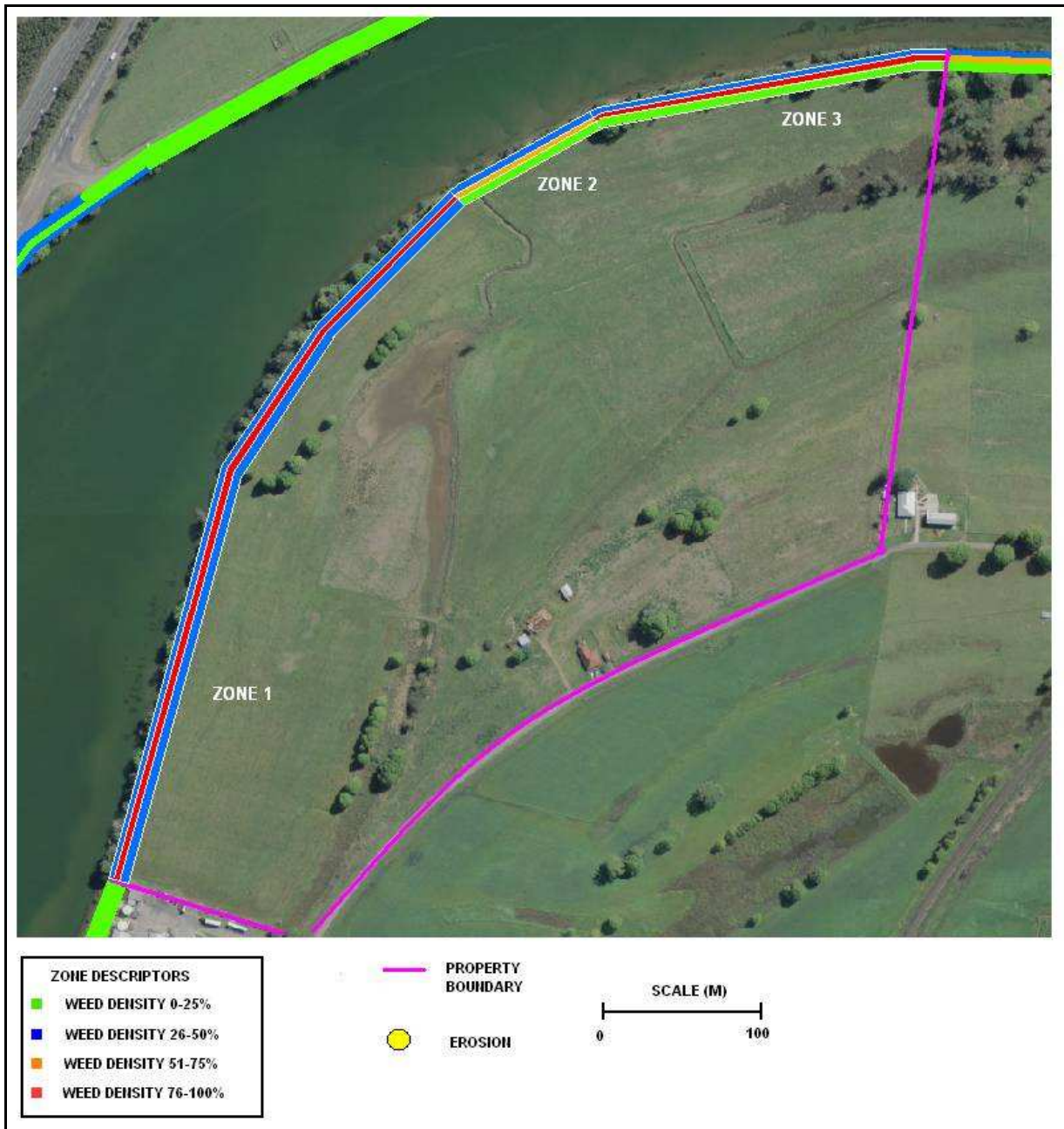


Figure 97: Riparian condition and extent

Table 80: Riparian condition summary

MGT ZONE	1	2	3
ASSESSOR	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	5-10m	10-20m
CANOPY COVER	51-75%	<25%	51-75%
MIDSTOREY COVER	76-100%	76-100%	76-100%
GROUND COVER	<25%	26-50%	26-50%
APPROPRIATE COVER	N	N	N
GRAZING IMPACT	N	N	N
NATURAL REGEN	Y	N	Y
CANOPY WEED	26-50%	0%	<25%
MIDSTORY WEED	76-100%	51-75%	76-100%
GROUND COVER WEED	26-50%	26-50%	26-50%
WEED 1	Lantana (Lantana camara)	Lantana (Lantana camara)	Lantana (Lantana camara)
WEED 1 DENSITY	Dominant (>50%)	Dominant (>50%)	Dominant (>50%)
WEED 2	Camphor Laurel (Cinnamomum camphora)	Morning Glory (Ipomea spp.)	Morning Glory (Ipomea spp.)
WEED 2 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)
WEED 3	Morning Glory (Ipomea spp.)	Wild Tobacco (Solanum mauritianum)	Castor Oil Plant (Rinicus communis)
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 4			Wild Tobacco (Solanum mauritianum)
WEED 4 DENSITY			Few Scattered (<10%)
WEED 5			Winter Senna (Senna pendula)
WEED 5 DENSITY			Few Scattered (<10%)
BANK	South Bank	South Bank	South Bank

Table 81: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy			800 (In kind)	800
N/A	Publicity	Printing, educational activities, media release	Environmental Levy			80 (In kind)	80
	Weed Control (Contractor)	Manual weed eradication along riparian zone; (5 days @ \$800/day)		4000			4000
	Fencing	Landholder to supply materials for and construct fence line to exclude stock (480m @ \$5000/km)		2400 (In kind)			2400
	Revegetation (3360m ²)	Plant out riparian zone gaps (2m centres) (\$6.50/ plant incl labour x 840 plants) (landholder labour in kind)		2520 (In kind)	2940		5460
	Weed Control (Landholder)	Initial weed eradication along riparian zone (three initial treatments); (3 days @ \$50/hr; landholder labour in kind)		1200 (In kind)			1200
	Weed Control (Contractor)	Manual weed eradication along riparian zone; (7 days @ \$800/day)			5600		5600
	Fencing	Landholder to supply materials for and construct fence line to exclude stock (650m @ \$5000/km)		3250 (In kind)			3250
	Revegetation (4500m ²)	Plant out riparian zone gaps (2m centres) (\$6.50/ plant incl labour x 1125 plants) (landholder labour in kind)		3375 (In kind)	3938		7313
All	On-going	Follow-up weed treatment & fence		30103			30103

Maintenance	maintenance- quarterly (21hrs / qtr) inspections and suppression as necessary for 10 years		(In kind)				
		TOTAL	42848	16478	880	60206	

Site 5 - Mylestom Drive, Repton NSW 2454

Lot/DP	Plan 31901 – 1603 (BSC LotID 9881)
Property Owners	Bellingen Shire Council
Catchment Details	Lower Bellinger River estuary – north bank; 960m river frontage; Area: 1.4ha
Land Use	Road Reserve

Property Summary

This site is within the fluvial transition zone where the most pronounced erosion processes observed are fretting of the bank toe (and subsequent mass failure) from wind and boat wave wash. Only minor sections of erosion are noted by Cohen & Telfer, 2010. A rock revetment wall spans most of the length of the site, however many section of the wall are degraded. There is a tidally submerged bench extending a short distance (2-3m) from the toe of the immediate bank face in some sections. The riparian zone contains some locally native plant species limited natural recruitment occurring due to competition mowing and vehicles. Minor weed infestations exist with species such as Camphor Laurel (*Cinnamomum camphora*), Morning Glory (*Ipomea* spp.), Winter senna (*Senna pendula*) and Lantana (*Lantana camara*)

Previous Management Efforts

N/A

Rehabilitation Strategy

1. Rehabilitation at this site should focus on removing problematic weed species as mentioned above. Following weed treatment, the riparian corridor should be expanded (5-7m back from bank crest) and revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Vehicle access (cars, mowers, etc) should be restricted in revegetated areas to allow healthy plant recruitment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.
2. The installation of rock fillets (refer to figure 98) is proposed in several sensitive, degraded scalloped areas to provide a higher degree of resilience against erosion from flooding and boat/wind wave wash. Rock fillets also create estuarine habitat, facilitating the mangrove establishment and fish recruitment. Once installed the adjacent bank should be revegetated as detailed previously.

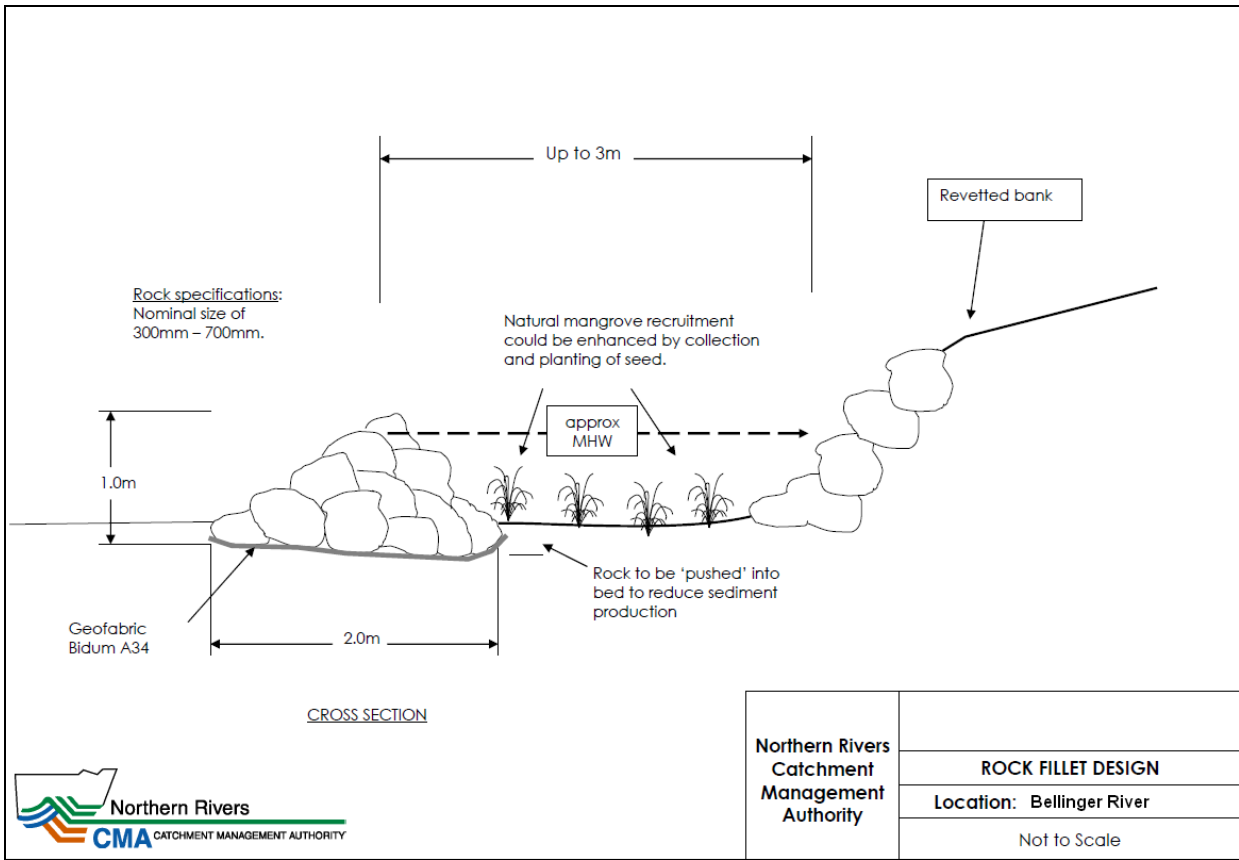


Figure 98: Design layout for structural works

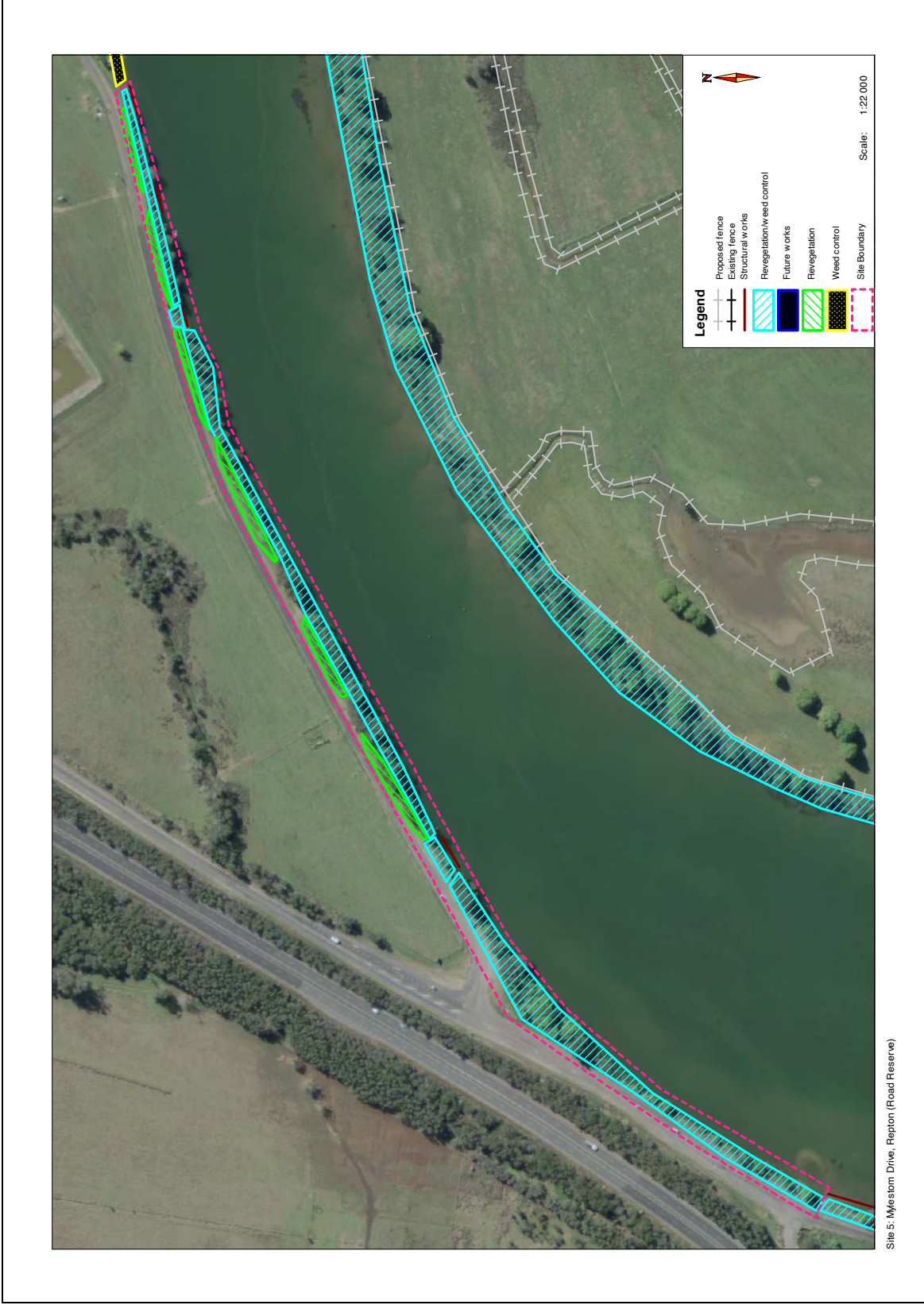


Figure 99: Property workplan map

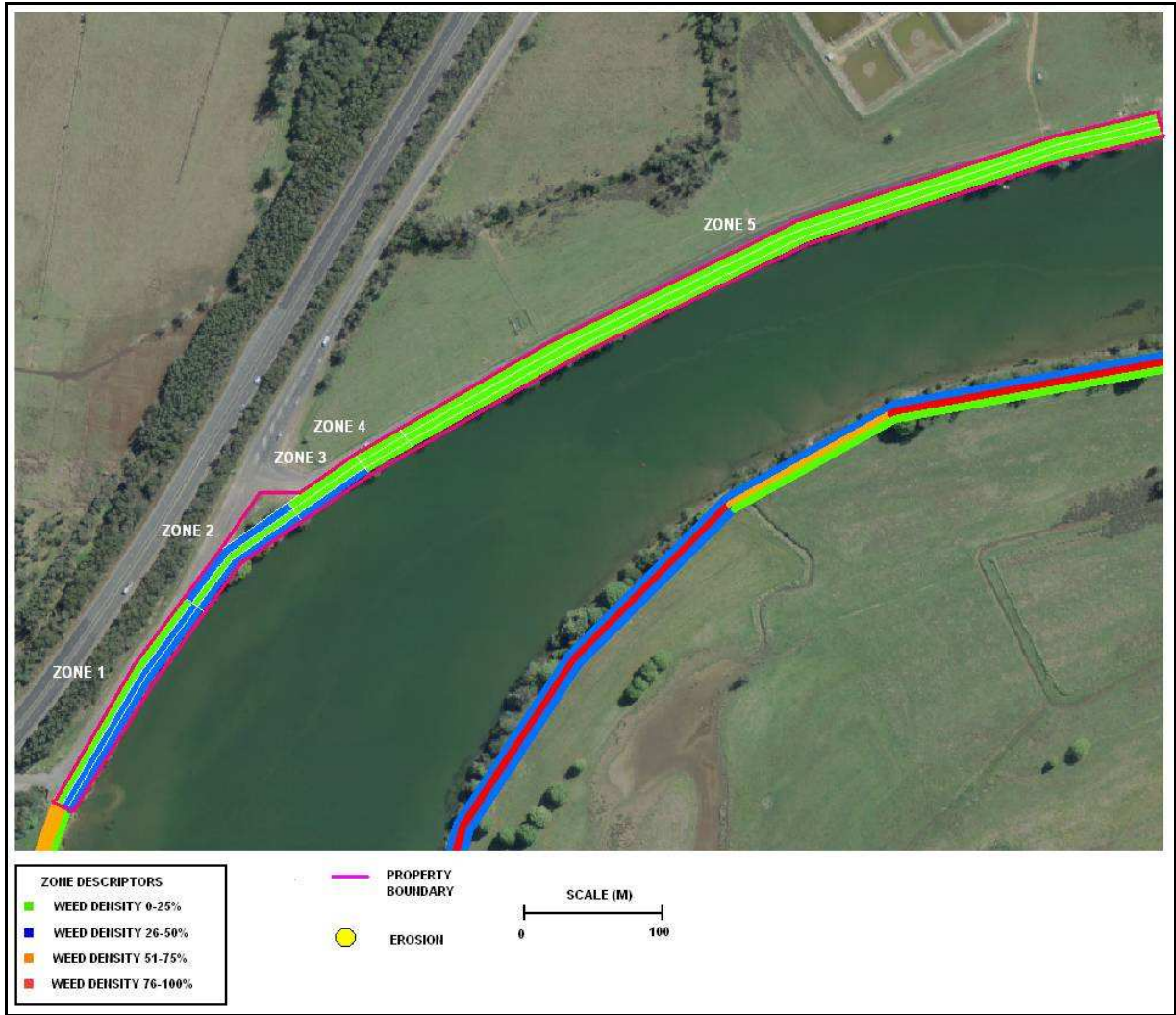


Figure 100: Riparian condition and extent

Table 82: Riparian condition summary

MGT ZONE	1	2	3	4	5
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	<5m	5-10m	<5m	<5m	5-10m
CANOPY COVER	<25%	76-100%	<25%	<25%	76-100%
MIDSTOREY COVER	51-75%	76-100%	76-100%	<25%	<25%
GROUND COVER	76-100%	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	N	Y	N	N	N
GRAZING IMPACT	N	N	N	N	N
NATURAL REGEN	Y	Y	Y	Y	Y
CANOPY WEED	<25%	26-50%	0%	0	0%
MIDSTORY WEED	26-50%	<25%	<25%	<25%	<25%
GROUND COVER WEED	26-50%	26-50%	26-50%	pasture	pasture
WEED 1	Camphor Laurel (Cinnamomum camphora)	Lantana (Lantana camara)	Coral Tree (Erythrina sykesii)	Winter Senna (Senna pendula)	Winter Senna (Senna pendula)
WEED 1 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 2	Lantana (Lantana camara)	Morning Glory (Ipomea spp.)		Wild Tobacco (Solanum mauritianum)	Wild Tobacco (Solanum mauritianum)
WEED 2 DENSITY	Clumps (11-50%)	Few Scattered (<10%)		Few Scattered (<10%)	Few Scattered (<10%)
WEED 3	Morning Glory (Ipomea spp.)	Camphor Laurel (Cinnamomum camphora)			
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)			
WEED 4	Small Leaf Privet (Ligustrum sinense)				
WEED 4 DENSITY	Few Scattered (<10%)				
WEED 5					
WEED 5 DENSITY					
BANK	North Bank	North Bank	North Bank	North Bank	North Bank

Table 83: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Weed Control (contractor)	Manual weed eradication along riparian zone (9 days @ \$800/day)		7200		7200	
All	Revegetation (6700m ²)	Plant out riparian zone gaps (2m centres) (\$6.50/ plant incl labour x 1680 plants)		10920		10920	
4-5	Structural Works (contractor)	Supply, delivery of materials, machinery and labour for installation of rock fillets (4 x 50m fillets @ \$150/m)		30000		30000	
All	On-going Maintenance	Follow-up weed treatment & maintenance- quarterly (14hrs / qtr) inspections and suppression as necessary for 10 years		19000		19000	
			TOTAL	67120	880	68000	

Site 6 - 96 Mylestom Drive, Repton NSW 2454

Lot/DP	Lot1DP934556
Property Owners	Select Parks Pty Ltd
Catchment Details	Lower Bellinger River estuary – north bank; 410m river frontage; Area: 1.84ha
Land Use	Tourist Park

Property Summary

The entire bank along the main channel at this site has been stabilised using bank protection works (rock revetment or retaining walls; however sections of the retaining wall are failing due to slump pressure. The riparian zone is a combination of lawn and vegetated areas containing locally native plant species. Man Arm Creek (spanning the eastern boundary) has suffered significant scour in recent flood events, leaving a bare gravel bank along most of this boundary line.

