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Bushfire Assessment

Bayside Brunswick

(Proposed Subdivision of Lot 1 DP871039
Bayside Way,
Brunswick Heads
on behalf of Codlea Pty Ltd)

August 2011

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TABLE OF CONTENTS

1. Introduction

1.1 Background

This Bushfire Assessment report has been prepared by LandPartners Limited in accordance with the relevant provisions of Planning for Bushfire Protection (PBP) (RFS 2006). The Assessment pertains to Lot 1 DP871039 Bayside Way, Brunswick Heads. The Assessment has been prepared to accompany a request to the Department of Planning (DoP) to subdivide the land for future residential development.

This bushfire assessment has been prepared under the Director General's requirements (issued 14.10.10, item 5.4) which requests that the requirements of PBP (RFS 2006) are addressed as part of the development application for the site made under part 3A of the *Environmental Planning and Assessment Act 1979*.

The Site contains land designated as 'Vegetation categories 1 and 2' and 'Buffer' on the Byron Shire Council Bushfire Prone Land Map 2004, hence the Site occurs on bushfire prone land (refer to Fig. 1); therefore the above process applies.

Clause 46 of the *Rural Fires Regulation 2002* specifies the points to be considered in preparing an application for a Bush Fire Safety Authority (BFSA). Regardless of the fact that under the Part 3A environmental impact assessment process a BFSA is not required, the points set by cl. 46 are still relevant in assessing the development according to PBP. In addition, Section 4 and Appendix 5 of PBP require consideration of a number of Bushfire Protection Measures (BPMs) and Provisions for Residential Subdivisions. These Measures, summarised below, are addressed in detail in this report:

- Asset Protection Zones;
- Siting & Design;
- Access;
- Services;
- Landscaping and Maintenance; and
- Construction Standards.

From our investigations we propose a series of recommendations that future development of this site, as envisaged by the proposed plan of subdivision, will need to implement to ensure that bushfire hazard has been satisfactorily addressed.

