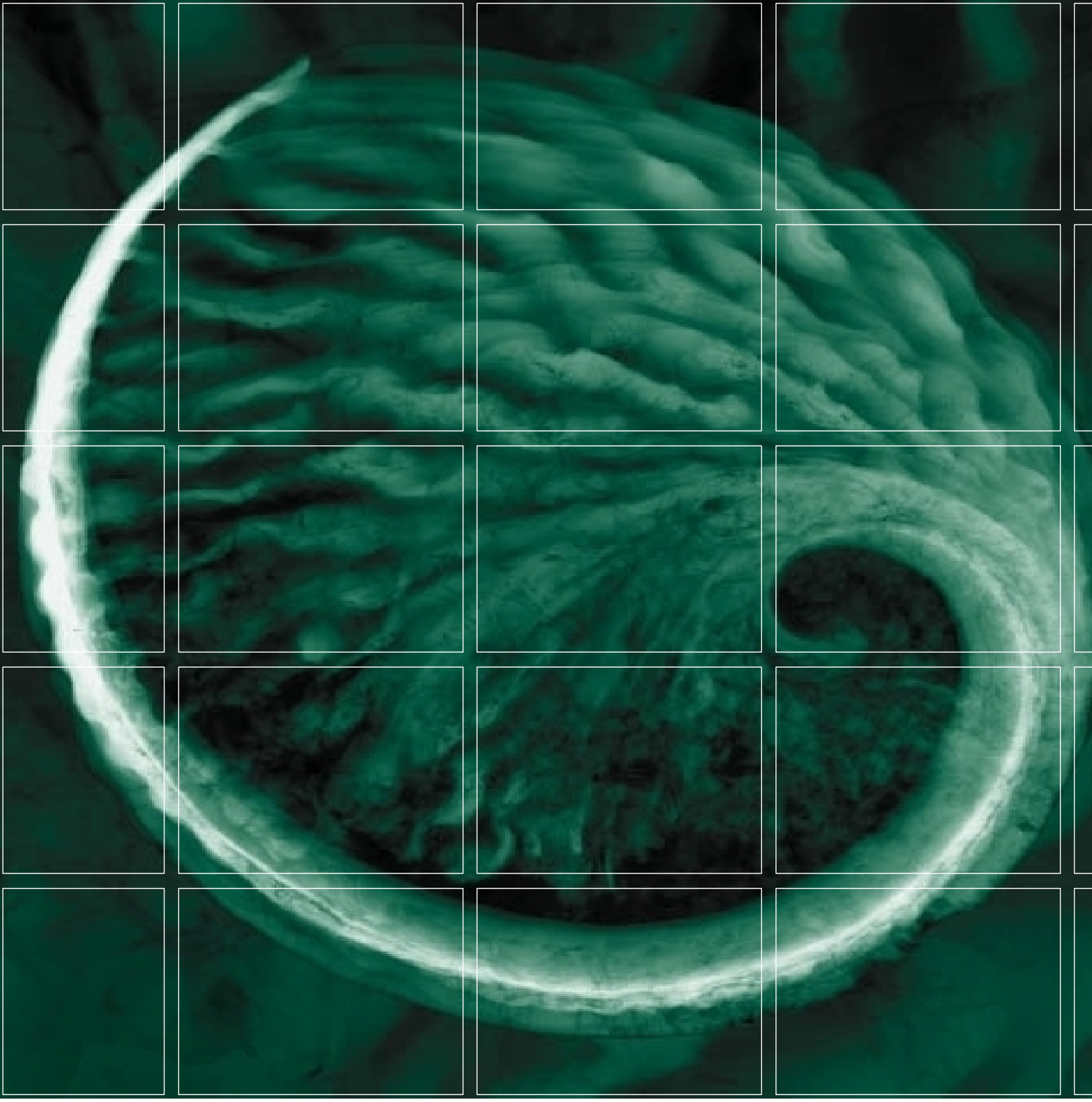

Consideration of Rainforest Policy "Parkside" @ Terrigal

Statement of Environmental Effects

Crighton Properties

December 2010

0050265SoEE Final

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Consideration of Rainforest Policy "Parkside" @ Terrigal

Statement of Environmental Effects

Crighton Properties

December 2010

Approved by:	*Andrew Biller*
Position:	Project Manager
Signed:	
Date:	*20 December, 2010*
Approved by:	*Steve O'Connor*
Position:	Principal
Signed:	
Date:	*20 December, 2010*

Environmental Resources Management Australia Pty Ltd Quality System

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Quality-ISO-9001-PMS302

FINAL REPORT

Crighton Properties

Consideration of Rainforest Policy
"Parkside" @ Terrigal

Statement of Environmental Effects

December 2010

Environmental Resources Management Australia
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1 INTRODUCTION

1.1 OVERVIEW

Environmental Resources Management Australia Pty Ltd (ERM) was commissioned by Crighton Properties Pty Ltd (Crighton Properties) to prepare a Statement of Environmental Effects (SoEE) in relation to rainforest vegetation and proposed management measures as part of the Parkside @ Terrigal development at Kings Avenue, Terrigal. A Local Environmental Study (LES) was prepared for Parkside @ Terrigal in 2010 (ERM) to support the proposed future rezoning of the site to facilitate the development of a hi-tech home office estate catering for the growing trend towards small office development within New South Wales.

Ecological assessments undertaken as part of the LES (Conacher Environmental Group, 2010) identified riparian and rainforest vegetation within the site, including rainforest species identified within Gosford City Council's (Council) Rainforest Policy. The Rainforest Policy requires the preparation of a SoEE where a development application falls within or adjacent to an area mapped as rainforest under the policy to determine the impact of the proposal upon that rainforest area.

This SoEE has been prepared to assess the potential impacts associated with the proposed future residential development of Parkside @ Terrigal on the rainforest area of the site.

1.2 SITE DESCRIPTION

The site is located within the Gosford Local Government Area (LGA) on the NSW Central Coast. It is situated south of an existing east/west urban corridor connecting the towns of Terrigal and Erina. The site is mostly vacant and has an area of approximately 54 hectares with frontage to Kings Avenue. A locality plan is provided in *Figure 1.1*.

The site includes Lot 202 DP 831864, Lots 8 and 9 DP 876102, Lot 2 DP 1111392, Lot 4 DP 37914 and Lot 1 DP 381971.

The site is sparsely vegetated at the Kings Avenue frontage, with vegetation cover increasing in the south towards the Kincumba Mountain Reserve which forms part of Gosford City Council's Coastal Open Space System. A cleared area exists on the north eastern portion of the site. The site also contains an artificial water body and a dwelling (as well as an approval for a future dwelling) (see *Figure 1.2*).

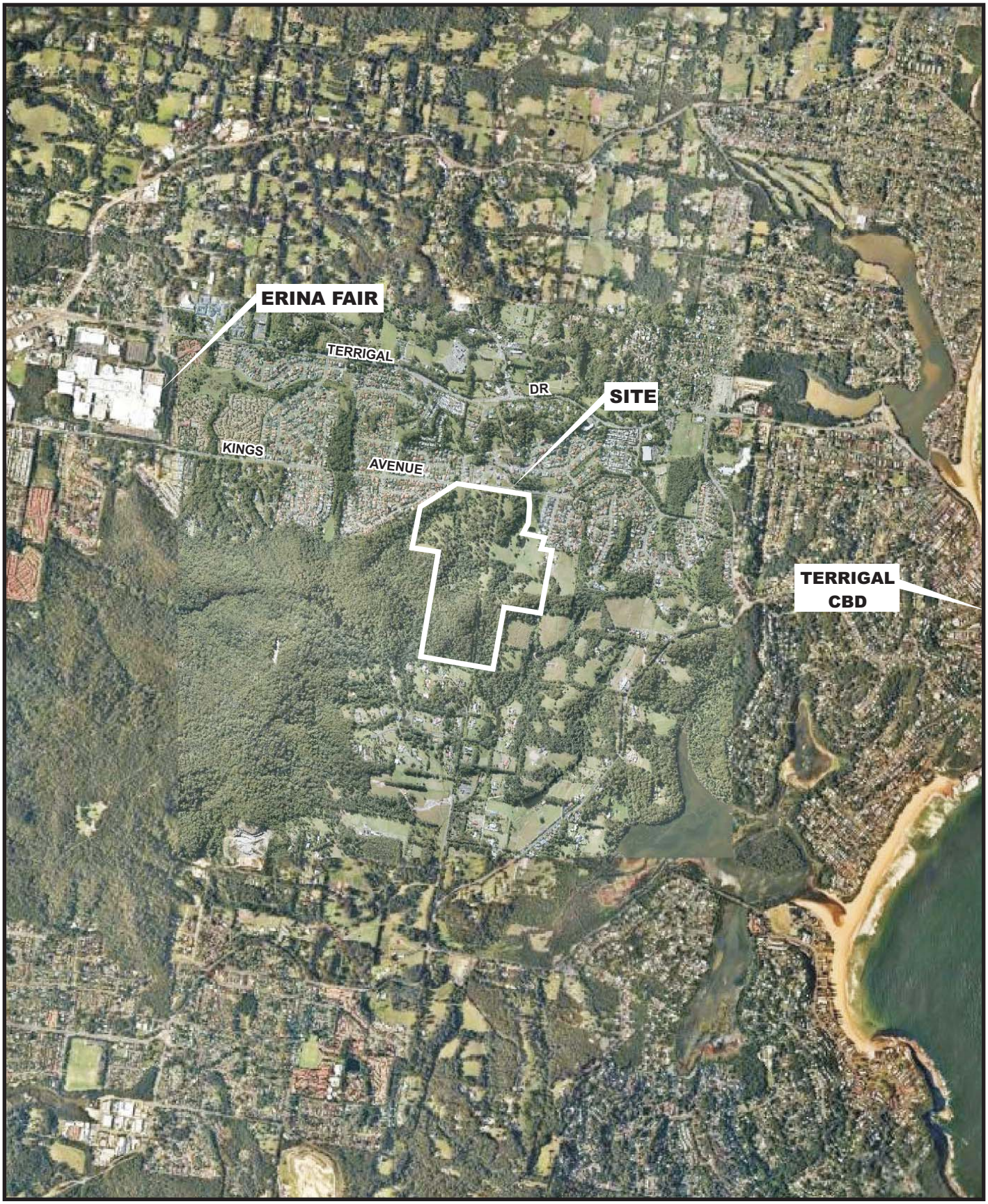

Figure 1.1

Locality Plan

Client:	Crighton Properties Pty Ltd	
Project:	Parkside Terrigal Rezoning Report - Local Environmental Study	
Drawing No:	0050265h_LES_Nov10_C001_R0.cdr	
Date:	14/12/2010	Drawing size: A4
Drawn by:	JD	Reviewed by: AA
Scale:	Refer to Scale Bar	

N

0 500 1000m

Maps and figures contained within this document may be based on third party data, may not be to scale and is intended for use as a guide only. ERM does not warrant the accuracy of any such maps or figures.

Source:
Conacher Environmental Group

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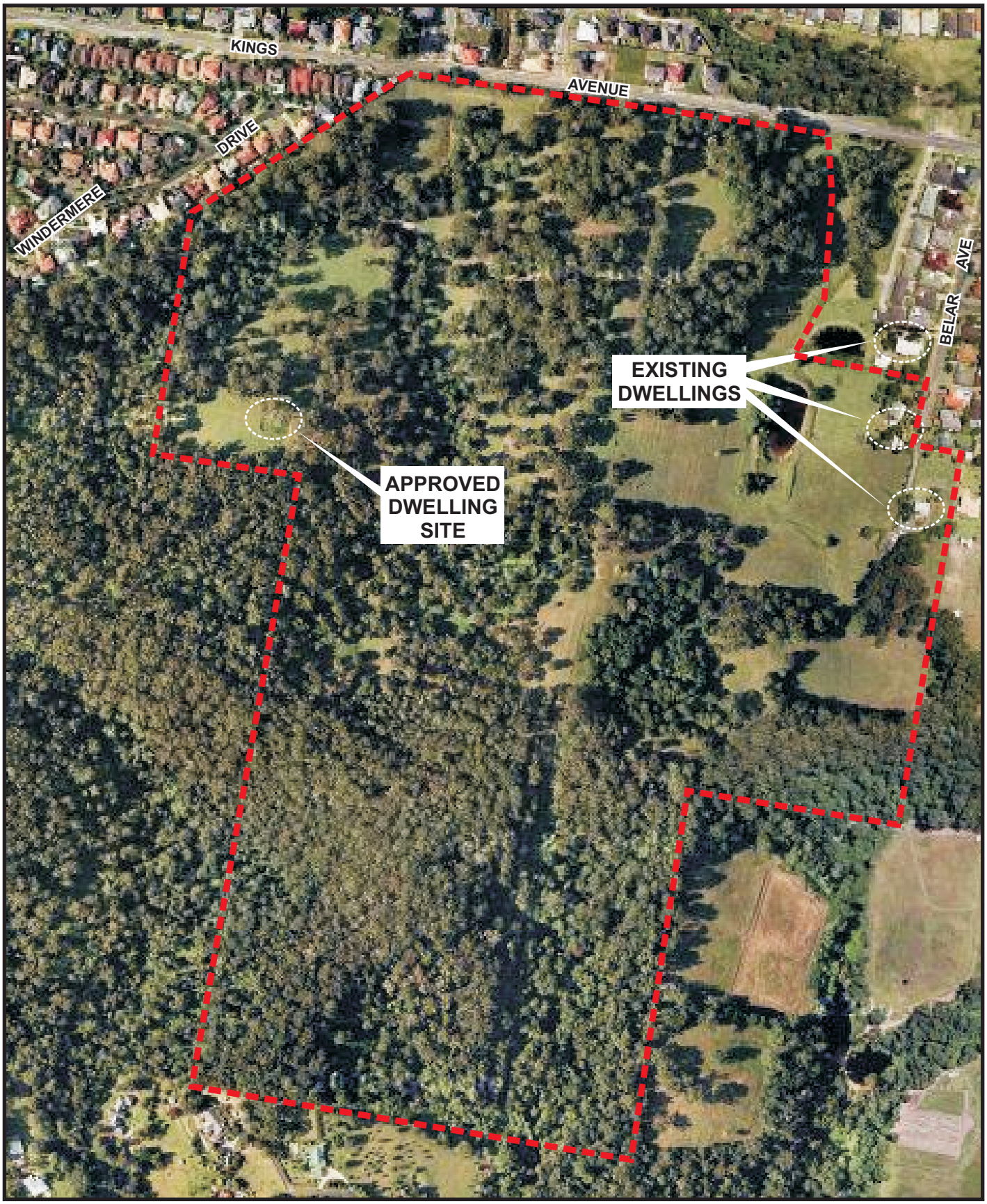

Figure 1.2

Aerial Photograph of Site

Legend

Site

Source:

© 2010 Google Earth

Client:	Crighton Properties Pty Ltd		
Project:	Parkside Terrigal Rezoning Report - Local Environmental Study		
Drawing No:	0050265h_LES_Nov10_C002_R0.cdr		
Date:	15/12/2010	Drawing size: A4	
Drawn by:	JD	Reviewed by: AA	
Scale:	Refer to Scale Bar		

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0 50 100 150m

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The site is situated in an area of moderate to steeply undulating terrain on the north eastern edge of a prominent south west trending ridgeline. The elevation of the site varies between 20 metres (m) AHD at the Kings Avenue frontage up to 70 m AHD at the southern portion of the site which forms part of the previously referenced ridgeline. A cleared electricity easement runs along the top of this ridgeline. Two gullies originate at the upper slopes of the site and drain towards the north.

Along the northern, north west and north east edge of the site is the extensive Terrigal to Erina urban corridor. This is characterised by detached, single and two storey, low density residential development. To the east and south east of the site are larger, predominantly cleared, rural residential style allotments containing single dwellings. The western and south western edge of the site adjoins the Kincumba Mountain Reserve which is characterised by steep topography and heavy vegetation.

An existing gravel road is located parallel to the rainforest community in the north west of the site. This road functions as a legal right of way for an approved dwelling within the adjacent Lot 2 DP 831864, access to which must be maintained at all times.

2 PROJECT OVERVIEW

2.1 PROJECT DESCRIPTION

A LES has been prepared for Parkside @ Terrigal (ERM, 2010) to support the proposed future rezoning of the site to facilitate the development of a hi-tech home office estate catering for the growing trend towards small office development within NSW. The LES incorporates specialist environmental, social and economic assessments. The outcomes of the specialist assessments were incorporated into a constraints analysis to determine the future development potential of the site (refer to *Section 2.2*).

A future rezoning of the site as proposed in the LES would facilitate the development of approximately 145 home based office residences connected by high speed optic fibre communication technology. In order to ensure that development takes place in a sustainable manner, it is proposed to put in place a number of specific measures including a range of environmental management plans. These include:

- water management plan based on the principles of Water Sensitive Urban Design;
- retention of areas with high ecological values, and dedication of a large portion of this land (27.28 hectares) to Council for inclusion within the Coastal Open Space System; and
- ecological site management plan to retain and manage areas remaining within private ownership.