Previous Management Efforts

A DECCW funded partnership project facilitated the construction several sections of rock revetment and revegetation along the immediate bank face at this site.

Rehabilitation Strategy

1. It is recommended that the current management practice of hedging the native trees/shrubs in the riparian zone be discontinued. This will allow the trees/shrubs to create a canopy shade and reduce competition from grasses and other weeds. However, ongoing weed management will be critical to ensure the survival and recruitment of native plants.
2. It is likely that the retaining wall is failing due to hydraulic pressure from water building up behind the wall. This and potential bank slump during wet periods are gradually cause the wall to collapse. Therefore additional drainage piping should be installed behind the wall to reduce hydraulic pressure. This coupled with additional support (e.g. piles, rock) in front of the wall should extend the life of the retaining wall significantly. Ultimately it is inevitable that this wall will need to be replaced.
3. The section of scour along the bank of Man Arm Creek should be revegetated heavily with deep rooted native plants along the bank crest (refer the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare)) and salt tolerant sedges and rushes such as *Baumea Juncea*, *Ficinia nodosa*, *Juncus krausii*, *Juncus acutus*, *Lomandra longifolia* and mangrove species (although mangroves may be difficult to establish) in the intertidal zone. Additional benefit would be gained through the placement of several small rock embayment walls along the bank. These wall could be constructed by hand and extend parallel to the bank at the mid-tide level with an arc back up the bank at either end. These will allow the capture of flotsam and sediment thereby facilitating the establishment of mangroves and other salt tolerant species as mentioned previously.

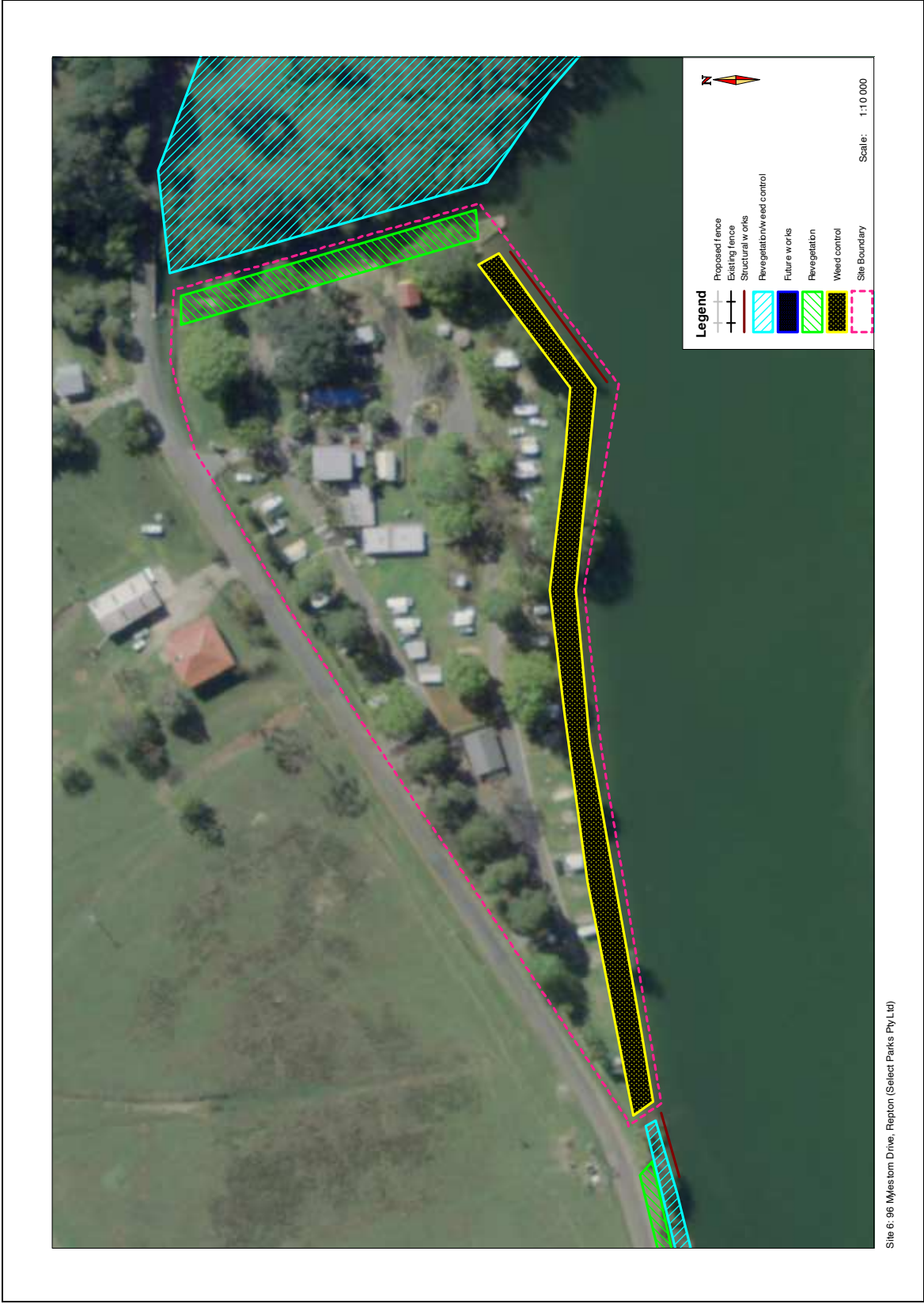


Figure 101: Property workplan map

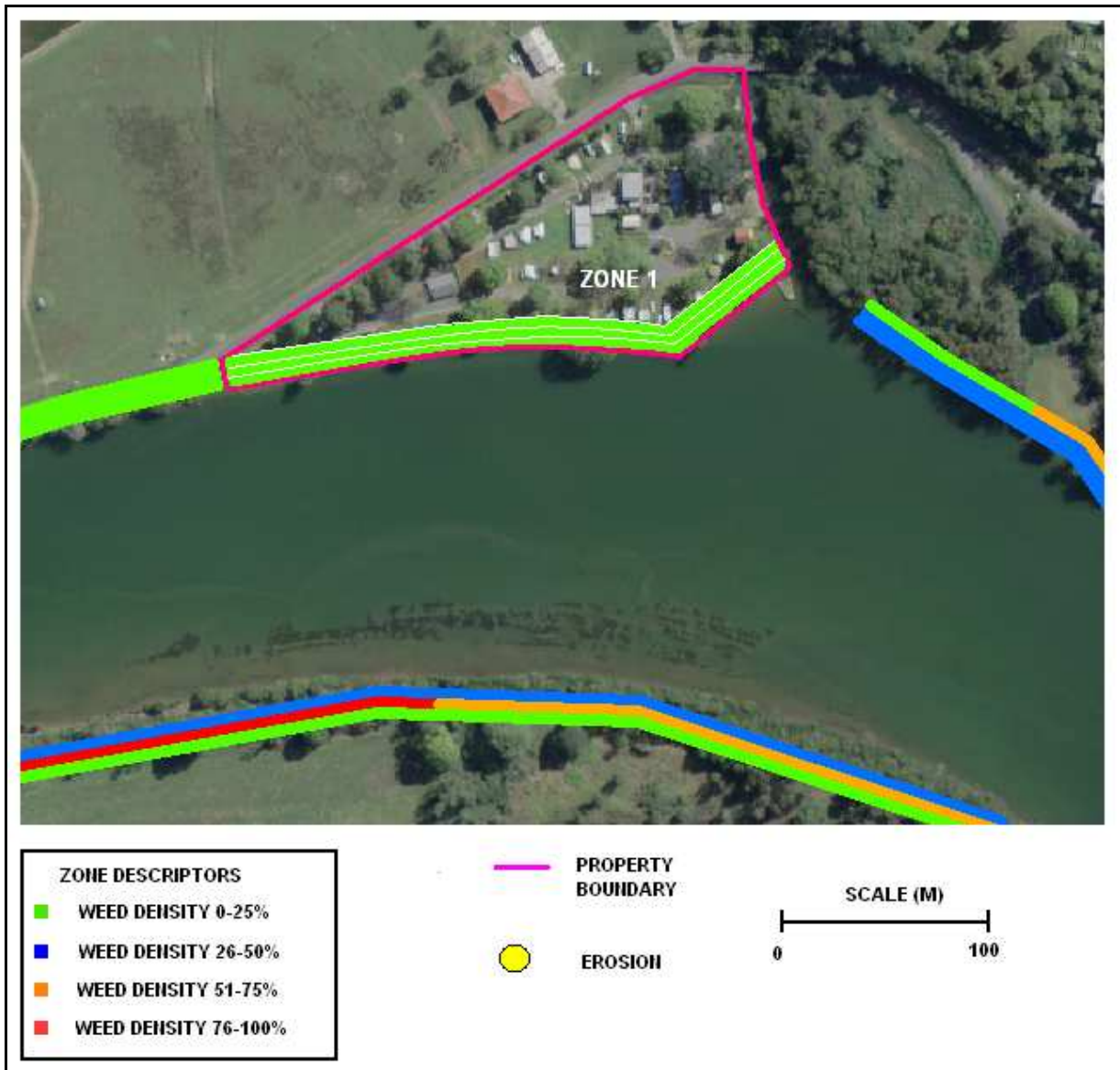


Figure 102: Riparian condition and extent

Table 84: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	<5m
CANOPY COVER	<25%
MIDSTOREY COVER	<25%
GROUND COVER	76-100%
APPROPRIATE COVER	Y
GRAZING IMPACT	N
NATURAL REGEN	N
CANOPY WEED	0%
MIDSTORY WEED	0%
GROUND COVER WEED	<25%
BANK	North Bank

Table 85: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
1	Retaining Wall (rock reinforcement only)	Supply, delivery of materials, machinery and labour for installation of rock reinforcement wall along outside of retaining wall (50m @ \$150/m)		?		7500	
Mar Arm Ck	Revegetation (900m ²)	Plant out creek bank scour area (1.25m centres) (\$6.50/ plant incl labour x 600 plants)			3900	3900	
Man Arm Ck	Structural Works (optional)	Supply, delivery of materials, machinery and labour for placement of rock revetment (40m @ \$100/m)			4000	4000	
All	On-going Maintenance	Follow-up weed treatment & maintenance- quarterly (7hrs / qtr) inspections and suppression as necessary for 10 years		9500 (In kind)		9500	
			TOTAL	9500	7900	19280	

Site 7 - 110- Mylestom Drive, Repton NSW 2454

Lot/DP	Lot316DP755553; Lot1042DP566198; Lot7002DP1054170; Plan 32683 – 1603 (BSC LotID 9881); BSC LotID 12626
Property Owners	Bellingen Shire Council; Crown Land
Catchment Details	Lower Bellinger River estuary – north bank; 615m river frontage; Area: 2.04ha
Land Use	Reserve

Property Summary

This site is midway along a long sweeping outside bend in the fluvial transition zone where the most pronounced erosion processes observed are fretting of the bank toe (and subsequent mass failure) from wind and boat wave wash, although overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). The site can be divided into three distinct sections (upstream to downstream):

1. The first section incorporates two Bellingen Shire Council reserves (Moran’s Mill). A tidally submerged bench extends approximately 3-4 metres from the toe of the immediate bank face with some existing mangrove clumps. Recent bank collapse is evident along the downstream end (zone 1). The riparian zone contains a diversity of locally native plant species with healthy natural recruitment occurring. Some minor weed problems exist with species such as Lantana (*Lantana camara*), Morning Glory (*Ipomea* spp.), Easter Senna (*Senna pendula*) and Balloon Vine (*Cardiospermum grandiflorum*).
2. Section two incorporates road and railway reserves fronting the River. Some minor erosion is evident although the majority of this site comprises semi-consolidated bedrock (shale material). The riparian zone contains a diversity of locally native plant species with some natural recruitment occurring. Some minor weed problems exist with species such as Lantana (*Lantana camara*), Easter Senna (*Senna pendula*) and Morning Glory (*Ipomea* spp.).
3. The third section encompasses a Crown reserve. Semi-consolidated bedrock juts out sharply into the river channel and as such is subject to some degree of erosion. The reserve site is somewhat denuded of vegetation although a narrow riparian strip exists with locally native plant species and similar weed problems as mentioned above.

Previous Management Efforts

The first section of this site (Moran’s Mill, zone 1) has been the focus of recent weed control and revegetation work under a joint NRCMA/Bellingen Council/Landcare initiative.

Rehabilitation Strategy

Rehabilitation at this site should focus on ongoing control of problematic weed species. With systematic, targeted weed control, natural plant recruitment will occur in this area. The existing riparian zone should be sufficient to buffer against gradual bank retreat. However, should future funds arise the entire reserve area should be revegetated back to the edge of the road verge.

The installation of rock fillets (refer to figure 103) is proposed along the degraded bank area (zones 1-2) to provide a higher degree of resilience against erosion from flooding and boat/wind wave wash. Rock fillets also create estuarine habitat, facilitating the mangrove establishment and fish recruitment. Once installed the adjacent bank should be revegetated using deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare).