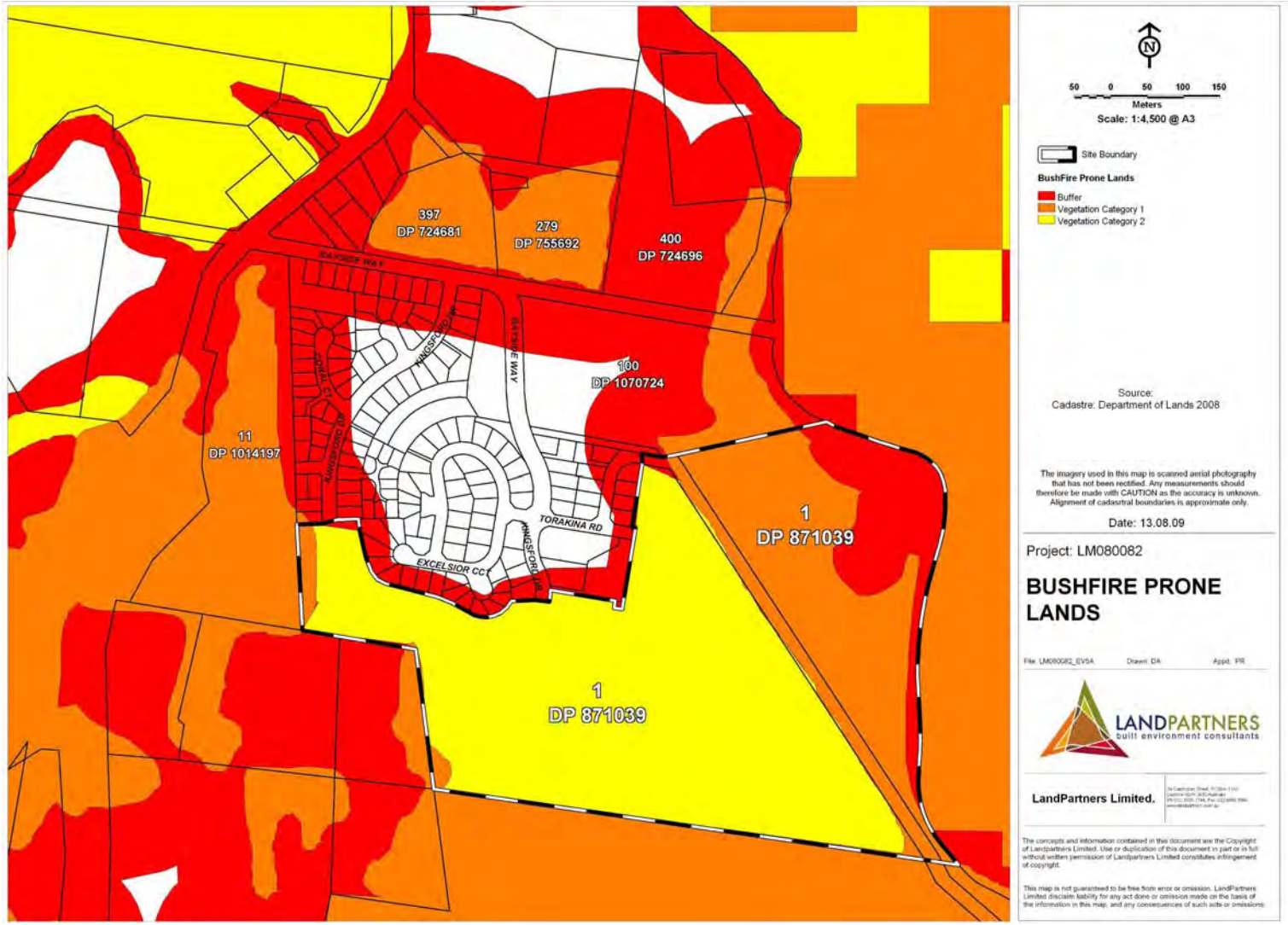


Figure 1. Bushfire mapping for the subject site (Source: Byron Shire Council 2004)

1.2 The Subject Site

The Subject Site or the Site (i.e. Lot 1 DP871039) is located at Bayside Way, Brunswick Heads in northeastern New South Wales and is approximately 31.26 ha in area (refer Fig. 2). While the majority of the Site consists of slashed heathland and grassland, areas of native vegetation occur along the eastern and western portions of the Site in association with Simpsons Creek (to the east) and Swamp Forest communities to the west.

The Site is bound to the north by urban development, to the east by Simpsons Creek to the west by rural land and to the south by vacant land dominated by native vegetation (refer to Fig. 3).

The majority of the Site is zoned 2(a) Residential, with a large area of land in the east of the Site zoned for Environmental Protection as either 7(a) Environmental Protection (Wetlands) or 7(b) Coastal Habitat in the Byron Local Environmental Plan (1988), as shown on Fig. 4.

A small area of land gazetted under State Environmental Planning Policy (SEPP) 14 – Coastal Wetlands occurs in association with Simpsons Creek as shown on Fig. 5.

1.3 Proposed Development

The application is for the concept approval of a residential subdivision of 167 lots, public reserves and parkland as shown on Fig. 6. The concept plan is for the utilisation of most of the land at the Site currently zoned 2(a) Residential, and also proposes the dedication of Environmental Protection Zoned land in the east of the Site to Council or other Authority.

1.4 Site Topography and Slope

The Site consists of flat land, which slopes very gently to the east to meet Simpsons Creek as shown on Fig. 7.