2.2 CONSTRAINTS ANALYSIS AND CONCEPT PLAN

An integrated assessment of the identified constraints and opportunities for the site was undertaken as part of the LES (ERM, 2010) using the outcomes of the specialist environmental assessments included with the LES. The results of the constraints and opportunities assessment were used to develop a Concept Plan based on:

- areas identified as being appropriate for urban development;
- areas which, subject to appropriate environmental management measures, could be developed for specified uses; and
- areas of the site which due to their environmental properties, need to be retained in an undeveloped state.

The LES (ERM, 2010) identifies the following primary constraints:

- threatened, endangered or vulnerable species and their habitats;
- land in excess of 20% slope;
- the need to incorporate bush fire asset protection zones;
- preservation of key riparian vegetation;
- flood prone land;
- geotechnical considerations; and
- road access constraints.

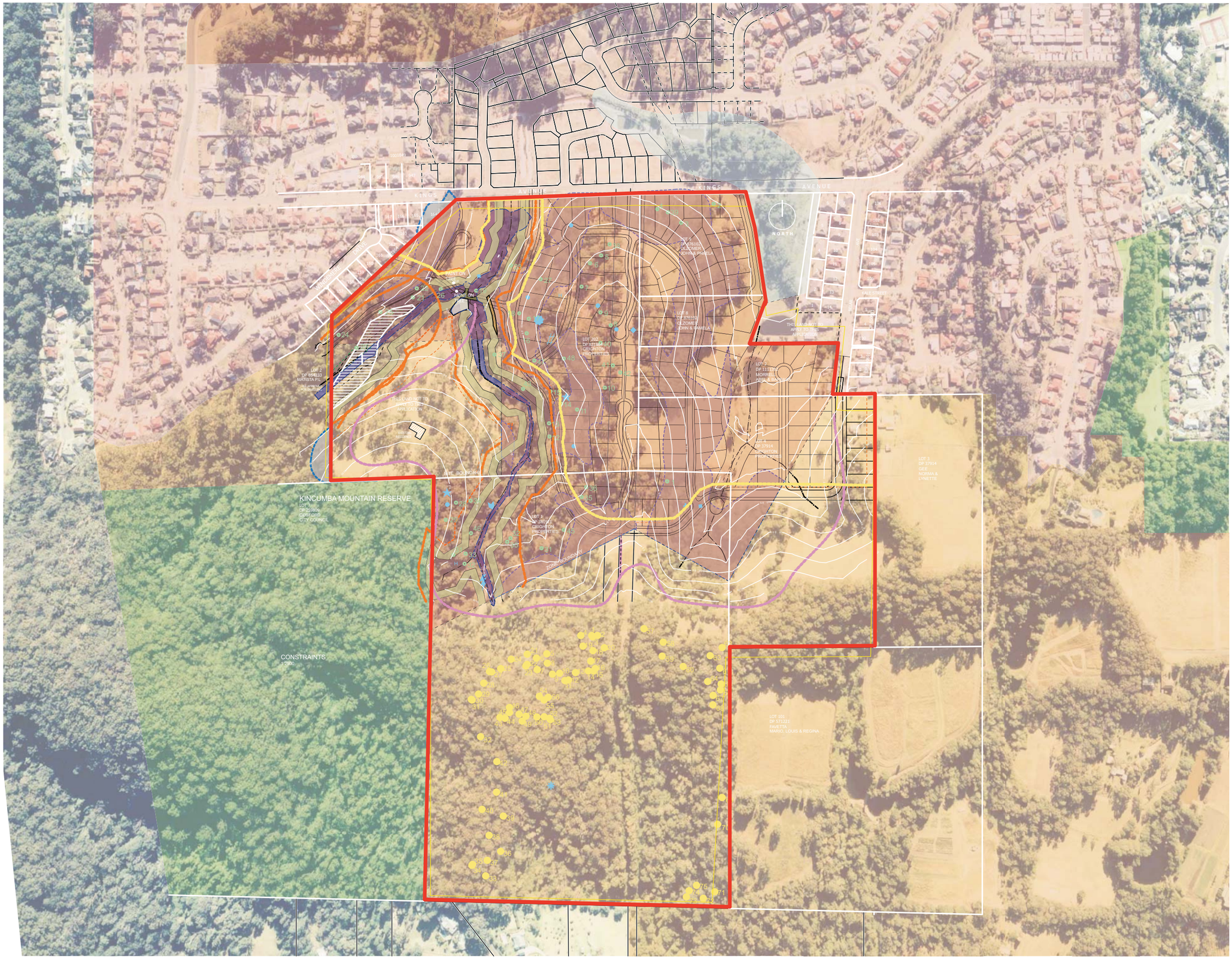
The results of the initial constraints mapping are shown within *Figure* 2.*1*. This mapping indicates that the primary ecological constraints on the site were confined to the riparian areas in the north western portion of the site.

An indicative Concept Plan (see *Figure 5.2* of the LES) was formulated showing the general proposal for urban development, community facilities, lower density residential, and those areas which due to their environmental attributes require protection. The Concept Plan does not form part of the draft Local Environmental Plan (Draft LEP) for the site, rather it provides an illustration of how development could possibly occur.

The Concept Plan provides for the protection of rainforest areas across the site (refer to *Section 4.2*). Rainforest vegetation in the southern area of the site will be dedicated to Council for conservation within the Kincumba Mountain Reserve, while the rainforest in the north west of the site will be retained and protected by proposed core riparian, rainforest and buffer management zones. This area will be managed by the Community Association in accordance with the Riparian and Buffer Zone Vegetation Management provided in Appendix 7 of Annex C of the LES (provided in *Annex B* to this report).

2.3 COMMUNITY TITLE DEVELOPMENT

Rather than a traditional Torrens Title arrangement, in order to ensure that the proposed hi–tech home office park estate is developed and managed in accordance with the principles outlined within the LES, the proposed development will be a Community Title subdivision utilising the provisions of the *Community Land Development Act 1989*. This will allow for enforcement of home office provisions and effective management of community facilities. In order to achieve this, a Community Management Statement is required to be prepared. The adoption of such a statement would be formally undertaken during the development approvals phase, however a draft Community Management Statement was prepared as part of the LES (refer to Annex H of the LES).



Legend

- 2(a): RESIDENTIAL
- 6(b): OPEN SPACE *(SPECIAL PURPOSES)*
- 7(a): CONSERVATION & SCENIC PROTECTION *(CONSERVATION)*
- 7(c2): CONSERVATION & SCENIC PROTECTION *(SCENIC PROTECTION - RURAL SMALL HOLDINGS)*
- 9(a): RESTRICTED DEVELOPMENT - *(FLOOD PRONE LAND)*
- COASTAL GULLY CLOSED FOREST (EEC - LOWLAND RAINFOREST)
- SLOPE OF THE LAND > 20%
- RIPARIAN ZONE
- HOLLOW BEARING TREE APPROX LOCATION
- NEW SURVEYED HOLLOW BEARING TREE APPROX LOCATION
- GREATER BROAD-NOSED BAT
- LITTLE BENTWING-BAT
- EASTERN FALSE PIPERSTRELLE
- YELLOW BELLIED SHEATHTAIL-BAT
- EASTERN FREETAIL-BAT
- POWERFUL OWL
- EASTERN BENTWING-BAT
- GREY-HEADED FLYING FOX FLIGHT DIRECTION
- SOOTY OWL
- YELLOW BELLIED GLIDER
- RAINFOREST BUFFER
- BUSHFIRE FLAME ZONE SETBACK
- BUSHFIRE TRAILS
- CENTER LINE OF CREEK
- POWER LINE EASEMENT
- SITE BOUNDARY - TOTAL
- 1% AEP

Source:
Crighton Properties Pty Ltd

Figure 2.1
Constraints Plan

Client:	Crighton Properties Pty Ltd		
Project:	Parkside Terrigal Rezoning Report - Local Environmental Study		
Drawing No:	0050265h_LES_Nov10_RF_SoEE_C001_R0.cdr		
Date:	17/12/2010	Drawing size:	A3
Drawn by:	JD	Reviewed by:	AA
Scale:	Not to Scale		

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Matters that must be included within the statement of a general nature include:

- the location, control, management, use and maintenance of any part of the community property that is an open access way or a private access way;
- the control, management, use and maintenance of any other part of the community property, including any special facilities provided on the community property;
- matters affecting the provision of, and payment for, internal fencing on the community parcel including any obligations of the community association or the subsidiary bodies;
- the storage and collection of garbage on and from the community parcel and any related obligations of the community association or the subsidiary bodies;
- the maintenance of water, sewerage, drainage, gas, electricity, telephone and other services;
- insurance of the community property;
- the executive committee of the community association, the office-bearers of the committee and the functions of the office-bearers;
- meetings of the executive committee;
- voting on a motion submitted to the executive committee otherwise than at a meeting of the committee; and
- the keeping of records of proceedings of the executive committee.

Over and above these general requirements or provisions, a number of specific provisions to ensure the implementation and effective management of the site as a home based office park, while protecting residential amenity, would include:

- description of access provisions;
- maintenance and upkeep provisions;
- financial management;
- architectural controls (including the requirement that each new dwelling contain a dedicated area between 30m^2 and 60m^2 capable of being utilised as a home office);
- on site parking provisions; and

- restrictions as to what type of business that can be conducted to ensure that residential amenity is preserved.

These are described in further detail in the LES (Annex H of the LES).

Chapter 5 details specific measures for the management of vegetation under Community Title, in particular the rainforest community within the north west of the site.

3 STATUTORY PLANNING

3.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The LES prepared to support a future rezoning application was prepared in accordance with the specifications provided by Gosford City Council to Crighton Properties on the 4 October 2007 as per Section 57 of the *Environmental Planning and Assessment Act 1979* (EP&A Act 1979).

The future rezoning of the site will be subject to the preparation, exhibition and gazettal of a draft Local Environmental Plan (draft LEP).

3.2 OTHER APPLICABLE LEGISLATION AND PLANNING POLICIES

Other applicable legislation and environmental planning instruments relevant to the proposed future rezoning and subdivision of the site include:

- State Environmental Planning Policy (Infrastructure) 2007;
- State Environmental Planning Policy 19 – Bushland in Urban Areas;
- State Environmental Planning Policy 44 – Koala Habitat Protection;
- State Environmental Planning Policy 55 – Remediation of Land;
- State Environmental Planning Policy 71 – Coastal Protection;
- Sydney regional Environmental Plan 6 – Gosford Coastal Area;
- Central Coast Regional Strategy;
- relevant Section 117 Directions under the EP&A Act 1979;
- NSW Coastal Policy 1997;
- Coastal Design Guidelines for NSW; and
- Coastal Management Guidelines.

Chapter 2 of the LES (ERM, 2010) considers the above relevant legislation and planning policies as they relate to the proposed Parkside @ Terrigal development.

3.3 GOSFORD CITY COUNCIL RAINFOREST POLICY

Gosford City Council Rainforest Policy aims to recognise the particular value of rainforests as a natural biological system and the suites (dry, gallery, gully and littoral) that occur within them. It provides for detailed vegetation mapping and assessment criteria for development assessments and rezonings.

All rainforest areas across the LGA are identified either through the mapping as shown in Attachment 1 of the Policy, or as a species composition description where associated with narrow gullies on soils derived from the Narrabeen group. The Ecological Site Assessment undertaken by Conacher Environmental Group (2010) (Refer to Annex C of the LES) identifies and maps areas of rainforest vegetation on site as Lowland Rainforest Endangered Ecological Community. Therefore the provisions of the Policy apply to the proposed development.

The objectives of the Rainforest Policy are:

"1. To recognise the particular value of rainforests as a natural biological system and recognise the suites (dry, gallery, gully and littoral) that occur within them;

- *to identify, conserve and protect rainforest communities in Gosford City for their ecological, educational and passive recreational values;*
- *to provide detailed vegetation mapping and assessment criteria for development assessment and rezonings;*
- *to increase public awareness of the importance of rainforest areas and support for their protection and where required rehabilitation;*
- *to increase the level of protection for all rainforest areas and where appropriate bring them into public ownership;*
- *to identify priority sites for regeneration and rehabilitation of rainforest areas under the care and control of Council; and*

2. To identify those areas which can be managed and preserved on both public and private land."

The Rainforest Policy requires the preparation of a SoEE where a development application falls within or adjacent to an area mapped as rainforest under the Rainforest Policy to determine the impact of the proposal upon that rainforest area (*Chapter 4* assesses the impact of the proposed development).

The consistency of the proposed development with the objectives of the Rainforest Policy is detailed in *Table 3.1*.

Table 3.1 Consistency with the Objectives of the Gosford Council's Rainforest Policy

Objective	Comment
To recognise the particular value of rainforests as a natural biological system and recognise the suites (dry, gallery, gully and littoral) that occur within them.	The proposed development recognises the value of rainforests as a natural biological system. The proposed development incorporates biological conservation principles including: • protection of areas of gully rainforest (corresponds to Lowland Rainforest Endangered Ecological Community), including transfer of the larger more intact area of rainforest and adjoining moist forest community in the south of the site to Council to enlarge the Kincumba Mountain Reserve and the active protection and management of the remaining portion of rainforest vegetation in accordance with the Riparian and Buffer Zone Management Plan and Ecological Site Management Plan; • maintenance of existing connectivity with adjacent vegetation across the site, including riparian zones; • retention of vegetated buffer zone between development footprint and coastal warm temperate rainforest area; • restoration and management of riparian vegetation across the site; and • implementation of a Water Quality Management Strategy, preparation and implementation of an Ecological Site Management Plan and Riparian and Buffer Zone Management Plan. Specific management measures for the rainforest community on site include: • removal of weeds and invasive species by low impact method; • natural regeneration, or (if required) supplementary planting using selected indigenous plant species to achieve a good cover and diversity; and • continued monitoring and maintenance of the condition of the vegetation within the rainforest.

Objective	Comment
To identify, conserve and protect rainforest communities in Gosford City for their ecological, educational and passive recreational values.	The rainforest within the subject site has been identified by Conacher Environmental Group and is described in *Section 4.2* and *Annex A* of this report as Coastal Warm Temperate Rainforest. Rainforest mapped within the southern section of the site is proposed to be dedicated to Gosford City Council for conservation within the Kincumba Mountain Reserve, thereby ensuring its protection and conservation for ecological, education and passive recreational values. Rainforest mapped within the north western section of the site will be preserved and protected through the establishment of management zones, including core riparian, rainforest and buffer zone areas. The management measures for these areas are identified in the Riparian and Buffer Zones Management Plan.
To provide detailed vegetation mapping and assessment criteria for development assessment and rezonings.	Conacher Environmental Group (2010) has undertaken a detailed assessment and mapping of the vegetation communities across the site, including the rainforest areas for the LES. An assessment of the potential impacts of the proposed development on the rainforest community identified on site is detailed in *Chapter 4* and identifies required management measures to mitigate the potential impacts.
To increase public awareness of the importance of rainforest areas and support for their protection and where required, rehabilitation.	The majority of the rainforest mapped on the site is proposed to be dedicated to Council for conservation within the Kincumba Mountain Reserve. This will facilitate their conservation for the benefit of the community and provide for increased access, appreciation and awareness of the public relating to the importance of rainforest areas. The protection and management of the rainforest area within the north west of the site provides for increased public awareness through the active management of this area by the Community Association and public access provided throughout the estate to areas of open space and bushland.
To increase the level of protection for all rainforest areas and where appropriate bring them into public ownership.	The majority of the rainforest mapped on the site is proposed to be dedicated to Council for conservation within the Kincumba Mountain Reserve. The remaining rainforest vegetation within the north west of the site will be managed under Community Title in accordance with the core riparian, riparian buffer and rainforest area management zones detailed in the Riparian and Buffer Management Plan and Ecological Site Management Plan, thereby ensuring this

Objective	Comment
	area is appropriately managed and conserved. The size of this portion does not warrant dedication to public ownership.
To identify priority sites for regeneration and rehabilitation of rainforest areas under the care and control of Council.	The majority of the rainforest mapped on the site is proposed to be dedicated to Council for conservation within the Kincumba Mountain Reserve. This rainforest area could become a priority for Council for regeneration and rehabilitation. The remaining portion will be managed by the Community Association in accordance with a Council endorsed strategy.
To identify those areas which can be managed and preserved on both public and private land.	The majority of the rainforest mapped on the site is proposed to be dedicated to Council for conservation within the Kincumba Mountain Reserve. The rainforest within the north west of the site will be managed under Community Title in accordance with the core riparian, riparian buffer and rainforest area management zones detailed in the Riparian and Buffer Management Plan and Ecological Site Management Plan, thereby ensuring this area is appropriately managed and conserved. Active environmental management, including weed control will improve its ecological condition and long term viability.

4 ENVIRONMENTAL IMPACT ASSESSMENT

4.1 INTRODUCTION

This impact assessment has been prepared to assess the potential impacts associated with the proposed future residential development of Parkside @ Terrigal on the rainforest area of the site. The rainforest community mapped in the southern parts of the site are proposed to be dedicated to Council for conservation in the Kincumba Mountain Reserve. As such, potential impacts associated with the proposed development of Parkside @ Terrigal on the rainforest community will be restricted to the mapped rainforest community within the north west of the site and is considered further below.