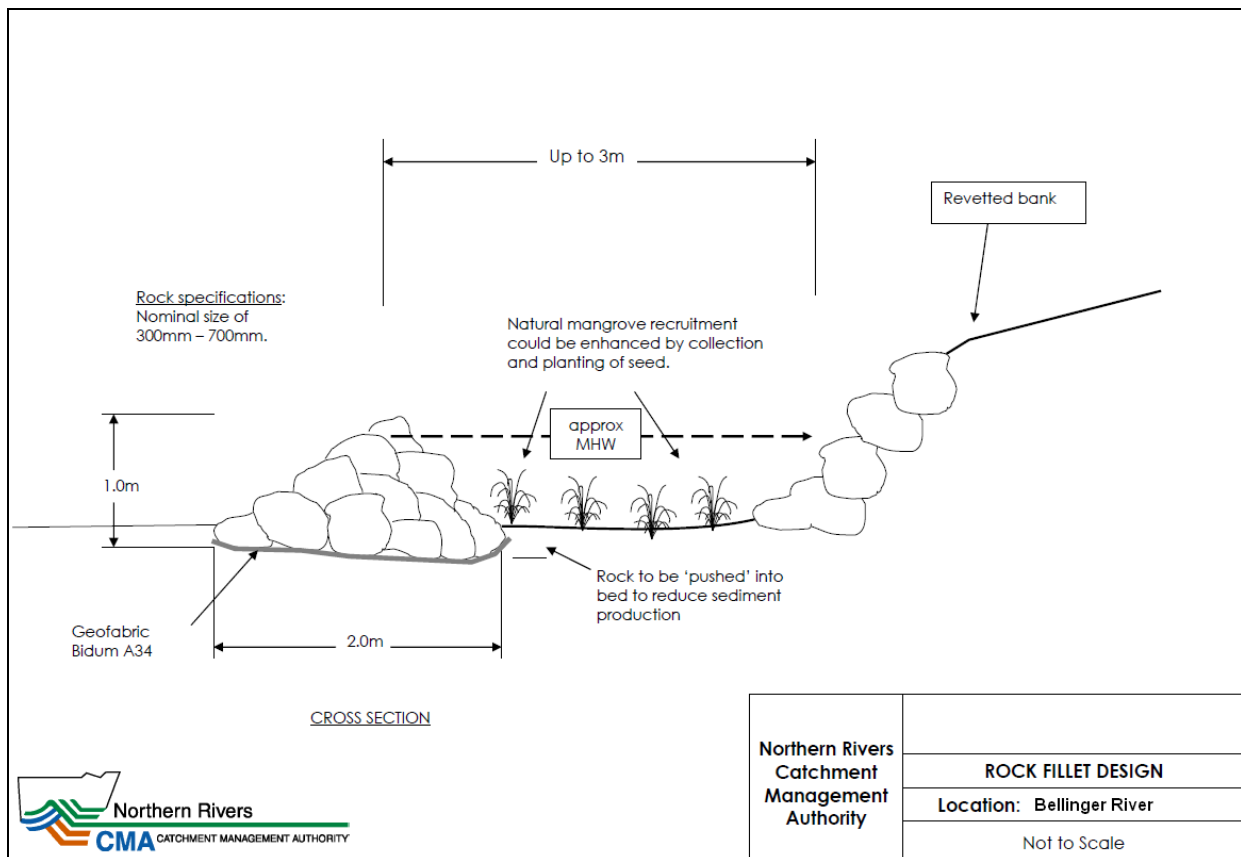


Figure 103: Design layout for structural works

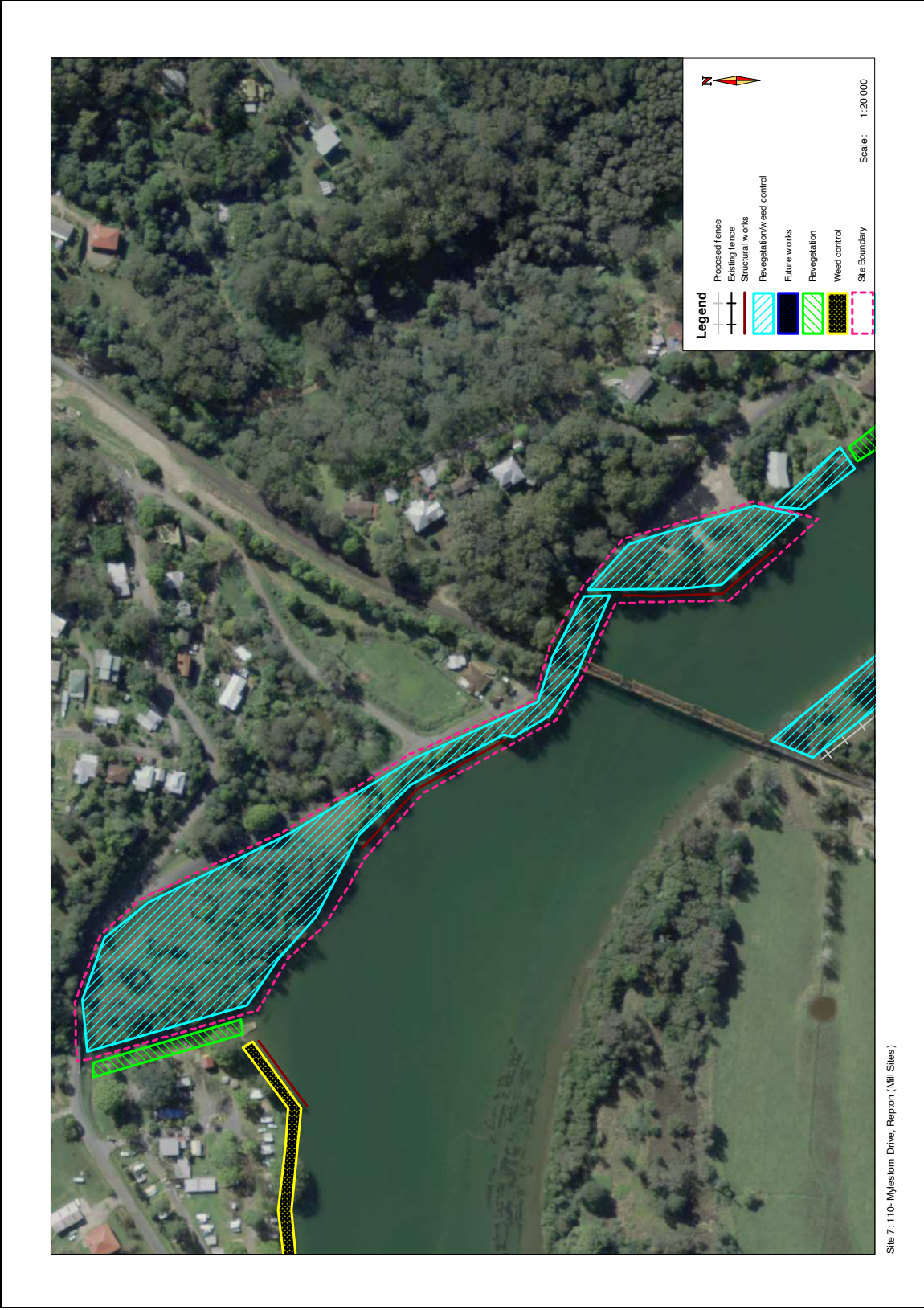


Figure 104: Property workplan map

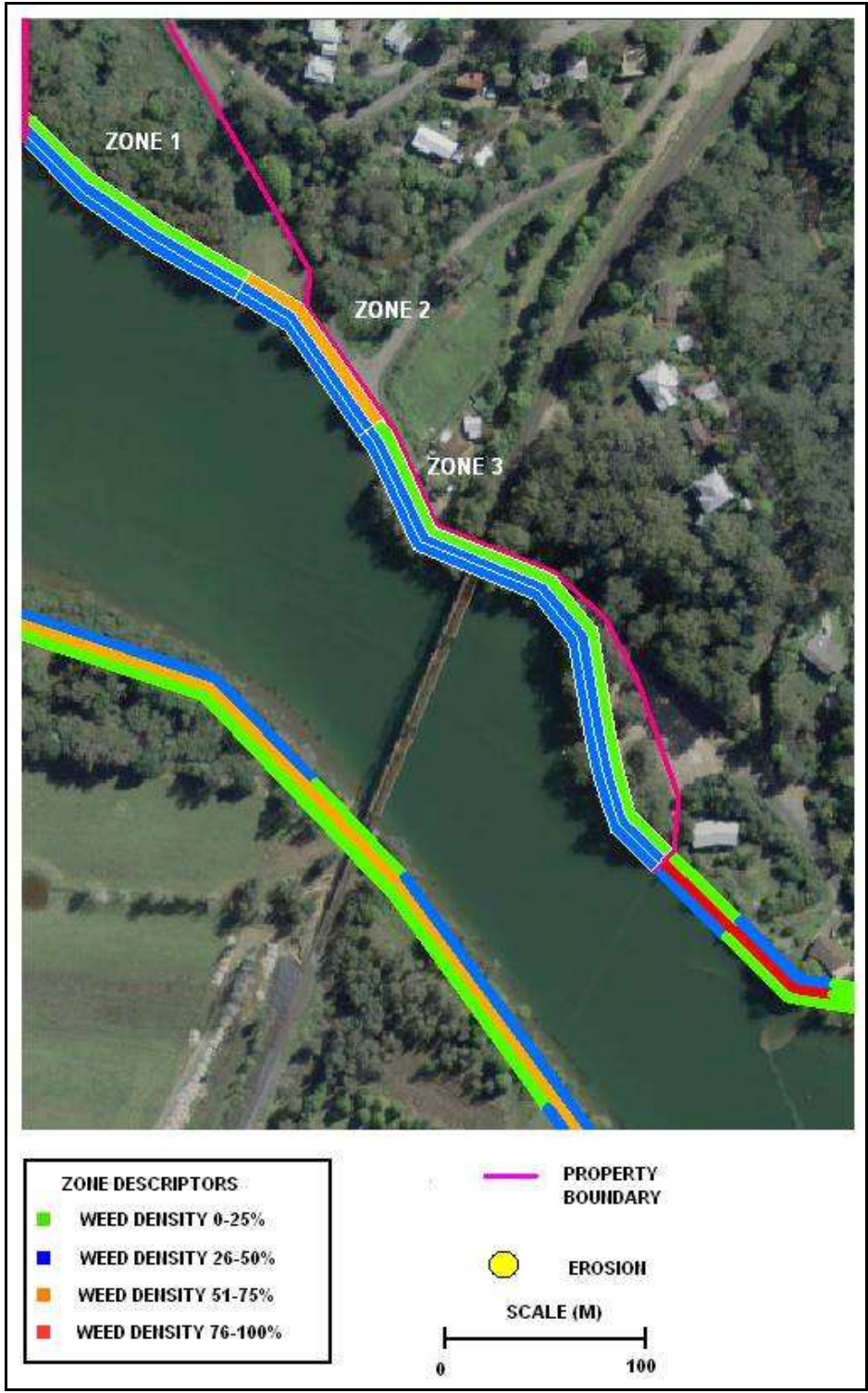


Figure 105: Riparian condition and extent

Table 86: Riparian condition summary

MGT ZONE	1	2	3
ASSESSOR	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	20-30m	5-10m	5-10m
CANOPY COVER	76-100%	<25%	76-100%
MIDSTOREY COVER	51-75%	51-75%	26-50%
GROUND COVER	76-100%	76-100%	76-100%
APPROPRIATE COVER	Y	N	Y
GRAZING IMPACT	N	N	N
NATURAL REGEN	Y	Y	Y
CANOPY WEED	0%	51-75%	0%
MIDSTORY WEED	26-50%	26-50%	26-50%
GROUND COVER WEED	26-50%	26-50%	26-50%
WEED 1	Winter Senna (Senna pendula)	Lantana (Lantana camara)	Morning Glory (Ipomea spp.)
WEED 1 DENSITY	Few Scattered (<10%)	Clumps (11-50%)	Clumps (11-50%)
WEED 2	Morning Glory (Ipomea spp.)	Morning Glory (Ipomea spp.)	Winter Senna (Senna pendula)
WEED 2 DENSITY	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)
WEED 3	Lantana (Lantana camara)	Winter Senna (Senna pendula)	Balloon Vine (Cardiospermum grandiflorum)
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 4	Balloon Vine (Cardiospermum grandiflorum)		Lantana (Lantana camara)
WEED 4 DENSITY	Few Scattered (<10%)		Few Scattered (<10%)
WEED 5	Coral Tree (Erythrina sykesii)		
WEED 5 DENSITY	Few Scattered (<10%)		
BANK	North Bank	North Bank	North Bank

Table 87: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	NRCMA or Other	Bellingen Shire Council	Total Budget
All	Project Coordination	Technical, administrative & practical support (2 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
1	Weed Control (contractor)	Manual weed eradication along riparian zone (1 day @ \$800/day)		800		800	
1	Revegetation of remaining reserve (5400m ²)	Plant out remaining reserve (2m centres) (\$6.50/ plant incl labour x 1350 plants)		8775		8775	
1-2	Structural works (optional)	Excavator to place rock fillets along margin of low tide bench adjoining retaining wall (2 x 50m fillets @ \$150/m)		15000		15000	
2	Weed Control (contractor)	Manual weed eradication along riparian zone (2 days @ \$800/day)		1600		1600	
2	Revegetation (2800m ²)	Plant out riparian zone gaps (3m centres) (\$6.50/ plant incl labour x 300 plants)		1950		1950	
3	Weed Control (contractor)	Manual weed eradication along riparian zone (1 day @ \$800/day)		800		800	
3	Revegetation (3800m ²)	Plant out riparian zone gaps (3m centres) (\$6.50/ plant incl labour x 400 plants)		2600		2600	
3	Structural works (optional)	Excavator to place rock fillets along margin of low tide bench adjoining retaining wall (2 x 50m fillets @ \$150/m)		15000		15000	

All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (12hrs / qtr) inspections and suppression as necessary for 10 years				16605		16605		
			TOTAL				880	63130		64010

Site 8 - Unnamed Road (Yellow Rock), Raleigh NSW 2454

Lot/DP	Plan 115 - 1714R
Property Owners	Bellingen Shire Council; Crown Land
Catchment Details	Lower Bellinger River estuary – south bank; 620m river frontage; Area: 2.13ha
Land Use	Road Reserve

Property Summary

This site is midway along a long sweeping inside bend alluvial floodplain in the fluvial transition zone. There is some evidence of fretting of the bank toe (and subsequent mass failure) from wind and boat wave wash, although overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). A tidally submerged bench extends approximately 3-4 metres from the toe of the immediate bank face with some existing mangrove clumps. The riparian zone is dominated by weed species including Lantana (*Lantana camara*), Morning Glory (*Ipomea* spp.), Easter Senna (*Senna pendula*) and Camphor Laurel (*Cinnamomum camphora*).

Previous Management Efforts

N/A

Rehabilitation Strategy

Rehabilitation at this site should focus on removing problematic weed species and subsequent revegetation. This should be a staged approach with particular attention to be focused on the major weed infestation currently extending along the majority of the inside bend. Multiple applications of herbicide will be necessary in the first instance. Following weed treatment, these areas should be revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Accompanying fence lines will be necessary to exclude cattle from the regeneration area. Ongoing, regular weed management will also be critical to ensure the survival and recruitment of native plants.

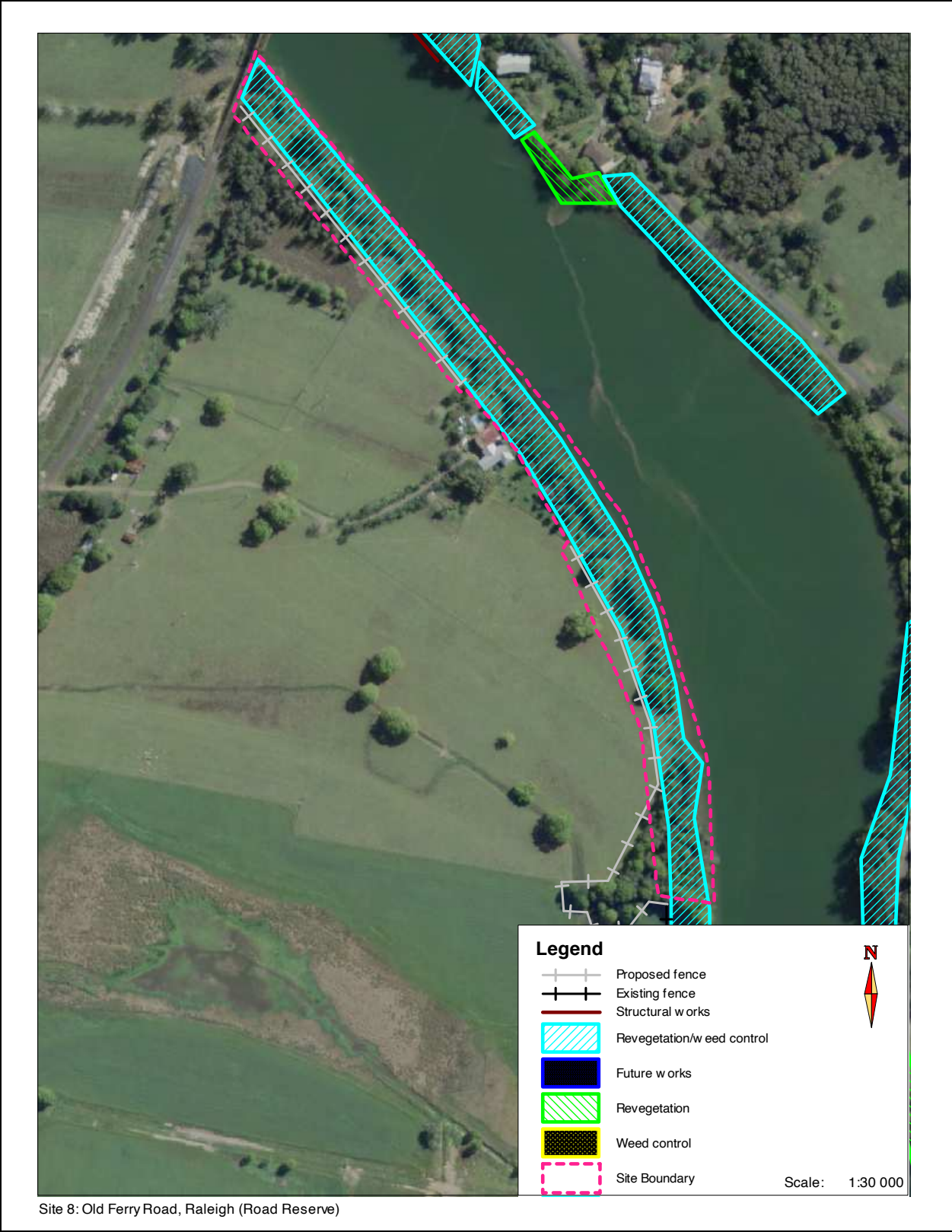


Figure 106: Property workplan map

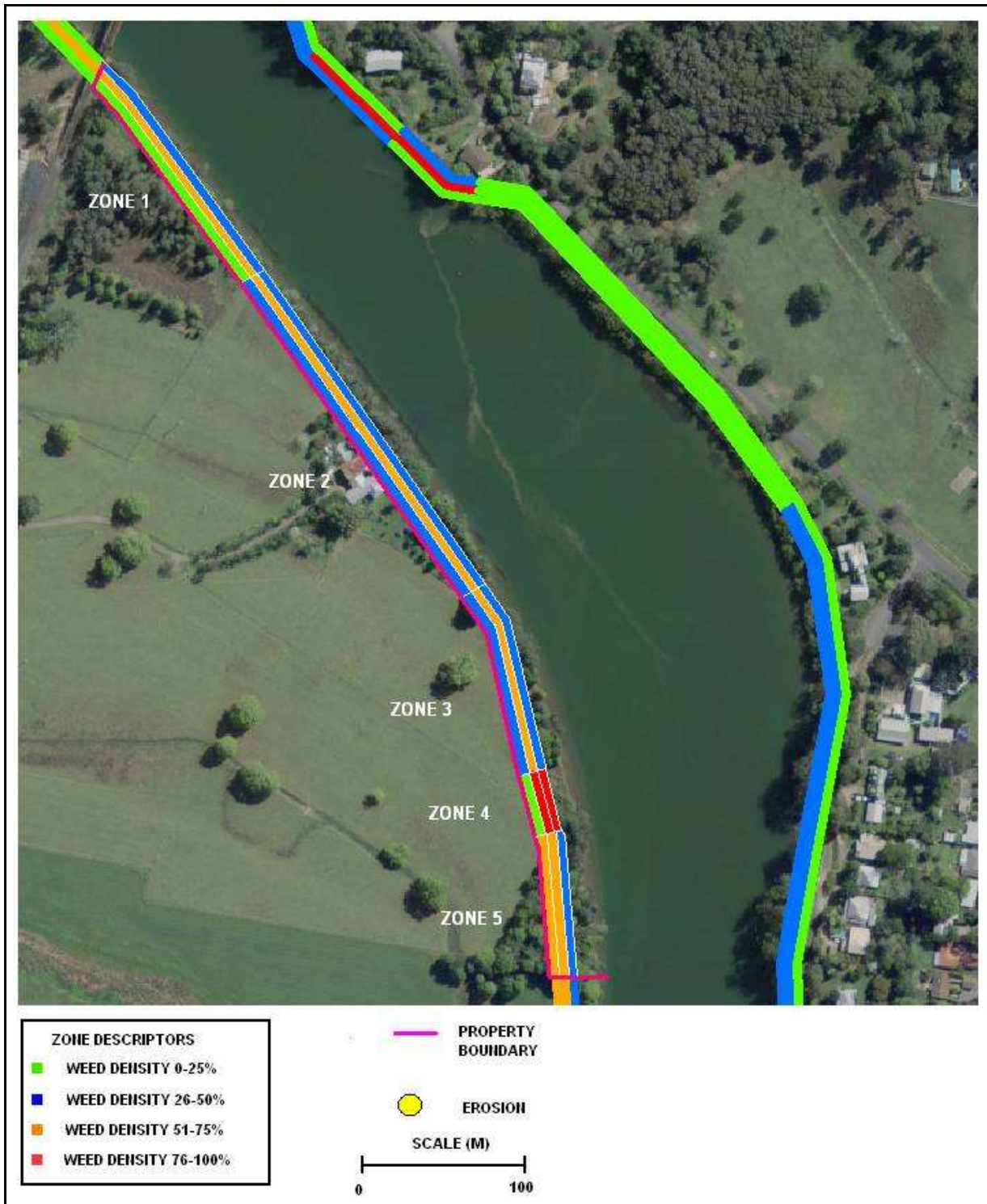


Figure 107: Riparian condition and extent

Table 88: Riparian condition summary

MGT ZONE	1	2	3	4	5
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	>30m	5-10m	<5m	5-10m	10-20m
CANOPY COVER	51-75%	76-100%	76-100%	Cleared	76-100%
MIDSTOREY COVER	76-100%	76-100%	76-100%	51-75%	76-100%
GROUND COVER	51-75%	26-50%	26-50%	76-100%	51-75%
APPROPRIATE COVER	N	N	N	N	Y
GRAZING IMPACT	N	N	N	N	N
NATURAL REGEN	Y	Y	Y	Y	Y
CANOPY WEED	<25%	26-50%	26-50%	0%	51-75%
MIDSTOREY WEED	51-75%	51-75%	51-75%	76-100%	51-75%
GROUND COVER WEED	26-50%	26-50%	26-50%	76-100%	26-50%
WEED 1	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)	Camphor Laurel (Cinnamomum camphora)	Small Leaf Privet (Ligustrum sinense)	Camphor Laurel (Cinnamomum camphora)
WEED 1 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)	Clumps (11-50%)
WEED 2	Lantana (Lantana camara)	Morning Glory (Ipomea spp.)	Lantana (Lantana camara)	Winter Senna (Senna pendula)	Lantana (Lantana camara)
WEED 2 DENSITY	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 3	Winter Senna (Senna pendula)	Winter Senna (Senna pendula)	Winter Senna (Senna pendula)	Lantana (Lantana camara)	Winter Senna (Senna pendula)
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 4	Morning Glory (Ipomea spp.)	Lantana (Lantana camara)	Morning Glory (Ipomea spp.)	Morning Glory (Ipomea spp.)	Morning Glory (Ipomea spp.)
WEED 4 DENSITY	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 5				Camphor Laurel (Cinnamomum camphora)	
WEED 5 DENSITY				Few Scattered (<10%)	
BANK	South Bank	South Bank	South Bank	South Bank	South Bank

Table 89: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (2 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Weed Control (Contractor)	Initial weed eradication along riparian zone (three initial treatments); (3 days @ \$800/day)		2400		2400	
All	Weed Control (Contractor)	Manual weed eradication along riparian zone; (7 days @ \$800/day)		5600		5600	
All	Fencing	Landholder to supply materials for and construct fence line to exclude stock (620m @ \$5000/km)		3100		3100	
All	Revegetation (15500m ²)	Plant out riparian zone (3m centres) (\$6.50/ plant incl labour x 1750 plants)		11375		11375	
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (17hrs / qtr) inspections and suppression as necessary for 10 years		23355		23355	
			TOTAL	45830	880	46710	

Site 9 - 172 Mylestom Drive, Repton NSW 2454

Lot/DP	Lot1DP608616
Property Owners	Edward Thomas Durie
Catchment Details	Lower Bellinger River estuary – south bank; 75m river frontage; Area: 0.27ha
Land Use	Residential

Property Summary

This site is on the downstream end of a long sweeping outside bend alluvial floodplain in the fluvial transition zone. There is some evidence of fretting of the bank toe (and subsequent mass failure/tree fall) from wind and boat wave wash, although the property is cradled by bedrock and overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). A tidally submerged bench extends approximately 2-3 metres from the toe of the immediate bank face with some existing mangrove clumps. The riparian zone is dominated by weed species including Lantana (*Lantana camara*), Morning Glory (*Ipomea* spp.), Easter Senna (*Senna pendula*).