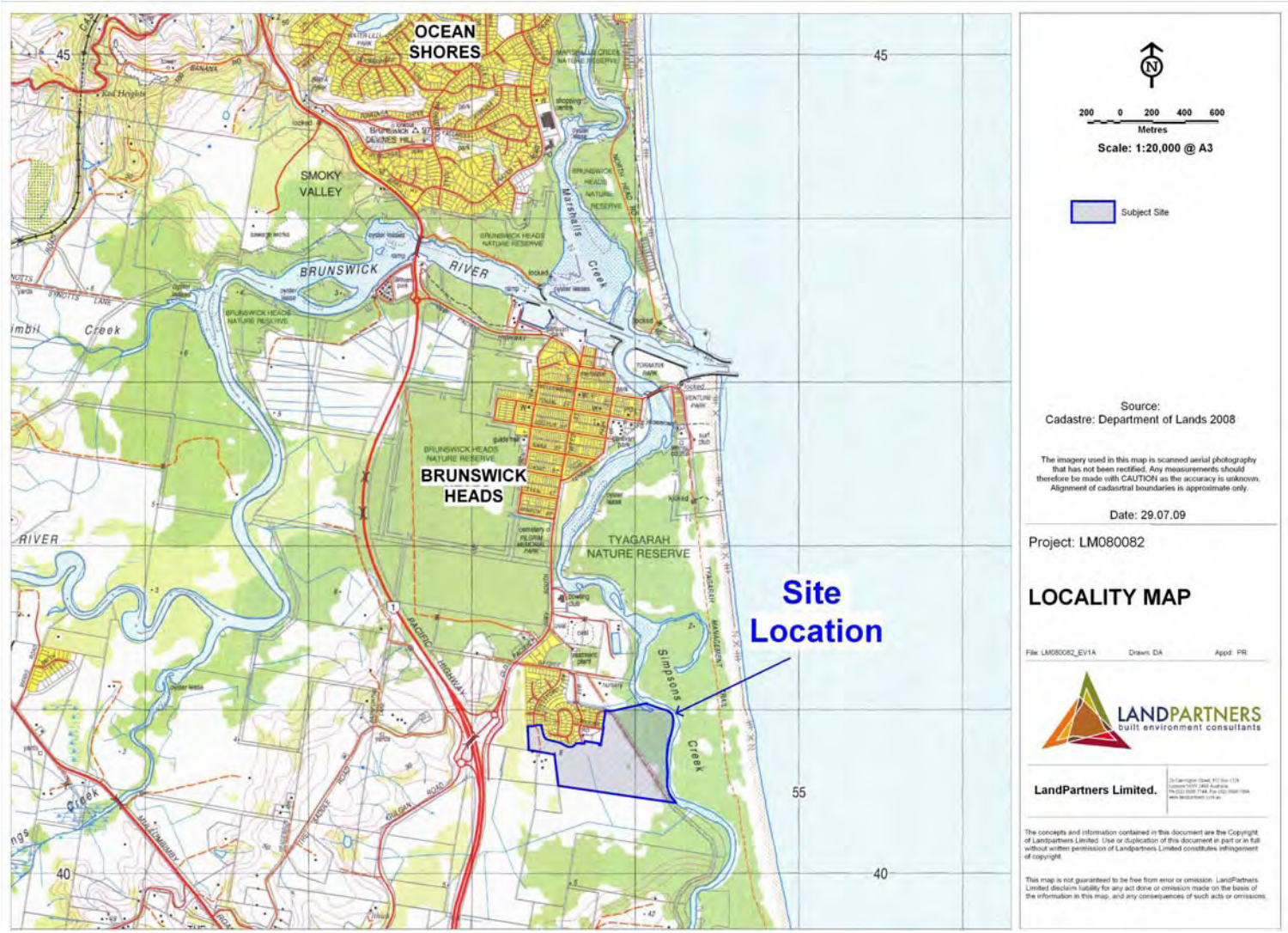


Figure 2. Locality plan

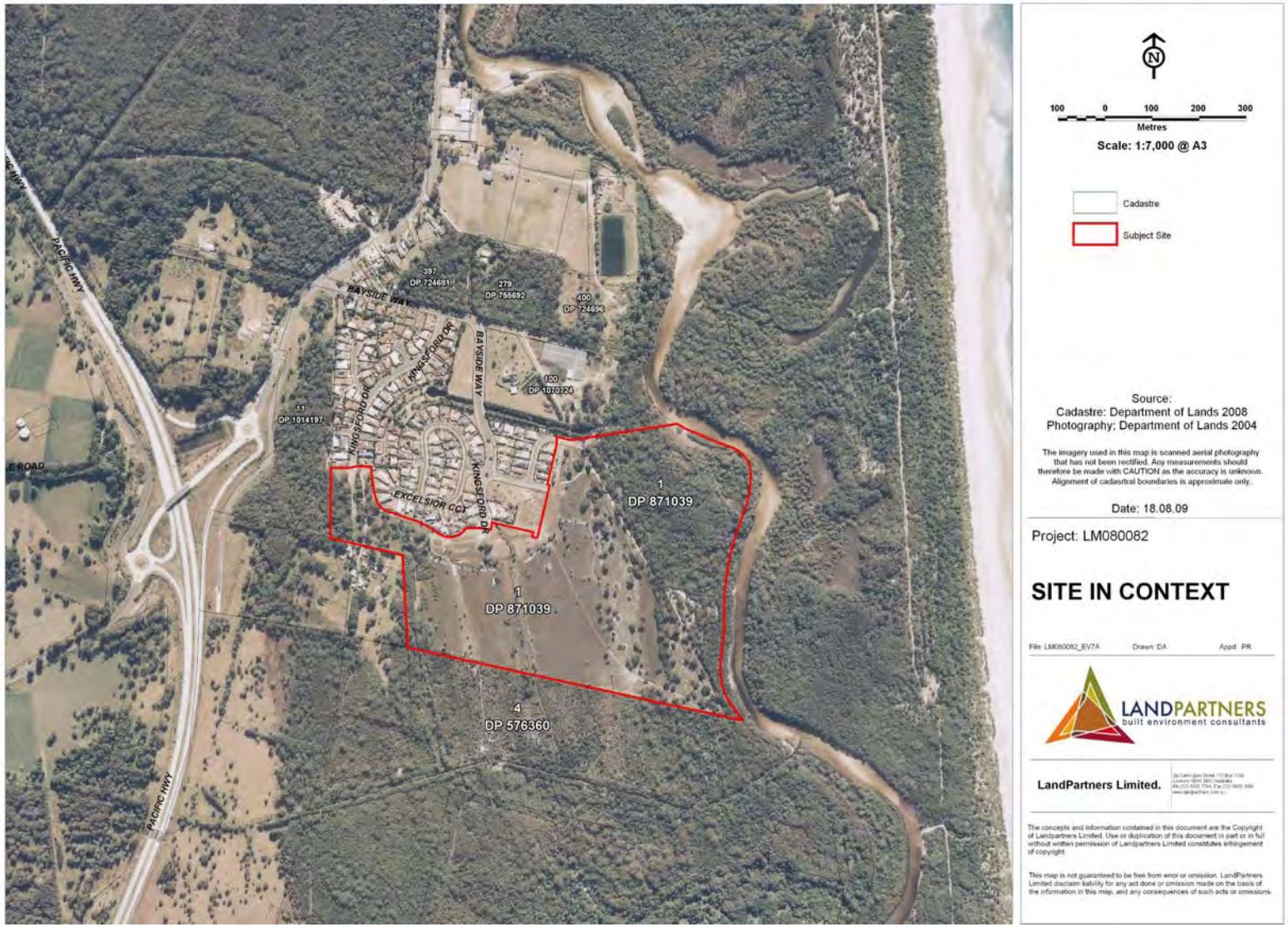


Figure 3. The Subject Site within the locality context

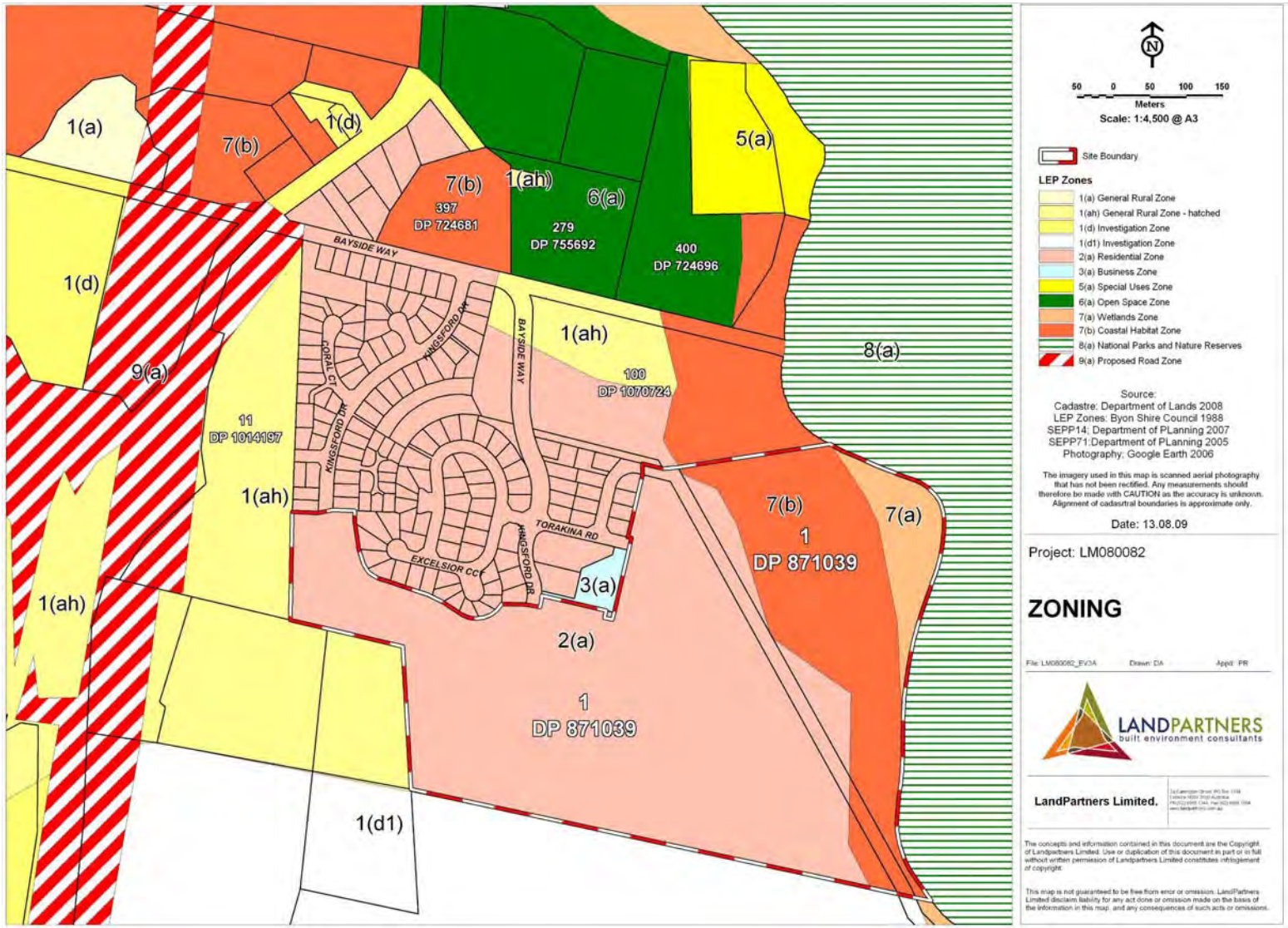


Figure 4. Subject Site & zoning

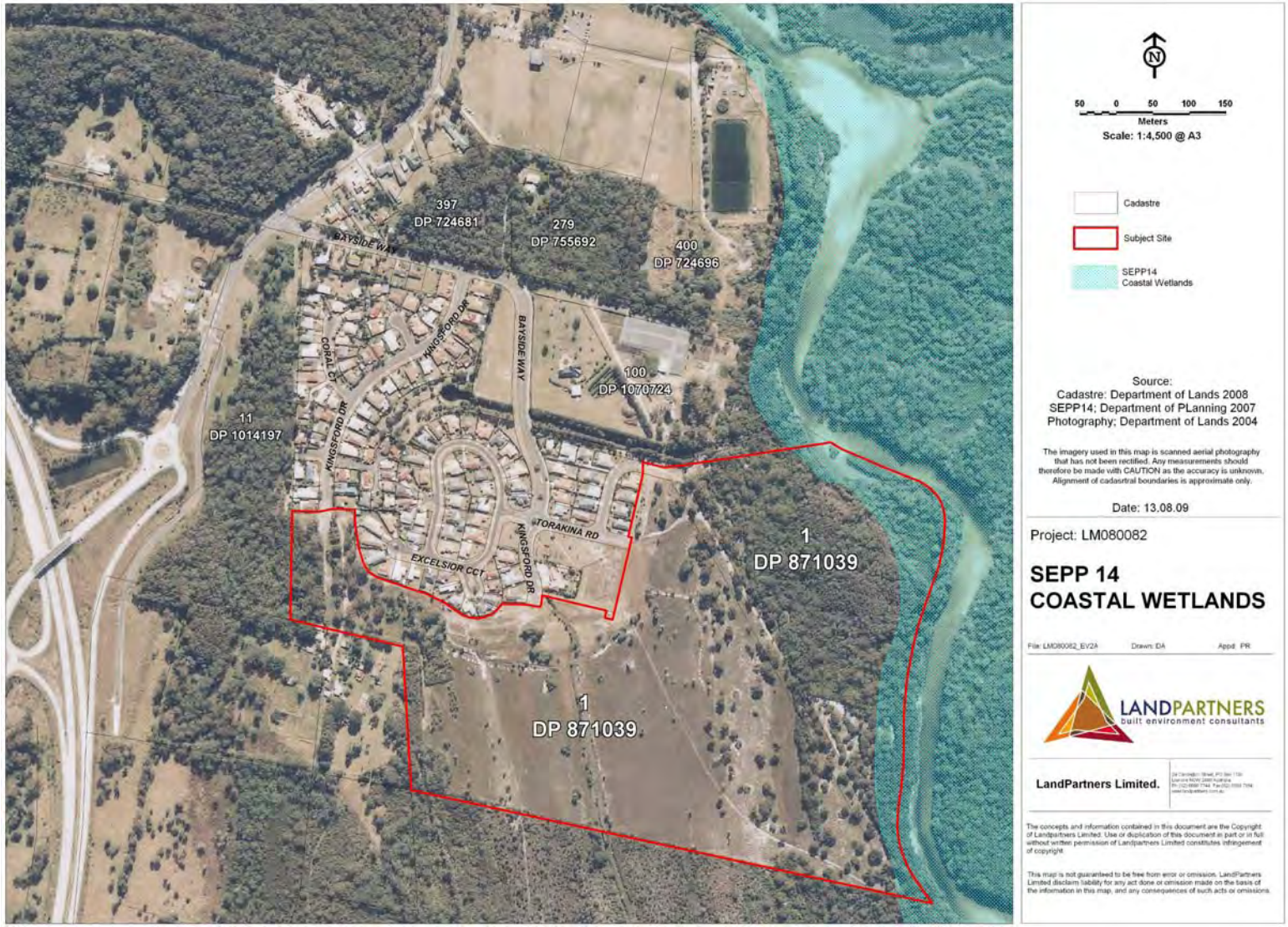


Figure 5. Subject Site & SEPP 14 Wetlands

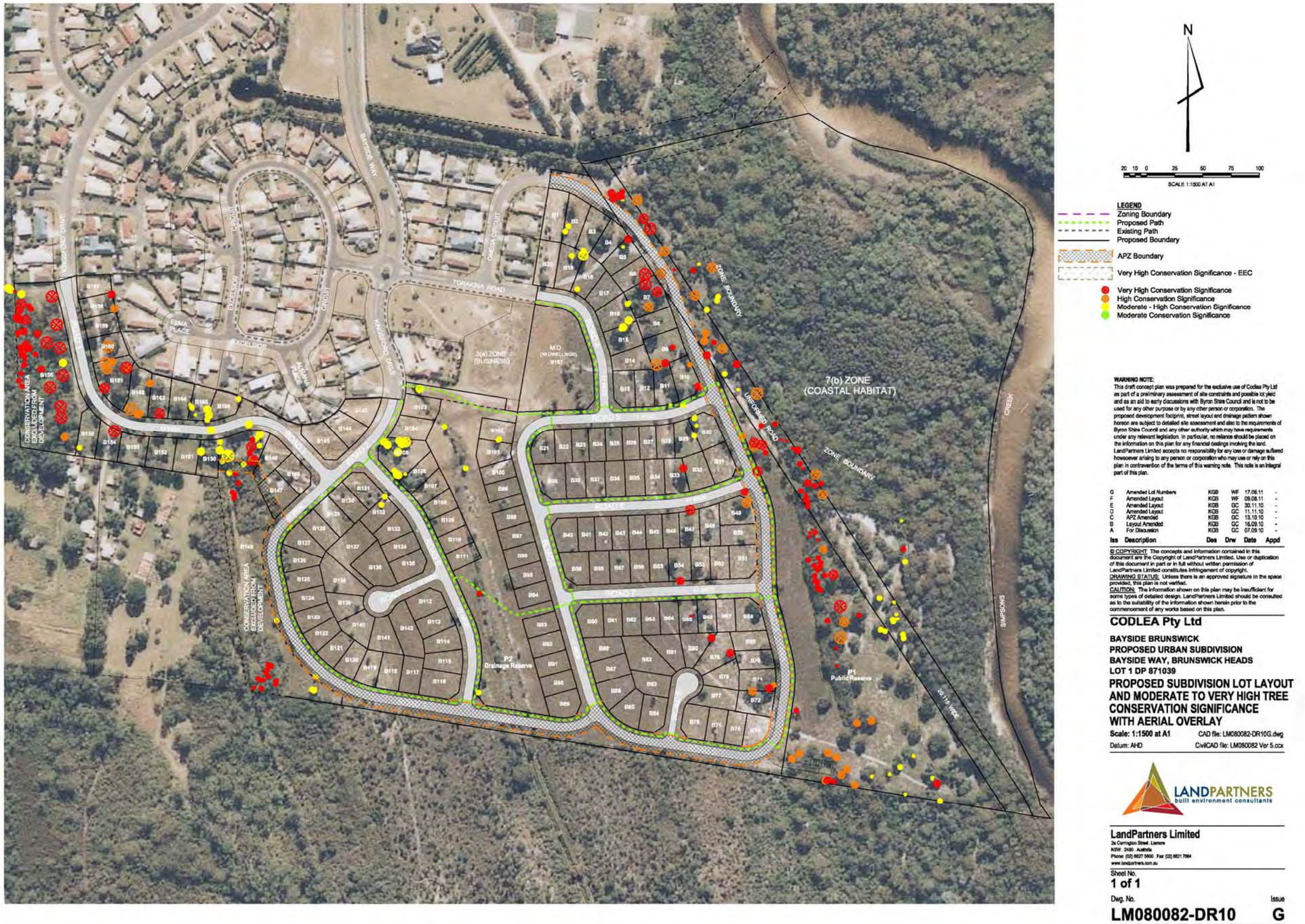


Figure 6. Proposed concept plan

1.5 Significant Environmental Features