4.2 FLORA AND FAUNA

4.2.1 Introduction

An ecological assessment was undertaken by the Conacher Environmental Group (2010) and included as Annex C of the LES. The report provides details on the vegetation, fauna and habitat present on the site in relation of the local area, as well as providing details on the likely impacts of the proposal upon threatened species, vegetation and habitats within the local area. The ecological site assessment was accompanied by the following assessments:

- flora and fauna survey report;
- threatened biodiversity assessment (seven part tests);
- threatened species recovery plans assessment;
- hollow bearing tree survey;
- *Environment Protection and Biodiversity Conservation Act 1999* assessment;
- SEPP 19 – Bushland in Urban Area assessment; and
- riparian and water course issues and management plan.

4.2.2 Rainforest and Riparian Vegetation

Conacher Environmental Group (2010) identified the Coastal Warm Temperate Rainforest within the site, predominately occurring within the drainage lines. This community corresponds with the Lowland Rainforest Endangered Ecological Community (ECC) as described within the *Threatened*

Species Conservation Act 1995. The location of this vegetation community within the site is identified in *Figure 4.1*.

A 50m development exclusion zone is proposed to be established around the identified rainforest vegetation. This exclusion zone will be afforded additional protection within a conservation zone. The proposed development exclusion zone is shown in Figure 1 of the Impact Mitigation Report for Riparian and Rainforest Vegetation (Conacher Environmental (refer to *Annex A).*

Larger more intact areas of the EEC (2.5 hectares) have been mapped in the southern parts of the site (see *Figure 4.1*). These areas are proposed to be dedicated to Council for conservation within the Kincumba Mountain Reserve (Conacher Environmental Group, 2010).

In addition, the riparian vegetation community of Coastal Narrabeen Moist Forest was identified on site by Conacher Environmental Group (2010) extending throughout the slopes and ridges of the central and southern parts of the site. This community grades into the Coastal Warm Temperate Rainforest.

Descriptions of these two vegetation communities prepared by Conacher Environmental Group (2010) are provided in *Annex A*.

Other vegetation communities identified on site (refer to *Figure 4.1*) include:

- Narrabeen Coastal Blackbutt Forest which is present as both disturbed and/or regenerating open forest in the central slopes of the proposed development area; and

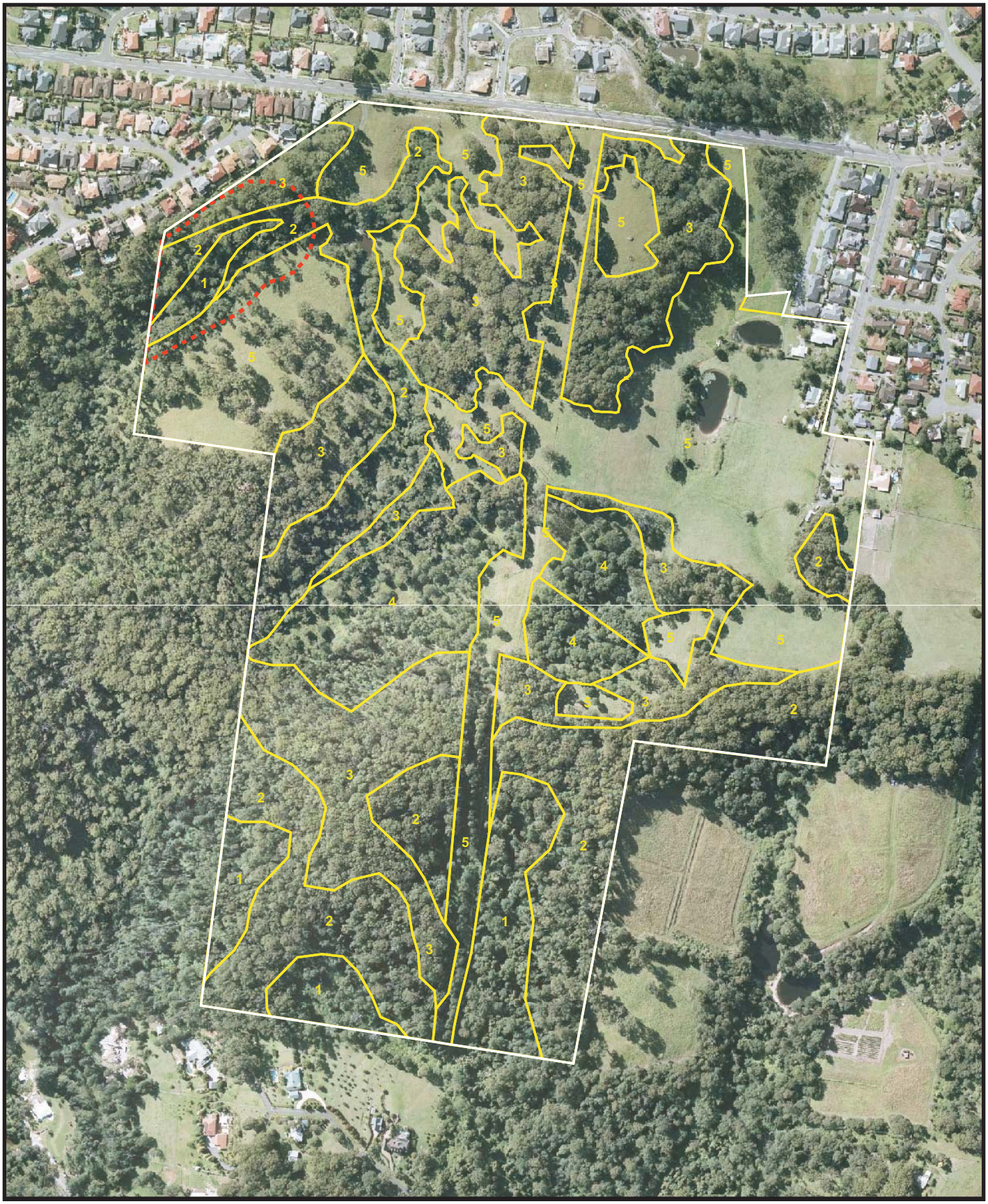
- cleared land characterised by grassland with scattered trees throughout the proposed development site with the exception of the southern part of the site.

4.2.3 Condition of Rainforest and Riparian Vegetation

The existing condition of the rainforest and riparian vegetation communities on site was assessed by Conacher Environmental Group (2010) (refer to *Annex A*).

Condition of Coastal Warm Temperate Rainforest

The Coastal Warm Temperate Rainforest in the north west of the site is currently buffered from impacts of existing residential development approximately 50 metres to the north by a narrow band (less than 10 metres wide) of Coastal Narrabeen Moist Forest and Narrabeen Coastal Blackbutt Forest. Downstream of the rainforest the drainage line is crossed by an existing farm access road.



Annex A - Figure 4.1

Vegetation Communities and Rainforest Buffer Area

Legend

- Subject Site Boundary
- Buffer to Rainforest
- 1 Coastal Warm Temperate Rainforest
- 2 Coastal Narrabeen Moist Forest
- 3 Narrabeen Coastal Blackbutt Forest
- 4 Disturbed Vegetation (regenerating)
- 5 Grassland with Scattered Trees

Notes:

1.Subject site boundary subject to final survey.
2. Survey locations are approximate and have not been fixed by land survey. Plan for indicative purposes only. Not for detailed measurement.
3. Vegetation Communities according to Bell 2004.

Source:

Conacher Environmental Group

Suffix	Revisions	Date	Init
R0	Preliminary Issue	17-12-10	JD

Client:	Crighton Properties Pty Ltd	
Project:	Parkside Terrigal Rezoning Report - Local Environmental Study	
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Date:	17/12/2010	Drawing size: A4
Drawn by:	JD	Reviewed by: AA
Scale:	Refer to Scale Bar	

N

0 100 200m

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This area of rainforest has been altered by past clearing, cattle grazing and edge effects from surrounding agricultural land. Weed infestation of a moderate to high level primarily in the shrub understorey and minor gully erosion is evident within the community.

Condition of Coastal Narrabeen Moist Forest

The Coastal Narrabeen Moist Forest community has been disturbed by past land use activities including logging and underscrubbing and high degree of edge effects from surrounding agricultural land. Minor gully erosion and minor disturbances associated with the construction of a bridge is evident within the community. Weed infestation of a moderate to high level primarily in the shrub and ground layer is evident within the community. In addition, an access road to the neighbouring lot traverses the Coastal Narrabeen Moist Forest.

4.2.4 Potential Impacts and Proposed Mitigation Measures

The proposed Parkside @ Terrigal Concept Plan provides for the retention of the rainforest and riparian vegetation throughout the site. An assessment of the potential impacts of development on the rainforest and riparian vegetation is provided in *Annex A*. The main impacts of development on the retained rainforest and riparian vegetation without management would be expected to include increased edge effects, alterations in hydrological regimes, increased sediment load and increase in nutrient load in riparian area resulting in altered floristics and structural characteristics including weed invasion. However, the retention of a buffer area and management of the retained vegetation along with implementation of appropriate stormwater controls will minimise these adverse impacts.

An assessment of the potential impact of the development on the Lowland Rainforest Endangered Ecological Community (EEC) was provided in the Threatened Species Biodiversity Assessments prepared by Conacher Environmental Group (2010) provided in Appendix 2 of Annex C of the LES. Retention, protection and management of the EEC within the development is expected to reduce an adverse effects on the EEC such that the development is unlikely to have an adverse effect on the extent of the community or adversely modify the composition of the community.

Design features of the proposed Concept Plan will ensure appropriate protection and management of the rainforest and riparian vegetation to minimise indirect impacts, including:

- exclusion of development from areas of Coastal Warm Temperate Rainforest;
- retention of the core riparian vegetation including the rainforest and areas of Coastal Narrabeen Moist Forest along the drainage line with a 50 metre

wide riparian buffer zone as determined in consultation with Department of Water and Energy;

- bush fire management measures have been incorporated into the existing road reserve; and adjoining future residential lots along the north west boundary have bush fire construction setbacks, ensuring fire management measures are located with adjoining lands, thereby ensuring the retention and protection of the rainforest and riparian vegetation communities;

- it is a legal requirement that the existing right of way access will need to be maintained (refer to *Section 4.3*); and

- management of the riparian vegetation protection zone by the Community Association in accordance with the Riparian and Buffer Zone Vegetation Management Plan. The plan has been provided in full in *Annex B*.

The following three vegetation management zones are proposed to provide for the retention and management of the rainforest and riparian vegetation:

- Rainforest Zone;

- Core Riparian Zone; and

- Riparian Buffer Zone.

Details on the description of these zones and proposed works are provided in Chapter 4 of *Annex A* and in the Riparian and Buffer Zone Vegetation Management Plan provided in full in *Annex B*. Key measures and management strategies contained within the management plan include:

- proposed weeding activities to be carried out within retained vegetation of the riparian area and riparian buffer zone;

- proposed regenerating activities to be carried out within and adjacent to retained vegetation;

- ongoing monitoring and maintenance activities; and

- relevant sediment and erosion control measures.

In addition, water quality management strategies to reduce level of nutrients are discussed further in *Section 4.3* of this assessment and in *Annex A*.

4.3 WATER QUALITY AND DRAINAGE

4.3.1 Water Quality

Given the site's location within the heavily urbanised Terrigal Lagoon Catchment, the issue of water quality management is considered critical to

ensure protection of natural systems to be retained on site and downstream and the integration of stormwater treatment measures.

A preliminary water cycle management plan was developed by Cardno Pty Ltd in 2005 (*Annex G* of the LES). This report examined two elements, the first being the recycling of domestic water through water sensitive urban design principles in conjunction with the reuse of wastewater and stormwater to reduce pressure on existing infrastructure services and water demand. The second element was the management of urban stormwater. This was addressed in a preliminary stormwater report prepared recently by Cahill and Cameron Pty Ltd for the western catchment of the site (*Annex P* of the LES).

Proposed water quantity and quantity measures to be implemented include the construction of on-site detention basins within the community precincts designed for a 100 year ARI event (see *Section 4.3* of the LES) and the implementation of allotment and community based stormwater quality measures in a treatment train approach to limit post developed pollutant loads to allowable levels.

Water quality management will be undertaken in two phases, the Construction Management Phase and the Post Development Phase.

General strategies likely to be implemented in the Construction Management Phase to ensure the management of water quality and runoff include:

- stabilisation of site access;
- installation of barrier and sediment fencing;
- energy dissipater on pipe outlets;
- use of geo fabric filter on drainage inlets and embankments;
- diversion of flow around disturbed areas using catch drains or banks;
- use of soil binder; and
- rapid revegetation following disturbance and protection of bare ground with mulch.

Similar erosion and sedimentation control measures are to be implemented during works within the riparian zone as identified in Section 2.5 and 2.6 of the Riparian and Buffer Zone Vegetation Management Plan (*Annex B*).

The main objectives of post development phase are urban stormwater pollution control and flow management. Upon completion of construction semi-permanent structures will be replaced with permanent mechanisms for the collection and treatment of rainfall runoff prior to discharging into the creek and detention basin systems including:

- rainwater tanks;

- grass lined inter allotment bio swales and exfiltration trenches;
- grass lined overland flow paths; and
- buffer filter strips.

Full details of systems are discussed in the Cardno 2005 report tabled in *Annex G* of the LES.

4.4 BUSH FIRE

The rainforest and riparian vegetation will be retained within the proposed development and will be identified as a low bush fire hazard for future development. A bush fire risk assessment has been prepared for the proposed Parkside @ Terrigal rezoning by Conacher Environmental Group (2010) and is provided in *Annex I* of the LES. This assessment considers the bush fire risk from the rainforest to development and provides appropriate bush fire protection measures. These measures such as asset protection zones and access for fire fighting equipment and personnel are all to be provided external to the riparian vegetation and rainforest areas thereby removing any potentially conflicting management objectives between bush fire and habitat enhancement outlined in the respective management plans for the development. Further, both plans will be enacted by the Community Association.

5 COMMUNITY TITLE AND MANAGEMENT OF THE RAINFOREST COMMUNITY

5.1 INTRODUCTION

The proposed Parkside @ Terrigal development will be a Community Title subdivision utilising the provisions of the *Community Land Development Act 1989* (see *Section 2.3*) All areas of open space within the development, including areas of rainforest and the riparian zone within the north of the site (ie that area not being dedicated to Council) will form part of the Community Scheme and will be managed in accordance with the Community Management Statement which contains 'rules' (By-Laws) by which the scheme will operate. This will allow for enforcement of home office provisions and effective management of community facilities and areas of open space and environment protection.

5.2 DEVELOPMENT CONTROLS AND COMMUNITY STRUCTURE

Annex H of the LES provided the draft Development Controls and Community Structure (Crighton Properties, 2008) for initial discussion with Council of the likely controls that will apply to the Parkside @ Terrigal development. The key features of the proposed Community Title subdivision that provide for the protection and management of the rainforest community on site include:

- providing the mechanism for the raising of and management of funds in order to cover the cost of management of the Community Assets, including the implementation of vegetation management zones and required management actions (for example weed control) throughout the rainforest, core riparian and riparian buffer zones, in accordance with the Riparian and Buffer Zone Vegetation Management Plan;

- providing a lawful mechanism (through the use of By-Laws) to regulate actions of the community members. These By-Laws, once established (upon registration of the subdivision) are enforceable under the *Community Land Management Act 1989*; and

- development and implementation of a comprehensive Asset Management Plan, the implementation of which will be enforceable under the Community Management Statement. The Asset Management Plan will comprise the following:

- vegetation management plan. A Riparian and Buffer Zone Vegetation Management Plan has been prepared which identifies management actions to protect and enhance the rainforest community and riparian corridor in the north west of the site (refer to *Annex B*). The implementation of this management plan will be enforceable under the Community Management Statement;

- water quality management plan;

- ecologically based site management plan – in accordance with the Ecological Site Assessment;

- bushfire management plan – in accordance with the Bushfire Risk Assessment; and

- asset maintenance schedule – to be prepared by a qualified building inspector on completion of Civil and Architectural works.

5.3 PROPOSED COVENANTS

To ensure that the Parkside @ Terrigal home based business estate is operated under the proposed Community Scheme, the site will be subject to an 88E restriction requiring it to be developed and managed in accordance with the Community Title legislation. In drafting this restriction, Gosford City Council would be the only authority with the power to vary the restriction. In addition to this restriction, a range of other restrictions under Section 88B or 88E would be registered in order to provide an additional level of control as detailed in *Table 5.1*.

Table 5.1 Proposed Covenants to apply to the Parkside @ Terrigal Development

Restriction Type	Description	Burden	Benefit	Authority Empowered to Vary
88E	Site to be managed as a Community Scheme in accordance with the Community Management Statement	Entire site	Community Association	Council
88B / 88E	Riparian Corridor to be managed in accordance with the Riparian and Buffer Zone Management Plan / Community Association to do the work	Riparian corridors on site	Community Association	Council
88B / 88E	Access to lots and Riparian Corridor to be managed in accordance with the Riparian and Buffer Zone Management Plan / Community Association to do the work	Riparian corridors off site (special facilities)	Community Association	Council
88B	APZ's to be managed in accordance with RFS requirements and findings of the BTA	APZ on individual lots	Individual lot owners / Community Association upon default	NSW Rural Fire Service
88B	Management of APZ in accordance with RFS requirements and findings of the BTA	APZ on Community Lot	Community Association	NSW Rural Fire Service

Section 4.2 outlines the aims and objectives of Gosford City Council's Rainforest Policy and consistency of the proposed Parkside @ Terrigal development with the objectives of the Rainforest Policy are discussed in detail in *Table 3.1*. In addition, the policy identifies that Council will conserve and protect rainforest areas though implementation of a number of measures including the following:

- provision of a 50 metre development exclusion zone;
- prohibition of industrial development and/or extractive industry within the rainforest catchment; and
- management of bush fire risks to the rainforest.