Previous Management Efforts

N/A

Rehabilitation Strategy

Rehabilitation at this site should focus on removing problematic weed species and subsequent revegetation. Following weed treatment, bare areas should be revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Overhanging trees at risk of toppling into the river may also be lopped, although complete removal requires authorisation (NRCMA). Ongoing, regular weed management will also be critical to ensure the survival and recruitment of native plants.

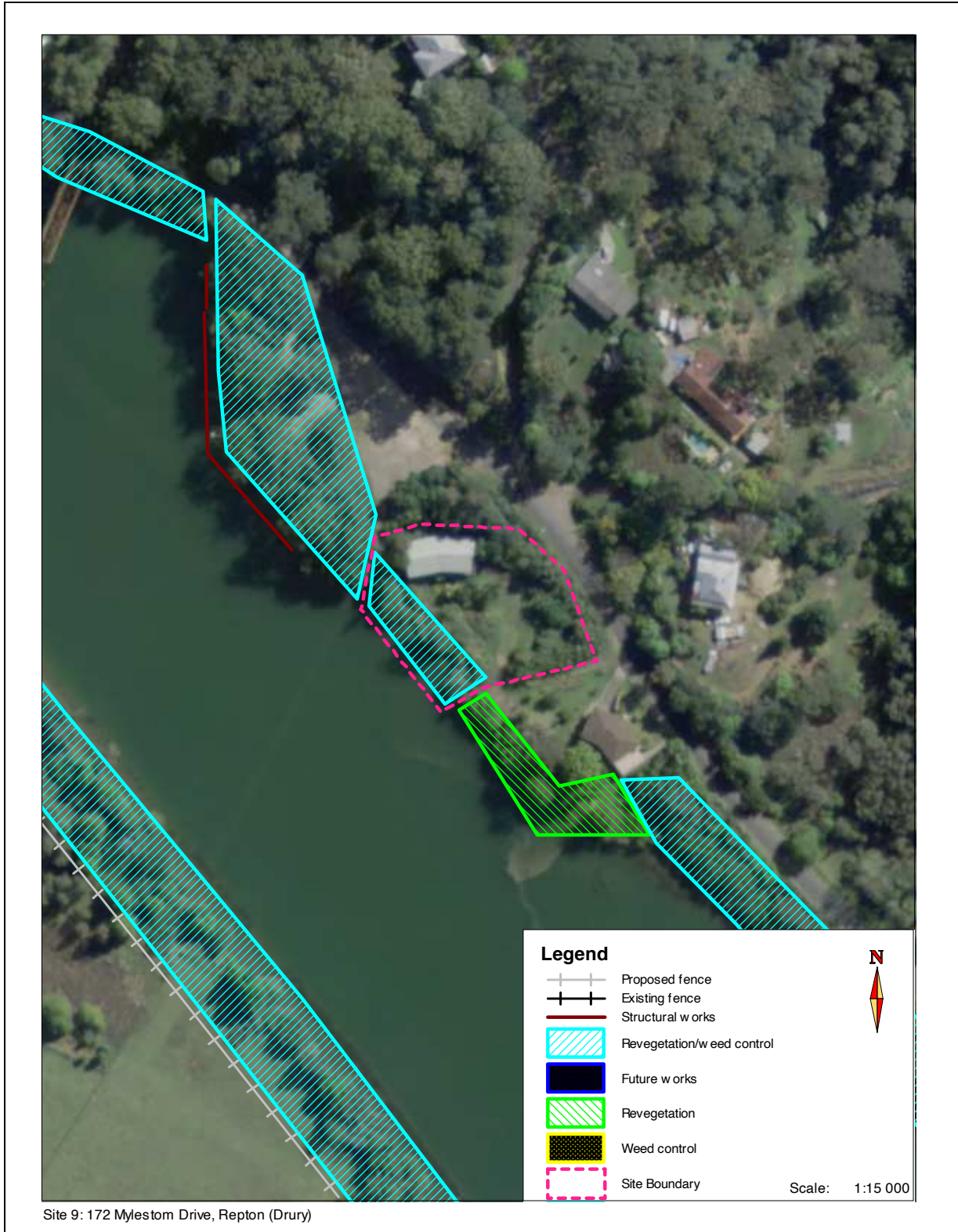


Figure 108: Property workplan map

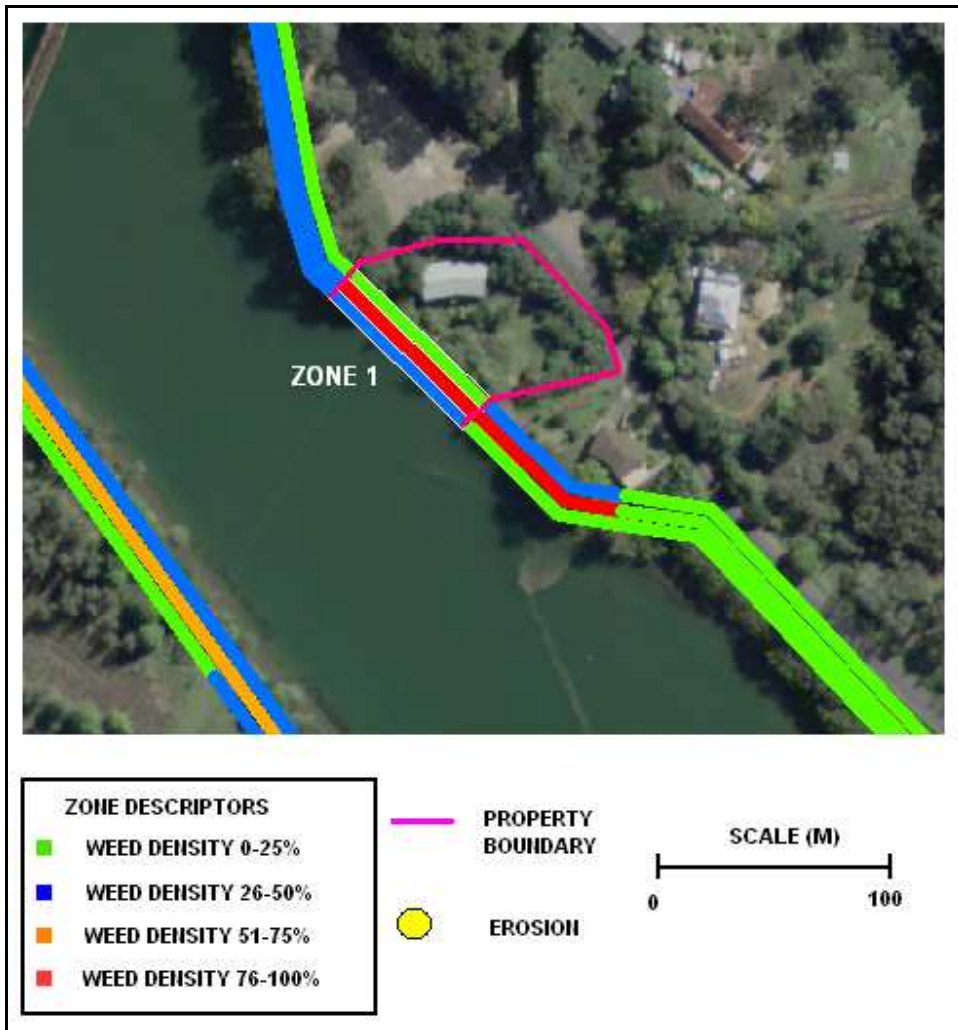


Figure 109: Riparian condition and extent

Table 90: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	5-10m
CANOPY COVER	<25%
MIDSTOREY COVER	76-100%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	N
NATURAL REGEN	Y
CANOPY WEED	0%
MIDSTORY WEED	76-100%
GROUND COVER WEED	26-50%
WEED 1	Lantana (<i>Lantana camara</i>)
WEED 1 DENSITY	Dominant (>50%)
WEED 2	Morning Glory (<i>Ipomea</i> spp.)
WEED 2 DENSITY	Few Scattered (<10%)
WEED 3	Winter Senna (<i>Senna pendula</i>)
WEED 3 DENSITY	Few Scattered (<10%)
BANK	North Bank

Table 91: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
1	Weed Control (Contractor)	Manual weed eradication along riparian zone; Lopping of leaning tree(s). (2 days @ \$800/day)		1600		1600	
1	Revegetation (740m ²)	Plant out riparian zone gaps (4m centres) (\$6.50/ plant incl labour x 50 plants)		325		325	
1	On-going Maintenance	Follow-up weed treatment & maintenance- quarterly (2hrs / qtr) inspections and suppression as necessary for 10 years		2805		2805	
			TOTAL	2805	1925	880	5610

Site 10 - 174 Mylestom Drive, Repton NSW 2454

Lot/DP	Lot2DP608616
Property Owners	EG & GK Mercer
Catchment Details	Lower Bellinger River estuary – south bank; 100m river frontage; Area: 0.16ha
Land Use	Residential

Property Summary

This site is on the downstream end of a long sweeping outside bend alluvial floodplain in the fluvial transition zone. There is some evidence of fretting of the bank toe (and subsequent mass failure/tree fall) from wind and boat wave wash, although bank protection works have been undertaken and overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). The riparian zone is chiefly a mown lawn area with a few large native and exotic shade trees. The only notable environmental weed is a small patch of fishbone fern which is currently assisting in stabilising the bank crest.

Previous Management Efforts

N/A

Rehabilitation Strategy

Rehabilitation at this site should focus on establishing some deep root complexes along the crest of the bank. This will mitigate the slump/rock wall failure occurring periodically. *Lomandra* (*Lomandra longifolia*) will provide an effective buffer, with the inclusion of other deep rooted native plants outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare) recommended to increase overall long term resilience. Overhanging trees at risk of toppling into the river may also be lopped, although complete removal requires authorisation (NRCMA). Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

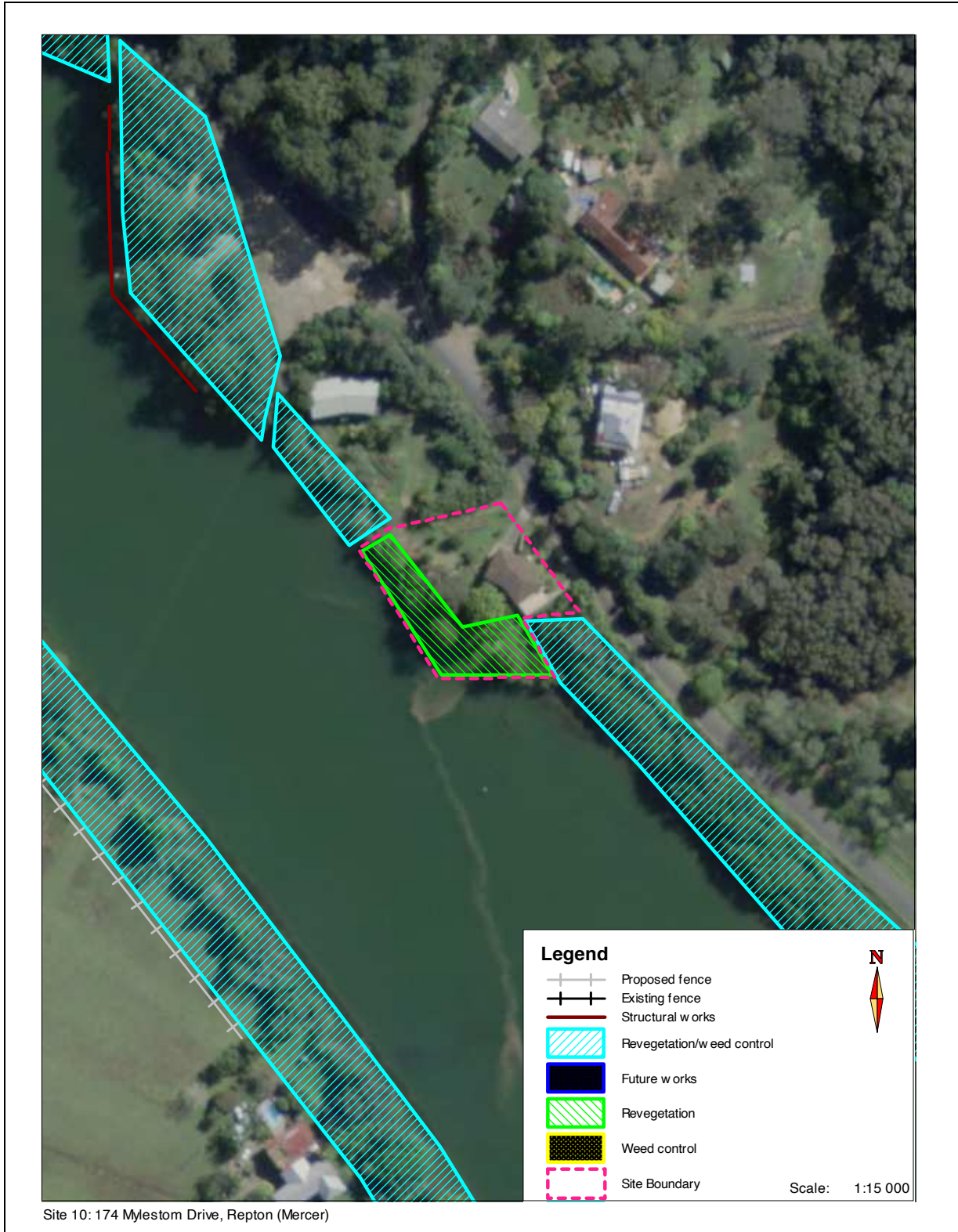


Figure 110: Property workplan map

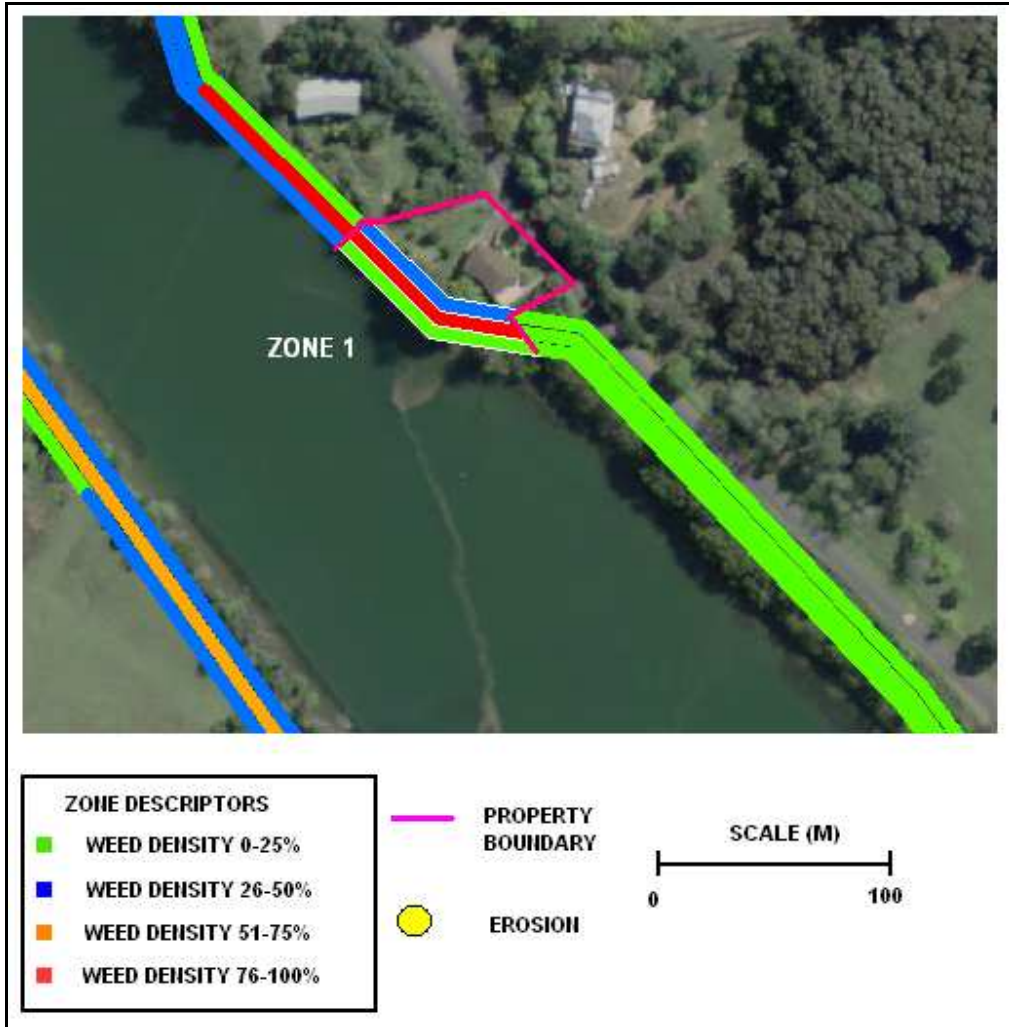


Figure 111: Riparian condition and extent

Table 92: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	<5m
CANOPY COVER	26-50%
MIDSTOREY COVER	<25%
GROUND COVER	76-100%
APPROPRIATE COVER	N
GRAZING IMPACT	N
NATURAL REGEN	N
CANOPY WEED	26-50%
MIDSTORY WEED	76-100%
GROUND COVER WEED	pasture
WEED 1	Morning Glory (<i>Ipomea</i> spp.)
WEED 1 DENSITY	Few Scattered (<10%)
WEED 2	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 2 DENSITY	Few Scattered (<10%)
BANK	North Bank

Table 93: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
1	Revegetation (1120m ²)	Plant out riparian zone bank crest (1m centres) (\$6.50/ plant incl labour x 100 plants)		650		650	
1	Tree Lopping (contractor)	Pruning of (at risk) trees leaning into the river (\$500 per tree)		500		500	
1	On-going Maintenance	Follow-up weed treatment & maintenance- quarterly (1.5hrs / qtr) inspections and suppression as necessary for 10 years		2030		2030	
			TOTAL	2030	1150	4060	

Site 11 - 176-194 Mylestom Drive, Repton NSW 2454

Lot/DP	Plan 33228 – 1603 (BSC LotID 9881)
Property Owners	Bellingen Shire Council
Catchment Details	Lower Bellinger River estuary – south bank; 200m river frontage; Area: 0.51ha
Land Use	Road Reserve

Property Summary

This site is on the downstream end of a long sweeping outside bend on alluvial floodplain (fluvial transition zone). A healthy mangrove buffer is protecting the bank from erosion and overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). The riparian comprises a healthy continuous stand of mangroves in the intertidal zone, beyond where the bank crest is dominated by weed species including Lantana (*Lantana camara*), Morning Glory (*Ipomea* spp.) and Easter Senna (*Senna pendula*).

Previous Management Efforts

N/A

Rehabilitation Strategy

Rehabilitation at this site should focus on removing problematic weed species and subsequent revegetation. This should be a staged approach with particular attention to be focused on the major weed infestation currently extending along the majority of the site (zone 1). Multiple applications of herbicide will be necessary in the first instance, followed by manual weed removal. Following weed treatment, these areas should be revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). Ongoing, regular weed management will also be critical to ensure the survival and recruitment of native plants.