The proposed Parkside @ Terrigal complies with this policy in that it:

- provides a 50 metre development exclusion zone around the rainforest community in the north west of the site;
- does not include prohibited developments; and
- provides for management of bush fire risks through implementation of bush fire protection measures such as asset protection zones, defendable space and access for fire fighting personnel and equipment as identified in the Bushfire Assessment Report prepared by Conacher Environmental Group (2010) (see *Annex I* of the LES).

REFERENCES

Conacher Environmental Group, 2010, **Ecological Site Assessment Information for Local Environmental Study, 'Parkside', Kings Avenue, Terrigal**. Prepared for Crighton Properties Pty Ltd.

Conacher Environmental Group, 2010, **Bushfire Risk Assessment for Local Environmental Study, 'Parkside', Kings Avenue, Terrigal**. Prepared for Crighton Properties Pty Ltd.

Conacher Environmental Group, 2010, **Impact Mitigation Report for Rainforest and Riparian Vegetation, Proposed Rezoning 'Parkside", Kings Avenue Terrigal.** Prepared for Crighton Properties Pty Ltd.

Crighton Properties Pty Ltd, 2008, **Parkside @ Terrigal Development Controls and Community Structure, October 2008 – V1**, **for Discussion Purposes.**

Environmental Resources Management Australia Pty Ltd (ERM), 2010, **Parkside @ Terrigal Local Environmental Study**. Prepared for Crighton Properties Pty Ltd.

Gosford City Council, **Policy Manual – D6.49 Rainforest Policy**.

Annex A

Impact Mitigation Report

IMPACT MITIGATION REPORT

FOR
RIPARIAN AND RAINFOREST VEGETATION

PROPOSED REZONING
"PARKSIDE"
KINGS AVENUE
TERRIGAL

DECEMBER 2010
(REF: 10134)

www.cegconsult.com

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1. INTRODUCTION

This Impact Mitigation Report has been prepared to detail the measures proposed to ameliorate the potential impact of the proposed residential development located at Kings Avenue, Terrigal (Parkside), on the riparian and rainforest areas of the subject site. These amelioration measures are included as an integral component of the rezoning proposal and future site development.

Gosford Council's Rainforest Policy identifies that where rezonings apply to sites mapped or identified as containing any of the listed key rainforest species the applicant must include a SEE which addresses the impact of increased nutrients on the rainforest ecosystem. As such this Report has been prepared to provide details for inclusion in the Statement of Environmental Effects Report.

This Report is prepared as additional documentation to the previous ecological survey and assessment report and the Riparian and Buffer Zone Vegetation Management Plan prepared by *Conacher Environmental Group* (2010). The Report focuses on the riparian and rainforest areas of the subject site, particularly those riparian and rainforest areas in the northern part of the subject site which are adjoined by the proposed residential areas.

Council's Rainforest Policy identifies that Council will conserve and protect rainforest areas by adopting a minimum of a 50 metre development exclusion zone (fringe buffer zone) surrounding any rainforest area. The requirement of a 50 metre development exclusion zone around rainforest areas has been modified in numerous cases throughout Gosford since the Rainforest Policy was adopted in 1985. The Rainforest Policy does not identify that it is possible to implement a variety of management actions and rehabilitation strategies to reduce the impact of nearby developments on rainforest areas. Since the implementation of Councils Rainforest Policy Council has also adopted policies on Soil Erosion Control and Water Quality Management, which, if implemented would contribute to the protection and enhancement of rainforest areas generally and the rainforest patch on this site specifically.

The implementation of a 50 metre development exclusion zone only to the identified rainforest patch as identified in Council's Rainforest Policy is not likely to achieve the objectives of the Rainforest Policy to the degree that the implementation of a 50m buffer zone and additional environmental protection measures within the proposed development, as proposed in this Report would achieve. The following sections of this Report detail the various mechanisms and procedures that are proposed to reduce the potential impacts of development on the retained vegetation, in particular the patches of remnant rainforest present within the site.

2. OBJECTIVES OF COUNCIL'S RAINFOREST POLICY

Gosford Council has developed a Rainforest Policy which has identified specific policy objectives as listed below:

(a) To recognise the particular value of rainforests as a natural biological system and recognise the suites (dry, gallery, gully and littoral) that occur within them;
(b) To identify, conserve and protect rainforest communities in Gosford City for their ecological, educational and passive recreational values;
(c) To provide detailed vegetation mapping and assessment criteria for development assessment and rezonings;

(d) To increase public awareness of the importance of rainforest areas and support for their protection and where required, rehabilitation;
(e) To increase the level of protection for all rainforest areas and where appropriate bring them into public ownership;
(f) To identify priority sites for regeneration and rehabilitation of rainforest areas under the care and control of council; and
(g) To identify those areas which can be managed and preserved on both public and private land.

The retention of the riparian and rainforest vegetation, in association with the proposed vegetation management regimes and water/soil management proposals as outlined in this Report address the objectives of the Rainforest policy as detailed below.

(a) *To recognise the particular value of rainforests as a natural biological system and recognise the suites (dry, gallery, gully and littoral) that occur within them.*

This proposal acknowledges the value of the rainforest system present within the subject site. The proposal includes measures designed to protect, maintain and improve the quality of the rainforest vegetation.

(b) *To identify, conserve and protect rainforest communities in Gosford City for their ecological, educational and passive recreational values.*

The rainforest within the subject site has been described in detail in Section 3 - Site Characteristics and by *Conacher Environmental Group* (2010). This proposal has identified measures to conserve and protect areas of the rainforest on-site. The rainforest mapped within the southern section of the subject site has also been proposed for dedication to Council for conservation within Kincumba Mountain Reserve. This will conserve and protect areas of rainforest for ecological, educational and passive recreational values.

The development proposal and associated ecological management measures have been prepared to protect the ecological integrity of the rainforest areas present within the central and western drainage lines of the subject site through the establishment of the Core Riparian Zone, Rainforest Area and Riparian Buffer Zone management zones described above. The Parkside development will therefore conserve and protect areas of rainforest for ecological, educational and passive recreational values on-site.

(c) *To provide detailed vegetation mapping and assessment criteria for development assessment rezonings*

A detailed classification, description and map of the rainforest areas present within the subject site has been prepared by *Conacher Environmental Group* (2010). This Report provides details on the protective and management measures prepared to protect the rainforest vegetation present within the subject site and provides a framework for the management and conservation of rainforest within the southern area and western drainage lines of the subject site.

(d) *To increase public awareness of the importance of rainforest areas and support for their protection and where required rehabilitation*

The proposed development provides an opportunity for increasing public awareness in regard to rainforest areas. The marketing image of the project focuses strongly on the natural features of the subject site and its close proximity to the natural environment. The proposed development therefore provides an opportunity to increase public awareness in regard to the importance of rainforest areas and support for their protection and rehabilitation.

(e) *To increase the level of protection for all rainforest areas and where appropriate bring them into public ownership*

The rainforest mapped within the southern section of the subject site has been proposed for transfer to Council for conservation within Kincumba Mountain Reserve. It is also proposed to protect the rainforest within the western drainage line within the subject site though the establishment of the Core Riparian Zone, Rainforest Area and Riparian Buffer Zone management zones described above. Therefore the proposal will increase the level of protection rainforest areas and bring an area of rainforest into public ownership.

(f) *To identify priority sites for regeneration and rehabilitation of rainforest areas under the care and control of council*

The rainforest mapped within the southern section of the subject site, once transferred to Council could become a priority for regeneration and rehabilitation by Council.

(g) *To identify those areas which can be managed and preserved on both public and private land*

The areas within the Core Riparian Zone, Rainforest Area and Riparian Buffer Zone management zones described above will be managed and preserved within private lands. The areas of rainforest transferred to Gosford Council will be managed and preserved within public lands within Kincumba Mountain Reserve.

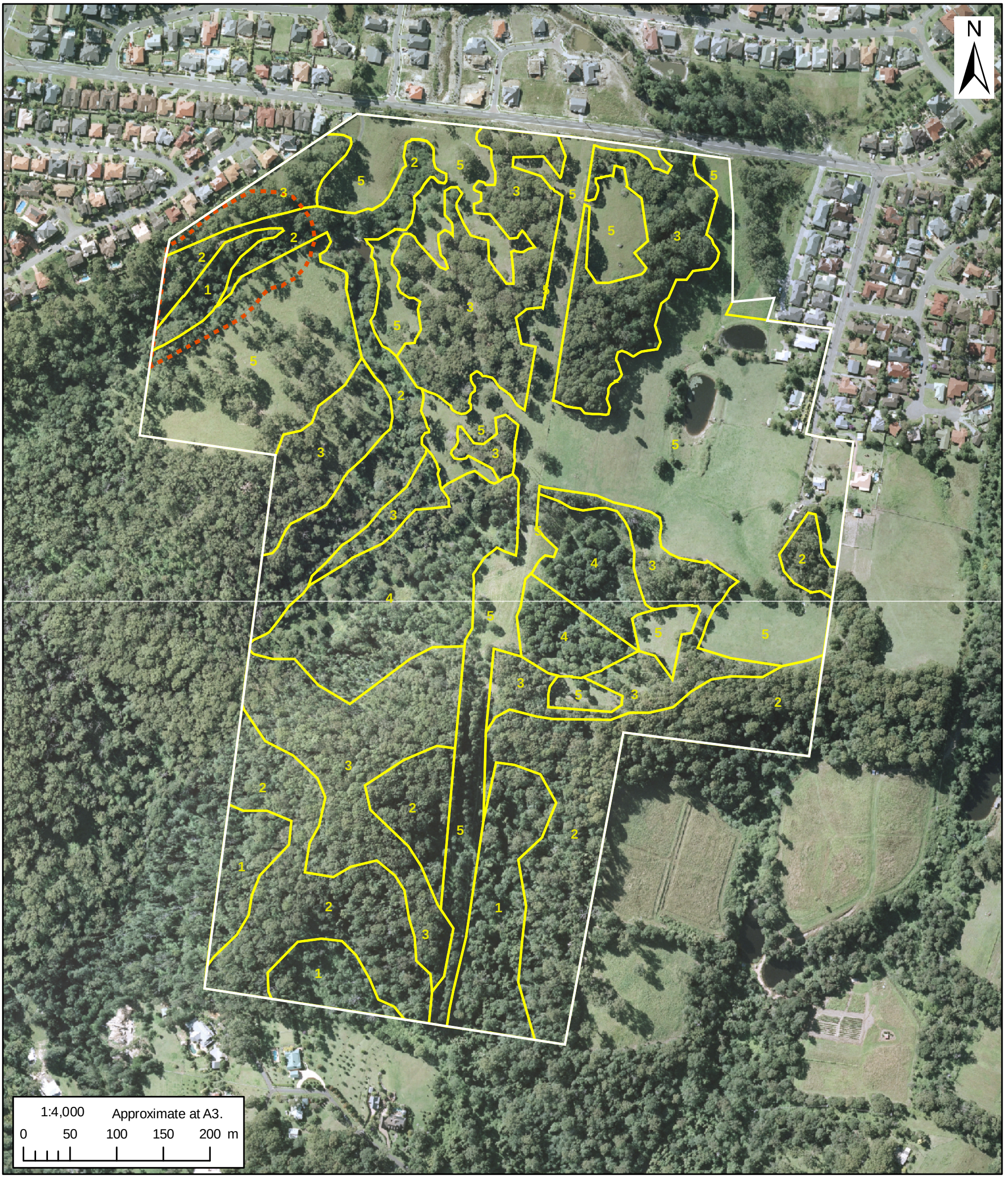
The rainforest area to be retained is proposed to be subject to any ongoing weed removal and bushland management regime which will improve its ecological condition and long term viability.

3. SITE CHARACTERISTICS

The biophysical characteristics of the overall site are described by *Conacher Environmental Group* (2010). The riparian and rainforest areas which are the focus of this Report are predominately within the riparian areas along the western and central drainage lines of the subject site and contain the following vegetation communities as described by *Conacher Environmental Group* (2010) and Bell (2004):

- Community 1 - Coastal Warm Temperate Rainforest;
- Community 2 – Coastal Narrabeen Moist Forest.

The locations of these vegetation communities within the site is shown in Figure 1.



Flora survey locations are approximate and have not been fixed by land survey.
Plan for indicative purposes only. Not for detailed measurement. *Subject Site boundary subject to final survey

Vegetation communities according to Bell 2004
Legend

- Subject Site Boundary
- Buffer to Rainforest
- 1 Coastal Warm Temperate Rainforest
- 2 Coastal Narrabeen Moist Forest
- 3 Narrabeen Coastal Blackbutt Forest
- 4 Disturbed Vegetation (regenerating)
- 5 Grassland with Scattered Trees

Original plan produced in A3 colour.

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Figure 1
Vegetation Communities and Rainforest Buffer Area
Kings Avenue, Terrigal

By.JM
16/12/10
Ref.No.10050

Source: Aerial © Department of Lands (2010)

The Coastal Warm Temperate Rainforest vegetation community is considered to be commensurate with the Endangered Ecological Community (EEC), Lowland Rainforest in the New South Wales North Coast and Sydney Basin Bioregions.

This area of EEC occurs as a linear patch of rainforest vegetation covering approximately 0.5 hectares (150 metres long by 30 metres wide) located along part of the western drainage line. Larger areas of this ECC (2.5 hectares) have been mapped in the southern parts of the subject site within an area proposed to be included within the Kincumba Mountain Reserve.

Descriptions of the two vegetation communities which collectively make up the riparian and rainforest vegetation communities discussed in this Report are provided below.

- **Coastal Warm Temperate Rainforest- (Archontophoenix *cunninghamiana, Acmena smithii* and *Livistona australis*).**

This vegetation is most similar to Map-unit 1 – Coastal Wet Gully Forest as described by House (2003) and Map-unit 1a – Coastal Warm Temperate Rainforest as described by Bell (2004).

***Structure*:**

Emergent Canopy: To 30 metres in height, with a variable Projected Foliage Cover (PFC) of 5-25%.

Canopy: To 20 metres in height, with a variable 70-80% PFC.

Shrubs: To 5 metres in height, with a variable 70% PFC.

Groundlayer: To 2 metres in height, with a variable 15-70% PFC.

Floristics:

(Main Species Present)

Emergent Canopy: *Eucalyptus saligna* (Sydney Blue Gum).

Canopy: *Archontophoenix cunninghamiana* (Bangalow Palm), *Acmena smithii* (Lillypilly), *Doryphora sassafras* (Sassafras), *Alphitonia excelsa* (Red Ash), *Livistona australis* (Cabbage Tree Palm), *Cryptocarya microneura* (Murrogun) and *Acacia schinoides*.

Shrubs: *Lantana camara* (Lantana), *Claoxylon australe* (Brittlewood), *Cyathea cooperi* (Straw Treefern), *Ficus coronata* (Sandpapper Fig), *Rubus rosifolius* (Forest Bramble), *Baloghia inophylla* (Brush Bloodwood) and *Wilkiea heugeliana* (Wilkiea).

Groundlayer: *Adiantum hispidulum* (Rough Maidenhair), *Blechnum cartilagineum* (Gristle Fern), *Carex longibracteata*, and *Viola hederacea* (Ivy-leaved Violet).

Vines: *Ripogonum fawcettianum* (Small Supplejack), *Morinda jasminoides, Smilax australis* (Lawyer Vine), *Smilax glyciphylla* (Sarsaparilla), *Flagellaria indica* (Whip Vine), *Stephania japonica* var. *discolor* (Snake Vine).

Disturbance:
This community has been disturbed by past logging, grazing and weed invasion. High levels of edge effects from the surrounding cleared agricultural land have also affected this community and some minor evidence of gully erosion.

Weed Invasion:
This community exhibits a moderate to high level of exotic weed invasion throughout, primarily in the shrub layer.

Variation:
The main variations within this community are associated with levels of disturbance or weed invasion and the broad transitions with the adjoining Coastal Narrabeen Moist Forest.

Location and Distribution:
This vegetation community is restricted to the bed of the steep well defined gully in the western drainage line and the southern areas of the subject site. The Coastal Warm Temperate Rainforest vegetation community is considered to be commensurate with the Endangered Ecological Community (EEC), Lowland Rainforest in the New South Wales North Coast and Sydney Basin Bioregions.

- **Coastal Narrabeen Moist Forest – (*Eucalyptus saligna, Eucalyptus pilularis* and *Syncarpia glomulifera*);**

This vegetation is most similar to Map-unit 1 – Coastal Wet Gully Forest as described by House (2003) and Map-unit 6a – Coastal Narrabeen Moist Forest as described by Bell (2004).