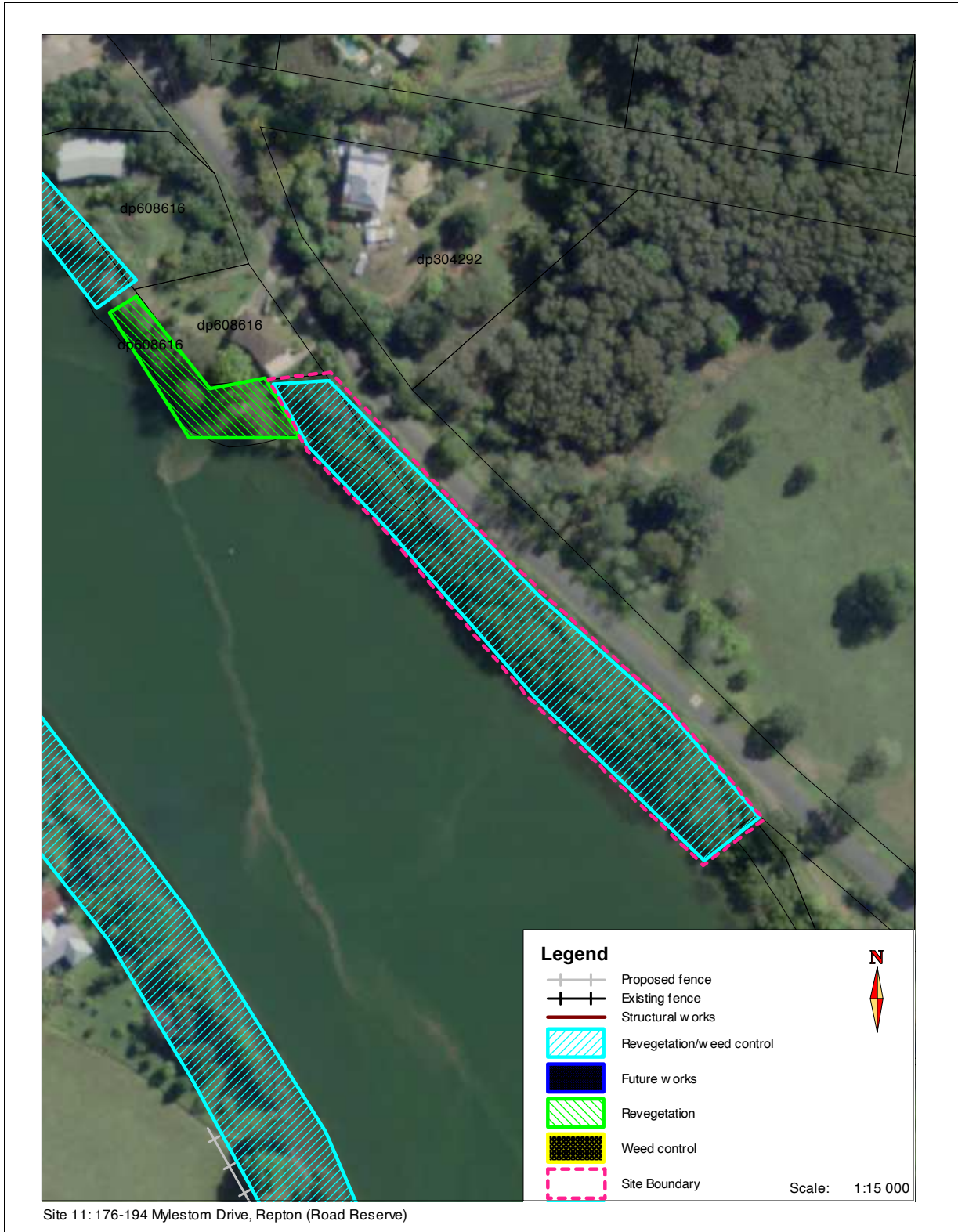


Figure 112: Property workplan map

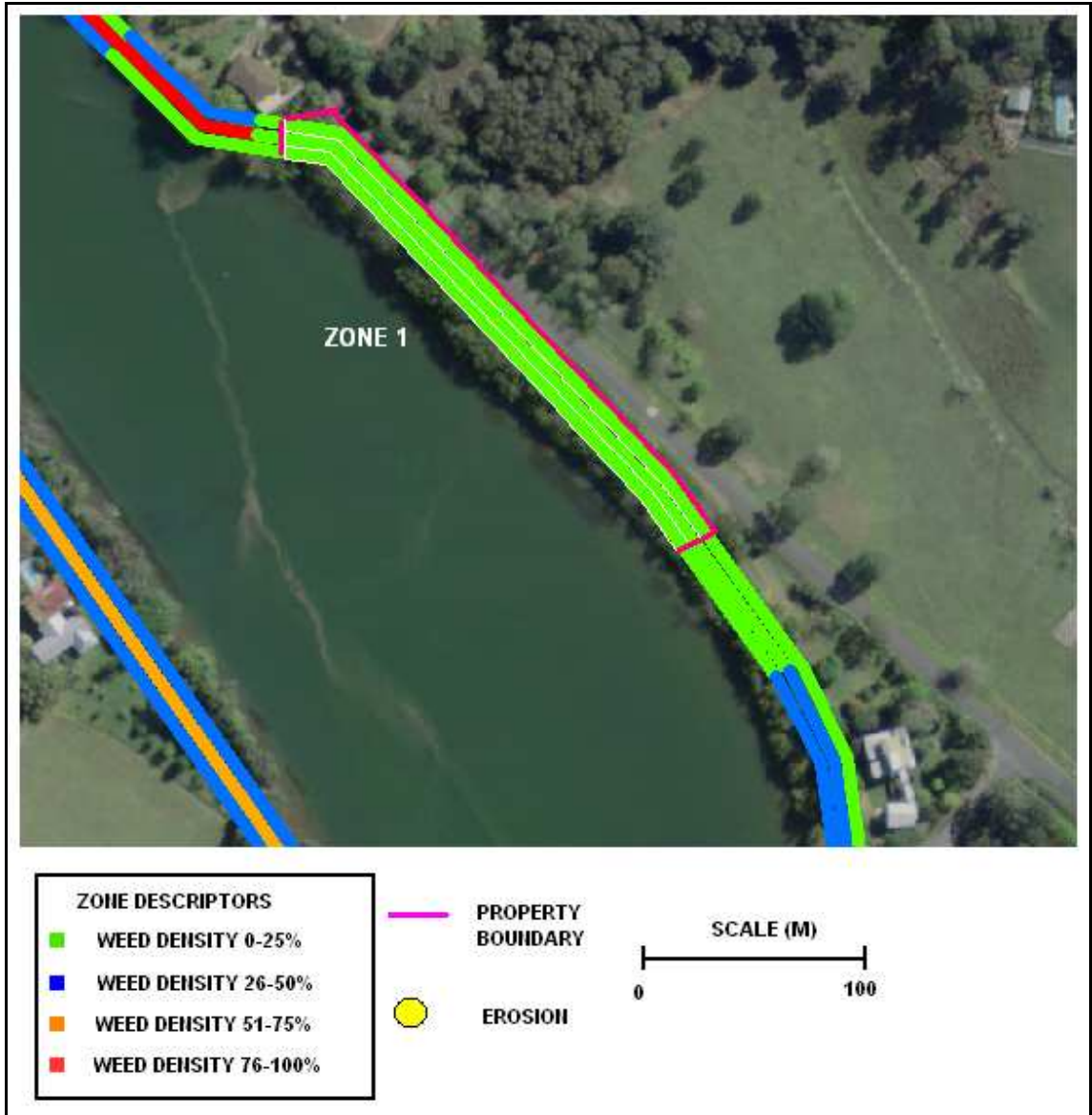


Figure 113: Riparian condition and extent

Table 94: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	5-10m
CANOPY COVER	76-100%
MIDSTOREY COVER	76-100%
GROUND COVER	<25%
APPROPRIATE COVER	Y
GRAZING IMPACT	N
NATURAL REGEN	Y
CANOPY WEED	0%
MIDSTORY WEED	<25%
GROUND COVER WEED	<25%
WEED 1	Winter Senna (<i>Senna pendula</i>)
WEED 1 DENSITY	Few Scattered (<10%)
WEED 2	Lantana (<i>Lantana camara</i>)
WEED 2 DENSITY	Few Scattered (<10%)
BANK	North Bank

Table 95: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)				
				Landholder	NRCMA or Other	Contributions		Total Budget
						Bellingen Shire Council		
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy			800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy			80 (In kind)	80	
1	Weed Control (Contractor)	Initial herbicide control along riparian zone (three initial treatments); (1.5 days @ \$800/day)				1200	1200	
1	Weed Control (Contractor)	Manual weed eradication along riparian zone; (4 days @ \$800/day)			3200		3200	
1	Revegetation (5000m ²)	Plant out riparian zone (3m centres) (\$6.50/ plant incl labour x 555 plants)			3608		3608	
All	On-going Maintenance	Follow-up weed treatment & maintenance- quarterly (6hrs / qtr) inspections and suppression as necessary for 10 years			8888		8888	
			TOTAL		15696	2080	17776	

Site 12 - River Street, Repton NSW 2454

Lot/DP	BSC LotID 9939
Property Owners	Bellingen Shire Council
Catchment Details	Lower Bellinger River estuary – south bank; 220m river frontage; Area: 0.5ha
Land Use	Road Reserve

Property Summary

This site is on the downstream end of a long sweeping outside bend on alluvial floodplain (fluvial transition zone). Bedrock outcropping is mostly protecting the bank from erosion and overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). Some areas of slump are evident along the upper bank (probably resulting from the extreme wet period in 2009). The riparian zone comprises a diversity of native species under threat from a number of invasive weed species including Lantana (*Lantana camara*), Morning Glory (*Ipomea* spp.) and Easter Senna (*Senna pendula*).

Previous Management Efforts

N/A

Rehabilitation Strategy

Rehabilitation at this site should focus on removing problematic weed species and subsequent revegetation. This should be a staged approach with particular attention to be focused on the major weed infestation currently extending along the majority of the site. Multiple applications of herbicide will be necessary in the first instance, followed by manual weed removal. Following weed treatment, these areas and other slumped areas should be revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellingen Landcare). Ongoing, regular weed management will also be critical to ensure the survival and recruitment of native plants.



Figure 114: Property workplan map

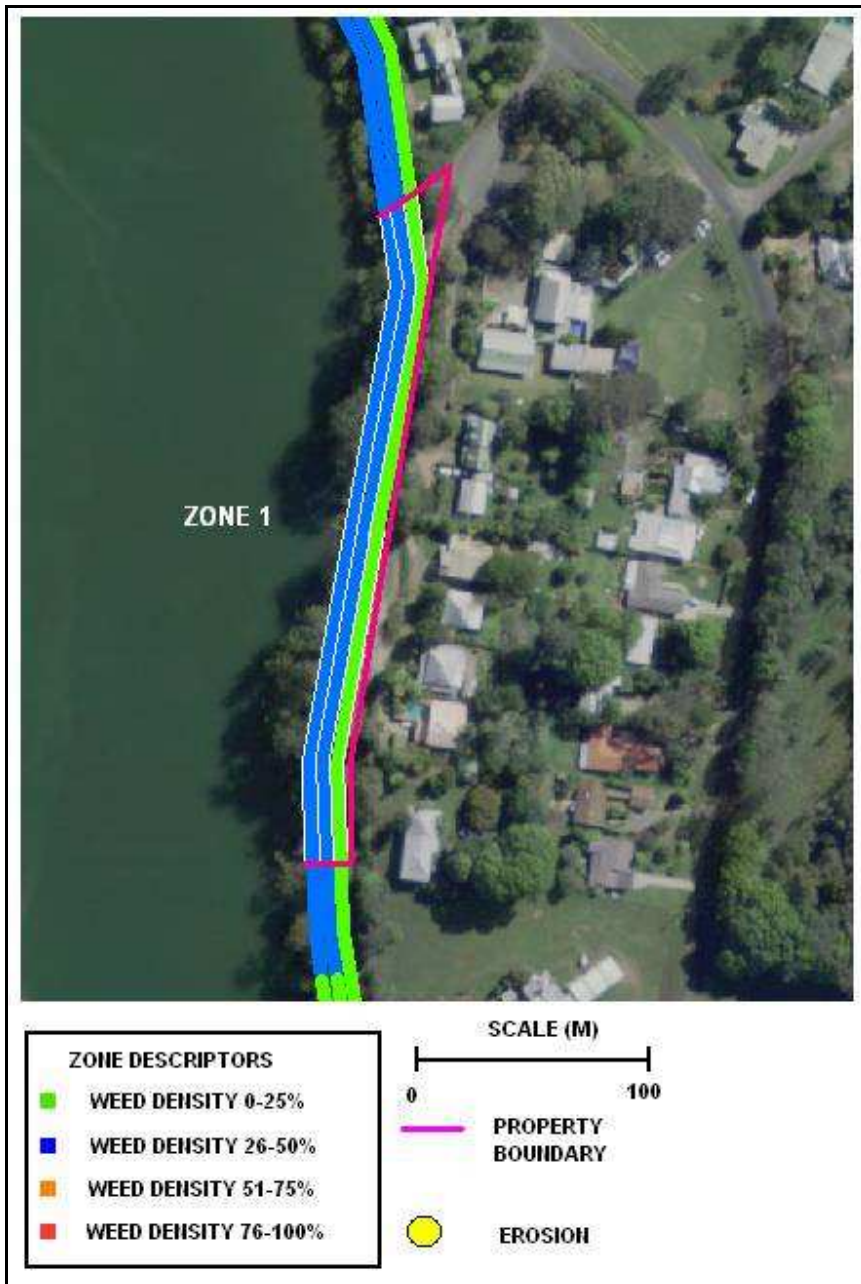


Figure 115: Riparian condition and extent

Table 96: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	5-10m
CANOPY COVER	76-100%
MIDSTOREY COVER	76-100%
GROUND COVER	76-100%
APPROPRIATE COVER	Y
GRAZING IMPACT	N
NATURAL REGEN	Y
CANOPY WEED	0%
MIDSTORY WEED	26-50%
GROUND COVER WEED	26-50%
WEED 1	Winter Senna (<i>Senna pendula</i>)
WEED 1 DENSITY	Clumps (11-50%)
WEED 2	Lantana (<i>Lantana camara</i>)
WEED 2 DENSITY	Clumps (11-50%)
WEED 3	Morning Glory (<i>Ipomea</i> spp.)
WEED 3 DENSITY	Few Scattered (<10%)
WEED 4	Wild Tobacco (<i>Solanum mauritianum</i>)
WEED 4 DENSITY	Few Scattered (<10%)
BANK	North Bank

Table 97: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
1	Weed Control (Contractor)	Initial herbicide control along riparian zone (three initial treatments); (1.5 days @ \$800/day)			1200	1200	
1	Weed Control (Contractor)	Manual weed eradication along riparian zone; (4 days @ \$800/day)			3200	3200	
1	Revegetation (5000m ²)	Plant out riparian zone (3m centres) (\$6.50/ plant incl labour x 555 plants)			3608	3608	
All	On-going Maintenance	Follow-up weed treatment & maintenance- quarterly (6hrs / qtr) inspections and suppression as necessary for 10 years			8888	8888	
			TOTAL		15696	2080	
						17776	

Site 13 - Unnamed Road (Yellow Rock), Raleigh NSW 2454

Lot/DP	Plan 115 - 1714R
Property Owners	Bellingen Shire Council
Catchment Details	Lower Bellinger River estuary – south bank; m river frontage; Area: ha
Land Use	Road Reserve

Property Summary

This site spans the downstream end of a long sweeping inside bend alluvial floodplain in the fluvial transition zone. There is some evidence of fretting of the bank toe (and subsequent mass failure) from wind and boat wave wash, although overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). A tidally submerged bench extends approximately 3-4 metres from the toe of the immediate bank face with some existing mangrove clumps. Limited recruitment of native species is evident, although the riparian zone is dominated by weed species including Lantana (*Lantana camara*), Morning Glory (*Ipomea* spp.), Small Leaf Privet (*Ligustrum sinense*) and Camphor Laurel (*Cinnamomum camphora*).

Previous Management Efforts

A fence has been erected along the crest of the high bank approximately 12 metres back from the edge of the low floodplain terrace.

Rehabilitation Strategy

Rehabilitation at this site should focus on staged removal of canopy and mid-storey weeds accompanied by revegetation. In particular, large Camphor Laurels should be stem injected in situ. Following treatment, these areas should be revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellingen Landcare). Ongoing, regular weed management will be critical to ensure the long term survival and recruitment of native plants.