***Structure*:**

Canopy: To 30 metres in height, with a variable Projected Foliage Cover (PFC) of 25-50%.

Secondary: To 20 metres in height, with a variable 60-80% PFC.

Shrubs: To 5 metres in height, with a variable 40% PFC.

Groundlayer: To 2 metres in height, with a variable 50% PFC.

Floristics:
(Main Species Present)

Canopy: *Eucalyptus saligna* (Sydney Blue Gum), *Eucalyptus pilularis* (Blackbutt) and *Syncarpia glomulifera* (Turpentine).

Secondary: *Ligustrum sinense* (Small-leaved Privet), *Acmena smithii* (Lillypilly), *Doryphora sassafras* (Sassafras), *Acacia schinoides*, *Acacia prominens* (Gosford Wattle), *Alphitonia excelsa* (Red Ash), *Callicoma serratifolia* (Black Wattle), *Cryptocarya microneura* (Murrogun) and *Cinnamomum camphora* (Camphor Laurel).

Shrubs: *Lantana camara* (Lantana) *Citriobatus pauciflorus* (Orange Thorn), *Cyathea cooperi* (Straw Treefern), *Polyscias sambucifolia* (Elderberry Panax), *Rubus rosifolius* (Forest Bramble), *Trochocarpa laurina* (Tree Heath) and *Wilkiea heugeliana* (Wilkiea).

Groundlayer: *Adiantum hispidulum* (Rough Maidenhair), *Blechnum cartilagineum* (Gristle Fern), *Carex longibracteata*, *Cissus hypoglauca* (Water Vine), *Doodia aspera* (Rasp Fern), *Entolasia marginata* (Bordered Panic), *Gahnia aspera* (Saw Sedge), *Ehrharta erecta* (Panic Veldtgrass), *Gymnostachys anceps* (Settlers Flax), *Hypolepis Muelleri* (Harsh Ground Fern), *Oplismenus imbecillis* (Basket Grass), *Smilax australis* (Lawyer Vine), *Smilax glyciphylla* (Sarsaparilla), *Stephania japonica* var. *discolor* (Snake Vine) and *Viola hederacea* (Ivy-leaved Violet).

Disturbance:
This community has been disturbed by past logging and more recently underscrubbing within the southwest portions. High levels of edge effects from the surrounding cleared agricultural land have also affected this community. There are some minor disturbances associated with construction of a bridge within the northwest of the subject site and some minor evidence of gully erosion.

Weed Invasion:
This community exhibits a moderate to very high levels of exotic weed invasion throughout, primarily in the shrub and ground layer.

Variation:
The main variations within this community are associated with levels of disturbance. The recently underscrubbed parts of this community in the southwest of the subject site have very little foliage cover within the secondary tree and shrub layers while portions of the central drainage line have very little of the canopy cover remaining.

Location and Distribution:
This vegetation community occurs along the drainage lines of the subject site.

The drainage and hydrological characteristics of the subject site are described in the Water Cycle Plan (*Cardno* 2005). The drainage lines of relevance to this Report include the central drainage line (approximately 500 metres in length) and the western drainage line (approximately 200 metres in length).

Both the central drainage and western drainage lines exhibit various levels of disturbance from edge effects, eucalypt dieback, erosion and decreased water quality. The natural hydrological flow within the central drainage line has also been altered by the presence of an online dam.

The edge effects present are largely the result of previous disturbances and current grazing within the subject site which has resulted in the removal of native vegetation and the incursion of weeds. Eucalypt dieback is most likely attributed to an overabundance of psyllids and Bell Miners within the subject site. The access and presence of cattle in the drainage lines has contributed to erosion and a decrease in water quality and the further incursion of weeds. Water quality has also been reduced by runoff from fertilizers associated pasture improvements.

4. PROPOSED RETENTION AND MANAGEMENT OF RIPARIAN AND RAINFOREST AREAS

A detailed Riparian and Buffer Zone Vegetation Management Plan has been prepared for the site by CEG (2010) following consultation with the Department of Water and Energy. This Management Plan identifies the specific management and revegetation proposals within the identified riparian zone and buffer zones to the riparian areas.

The following zones have been proposed for the retention and management of riparian and rainforest areas within the subject site:

- Core Riparian Zone (CRZ);
- Riparian Buffer Zone (RBZ);
- Rainforest Area.

Descriptions of these zones and the proposed management and rehabilitation works are detailed below.

CORE RIPARIAN ZONE (CRZ)

The Core Riparian Zone (CRZ) includes the land contained within and adjacent to the channel. The width of the area required adjacent to the channel is measured horizontally from the 'top of bank' on both sides of the watercourse and determined by the order of the watercourse, which relates to its riparian functionality (DWE 2008). The watercourse within the subject site is a 'First Order' watercourse and therefore requires a 10 metre wide CRZ (DWE 2008). The actual CRZ proposed within the subject site is wider than this in some areas due to variations in the width of the watercourse and includes any areas occupied by dams or ponded water.

Current Condition
The vegetation within this area consists of mesic species forming a variable moderate to dense cover. Vegetation in some parts of the CRZ does not contain any eucalypts and is dominated by species such as *Alphitonia excelsa* (Red Ash)

Function
The CRZ will provide a vegetated corridor through which the watercourse flows. The vegetated banks will be stabilised by the existing and rehabilitated vegetation within the CRZ which will also provide habitat and linkages to other areas for native fauna species.

Regeneration Works proposed within the Core Riparian Zone

The following works are proposed within the CRZ:

- The establishment of Vegetation Protection Zones which shall include all of the CRZ and associated riparian buffer zone;
- Existing native vegetation to be retained in CRZ;
- Removal of weeds and invasive species from the CRZ by low impact methods;
- Regeneration of the native vegetation will be encouraged by the creation of space by weed removal, allowing natural regeneration of the vegetation by natural recruitment of propagules;
- Replanting of selected indigenous plant species within the CRZ;
- Natural regeneration of the native vegetation within the CRZ;

- Continued monitoring and maintenance of the condition of the vegetation within the CRZ;
- Construction of all watercourse crossings, culverts and creek bank stabilisation works to comply with the DWE guidelines; and
- Replanting of vegetation on the road batter adjacent to Kings Avenue to consolidate CRZ vegetation connectivity to other offsite areas of watercourse vegetation to the north. (These works are described in detail in the Riparian and Buffer Zone Management Plan).

RIPARIAN BUFFER ZONE (RBZ)

The Riparian Buffer Zone (RBZ) protects the environmental integrity of the CRZ from edge effects such as weed invasion. As such it is situated adjacent to the CRZ.

Current Condition
The RBZ is currently vegetated by either pasture grass or large trees with some small patches of riparian vegetation present.

Function
The 10m RBZ to the riparian areas is to function as an area to buffer the impacts of adjacent development on the vegetation and habitats of the CRZ, and to create areas of additional native vegetation from existing pasture vegetation.

Several strategies have been incorporated into designing this zone to buffer against the potential effects which the proposed development may have on the vegetation and habitats present. These strategies are targeted at:

- Sedimentation and erosion reduction;
- Water quality and hydrological flow maintenance;
- Access control;
- Riparian vegetation protection and enhancement;
- Fauna habitat and movement corridor enhancement;
- Protection of surrounding habitats.

Descriptions of each of the strategies proposed to achieve these objectives are provided below.

Sedimentation and Erosion Reduction
Water and soil quality will be maintained within the RBZ by preventing erosion and controlling construction area sediment load, particularly during times of peak flow. Soil stabilisation measures will be implemented to ensure the stabilisation of the upslope bank, the revegetation of cleared surfaces with native seeding and plantings and the exclusion of mowing and slashing.

Water Quality and Hydrological Flow Maintenance
Currently the large areas of cleared pasture on-site provide increased runoff and nutrients into the watercourse. Table 1 extracted from the report prepared by Cardno (2005) shows how runoff water quality differs with landuse. Treatment measures include gross pollutant traps, rainwater tanks, buffer strips, grass swales, bioretention trenches and a constructed wetland within the primary detention basin. Outlet protection systems will also be used to prevent scouring. It is proposed that clean

water, including overflow from roof water from the proposed development, will be channelled into the watercourse to maintain flows (Cardno 2005). The implementation of the water quality treatment and flow maintenance measures proposed will ensure that a change in landuse on the site will provide improved and acceptable outcomes both within the RBZ and for the output into the catchment.

TABLE 1
LAND USE / VEGETATION CATEGORIES*

Pollutant	Native Vegetation / Forest	Rural grazing	Urban
Sediments	85	500	50 to 200
Suspended Solids	6	30	85
Total Nitrogen	0.2	0.8	1.2
Total Phosphorus	0.03	0.09	0.13

*(Values derived using the Event Mean Concentration method (Cardno 2005))

Access Control
Access to the proposed RBZ will be restricted through the use of bollards, chains and retaining walls. The control of access into the RBZ and CRZ is necessary to reduce environmental damage caused by human disturbances such as the creation of unplanned walking tracks, dumping of rubbish and garden wastes and vehicle access.

The negative effects of livestock on riparian ecology, channel stabilisation, water quality, aquatic fauna habitats, terrestrial riparian wildlife populations and riparian vegetation is well documented (Kauffman and Krueger 1984). This is currently an issue on the subject site however these effects will be eliminated if the subject site is developed and the proposed riparian zone management procedures and program is in place.

Riparian Vegetation Protection and Enhancement
The native riparian vegetation currently along the watercourse is patchy, in places heavily weed infested and suffering the effects of grazing and trampling by livestock. The creation of the RBZ will ensure that revegetation of native species occurs to a distance of 10 metres along both sides of the watercourse. This will increase the quality of vegetation present and enhance the conservation outcome of the RBZ. Increased uptake of nutrients by the increased vegetative cover will help to reduce nutrient levels within the creek which contribute to nuisance algal and plant growth. Planting of vegetation surrounding the dam in the riparian zone will also help to reduce algal levels through shading and the reduction of water temperature levels (*Land and Water Australia* 2002).

The planting of a 10 metre wide strip of vegetation will also provide greater protection and dampening against strong winds which may uproot existing trees. The establishment of the RBZ will help to preserve riparian habitats within the subject site and provide a positive outcome for the conservation of the north-western patch of the Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregion endangered ecological community within the subject site

Fauna Habitats and Movement Corridor Enhancement
The proposed vegetation regeneration will help preserve habitat connectivity for locally occurring fauna. The RBZ will also facilitate the movement of native fauna throughout the central and western riparian areas and provide greater connectivity

with Kincumba Mountain Reserve. Replanting of vegetation on the road batter adjacent Kings Avenue is also proposed to consolidate flora and fauna connectivity to other off-site areas of watercourse vegetation to the north.

Protection of Surrounding Habitats
The above strategies will help to ensure that the current ecological condition of the downstream catchment of Terrigal Lagoon and its habitats are maintained. Furthermore two supplementary offline basins upstream of the primary basin in the north-east section of the subject site will be created to reduce the effects of stormwater overflow on the offsite wetland area adjacent to the north-eastern boundary. Ongoing weed management within the RBZ will help to prevent the further incursion of weeds upstream of the central and western riparian areas into Kincumba Mountain Reserve.

Regeneration Works within the Riparian Buffer Zone

- The establishment of Vegetation Protection Zones which shall include all of the CRZ and RBZ;
- Existing native vegetation areas within the RBZ to retain trees and natural vegetation;
- Removal of weeds and invasive species from the CRZ and RBZ;
- Grassed areas within the RBZ to be regenerated and replanted (where necessary) with native grass and shrub species;
- Replanting of selected indigenous plant species within the RBZ;
- Natural regeneration of the native vegetation within the CRZ;
- No mowing or slashing to be permitted within the RBZ;
- Continued monitoring and maintenance of the condition of the vegetation within the CRZ and RBZ;
- Installation of access controlling structures (bollards, fences, retaining walls etc) at strategic locations to prevent unauthorised access and disturbance by vehicles;
- Replanting of vegetation on the road batter adjacent to Kings Avenue to consolidate vegetation connectivity to other offsite areas of watercourse vegetation; and
- Long-term management will include ongoing weed control by low impact methods.

RAINFOREST AREA

Several areas of Rainforest characterised by non-eucalypt trees, palms and a dense layer of mesic shrubs and groundcovers are associated with parts of the CRZ and RBZ. The principal rainforest area is mapped as Vegetation Community 1 (*Conacher Environmental Group* 2008) and contains the areas identified as Coastal Warm Temperate Rainforest (Figure 1).

Current Condition
The areas of rainforest associated with the CRZ are currently affected by various levels of weed invasion from such species as Lantana and Bitou Bush.

Regeneration Works proposed within the Rainforest Areas
The rainforest areas will be retained and enhanced by weed removal and subsequent natural regeneration, or (if required), supplementary planting to achieve a good cover and diversity. As the Rainforest areas are contained within the CRZ and some of the RBZ, the following works are proposed for the Rainforest in tandem with the CRZ and RBZ:

- The establishment of Vegetation Protection Zones which shall include all of the CRZ, RBZ and Rainforest;
- Existing native vegetation is to be retained within the Rainforest areas;
- Removal of weeds and invasive species from the Rainforest areas by low impact methods;
- Regeneration of the native rainforest vegetation will be encouraged by the creation of space by low impact weed removal, allowing natural regeneration of the rainforest vegetation by natural recruitment of propagules;
- Replanting of selected indigenous plant species within the rainforest areas;
- Natural regeneration of the native vegetation within the rainforest areas will be encouraged;
- Continued monitoring and maintenance of the condition of the vegetation within the rainforest.

In addition to the CRZ & RBZ, a 50m development exclusion zone is proposed to be established around the identified rainforest vegetation. This exclusion zone will be afforded additional protection within a conservation zone. The proposed development exclusion zone is shown in Figure 1.

5. WATER QUALITY MANAGEMENT

Several water management strategies have been designed by Cardno (2005) and *Cahill and Cameron* (2007) for the effective management of water quality for the Parkside development to ensure the protection of natural systems and the integration of stormwater treatment measures within the natural and man made environment. The reduction of runoff volumes and peak flows and the protection of water quality and the maintenance of environmental flows are key priorities of the management strategies proposed.

Best Management practices are to be implemented before and during construction as well as after the subdivision is built for the purpose of reducing to acceptable or negligible levels, the potential export of pollutants to comply with Gosford City Council's DCP 165.

It is proposed that water quality management will be undertaken in two phases, the Construction Management Phase and the Post Development Phase. Strategies likely to be implemented during these phases to ensure the maintenance of water quality with the central drainage line and the western drainage line are outlined below.

Construction Management Phase

The main objective of the construction management phase is to ensure the management of water quality. Suitable control measures to be implemented during this phase are likely to include:

- Protection of bare ground with mulch;
- Rapid revegetation following earthwork disturbance;
- Installation of temporary retarding basins to trap sediments;
- Stabilisation of site access;
- Implementation of barrier and sediment fencing;
- Installation of energy dissipaters on pipe outlets;
- Instillation of geo fabric on drainage inlets and embankments;
- Diversion of flow around disturbed areas using catch drains or banks;
- The use of soil binder; and

- Grassing and landscaping of disturbed areas.

These controls have been designed to take into account the nature of the topography of the subject site and will help to manage the quality of water runoff into drainage lines and water runoff from the subject site.

Post Development Phase

The main objectives of the post development phase of water quality management are urban stormwater pollution control and flow management in the local environment.

Flow management within the CRZ will be achieved by the following methods:

- Reducing the number of discharge points;
- Providing scour protection;
- Providing erosion protection at outlets; and
- Dissipating the pipe or overland concentrated flow.

Stormwater will be managed by the collection and treatment of rainfall runoff from paved and landscape areas, prior to it discharging into the creek and dams. The proposed collection and treatment methods include the utilisation of:

- Rainwater tanks
- Grass lined inter allotment bio swales;
- Grass lined overland flow paths; and
- Buffer strips.

At the subdivision level the existing dams will be used as minor gross pollutant traps and ponds to ensure that no unacceptable discharges occur from the development site.

The water management systems proposed are expected to achieve the post-development pollutant load retention levels shown in Table 2 specified in the Gosford Council publication "Water Cycle Management Guidelines", for sites draining into coastal catchments such as Terrigal lagoon, as extracted from the report prepared by Cahill and Cameron (2007).

TABLE 2
POST DEVELOPMENT POLLUTION TREATMENT RATES

Pollutant	Gosford Council Water Cycle Management Guidelines
Suspended Solids	80% retention
Total Phosphorus	45% retention
Total Nitrogen	45% retention
Gross pollutants	Retention of litter greater than 40mm in size for flows up to 25% of the 1-year ARI peak flow
Oil and grease	No visible pollution downstream of the site for flows up to 25% of the 1-year ARI peak flow

6. ASSESSMENT OF POTENTIAL IMPACTS AND AMELIORATION MEASURES

There are a range of threatening processes listed in the *Threatened Species Conservation Act* (1995) which are relevant to the riparian and rainforest areas within the subject site. Proposed management strategies and amelioration measures to

decrease the operation of these threatening processes within riparian areas and the rainforest area of the western drainage line on-site have been identified below.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**

  Currently the large areas of cleared pasture and grazing land on-site provide increased runoff and increased nutrients into the watercourse. It is proposed that overflow from roof water from the proposed development will be directly channelled into the watercourse to maintain flows (*Cardno* 2005).

- **Clearing of native vegetation**

  Clearing of native vegetation will not occur within the RBZ and vegetation that has been previously cleared or degraded by farming will be regenerated with native species.

- **Competition and grazing by the feral European Rabbit**
- **Competition and habitat degradation by Feral Goats**
- **Herbivory and environmental degradation caused by feral deer**
- **Predation by the European Red Fox *Vulpes vulpes* (Linnaeus, 1758)**
- **Predation by the Feral Cat, *Felis catus* (Linnaeus, 1758)**
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*, Linnaeus 1758**

  The future changed land use from stock grazing to residential development with ongoing management of reserved and open space lands will decrease the potential for the site to be degraded by rabbits, deer, foxes, pigs and goats.

  Management of domestic dogs and cats will be required to ensure that these animals do not disturb or predate fauna within the retained habitats on the site.

- **High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.**

  It is expected that the CRZ will be less vulnerable to high fire frequencies as a result of the proposed development. This will ensure the protection of the riparian vegetation, native animals and the habitats present.

- **Invasion and establishment of exotic vines and scramblers**
- **Invasion, establishment and spread of Lantana**
- **Invasion of native plant communities by *Chrysanthemoides monilifera***
- **Invasion of native plant communities by exotic perennial grasses**

  Weeding works proposed for the RBZ will ensure the removal of exotic vines and scramblers such as *Anredera cordifolia* (Madiera Vine), *Rubus anglocandicans** (Blackberry) and *Cardiospermum grandiflorum* (Balloon Vine). The proposed weeding program will also result in the removal of Lantana, *Crysanthemoides monilifera* and exotic perennial grass species.

- **Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners**

This threatening process is currently an issue within the subject site with the dieback of eucalypt canopy occurring within the RBZ. The proposed vegetation regeneration works will ensure seedling establishment in areas suffering from dieback through weed management. This will help to manage the loss of forest structure within these areas.

- **Predation by *Gambusia holbrooki* Girard, 1859 (Plague Minnow or Mosquito Fish)**

  The restoration of fully functioning ecosystems and ecological processes has been suggested as an indirect method of control in the 'Approved NSW Threat Abatement Plan for Predation', which may help to reduce the abundance of *Gambusia holbrooki* within the subject site, which will in turn decrease current predation pressure on native frog species.

- **Removal of dead wood and dead trees**

  The management of the RBZ will ensure that dead wood and dead trees are not removed. The placement of dead wood within the RBZ from areas to be developed within the subject site will be considered as a strategy to improve and promote fauna habitats. In particular, any tree hollows to be removed from the subject site will be placed throughout the non-development areas to provide hollow log habitat for ground dwelling fauna.

  The range of threatening processes listed on the *Fisheries Management Act* (1994) and proposed management strategies which are relevant to the protection of the proposed RBZ are identified below.

- **The removal of large woody debris from NSW rivers and streams**

  The management of the RBZ will ensure that large woody debris are not removed from the watercourse where possible. Large woody debris will be relocated rather than removed from the RBZ as identified in the Riparian Zone Management Plan.

- **The degradation of native riparian vegetation along New South Wales water courses**

  The management of the proposed RBZ will ensure regeneration of all degraded riparian vegetation to 10 metres either side of the CRZ and the ongoing monitoring and maintenance of vegetation within the CRZ.

- **Instream structures and other mechanisms that alter natural flow**

  The proposed development incorporates two watercourse crossings which are expected to comply with the NSW Department of Water and Energy (DWE) *Guidelines for Controlled Activities – Watercourse Crossings* (DWE 2008). This will ensure that in stream structures will not alter natural flows. As described above it is proposed that overflow from roof water from the proposed development will be directly channelled into the watercourse to maintain natural flows (Cardno 2005).

7. CONCLUDING COMMENTS

Standard development setbacks between residential and bushland areas are most likely to be less effective unless active management of the bushland is undertaken and other measures to reduce impacts are implemented.

Buffer zones require ongoing active management to maintain the objective of protection of a core habitat/vegetation area. The width of a buffer zone determined by a prescriptive, standard distance is not likely to achieve sustainable long term protection or conservation to an altered ecosystem, such as a rainforest vegetation community, as would a buffer zone and additional environmental/ecological management measures implemented with specific objectives and actions.

This Report has provided specific and general details as to how the rainforest area can be retained, protected and managed to ensure its long term survival within the site.

The implementation of a standard 50 metre development exclusion zone alone around the rainforest area as identified in Council's Rainforest Policy would not provide any mechanism to control or reduce the long term impacts of weed invasion, nutrient encroachment, access or vegetation dieback. As a result, a combination of a 50m development exclusion zone and active management within the riparian buffer zone (RBZ) is proposed.

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Annex B

Riparian and Buffer Zone Vegetation Management Plan

RIPARIAN, BUFFER ZONE AND PRIVATE CONSERVATION AREAS VEGETATION MANAGEMENT PLAN

"PARKSIDE"
KINGS AVENUE
TERRIGAL

DECEMBER 2010
(REF: 10134)

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PREFACE

This Vegetation Management Plan has been prepared by *Conacher Environmental Group* to identify matters in relation to the management of riparian vegetation and private conservation land proposed to be retained, rehabilitated and managed on the site.

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SECTION 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This Vegetation Management Plan (VMP) provides details on the management of vegetation within riparian areas, buffer zones and private conservation areas during and after the proposed residential subdivision.

Riparian corridors form a transition zone between terrestrial and aquatic environments and perform a range of important environmental functions. Riparian corridors:

- Provide bed and bank stability and reduce bank and channel erosion;
- Protect water quality by trapping sediment, nutrients and other contaminants;
- Provide a diversity of habitat for terrestrial, riparian and aquatic flora and fauna species;
- Provide connectivity between wildlife habitats;
- Allow for conveyance of flood flows and control the direction of flood flows;
- Provide an interface between developments and waterways.

Measures and management strategies for the protection of native riparian vegetation within the site are outlined within this document. These include:

- Proposed weeding activities to be carried out within retained vegetation of the riparian area and buffer zone;
- Proposed regeneration activities to be carried out within and adjacent to retained vegetation;
- Ongoing monitoring and maintenance activities to be carried out within retained vegetation of the site;
- Relevant sediment/erosion control measures.

Private Conservation areas seek to enhance biodiversity connectivity and fauna movement across the site. Proposed biodiversity improvement measures include:

- Weed management;
- Natural regeneration;
- Assisted revegetation;
- Habitat enhancement by additional groundcover and nest boxes.

In preparing this VMP, a number of existing reports have been utilised. Brief details on these are provided below:

1. Urban Bushland Management Guidelines (Dept. of Planning, 1991)

The Department of Urban Affairs and Planning's Guidelines for Preparing Management Plans for Urban Bushland have been followed when preparing this management plan. The Urban Bushland Management Guidelines (Dept. of Planning, 1991) contain a number of relevant strategies, which are aimed at maintaining and enhancing native flora and fauna and their habitats.

2. Landscape and Vegetation Management Policy (Gosford City Council)

The Gosford City Council's Landscape and Vegetation Management Policy has been adhered to in the preparation of this report.

3. Guidelines for Controlled Activities – Vegetation Management Plans

A controlled activity is an activity undertaken within the riparian zone of a water body. The NSW Department of Water and Energy (DWE) has issued guidelines for undertaking Vegetation Management Plans in relation to controlled activities. These guidelines outline the requirements and criteria to be considered within a Vegetation Management Plan. The DWE guidelines were considered and followed when compiling this Vegetation Management Plan.

4. Guidelines for Controlled Activities – Riparian Corridors

This guide produced by the NSW Department of Water and Energy (DWE) outlines the various components of a riparian corridor and defines the widths of Riparian corridors based on the stream size or 'order'.

5. Guidelines for Controlled Activities – Watercourse Crossings

This guide produced by the NSW Department of Water and Energy (DWE) outlines the various requirements and consideration for watercourse crossings of various designs. The proposed development incorporates two watercourse crossings which are expected to comply with these guidelines.

1.2 PROCEDURE FOR PREPARING VEGETATION MANAGEMENT PLAN

This Vegetation Management Plan has been prepared to address the following matters:

- Protection of retained native vegetation, habitat and other elements of biodiversity within the riparian zone, biodiversity buffer areas and private conservation lands;
- Management of the riparian zone vegetation and buffer zones and private conservation lands;
- Noxious and bushland weed control with follow up weeding and maintenance of bushland and riparian vegetation on site;
- Soil erosion and drainage issues that impact on vegetated areas;
- Site management during construction works including silt fencing and exclusion fencing around native vegetation habitats and natural features.

This VMP is the culmination of detailed site investigations, consultations with the client and incorporation of information as required by Council and state government departments.

The following procedures were implemented during the preparation of the VMP:

i) Initial project meeting with client to discuss project;

ii) Site Inspections to locate and identify any significant vegetation and to establish the current condition of the riparian and surrounding vegetation; and

iii) Consideration of the proposed development to minimise the impact on areas of natural vegetation and enhance current stands of natural vegetation where possible.

The following sections of this VMP identify issues relevant to proposed development and future management of the site in relation to retained vegetation.

1.3 SITE DETAILS

The riparian and buffer areas subject to this Vegetation Management Plan consist of the 7(c2) – Conservation and Scenic Protection zoned land and 7(a) Conservation zone land located in and adjacent to the creeklines within 'Parkside' at Kings Avenue Terrigal and within the corridor areas identified Figure 2.

1.4 PROPOSED DEVELOPMENT

It is proposed to subdivide the land to create residential building allotments with associated infrastructure such as access, electricity and water. The proposed development will also provide for a Riparian Zone with retained vegetation that will be managed together with its associated 10 metre vegetated buffer on both sides with a further 10 metre wide bushfire asset protection zone outside the vegetation buffer zone as shown in Figure 1. Additionally some areas to be privately owned will be managed in accordance with this plan by the community association.

The overall objective of this Vegetation Management Plan is to provide details on how the site can be managed to create a mosaic of vegetation, including trees, shrubs and grass cover within a weed reduced riparian area and adjoining buffer areas and corridor areas.

The areas included within this Vegetation Management Plan will become the responsibility of a combination of the Community body covered under the Community Title Management Statement and the private landholders in the rural residential parts of the site. Figure 2 identifies the approximate areas covering the future community land, private land within the development area and private land not included within the area of proposed works. The works required in the adjoining, but off-site lands 7(a), would require agreement with the adjacent landowner to be undertaken. We understand that mutual consent by adjacent land owners has been formalised.

SECTION 2

VEGETATION MANAGEMENT STRATEGY

2.1 DETAILS ON PROTECTIVE MEASURES AND MANAGEMENT STRATEGIES FOR THE VEGETATION IDENTIFIED WITHIN THE SITE

It is considered that the remaining native vegetation within the subject site provides habitat for native flora and fauna species within the canopy, shrub and groundcover layers. The tree and shrub canopy is visible from nearby roads and forms part of a fragmented drainage line vegetation community.

The subject site has been subjected to past as well as more recent placement of fill material. The whole of the subject site also suffers a high level of weed invasion especially within the riparian zone.

Protective measures recommended within the subject site are:

- A Core Riparian Zone (CRZ) be established based on the order of the watercourse. The watercourse on-site is a First Order watercourse and therefore requires a 10 metre wide CRZ. The actual CRZ proposed is wider than this;
- A Vegetated Buffer (VB) of 10 metres width be established on both sides of the CRZ;
- The establishment of Vegetation Protection Zones which shall include all of the Riparian Zone (CRZ) and Buffer Area (VB) as shown on Figure 1;
- Removal of weeds and invasive species from the Riparian Zone and Buffer Areas;
- Replanting of selected indigenous plant species within riparian buffer zone;
- Natural regeneration of the native vegetation within the Riparian Zone;
- Continued monitoring and maintenance of the condition of the vegetation within the Riparian Zone and Buffer Area;
- Installation of access controlling structures (bollards, fences, retaining walls etc) at strategic locations to prevent unauthorised access and disturbance by vehicles;
- Construction of all watercourse crossings, culverts and creek bank stabilisation works to comply with the DWE guidelines;
- Replanting of vegetation on the road batter adjacent to Kings Avenue to consolidate vegetation connectivity to other offsite areas of creekline vegetation;
- Natural regeneration, weed management and assisted revegetation by replanting native plant species within existing cleared areas identified within the 7(a) conservation zone on private lands.

2.2 DETAILED PROPOSED WEEDING ACTIVITIES TO BE CARRIED OUT WITHIN RETAINED VEGETATION OF THE SITE

The objectives of management actions are to manage natural vegetation and rehabilitate the disturbed vegetation within this site. This will primarily involve the removal of weed infestations, replanting of suitable native species and the ongoing maintenance of disturbed areas. There are currently a number of bush regeneration techniques used in bushland management for the removal of weeds. These include (Buchanan, 1989):

- the Bradley Method of minimal soil disturbance during weed removal;
- clearing and stabilising techniques;
- the use of herbicides;
- the use of fire; and
- biological controls.

The weed removal / bush regeneration technique that is most suitable for this situation is a variation of the Bradley Method. This method identifies that weed removal should be accomplished with minimal disturbance to the soil and surrounding native plants, an ideal situation in areas sensitive to erosion and where native plants can regenerate. The Bradley Method incorporates three basic philosophies:

- Work from areas containing less disturbed native vegetation towards more weed infested areas;

- Minimal disturbance to the soil and surrounding native plants. This is an important aspect especially in this situation as the topography and riparian morphology of the site makes it susceptible to erosion once plant cover has been removed;

- Allow natural native plant regeneration to occur throughout the native plant community. In some cases it may be necessary to assist regeneration by replanting areas of weed removal with locally occurring native species.

It is expected that weed removal within the subject site will be undertaken in accordance with methods described below and in Appendix I.

Exotic species targeted for removal throughout the duration of the management plan are listed in Table 2.1. General management strategies enabling appropriate removal of these species are provided in Appendix I.

TABLE 2.1
EXOTIC SPECIES TARGETED FOR REMOVAL

On Site	Scientific Name	Common Name
#	*Ageratina adenophorum*	Crofton Weed
	Bambusa sp.	Bamboo
#	*Cirsium vulgare*	Spear Thistle
#	*Impatiens walleriana*	Busy Lizzie
#	*Lantana camara*	Lantana
#	*Ligustrum sinense*	Small-leaved Privet
#	*Lonicera japonica*	Japanese Honeysuckle
	Musa sp.	Banana
#	*Nephrolepis cordifolia*	Fishbone Fern
#	*Nicotiana glauca*	Tobacco Bush
#	*Paspalum dilatatum*	Paspalum
#	*Paspalum urvillei*	Vasey Grass
#	*Cortaderia selloana*	Pampas Grass
#	*Protasparagus aethiopicum*	Asparagus Fern
#	*Rubus anglocandicans*	Blackberry
#	*Senna pendula var. glabrata*	Cassia
#	*Thunbergia alata*	Black-eyed Susan
#	*Tradescantia fluminensis*	Wandering Jew
#	*Zantedeschia aethiopica*	White Arum Lily
# = Species observed on site		

Other invasive weed species may occur after the initial weeding phase. These species should be removed during the maintenance period for this plan.

The extent of weed infestations present and intensity of weed control/removal works required vary throughout the riparian areas. Figure 2 identifies the extent of areas within the site requiring high, medium and low intensity weed removal and regeneration works.

The initial stages of the weeding phase of this plan are estimated to take approximately four weeks, while the ongoing maintenance period for the restoration process should continue for at least two years in order to be effective.

Monitoring of the progress of weed removal, plant growth and natural regeneration should be undertaken on a minimum of a yearly basis with progress reports, including photographs, prepared and forwarded to Gosford City Council and the Department of Energy and Water.

2.3 DETAILED PROPOSED REGENERATION AND REPLANTING ACTIVITIES TO BE CARRIED OUT WITHIN RIPARIAN AND BUFFER ZONE AND PRIVATE CONSERVATON LAND

The native vegetation within the site subject to this Riparian and Buffer Zone Vegetation Management Plan is generally restricted to the Riparian Zone and the 10 metre wide Buffer Zone between the Riparian Zone and future development. It is expected that removal of the weed species in these areas in accordance with Section 2.2 will allow natural regeneration of the locally endemic native species. Additionally where supplemental planting is required the species identified in Table 2.2 should be considered for replacement planting. Revegetation will ensure bed and bank stability along the subject watercourse and increased biodiversity for cleared land on the upper-slopes of the site.

While a mixture of species have been recommended it would be appropriate that these be planted in groups of at least 10 plants of the same species at appropriate spacing for each species. This will achieve a clumping effect for planted species.

Additionally it is anticipated that natural recruitment of the tree, shrub and groundcover layers will occur within the buffer adjacent to retained native riparian vegetation.

Replanting stock is to be grown from cuttings and seeds of plants growing on the site. Exotic species are not to be used for replanting or rehabilitation works. These plants are then to be planted into suitably prepared areas within the buffer zone. The combination of planting species has been selected to provide a continuation of the moist forest/vegetation with mesic elements characteristic of the riparian vegetation.

This mesic / riparian type vegetation also has a lower bushfire risk to nearby developments than the drier open forests dominated by large eucalypts.