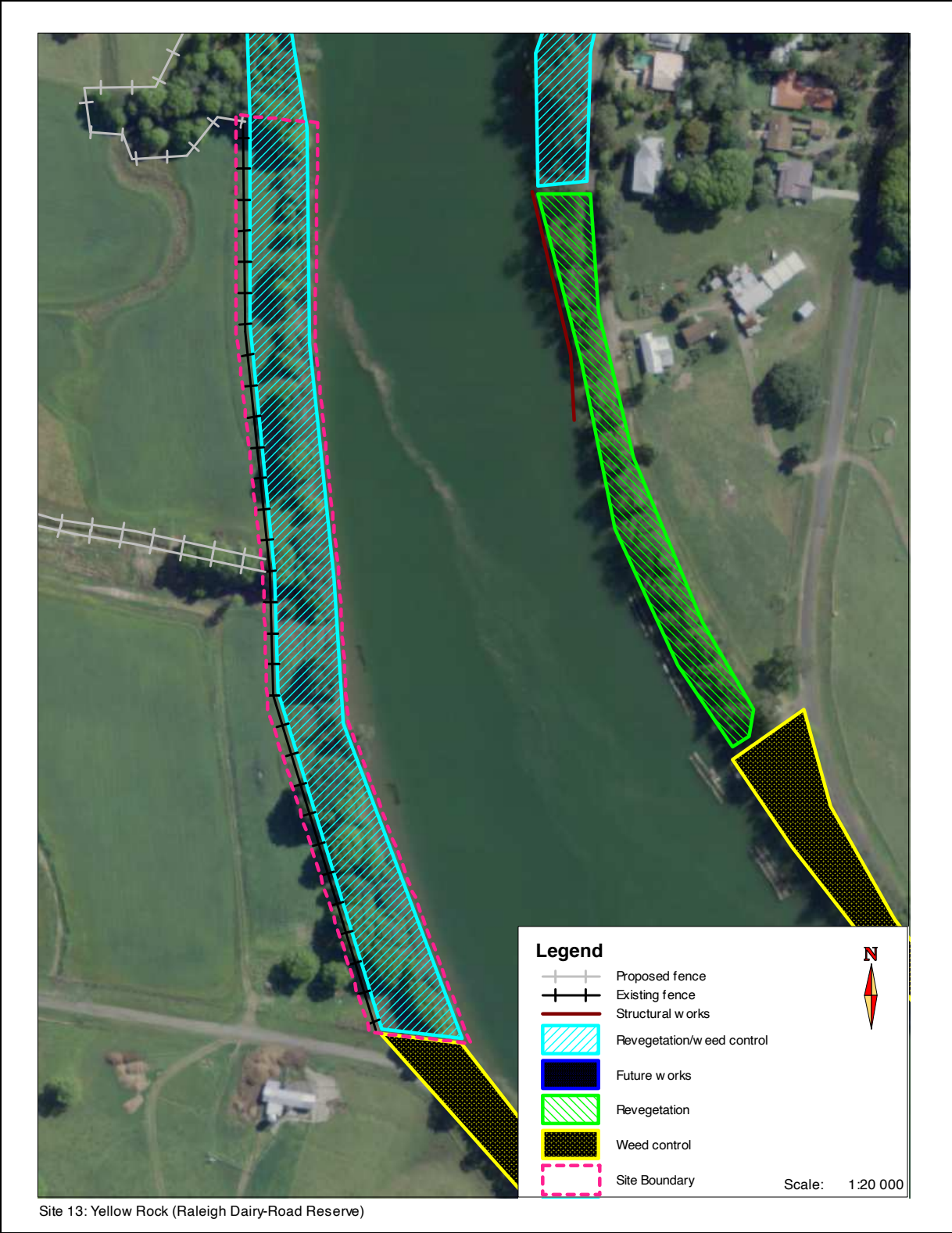


Figure 116: Property workplan map

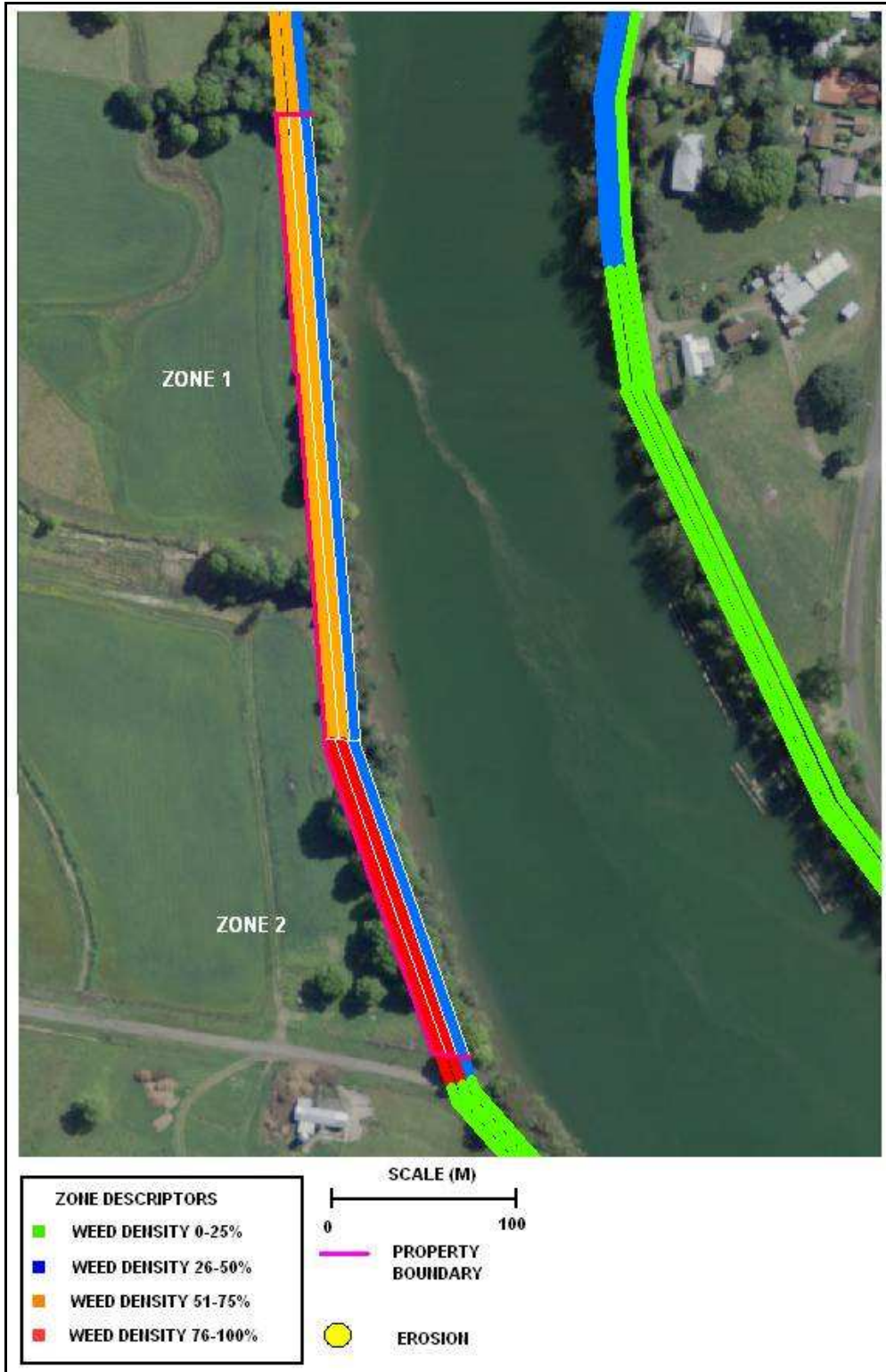


Figure 117: Riparian condition and extent

Table 98: Riparian condition summary

MGT ZONE	1	2
ASSESSOR	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	10-20m
CANOPY COVER	51-75%	76-100%
MIDSTOREY COVER	76-100%	76-100%
GROUND COVER	26-50%	51-75%
APPROPRIATE COVER	N	Y
GRAZING IMPACT	N	N
NATURAL REGEN	Y	Y
CANOPY WEED	51-75%	76-100%
MIDSTORY WEED	51-75%	76-100%
GROUND COVER WEED	26-50%	26-50%
WEED 1	Camphor Laurel (<i>Cinnamomum camphora</i>)	Camphor Laurel (<i>Cinnamomum camphora</i>)
WEED 1 DENSITY	Clumps (11-50%)	Dominant (>50%)
WEED 2	Lantana (<i>Lantana camara</i>)	Small Leaf Privet (<i>Ligustrum sinense</i>)
WEED 2 DENSITY	Clumps (11-50%)	Few Scattered (<10%)
WEED 3	Winter Senna (<i>Senna pendula</i>)	Lantana (<i>Lantana camara</i>)
WEED 3 DENSITY	Clumps (11-50%)	Few Scattered (<10%)
WEED 4	Small Leaf Privet (<i>Ligustrum sinense</i>)	Morning Glory (<i>Ipomea</i> spp.)
WEED 4 DENSITY	Clumps (11-50%)	Few Scattered (<10%)
WEED 5	Morning Glory (<i>Ipomea</i> spp.)	
WEED 5 DENSITY	Few Scattered (<10%)	
BANK	South Bank	South Bank

Table 99: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)		
				Landholder	Contributions	
					NRCMA or Other	Bellingen Shire Council
All	Project Coordination	Technical, administrative & practical support (2 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80
All	Weed Control (Contractor)	Manual weed eradication along riparian zone; stem inject Camphors (2 days @ \$800/day)		1600		1600
All	Revegetation (10000m ²)	Plant out gap riparian zone (4m centres) (\$6.50/ plant incl labour x 625 plants) (landholder labour in kind)		4063		4063
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (9hrs / qtr) inspections and suppression as necessary for 10 years		6542		6542
			TOTAL	12205	880	13085

Site 14 - 32 River Street, Mylestom NSW 2454

Lot/DP	Lot1DP242682; Lot110DP755553
Property Owners	Douglas Baden Sawtell
Catchment Details	Lower Bellinger River estuary – north bank; 270m river frontage; Area: 1.90ha
Land Use	Rural – Beef Cattle

Property Summary

This site is part of a inside bend section alluvial floodplain and bedrock out-cropping along the low tide bench. Undercutting is evident along the bank toe (most likely a combination of fretting from boat wash and scour during floods). The tidally submerged bench extends approximately 3-4 metres from the toe of the immediate bank face. Overall active bank erosion is considered to be stable (Cohen & Telfer, 2010), although landholder anecdotes suggest that significant erosion is still occurring. The riparian zone contains a diversity of locally native plant species with healthy natural recruitment occurring. Some minor weed problems exist with species such as Lantana (*Lantana camara*) and Easter Senna (*Senna pendula*).

Previous Management Efforts

A fence has been erected along the riparian fringe approximately 7 metres back from the bank crest. Active, targeted weed control is being undertaken along the riparian zone to suppress the establishment of the aforementioned weed species and other typical riparian weeds in this part of the estuary.

Rehabilitation Strategy

1. Rehabilitation at this site should focus on ongoing control of problematic weed species. The riparian zone should also be revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). This buffer may need to be re-established and/or expanded in the advent of damaging flood events hampering successful plant establishment.
2. The landholder has expressed intent to construct a retaining wall along sections of the shear bank to mitigate ongoing erosion (zone 1). This proposal is supported in principle, however accompanying rock fillets or some other kind of fish habitat structures are recommended to provide additional environmental benefits. Smaller rock fillet/wall structures are also proposed along other sections of the bank (zone 2) where undercutting is occurring at a lesser rate.

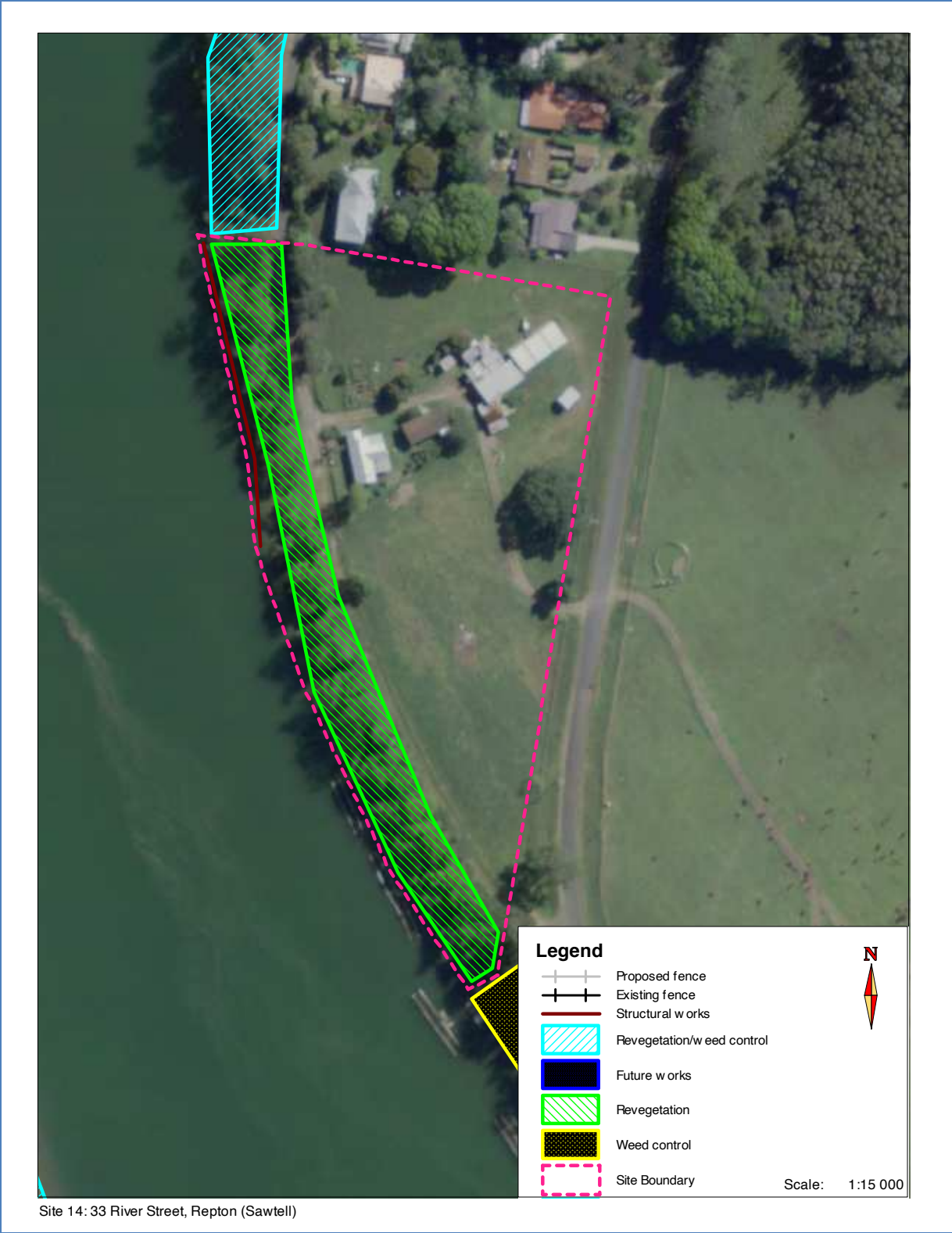


Figure 118: Property workplan map

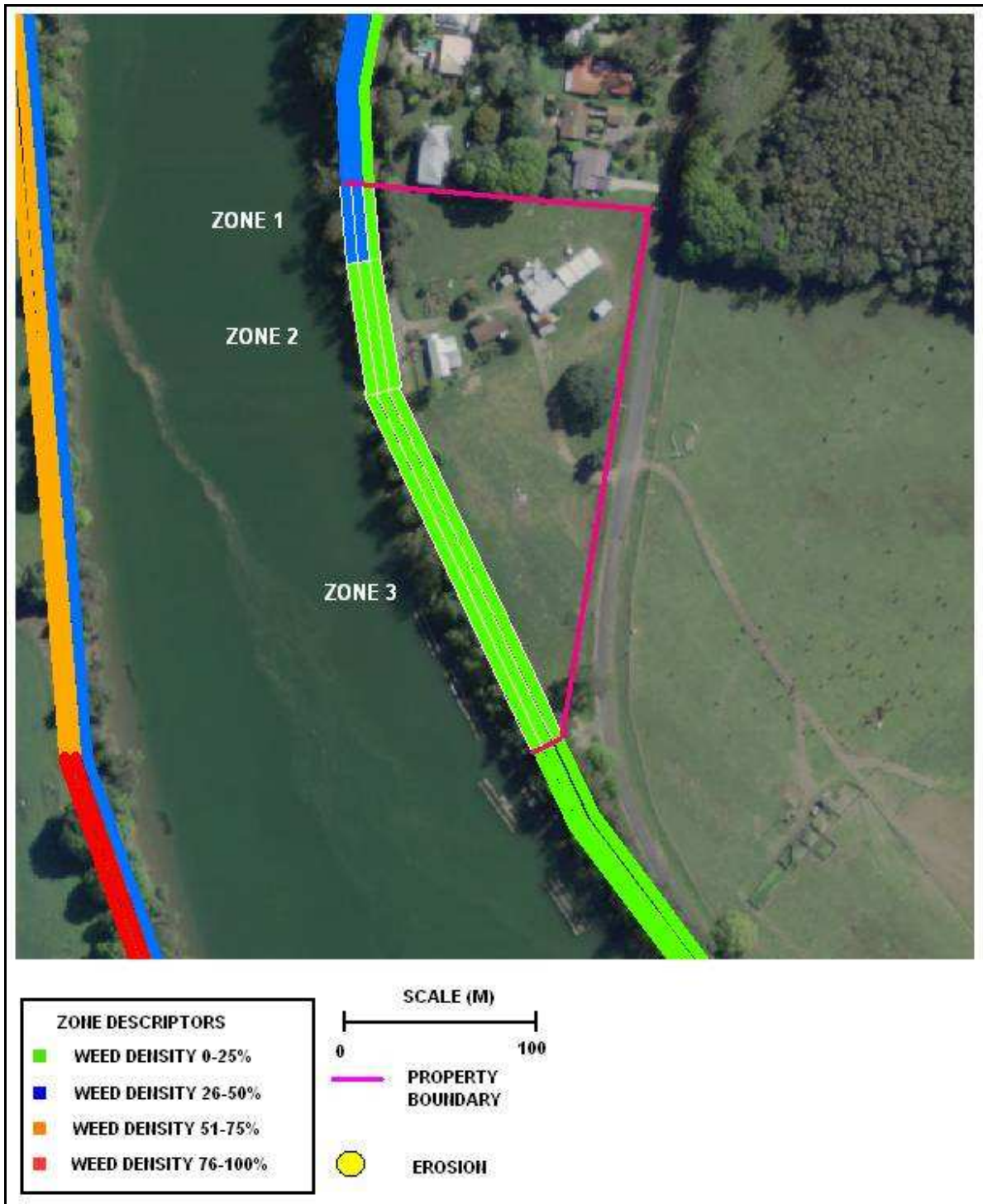


Figure 119: Riparian condition and extent

Table 100: Riparian condition summary

MGT ZONE	1	2	3
ASSESSOR	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	<5m	5-10m
CANOPY COVER	76-100%	26-50%	76-100%
MIDSTOREY COVER	76-100%	26-50%	76-100%
GROUND COVER	76-100%	76-100%	51-75%
APPROPRIATE COVER	Y	N	N
GRAZING IMPACT	N	N	N
NATURAL REGEN	Y	N	Y
CANOPY WEED	0%	0%	0%
MIDSTORY WEED	26-50%	0%	<25%
GROUND COVER WEED	26-50%	pasture	0%
WEED 1	Winter Senna (Senna pendula)		Winter Senna (Senna pendula)
WEED 1 DENSITY	Clumps (11-50%)		Few Scattered (<10%)
WEED 2	Lantana (Lantana camara)		Morning Glory (Ipomea spp.)
WEED 2 DENSITY	Clumps (11-50%)		Few Scattered (<10%)
WEED 3	Morning Glory (Ipomea spp.)		Lantana (Lantana camara)
WEED 3 DENSITY	Few Scattered (<10%)		Few Scattered (<10%)
WEED 4	Wild Tobacco (Solanum mauritianum)		
WEED 4 DENSITY	Few Scattered (<10%)		
BANK	North Bank	North Bank	North Bank

Table 101: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (2 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Weed Control (landholder)	Manual weed eradication along riparian zone (7 hrs @ \$35/hr)		245 (In kind)		245	
All	Revegetation (1890m ²)	Plant out gap areas along riparian zone (\$6.50/ plant incl labour x 475 plants) (landholder labour in kind)		1425 (In kind)	1663	3088	
2	Structural works (optional)	Excavator to place rock fillets along margin of low tide bench adjoining retaining wall (2 x 50m fillets @ \$150/m)			15000	15000	
2	Retaining Wall	Construction of retaining wall and back fill material (design to be confirmed)		?	?	?	
3	Structural works (optional)	Hand place rock fillets along margin of immediate bank face (50 m @ \$70/m; materials only) (landholder labour in kind)		1500 (In kind)	3500	5000	
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (3hrs / qtr) inspections and suppression as necessary for 10 years		4213 (In kind)		4213	
			TOTAL	7383 + retaining wall	16663 + retaining wall	24962 + retaining wall	880

Site 15 - Yellow Rock Road, Raleigh NSW 2454

Lot/DP	Plan 115 – 1714 (BSC LotID 10007)
Property Owners	Bellingen Shire Council
Catchment Details	Lower Bellinger River estuary – south bank; 830m river frontage; Area: 1.74ha
Land Use	Road Reserve

Property Summary

This site marks the beginning of a straight section on alluvial floodplain (fluvial transition zone). There is some evidence of fretting of the bank toe (and subsequent bank collapse) from wind and boat wave wash, although overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). A tidally submerged bench extends approximately 3-4 metres from the toe of the immediate bank face with some existing mangrove clumps. The riparian zone contains a healthy diversity locally native plant species with very little competition from weed species. Weed species such as Lantana (*Lantana camara*), Morning Glory (*Ipomea* spp.) and Easter Senna (*Senna pendula*) can be found sporadically along the riparian corridor.

Previous Management Efforts

N/A

Rehabilitation Strategy

The riparian corridor along this section represents possibly the best example of a target condition on the floodplain in the lower estuary therefore minimal intervention is necessary. It is recommended that periodic (e.g. biennial) weed control is undertaken to maintain this riparian zone in mint condition.