Planting rates for areas to be replanted within the buffer zone will vary according to the presence of existing vegetation. Planting rates greater than 12-18 plants per 100 square metres (for the tree, shrub and ground layers combined) are recommended to achieve the closed forest/rainforest type vegetation proposed.

TABLE 2.2 RECOMMENDED SPECIES FOR RE-PLANTING	
Scientific Name	**Common Name**
Trees	
Eucalyptus saligna	Blue Gum
Eucalyptus pilularis	Blackbutt
Acacia prominens	Gosford Wattle
Acmena smithii	Lillypilly
Alphitonia excelsa	Red Ash
Archontophoenix cunninghamiana	Bangalow Palm
Elaeocarpus reticulatus	Blueberry Ash
Livistona australis	Cabbage Tree Palm
Sloanea australis	Maidens Blush
Shrubs	
Acacia binervia	Coast Myall
Acacia suaveolens	Sweet Scented Wattle
Omalanthus populifolius	Bleeding Heart
Pittosporum revolutum	Yellow Pittosporum
Polyscias sambucifolia	Elderberry Panax
Wilkiea heugeliana	Wilkiea
Dianella caerulea var. *producta*	Blue Flax Lily
Dichelachne micrantha	Short-hair Plume Grass
Doodia aspera	Rasp Fern
Entolasia marginata	Bordered Panic
Gymnostachys anceps	Settlers Flax
Lepidosperma laterale	Variable Sword-sedge
Note: Natural germination and establishment of other native species is to be encouraged	
Note: Other native species present within the site can be added if required	

In addition to the riparian and buffer areas, vegetation replanting is proposed for the road batters above the creek culvert that flows under Kings Avenue. This area is to be revegetated to consolidate the connectivity of creekline vegetation with other areas offsite.

2.4 DETAILS OF ANY ONGOING MONITORING AND MAINTENANCE ACTIVITIES TO BE CARRIED OUT WITHIN RETAINED VEGETATION OF THE SITE

It is recommended that regular monitoring inspections be undertaken at 6 monthly intervals for 2 years after weeding and replanting works have been undertaken. This will allow the determination of the health of the vegetation and may include identification of any areas suffering from disturbance or in need of rehabilitation, weed control, sediment or storm water control, bank and soil stabilisation or maintenance of rehabilitated or regenerating areas.

Monitoring and review will include a performance evaluation of the works and will include assessment for replanting where losses have occurred, addressing any deficiencies observed, and determining a successful outcome. A successful outcome is usually defined as a minimum of 80% survival rate for all plantings and a maximum of 5% weed cover for the treated riparian corridor is achieved.

Following these monitoring inspections a report with accompanying photos (taken at repeatable locations) will be submitted to Council and Department of Water and Energy. Photo points will be located by GPS or shown on survey maps.

Maintenance is to be undertaken within the regenerating bushland every week for the first 12 months. Maintenance will include watering, replacement planting, weeding (herbicide or low impact weeding as required), re-erecting sediment fencing, mulching, removing rubbish and regular inspections and performance assessment.

All monitoring and maintenance post development is to be the responsibility of the Community Association.

2.5 SOIL EROSION AND DRAINAGE ISSUES

The objective of stormwater management is to ensure drainage from upstream and the nearby residential areas and associated infrastructure does not have a negative impact on vegetated areas, dwellings and surrounding waterways.

Erosion and sediment control measures are to be implemented to minimise adverse effects as a result of increased erosion and sediment loading. These include:

- Coordinated work practices aimed at minimising land disturbance;
- Implementation of appropriate erosion and sediment control measures;
- The minimisation of groundcover disturbance through the dedication of vegetation protection zones encompassing the Riparian Zone and the Buffer Area;
- Routine site inspections of drains, channels, sediment control structures and water quality;
- Identification of potential erosion areas;
- Installation and maintenance of flow control structures and soil stabilising vegetation wherever required;
- Construction of all watercourse crossings in accordance with the DWE guidelines.

The minimisation of soil erosion will be achieved through soil stabilisation measures, sediment fencing and water control techniques. Soil stabilisation measures to be implemented include, immediate revegetation of cleared surfaces via seeding, planting of native species, mulching and the installation of biodegradable blankets.

2.6 SITE MANAGEMENT DURING CONSTRUCTION

Inspections of the site by the supervising consultant should be undertaken prior to and during the construction operations to ensure that vegetated areas designated for retention and exclusion zones are adequately marked and that other appropriate protection procedures are being maintained. Construction and landscape works are likely to alter the environment and soil properties surrounding the vegetation retained on site. Therefore, the following management strategies are proposed to minimise damage to native vegetation retained during the construction period.

Exclusion zones

The compaction of soil surrounding retained vegetation is detrimental to root growth by reducing water infiltration and soil oxygenation rates. A vegetation protection zone will be established containing the Riparian Zone and the Buffer Area in accordance with the vegetation protection guidelines (Section 2.7) using post and wire fencing or suitable high visibility marking tape or orange plastic net fencing. This will reduce the effects of soil

compaction by prohibiting vehicle access and the stockpiling of construction material such as soil and woodchips within the vegetation protection zone.

Silt Fencing
Erosion and sediment control measures are to be implemented to minimise adverse effects of increased erosion and sediment loading. These include: the safe disposal of waste products, coordinated work practices aimed at minimising land disturbance, the disposal of 'clean' water off site, the minimisation of vegetation disturbance through the dedication of 'no go areas', routine site inspections of drains, channels, sediment control structures and water quality, identification of potential erosion areas, installation and maintenance of flow control structures and soil stabilising vegetation wherever required.

The minimisation of soil erosion will be achieved through soil stabilisation measures and water control techniques. Suitable soil stabilisation measures to be implemented include the immediate revegetation of cleared surfaces via seeding, planting of native species, mulching or the installation of biodegradable blankets. Suitable water control measures include construction of earth banks, catch drains, detention and sediment ponds (including Gross Pollutant Traps), grassed and armoured waterways, rock earth and sand bag dams and outlet protection systems to prevent scouring.

Mulching
Mulching is an efficient method to impede the establishment of weed species, soil erosion, compaction and desiccation. Woodchip or other suitable mulch is to be placed at a depth of 75-100mm covering any areas of tree replanting or landscape areas. Areas surrounding the stems/trunks of plants are to be kept free from mulch, thereby reducing the incidence of collar rot on retained or planted flora.

2.7 VEGETATION PROTECTION GUIDELINES

The following guidelines are proposed in relation to retained vegetation on the site and the proposed development:

i. Implementation of an adequate ***Vegetation Protection Zone (VPZ)*** will be required surrounding any retained vegetation. This *vegetation protection zone* can generally be provided by preserving an area around the vegetation with a radius of at least 1.25 x the average canopy radius from the trunk (of typical tree forms) or 0.5 x the tree height. *British Standard BS 5837* (1991);
ii. The boundary of the Vegetation Protection Zone is to be established at the outer boundary of the Vegetation Buffer Zone as shown in Figure 1;
iii. Before construction commences vegetation protection zones should be adequately marked and sign posted using star pickets and wire or high visibility tape or plastic net fencing;
iv. All trees not nominated for retention are to be removed prior to any construction activity or bulk earthworks. Approved tree removal operations in the vicinity of retained trees are to be undertaken in a manner that avoids canopy damage and soil compaction. Such works are to be supervised by a qualified Arborist;
v. Stumps are to be ground - not dozed or dug out;
vi. All trenches footings and major earth movement should avoid *vegetation protection zones*;
vii. Stockpiling materials and soils within *vegetation protection zones* is to be avoided;
viii. Machinery is to avoid *vegetation protection zones* during all operations;
ix. Any trenching or construction works undertaken within *vegetation protection zones* should be witnessed, supervised and recorded (photographed and documented) by a qualified Ecologist or Arborist;

x. Post-construction access control can be achieved using bollards, fences or retaining walls to limit pedestrian access and to control unauthorised vehicular access.

2.8 BUSHFIRE PROTECTION MEASURES

The replanted areas within the riparian buffer zone are not proposed to be managed as a bushfire asset protection zone. The required 10 metre wide asset protection zones are to be located outside of this riparian buffer zone and will include areas incorporated into road reserves, stormwater controls, nutrient control grassed swales and building line setbacks. Rainforest type species have been selected for replanting within the riparian buffer zone areas as these species create a lower bushfire risk to future residential developments than eucalypt species.

The bushfire protection measures to be utilised for future residential development will be specified in the Bushfire Assessment Report prepared in accordance with Planning for Bushfire Protection (RFS, 2006).

2.9 OPERATION OF THE COMMUNITY ASSOCIATION

The site is proposed to be developed as a Community Title subdivision under the NSW Community Land Development Act. Accordingly all open space throughout the site, inclusive of the Riparian Corridors will be designated 'Common Property' (Lot 1).

In accordance with the Act, the Community Association has the power to levy each owner within the Community Scheme, a regular (usually quarterly) fee to manage the Community Association Property (Lot 1 Land) in accordance with the management plans which are registered with the Community Management Statement.

Additionally the Community Association also has the power to levy a fee (if identified from the start of the scheme) to manage any other land within the Community Scheme to which it directs within its management plans as "Special Facilities".

In this instance the Riparian Corridors within the site will form (Lot 1) within the scheme, whilst the private conservation areas will be managed by the community scheme.

As such, the Community Association will (by contract with an external contractor) carry out the actions contained within the vegetation management plan which relate to the Riparian Corridor, both on the site and upon the adjacent site, at it's own expense. The funding for this scheme will be raised in advance by levying the owners within the subdivision a regular budgeted fee. This arrangement will exist in perpetuity upon the formation of the Community Scheme.

SECTION 3

WORKS PROGRAM

3.1 WORKS PROGRAM

A proposed works program is outlined in Table 3.1.

TABLE 3.1
PROPOSED WORKS PROGRAM

Action	Responsibility	Funded By
Pre-construction		
• Collection of seed/plant propagation.	- Contract grower	Developer
• Identification (flagging) of vegetated areas to be retained (VPZ).	- Project Supervisor	Developer
• Erection of erosion control fencing.	- Contractor with advice of Project Supervisor	Developer
• Installation of protective fencing and signs around adjacent bushland (VPZ).	- Contractor with advice of Project Supervisor	Developer
• Commencement of weeding / regeneration within retained vegetation.	- Contractor / suitably qualified Bushland Regenerator	Developer
• Preparation of a landscape/tree planting program if required.	- Contractor / Project Supervisor	Developer
Construction		
• Commencement of weeding / regeneration within retained vegetation.	- Contractor / suitably qualified Bushland Regenerator	Developer
•		
• Monitor erosion control fencing (weekly – and after rain) and replace if required.	- Contractor with advice of Project Manager	Developer
• Monitor vegetation protection fencing and signs and replace if required.	- Contractor with advice of Project Supervisor	Developer
• Implementation of tree/shrub planting program	- Contract landscaper/bush regenerator	Developer

TABLE 3.1 PROPOSED WORKS PROGRAM		
Action	**Responsibility**	**Funded By**
Post-construction		
• Plant new landscape trees recognised within landscape plan.	- Contractor engaged by Community Association	Community Association
• Remove vegetation protection fencing and signs.	- Contractor engaged by Community Association	Community Association
• Continuation of weeding / regeneration within retained vegetation.	- Contractor / suitably qualified Bushland Regenerator engaged by Community Association	Community Association
• Monitoring of retained vegetation *at 3, 6, 9, 12 months, and annually thereafter for 2 years* – conduct maintenance if required.	- Project Supervisor engaged by Community Association	Community Association
• A yearly report on the status of the bushland including photographs shall be sent to Council.	- Project Supervisor engaged by Community Association	Community Association

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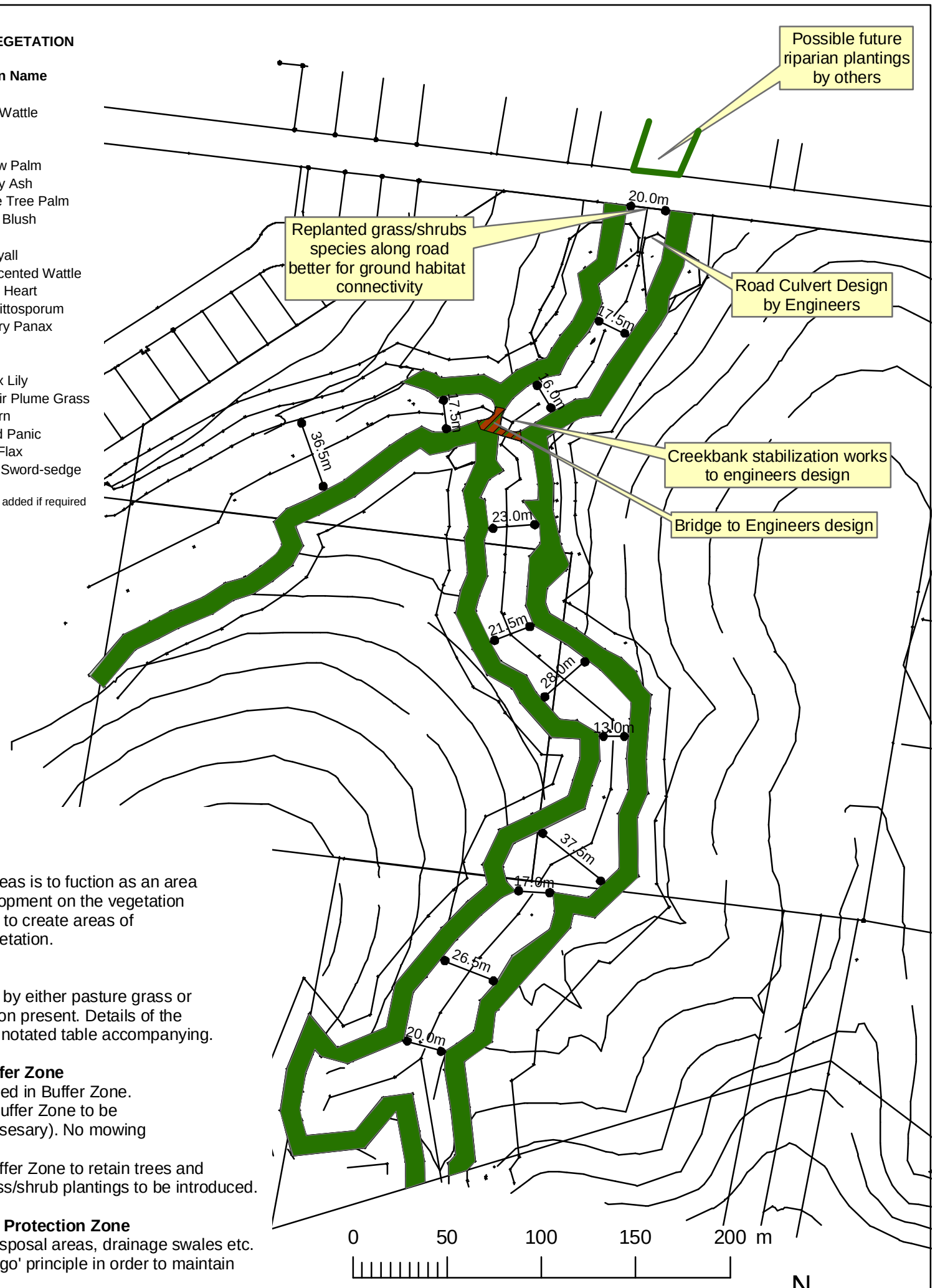
Wright, P. (1991) *Bush Regenerators Handbook*, The National Trust of Australia (NSW)

RECCOMMENDED SPECIES FOR RE-VEGETATION WITHIN BUFFER AREA

Scientific Name	Common Name
Trees	
Acacia prominens	Gosford Wattle
Acmena smithii	Lillypilly
Alphitonia excelsa	Red Ash
Archontophoenix cunninghamiana	Bangalow Palm
Elaeocarpus reticulatus	Blueberry Ash
Livistona australis	Cabbage Tree Palm
Sloanea australis	Maidens Blush
Shrubs	
Acacia binervia	Coast Myall
Acacia suaveolens	Sweet Scented Wattle
Omalanthus populifolius	Bleeding Heart
Pittosporum revolutum	Yellow Pittosporum
Polyscias sambucifolia	Elderberry Panax
Wilkiea heugeliana	Wilkiea
Groundcovers	
Dianella caerulea var. *producta*	Blue Flax Lily
Dichelachne micrantha	Short-hair Plume Grass
Doodia aspera	Rasp Fern
Entolasia marginata	Bordered Panic
Gymnostachys anceps	Settlers Flax
Lepidosperma laterale	Variable Sword-sedge

Note: Other native species present within the site can be added if required



10m Buffer Zone Works

Function

The 10m Buffer Zone to the riparian areas is to fuction as an area to buffer the impacts of adjacent development on the vegetation and habitats of the Riparian Zone, and to create areas of additional vegetation from existing vegetation.

Current Condition

The Buffer Zone is currently vegetated by either pasture grass or large trees with some riparian vegetation present. Details of the vegetation present are provided the annotated table accompanying.