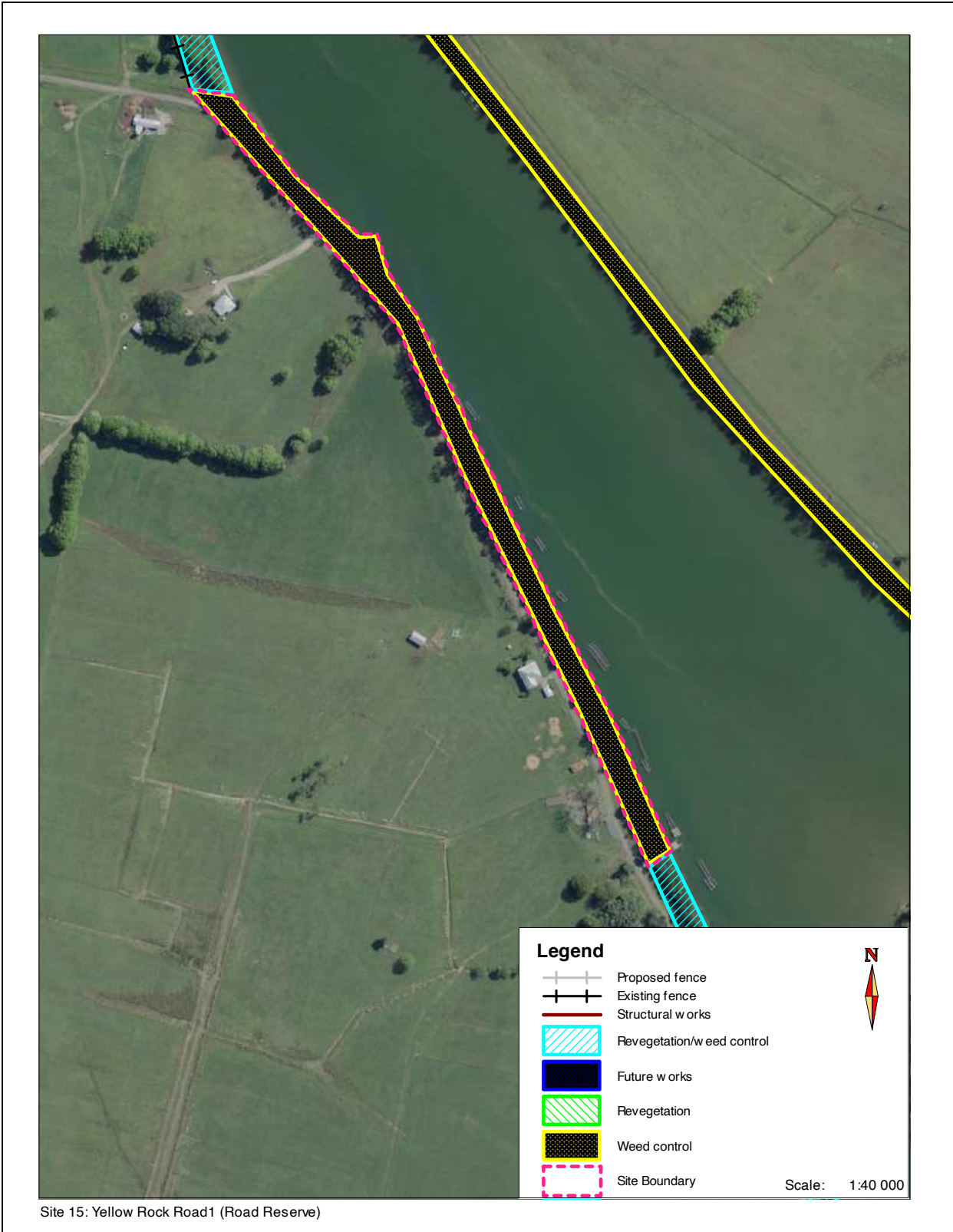


Figure 120: Property workplan map

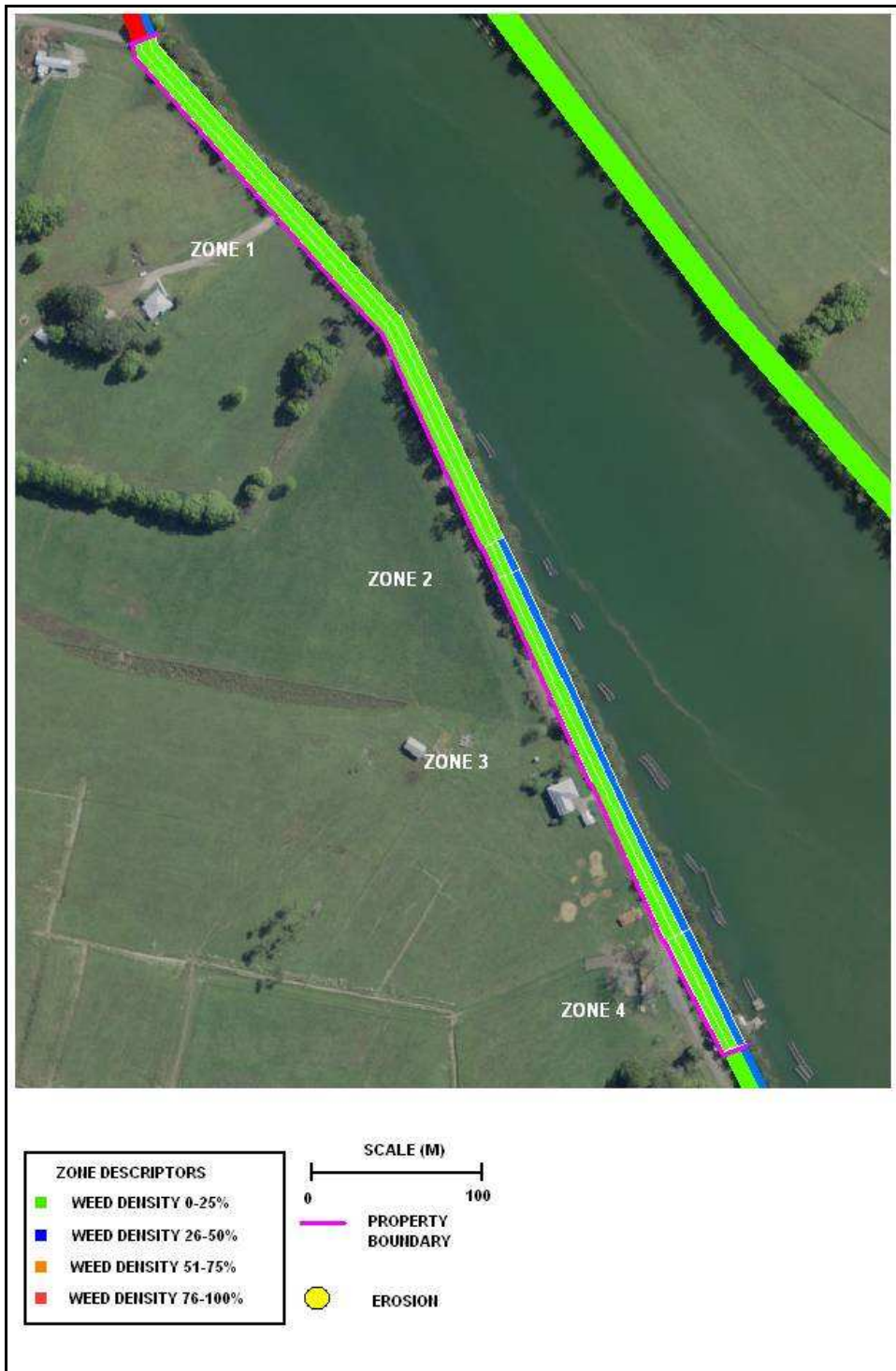


Figure 121: Riparian condition and extent

Table 102: Riparian condition summary

MGT ZONE	1	2	3	4
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	5-10m	5-10m	5-10m	5-10m
CANOPY COVER	76-100%	76-100%	76-100%	76-100%
MIDSTOREY COVER	76-100%	76-100%	51-75%	76-100%
GROUND COVER	26-50%	26-50%	26-50%	26-50%
APPROPRIATE COVER	Y	Y	N	Y
GRAZING IMPACT	N	N	N	N
NATURAL REGEN	Y	Y	Y	Y
CANOPY WEED	0%	0%	0%	0%
MIDSTORY WEED	<25%	<25%	<25%	<25%
GROUND COVER WEED	<25%	26-50%	26-50%	26-50%
WEED 1	Morning Glory (Ipomea spp.)	Lantana (Lantana camara)	Lantana (Lantana camara)	Morning Glory (Ipomea spp.)
WEED 1 DENSITY	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 2	Lantana (Lantana camara)		Morning Glory (Ipomea spp.)	Winter Senna (Senna pendula)
WEED 2 DENSITY	Few Scattered (<10%)		Few Scattered (<10%)	Few Scattered (<10%)
WEED 3			Winter Senna (Senna pendula)	
WEED 3 DENSITY			Few Scattered (<10%)	
BANK	South Bank	South Bank	South Bank	South Bank

Table 103: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			
				Landholder	Contributions		Total Budget
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
All	Weed Control (contractor)	Manual weed eradication along riparian zone (4 days @ \$800/day)		3200		3200	
All	On-going Maintenance	Follow-up weed treatment - biennial (1 day / 2yrs) inspections and suppression as necessary for 10 years		4000		4000	
			TOTAL	7200	800	8000	

Site 16 - Mylestom Drive, Mylestom NSW 2454

Lot/DP	Plan 33102 – 1603 (BSC LotID 9881)
Property Owners	Bellingen Shire Council
Catchment Details	Lower Bellinger River estuary – north bank; 1300m river frontage; Area: 2.16ha
Land Use	Road Reserve

Property Summary

This site marks the beginning of a straight section on alluvial floodplain (fluvial transition zone). There is some evidence of fretting of the bank toe (and subsequent bank collapse) from wind and boat wave wash, although overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). A tidally submerged bench extends approximately 3-4 metres from the toe of the immediate bank face with some existing mangrove stands. The riparian zone contains a healthy diversity locally native plant species with very little competition from weed species. Chief weed threats include Lantana (*Lantana camara*), Morning Glory (*Ipomea* spp.) and Easter Senna (*Senna pendula*).

Previous Management Efforts

N/A

Rehabilitation Strategy

The riparian corridor along this section represents one of the best examples of a target condition on the floodplain in the lower estuary therefore minimal intervention is necessary. It is recommended that periodic (e.g. biennial) weed control is undertaken to maintain this riparian zone in exemplary condition.



Figure 122: Property workplan map

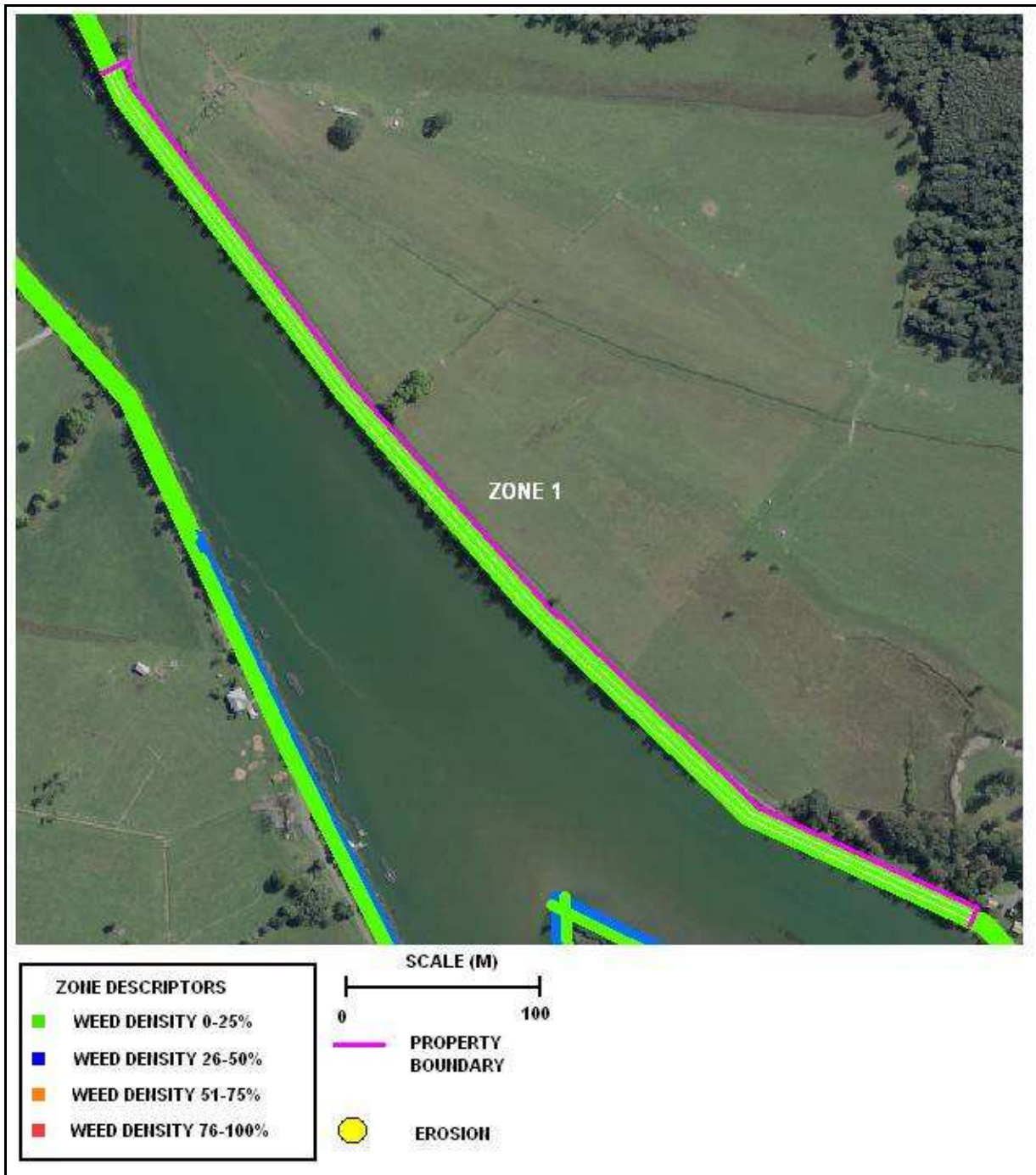


Figure 123: Riparian condition and extent

Table 104: Riparian condition summary

MGT ZONE	1
ASSESSOR	A. Rickert
RIPARIAN WIDTH	5-10m
CANOPY COVER	76-100%
MIDSTOREY COVER	76-100%
GROUND COVER	51-75%
APPROPRIATE COVER	N
GRAZING IMPACT	N
NATURAL REGEN	Y
CANOPY WEED	0%
MIDSTORY WEED	<25%
GROUND COVER WEED	0%
WEED 1	Winter Senna (<i>Senna pendula</i>)
WEED 1 DENSITY	Few Scattered (<10%)
WEED 2	Morning Glory (<i>Ipomea</i> spp.)
WEED 2 DENSITY	Few Scattered (<10%)
WEED 3	Lantana (<i>Lantana camara</i>)
WEED 3 DENSITY	Few Scattered (<10%)
BANK	North Bank

Table 105: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)				
				Landholder	Contributions			Total Budget
					NRCMA or Other	Bellingen Shire Council		
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)		800	
1	Weed Control (contractor)	Manual weed eradication along riparian zone (10 days @ \$800/day)		8000			8000	
1	On-going Maintenance	Follow-up weed treatment - biennial (3 days / 2yrs) inspections and suppression as necessary for 10 years		12000			12000	
			TOTAL		20000	800	20800	

Site 17 - Yellow Rock Road, Raleigh NSW 2454

Lot/DP	Plan 32008 – 1603 (BSC LotID 10007)
Property Owners	Bellingen Shire Council
Catchment Details	Lower Bellinger River estuary – north bank; 980m river frontage; Area: 1.81ha
Land Use	Road Reserve

Property Summary

This site spans a straight section on alluvial floodplain with Tuckers Island anabranch at its lower extent. There is some evidence of fretting of the bank toe (and subsequent bank collapse) from wind and boat wave wash, although overall active bank erosion is considered to be stable (Cohen & Telfer, 2010). A rock revetment wall spans the downstream half of the site. There is a tidally submerged bench extending a short distance (2-3m) from the toe of the immediate bank face along the upper half of the site. The riparian zone contains some locally native plant species limited natural recruitment occurring due to competition from mowing. Weed infestations are particularly notable in between stands of native vegetation with species such as Lantana (*Lantana camara*), Morning Glory (*Ipomea* spp.) and Easter Senna (*Senna pendula*) being the major concerns.

Previous Management Efforts

Several pockets of native vegetation have been planted along the river bank adjacent to the rock revetment wall along the bottom half of the site. These pockets are suffering from smothering with vine weeds (chiefly Coastal Morning Glory and Balloon Vine).

Rehabilitation Strategy

Rehabilitation at this site should focus on removing problematic weed species as mentioned above. Following weed treatment, the riparian corridor and existing vegetation pockets should be expanded (5-7m back from bank crest) and revegetated with deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellingen Landcare). Vehicle access (cars, mowers, etc) should be restricted in revegetated areas to allow healthy plant recruitment. Ongoing weed management will also be critical to ensure the survival and recruitment of native plants.

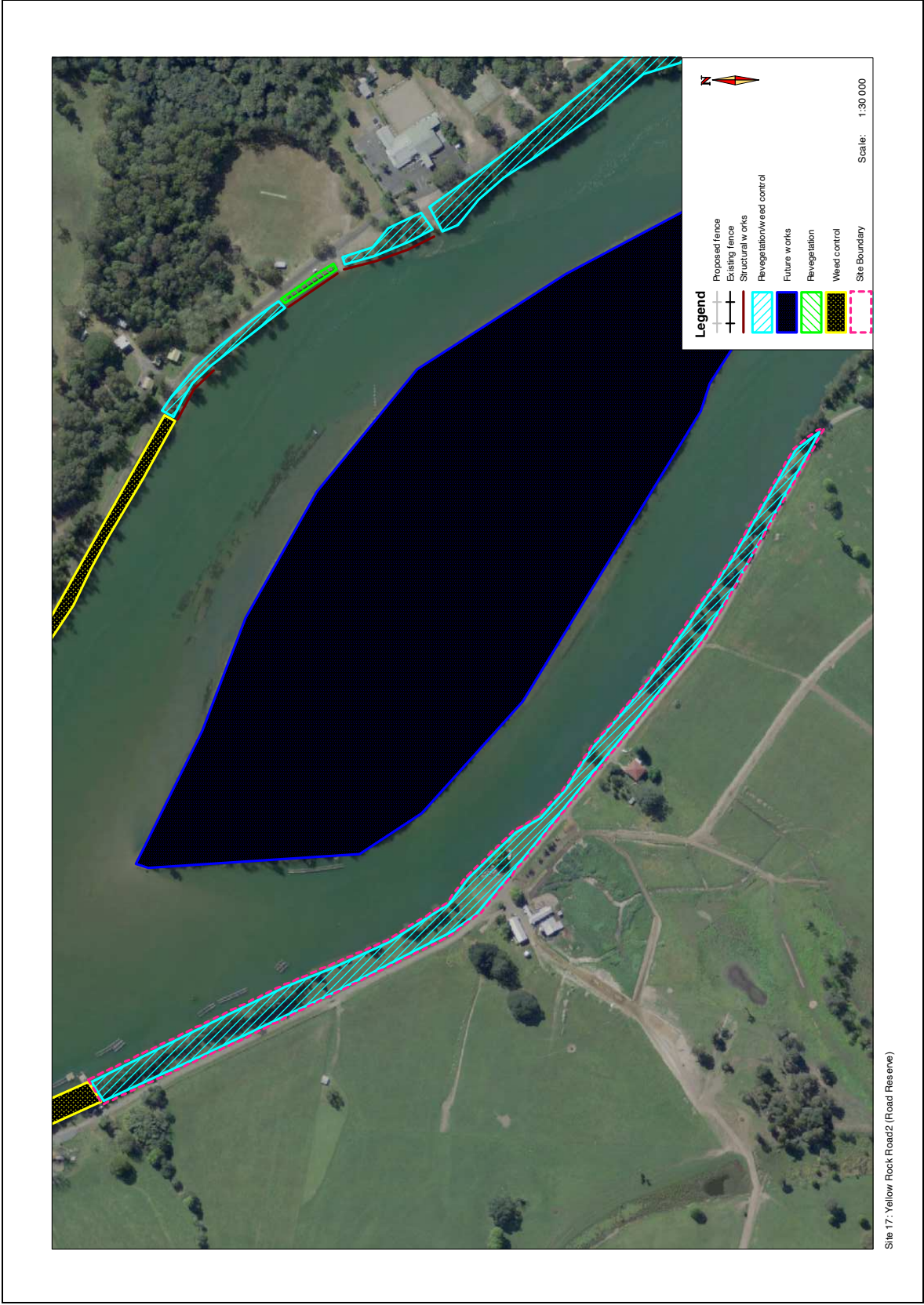


Figure 124: Property workplan map

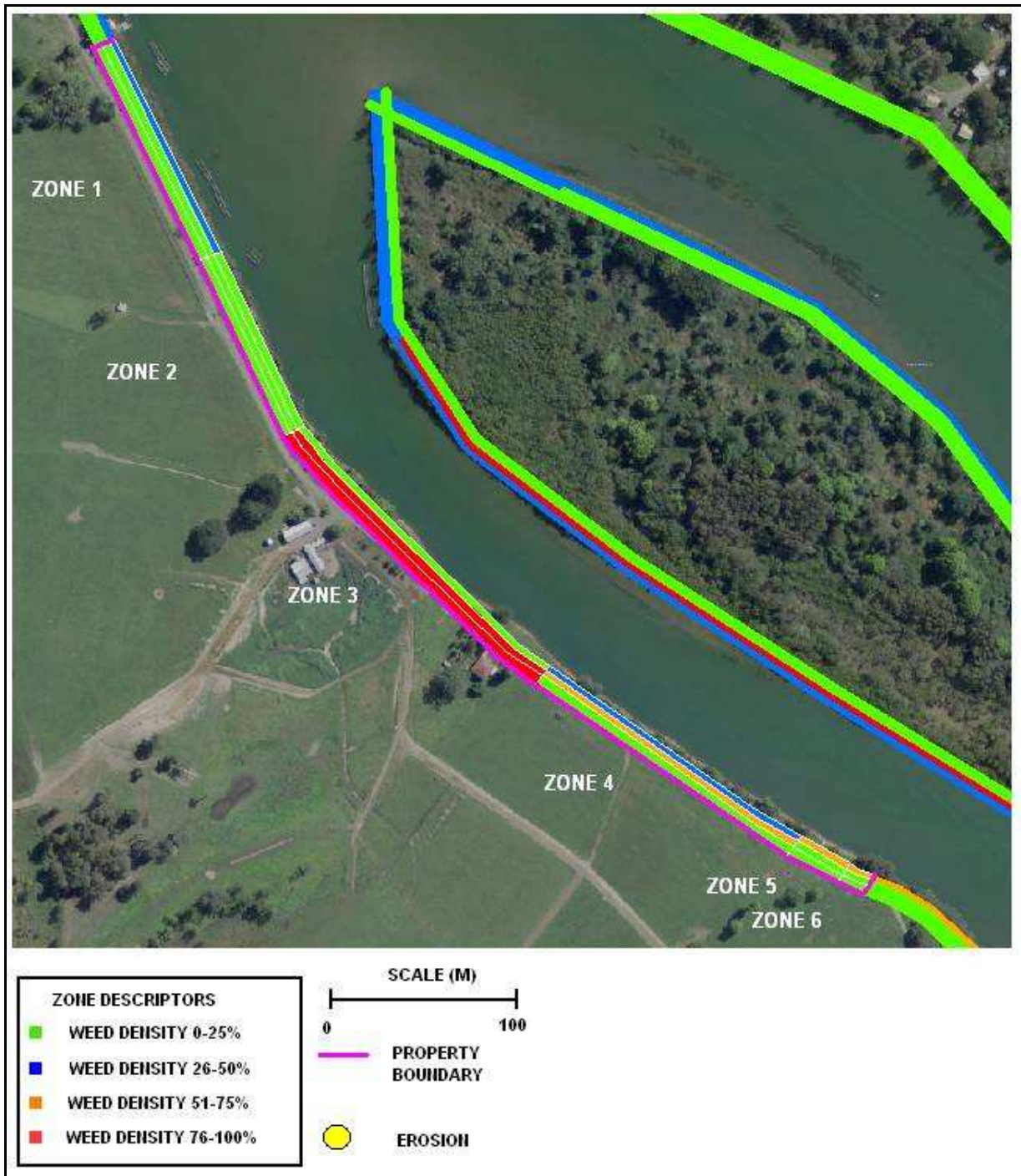


Figure 125: Riparian condition and extent

Table 106: Riparian condition summary

MGT ZONE	1	2	3	4	5	6
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	<5m	<5m	<5m	5-10m	<5m	<5m
CANOPY COVER	76-100%	<25%	<25%	51-75%	<25%	51-75%
MIDSTOREY COVER	76-100%	26-50%	<25%	76-100%	<25%	26-50%
GROUND COVER	26-50%	76-100%	76-100%	26-50%	76-100%	26-50%
APPROPRIATE COVER	N	N	N	N	N	N
GRAZING IMPACT	N	N	N	N	N	N
NATURAL REGEN	Y	N	N	Y	N	N
CANOPY WEED	0%	0%	76-100%	0%	0%	0%
MIDSTOREY WEED	<25%	<25%	76-100%	51-75%	0%	26-50%
GROUND COVER WEED	26-50%	pasture	pasture	26-50%	51-75%	26-50%
WEED 1	Winter Senna (Senna pendula)	Camphor Laurel (Cinnamomum camphora)	Lantana (Lantana camara)	Morning Glory (Ipomea spp.)	Morning Glory (Ipomea spp.)	Morning Glory (Ipomea spp.)
WEED 1 DENSITY	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Clumps (11-50%)	Few Scattered (<10%)
WEED 2	Lantana (Lantana camara)	Winter Senna (Senna pendula)	Camphor Laurel (Cinnamomum camphora)	Lantana (Lantana camara)	Blue Billy Goat (Ageratum houstonianum)	Lantana (Lantana camara)
WEED 2 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Clumps (11-50%)	Few Scattered (<10%)	Few Scattered (<10%)
WEED 3	Morning Glory (Ipomea spp.)	Lantana (Lantana camara)	Winter Senna (Senna pendula)	Blue Billy Goat (Ageratum houstonianum)		Bitou Bush (Chrysanthemoides monilifera)
WEED 3 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)	Few Scattered (<10%)		Few Scattered (<10%)
WEED 4	Bitou Bush (Chrysanthemoides monilifera)	Morning Glory (Ipomea spp.)	Morning Glory (Ipomea spp.)			
WEED 4 DENSITY	Few Scattered (<10%)	Few Scattered (<10%)	Dominant (>50%)			

WEED 5									
WEED 5 DENSITY									
BANK	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank	South Bank

Blue Billy Goat
(Ageratum
houstonianum)
Few Scattered
(<10%)

Table 107: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (16 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
All	Weed Control (contractor)	Manual weed eradication along riparian zone (9 days @ \$800/day)		7200		7200	
All	Revegetation (18100m ²)	Plant out riparian zone gaps (3m centres) (\$6.50/ plant incl labour x 2000 plants)		13000		13000	
All	On-going Maintenance	Follow-up weed treatment & maintenance- quarterly (14hrs / qtr) inspections and suppression as necessary for 10 years		20200		20200	
			TOTAL	40400	880	41280	

Site 18 - Mylestom Drive-River Street, Mylestom NSW 2454

Lot/DP	Plan 33102 – 1603R (BSC LotID 9881)
Property Owners	Bellingen Shire Council
Catchment Details	Lower Bellinger River estuary – north bank; 1090m river frontage; Area: 1.59ha
Land Use	Road Reserve

Property Summary

This site spans a straight section through outside bend on alluvial floodplain with Tuckers Island intersecting the river channel. There is some evidence of fretting of the bank toe (and subsequent bank collapse) from wind and boat wave wash, with minor sections of erosion are noted by Cohen & Telfer, 2010. The site can be further divided into three sections (upstream-downstream):

1. The first section begins at the outlet of the watercourse and incorporates the Mylestom boat ramp facilities (zone 1-3). Several sections of bank suffering ongoing mass failure between more stable areas with healthy mangrove communities buffering the bank. A tidally submerged bench extends approximately 3-4 metres from the toe of the immediate bank for the majority of this section. Riparian vegetation is generally in good condition with minor weed invasion from species such as Morning Glory (*Ipomea* spp.) and Winter Senna (*Senna pendula*).
2. Section two spans between the eastern boat ramp and the beginning of the retaining wall running along the Mylestom river reserve. Undercut and some bank slip are evident in this section, although mostly this section is stable with healthy mangrove communities and along the intertidal bench. The remainder of the riparian zone is relatively wide and healthy with a diversity of local native plants. Some weed problems exist with species such as Morning Glory (*Ipomea* spp.), Lantana (*Lantana camara*), Bitou bush (*Chrysanthemoides monilifera*) and Winter Senna (*Senna pendula*).
3. The final section includes the bund/park area directly in front of Mylestom township. A retaining wall runs along the bank with the downstream half of the wall recently having been reinforced along the toe with rock. A low tide bench extends 4-5 metres beyond the retaining wall along the upstream half of the retaining wall. Riparian vegetation is limited to scattered shade trees across the park lawn.

Previous Management Efforts

Previous work at this site includes the construction of a retaining wall (log crib style) and bank battering to create the public park area. More recently a rock revetment wall and swimming enclosure have been constructed as part of the Estuary Management Program (DECCW/BSC).

Rehabilitation Strategy

Rehabilitation at this site should focus on ongoing control of problematic weed species. This should be coupled with revegetation to fill out gaps using deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare).

The installation of rock fillets (refer to figure 126) is proposed along the degraded bank area (zones 1-3) and adjacent to the boat ramps to provide a higher degree of resilience against erosion from flooding and boat/wind wave wash. Rock fillets also create estuarine habitat, facilitating the mangrove establishment and fish recruitment. Once installed the adjacent bank should be revegetated as detailed previously.

Rehabilitation at this site should focus on ongoing control of problematic weed species. This should be coupled with revegetation to fill out gaps using deep rooted plants as outlined in the Bellinger River Estuary Revegetation Guide (BSC/Bellinger Landcare). This should be coupled with some plantings to reduce the bank slump potential and maintain the integrity of the retaining wall. Species such as Lomandra (*Lomandra longifolia*), River Lily (*Crinum pendiculatum*) and other shrub species would suffice while still maintaining the visual amenity of the River

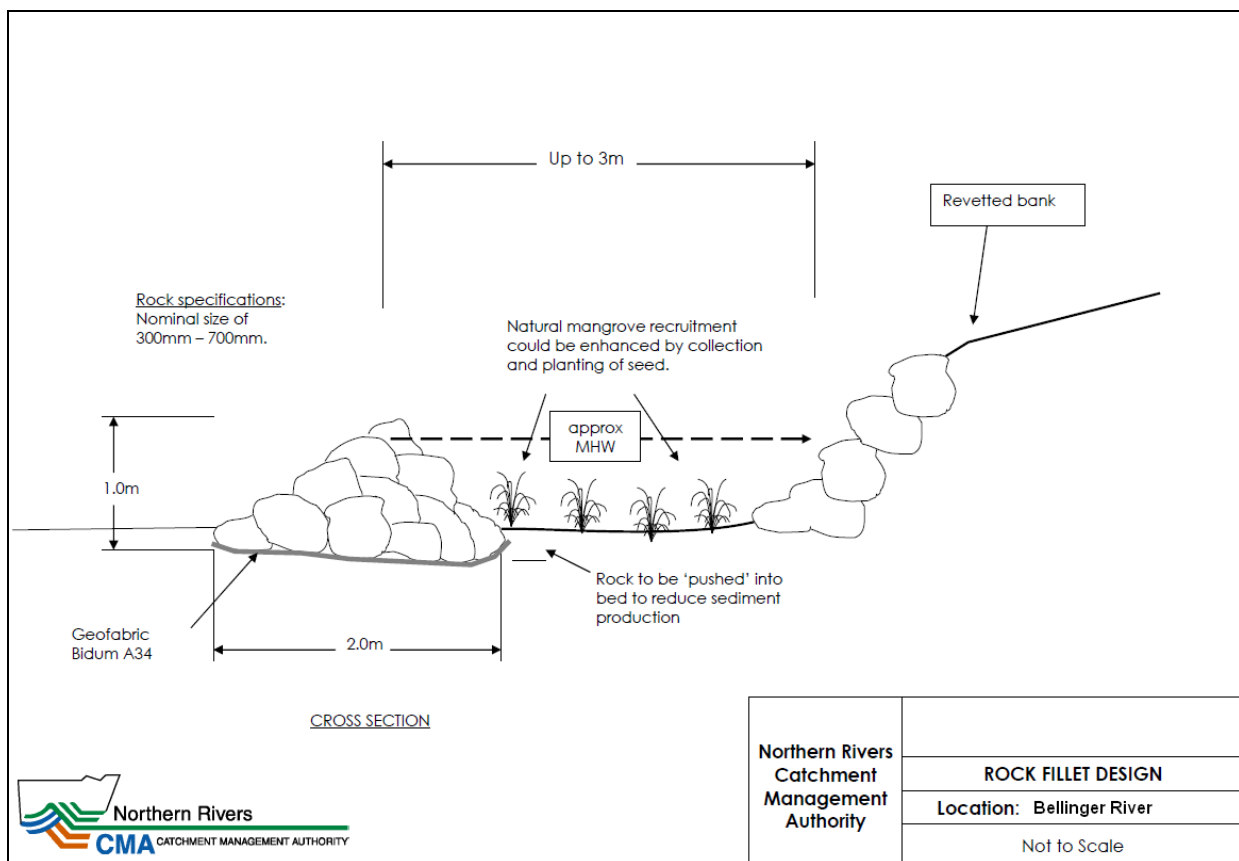


Figure 126: Design layout for structural works

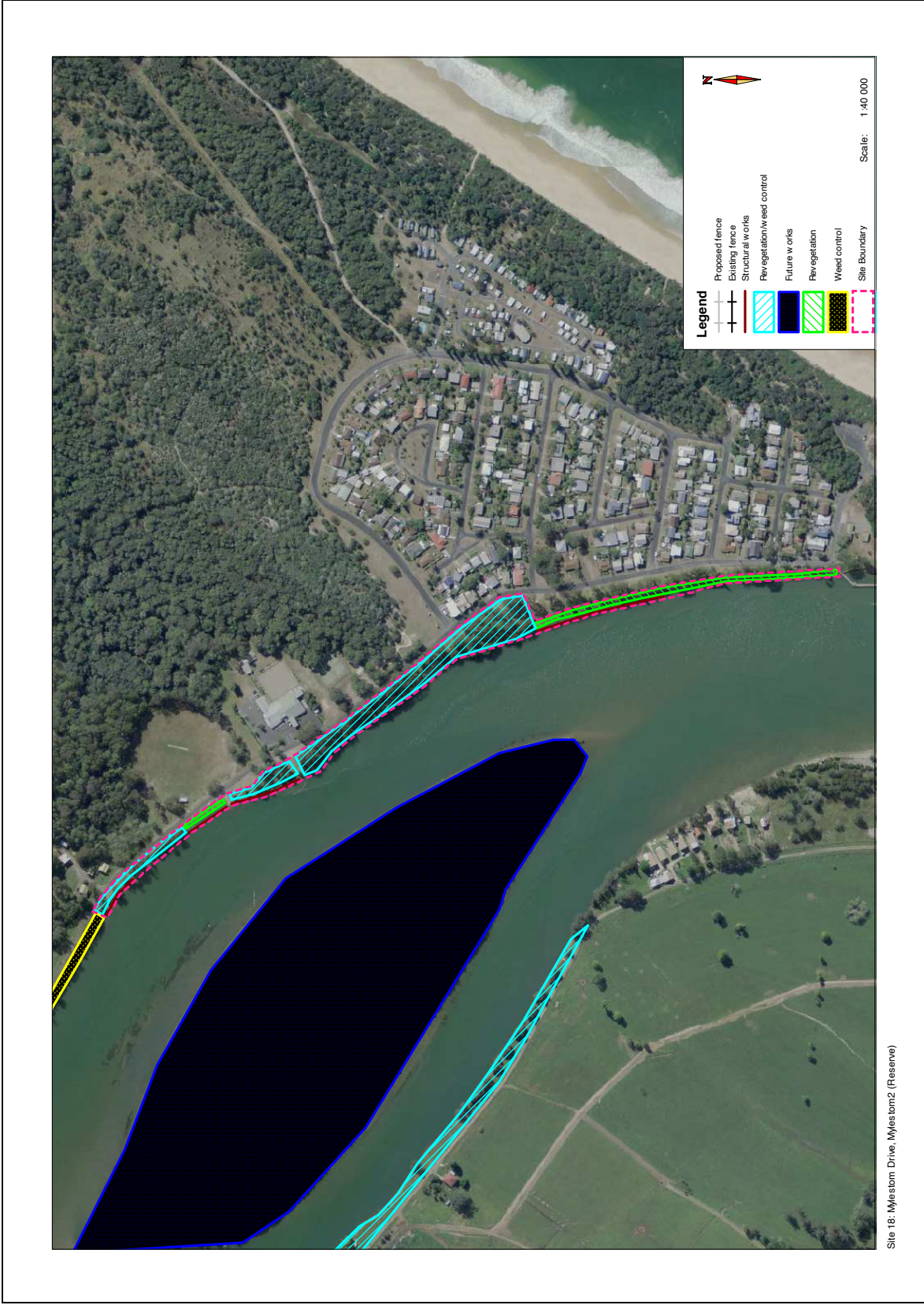


Figure 127: Property workplan map



Figure 128: Riparian condition and extent

Table 108: Riparian condition summary

MGT ZONE	1	2	3	4	5
ASSESSOR	A. Rickert	A. Rickert	A. Rickert	A. Rickert	A. Rickert
RIPARIAN WIDTH	<5m	<5m	<5m	10-20m	20-30m
CANOPY COVER	26-50%	<25%	26-50%	76-100%	<25%
MIDSTOREY COVER	51-75%	<25%	<25%	76-100%	<25%
GROUND COVER	76-100%	76-100%	76-100%	76-100%	76-100%
APPROPRIATE COVER	N	N	N	Y	Y
GRAZING IMPACT	N	N	N	N	N
NATURAL REGEN	Y	N	N	Y	N
CANOPY WEED	0%	0%	0%	0%	0%
MIDSTOREY WEED	<25%	0%	0%	<25%	<25%
GROUND COVER WEED	26-50%	pasture	pasture	<25%	pasture
WEED 1	Winter Senna (Senna pendula)			Coral Tree (Erythrina sykesii)	Morning Glory (Ipomea spp.)
WEED 1 DENSITY	Clumps (11-50%)			Few Scattered (<10%)	Few Scattered (<10%)
WEED 2	Morning Glory (Ipomea spp.)			Winter Senna (Senna pendula)	
WEED 2 DENSITY	Clumps (11-50%)			Few Scattered (<10%)	
WEED 3				Lantana (Lantana camara)	
WEED 3 DENSITY				Clumps (11-50%)	
WEED 4				Morning Glory (Ipomea spp.)	
WEED 4 DENSITY				Clumps (11-50%)	
WEED 5				Bitou Bush (Chrysanthemoides monilifera)	
WEED 5 DENSITY				Few Scattered (<10%)	
BANK	North Bank	North Bank	North Bank	North Bank	North Bank

Table 109: Property workplan

Mgt Zone	Activity	Activity Details	Source of Potential Funding (optional)	Indicative Cost (\$ ex GST)			Total Budget
				Landholder	Contributions		
					NRCMA or Other	Bellingen Shire Council	
All	Project Coordination	Technical, administrative & practical support (2 hrs @ \$50/hr)	Environmental Levy		800 (In kind)	800	
N/A	Publicity	Printing, educational activities, media release	Environmental Levy		80 (In kind)	80	
1-3	Weed Control (contractor)	Manual weed eradication along riparian zone (1 day @ \$800/day)		800		800	
1-3	Revegetation (1850m ²)	Plant out remaining reserve (3m centres) (\$6.50/ plant incl labour x 200 plants)		1300		1300	
1-3	Structural works (optional)	Excavator to place rock fillets along margin of low tide bench adjoining retaining wall (2 x 50m fillets @ \$150/m)		15000		15000	
4	Weed Control (contractor)	Manual weed eradication along riparian zone (4 days @ \$800/day)		3200		3200	
4	Revegetation (13700m ²)	Plant out riparian zone gaps (4m centres) (\$6.50/ plant incl labour x 850 plants)		5525		5525	
5	Revegetation (2350m ²)	Plant out above retaining wall (~2m centres) (\$6.50/ plant incl labour x 400 plants)			2600	2600	
5	Structural works (optional)	Excavator to place rock fillets along margin of low tide bench adjoining retaining wall (3 x 50m fillets @ \$150/m)		22500		22500	
All	On-going Maintenance	Follow-up weed treatment & fence maintenance- quarterly (9.5hrs / qtr) inspections and suppression as necessary for 10 years		13425		13425	
			TOTAL	61750	3480	65230	