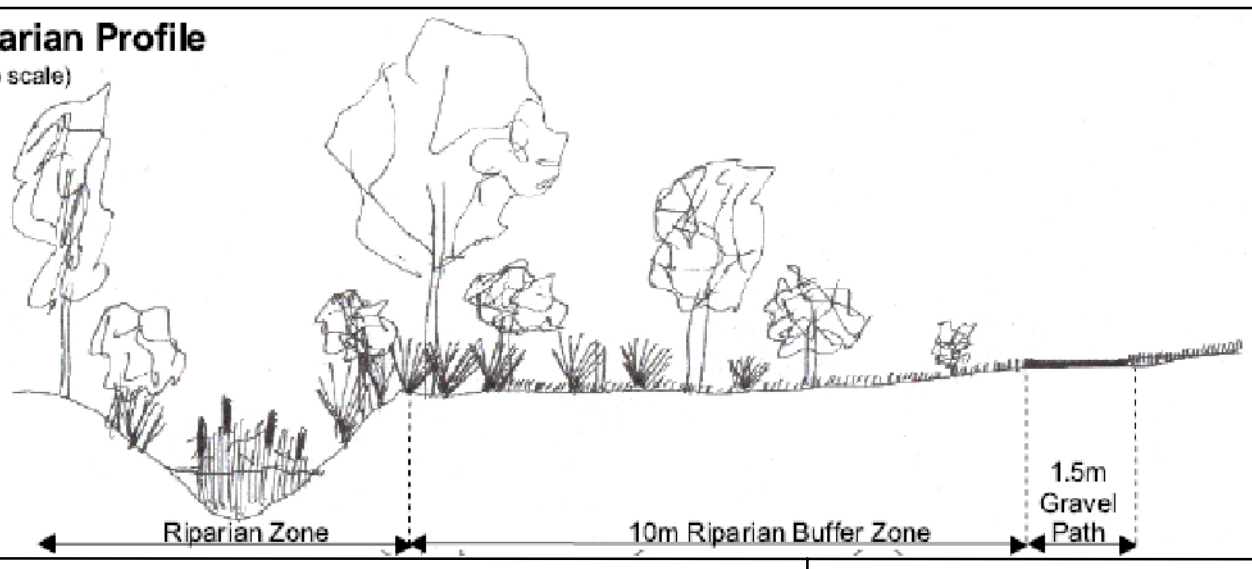
Works within the 10m Vegetation Buffer Zone

- Existing natural vegetation to be retained in Buffer Zone.
- Grassed areas within the Vegetation Buffer Zone to be regenerated and replanted (where nessesary). No mowing or slashing to be permitted.
- Existing vegetated areas within the Buffer Zone to retain trees and natural vegetation, supplementary grass/shrub plantings to be introduced.

Works within the 10m Bushfire Asset Protection Zone

- Nutrient control measures - grassed disposal areas, drainage swales etc. may be permitted only on an 'ingo' 'outgo' principle in order to maintain an APZ width of 10.0m.
  Supplementary plantings to Landscape and natural area where natural regeneration is ocurring.
- Weed removal to be undertaken.

Riparian Profile
(not to scale)



**Subject Site boundary subject to final survey*

Plan for indicative purposes only. Not for detailed measurement.
Map based on survey by Cahill.

Legend

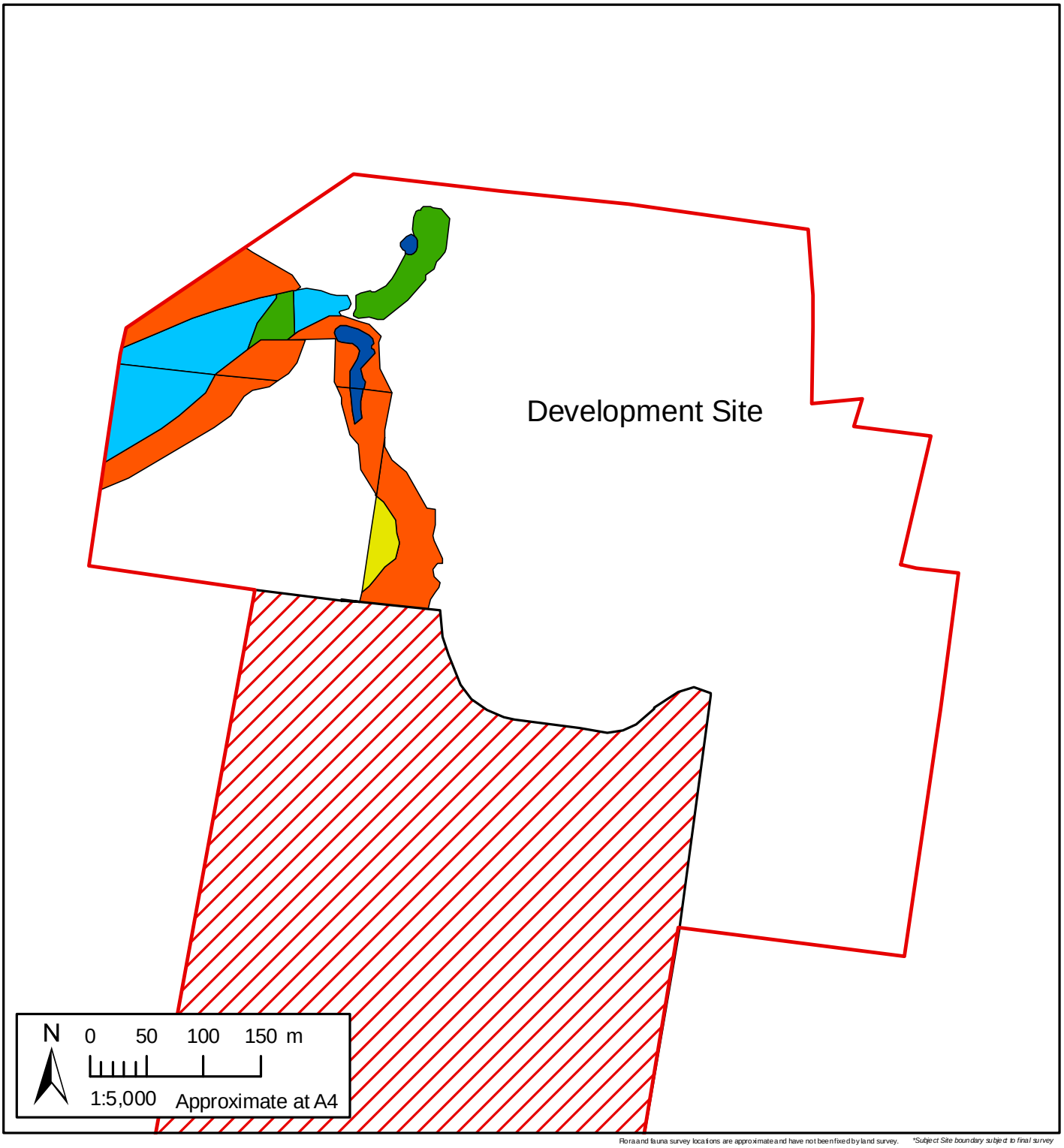
Riparian Buffer Zone (10M Wide)

conacher environmental group
ABN: 62 274 841 042
PO Box 4033
78 York Street
East Gosford NSW 2250
Ph: (02) 4324 7888
Fax: (02) 4324 7899
cegconsult@bigpond.com

Figure 1 -
Buffer Zone Management Plan
Parkside, Terrigal

Ver.FX By. JM 13/05/10 Ref.No.CE24

Source: Aerial © Department of Lands (2007)



Flora and fauna survey locations are approximate and have not been fixed by land survey. *Subject Site boundary subject to final survey
Plan for indicative purposes only. Not for detailed measurement.

Legend

- Subject Site Boundary
- **Low Intensity Works** Reasonably intact vegetation with low levels of weed invasion. Targeted weed removal required with encouragement of natural bushland regeneration. Occasional works undertaken on a part-time programmed basis, works to be identified in Community Plan and sourced form Community funding.
- Dam (community land)
- **Medium Intensity Works** Partially intact vegetation with moderate levels of weed invasion. Ongoing weed removal targeting specific weeds (e.g. Lantana, Blackberry and Privet). Some areas requiring replanting with assisted natural regeneration, works to be identified in Community Plan.
- **High Intensity Works** Disturbed and extensively weed infested areas. Significant weed removal, assisted regeneration and replanting. Long-term commitment to weeding / regeneration programs required. Enrichment of fauna habitat recources required. Detailed works and funding program needed to establish procedures / costings / timing etc as identified in Community Plan.
- Private Conservation Land
- Area to be Dedicated to Council

Original plan produced in A4 colour

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Figure 2 (a)

Weed Removal and Riparian Bushland Regeneration Works

Kings Avenue, Terrigal

ByJMDC
19/11/10
Ref.No.10050

Source: Aerial © Department of Lands (2010)

APPENDIX I

WEED MANAGEMENT TECHNIQUES

WEED MANAGEMENT TECHNIQUES
FOR USE IN AREAS OF VEGETATION RETENTION

Employing the Bradley Method for regeneration requires the removal of weeds in phases. Stages of weed removal can be broken into three components:

Primary Weeding
Primary weeding is the initial weeding. It is recommended that primary weeding should be carried out on the subject land to remove the majority of dominant weeds. This involves removal of weeds through herbicide use and hand removal. It is important to note primary weeding usually initiates new growth of both weeds and native species. Primary weeding of the site may take up to four weeks and it is recommended that this work either be carried out by a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

Secondary or Follow-up Weeding
Secondary or follow-up weeding involves intensive weeding in areas that have already received primary work to remove weed regrowth or overlooked weeds. It is recommended that secondary weeding be conducted 3-6 months after primary weeding. Secondary weeding of the site may take up to two weeks and should be carried out by either a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

Maintenance Weeding
After primary and secondary weeding and natural regeneration of the bushland, the area should be able to resist most weeds. However, weeds will re-establish on the site from birds, wind and water transporting seed and other propagules into the site. Maintenance weeding should be undertaken once or twice a year until such time as the resistance of the bushland to weeds increases, then only requiring hand-weeding every two to three years. Maintenance weeding of the site may take up to one week and should be carried out by either a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

Natural regeneration of the dominant native plant species is expected to occur over time provided ongoing management works are maintained.

Weed removal should be undertaken using small tools such as spades, mattocks, garden forks and saws to reduce soil disturbance and minimise damage to nearby plants. In addition to hand removal of weeds in some situations where weeds are abundant, such as for many of the grass species and when native plants will not be affected by spray drift, the use of Glyphosate herbicide is recommended in accordance with the manufacturers specifications. Herbicides should not be applied prior to rain occurring as this reduces the herbicides' effectiveness and increases the potential to enter creeks and drainage lines in runoff.

Weeds are to be progressively removed in accordance with the following techniques recommended by the National Trust, NSW National Parks and Wildlife Service and Australian Association of Bush Regenerators.

Woody Weeds Removal Techniques:

Cut and Paint (Woody weeds to 10 cm basal diameter)
- Make a horizontal cut close to the ground using secateurs, loppers or a bush saw; and
- Immediately apply herbicide to the exposed flat stump surface.

Considerations:
- Cuts should be horizontal to prevent herbicide from running off the stump, sharp angle cuts are hazardous;
- Herbicide must be applied immediately before the plant cells close (within 30 seconds) and translocation of herbicide ceases;
- If plants resprout cut and paint the shoots after sufficient regrowth has occurred; and
- Stem scraping can be more effective on some woody weeds.

Stem Injection
- At the base of the tree drill holes at a 45 degree angle into the sapwood;
- Fill each hole with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Frilling or Chipping
- At the base of the tree make a cut into the sapwood with a chisel or axe;
- Fill each cut with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Considerations:
- Plants should be actively growing and in good health;
- Deciduous plants should be treated in spring and autumn when leaves are fully formed;
- For multi-stemmed plants, inject or chip below the lowest branch or treat each stem individually; and
- Herbicides must be injected immediately before plant cells close (within 30 seconds) and translocation of herbicide ceases.

Small Hand-Pullable Plants Removal Techniques:

Hand Removal
- Remove any seeds or fruits and carefully place into a bag;
- Grasp stem at ground level, rock plant backwards and forwards to loosen roots and pull out; and
- Tap the roots to dislodge any soil, replace disturbed soil and pat down.

Considerations:
- Leave weeds so roots are not in contact with the soil eg. hang in a tree, remove from site or leave on a rock.

Vines and Scramblers Removal Techniques:

Hand Removal
- Take hold of one runner and pull towards yourself;
- Check points of resistance where fibrous roots grow from the nodes;
- Cut roots with a knife or dig out with a trowel and continue to follow the runner;
- The major root systems need to be removed manually or scrape/cut and painted with herbicide; and
- Any reproductive parts need to be bagged.

Stem Scraping

- Scrape 15 to 30 cm of the stem with a knife to reach the layer below the bark/outer layer; and
- Immediately apply herbicide along the length of the scrape.

Considerations:

- A maximum of half the stem diameter should be scraped. Do not ringbark;
- Larger stems should have two scrapes opposite each other; and
- Vines can be left hanging in trees after treatment.

Weeds with Underground Reproductive Structures Removal Techniques:

Hand Removal of Plants with a Taproot

- Remove and bag seeds or fruits;
- Push a narrow trowel or knife into the ground beside the tap root, carefully loosen the soil and repeat this step around the taproot;
- Grasp the stem at ground level, rock plant backwards and forwards and gently pull removing the plant; and
- Tap the roots to dislodge soil, replace disturbed soil and pat down.

Crowning

- Remove and bag stems with seed or fruit;
- Grasp the leaves or stems together so the base of the plant is visible;
- Insert the knife or lever at an angle close to the crown;
- Cut through all the roots around the crown; and
- Remove and bag the crown.

Herbicide Treatment – Stem Swiping

- Remove any seed or fruit and bag; and
- Using a herbicide applicator, swipe the stems/leaves.

Considerations:

- Further digging may be required for plants with more than one tuber;
- Some bulbs may have small bulbils attached or present in the soil around them which need to be removed;
- It may be quicker and more effective to dig out the weed;
- Protect native plants and seedlings; and
- For bulb and corm species the most effective time to apply herbicide is after flowering and before fruit is set.

Exotic vegetation should be removed and stockpiled in a clear area away from adjoining bushland. This stockpile should be removed from the site at a convenient time. As part of the regular maintenance of the restored area any regrowth of the exotic plant species should be removed and disposed of appropriately.

Use of Herbicides

There are various categories of herbicides currently used (Buchanan, 1989), specifically those that kill on contact (contact herbicides), and those that must move through the tissue of the plant (systematic herbicides). Other herbicides include those that are non-selective and those that are selective. There are also those herbicides that kill all existing plants and those that prevent germination (Buchanan, 1989). The most commonly used biodegradable

herbicides by bush regenerators are those containing glyphosate (ZERO ®, Glyphosate 340 ® and Roundup ®).

An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds. Another advantage is that the dead weeds may provide some measure of soil stabilisation for a short period of time.

Herbicides should not be applied prior to rain occurring. This reduces the herbicides effectiveness as well as being transported in runoff to creeklines and waterways.

An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds.

Buchanan (1989), recommends that the use of herbicides should be considered when:

1. there are small areas of dense weeds with few or no native plants to protect;
2. there are large areas of weeds;
3. the weeds are growing too rapidly for physical removal; and
4. the weeds are located in areas with a high potential for erosion if vegetation is removed.

The spraying of weeds must only be undertaken by experienced persons. The success of each treatment must be evaluated by the operator after a set period of time according to the labelled effectiveness for each herbicide. Care must be taken when applying herbicides near drainage lines to avoid excess use due to the sensitivity of the wetlands and waterways into which runoff will eventually flow.

APPENDIX II

ESTIMATED COSTINGS

Works Required To Implement The Riparian and Buffer Zone Vegetation Management Plan (Pre-Construction Phase)

Task	Description	Effort / units required	Cost per unit	Total Cost (Estimate)
Pre-construction				
Provenance seed collection, storage and management	Collection of provenance seed for tubestock	4 days	$900 per day	$3,600
Site preparation & weed removal	Labour and herbicides for initial weed control (targeting noxious, woody & problem weeds)	6 days	$950 per day	$5,700
Protective Fencing	Supply & Install	1000LM	$10/LM	$10,000
Sub-total				$19,300.00
GST				$1,930.00
Total				**$21,230.00**

Works Required To Implement The Riparian and Buffer Zone Vegetation Management Plan (Construction Phase)

Task	Description	Effort/units required	Cost per unit	Total Cost (Estimate)
Construction				
Initial revegetation works – including the supply and installation of tree guards and native chip mulch and native indigenous tubestock.	Revegetation with Tree species	11,000m^2 @ 1 plant per 40m^2	$5.00 per tree/shrub installed	$1,375.00
	Revegetation with Sub-Canopy species	11,000m^2 @ 1 plant per 20m^2	$5.00 per tree/shrub installed	$2,750.00
	Revegetation with Shrub species	11,000m^2 @ 1 plant per 10m^2	$5.00 per tree/shrub installed	$5,500.00
	Revegetation with Grass species	3,000m^2 @ 3.5 plants per 1m^2	$2.50 per virocell installed	$7,500.00
	Hydro-mulching	3,000m^2	$1.50 per m^2	$4,500.00
Sub-total				$21,625.00
GST				$2,162.00
Total				**$23,787.00**

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