As the Site has high environmental values, several ecological assessments have been completed (Woodward Clyde 1996, Byron Shire Council 1995 & 1998, James Warren & Associates 2009). The findings of these reports are summarised as follows:

- Vegetation at the Site is characteristic of three Endangered Ecological Communities (EECs):
  - Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions;
  - Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions; and
  - Coastal Saltmarsh of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
- Seven (7) threatened fauna species have been recorded at the Site (Wallum Froglet, Koala, Osprey, Little Bentwing bat, Yellow-bellied Sheathtail-bat, Southern Myotis and Grey-headed Flying-fox).
- The 2009 Flora and Fauna Assessment by James Warren & Associates (JWA) also considered a number of other threatened fauna species as having potential to occur at the Site based on habitat requirements (Australasian Bittern, Black Bittern, Black-necked Stork, Collared Kingfisher, Common Blossom Bat, Common Planigale, Eastern Long-eared Bat, Freckled Duck, Glossy Black-cockatoo, Grass Owl, Greater Broad-nosed Bat, Long-nosed Potoroo, Magpie Goose, Mangrove Honeyeater, Pied Oystercatcher, Swift Parrot, Wallum Sedge Frog and White-eared Monarch).

An assessment of these species with regard to the provisions of Section 3A of the EP&A Act has been undertaken by James Warren & Associates (2010).

A Cultural Heritage Assessment of the Site has been completed by Everick Heritage Consultants (2009). A walking survey of the Site revealed no items of indigenous or non-Indigenous cultural heritage.

2. Risk Assessment and Consultant Qualifications

Field assessment in February 2009 determined that the Site would have a moderate to high bushfire risk due to the occurrence of significant stands of native vegetation to the east, and the occurrence of Swamp Forest communities in the west, and neighbouring unmanaged Heathland to the south.

This report has been prepared by Ian Colvin (former LandPartners employee) and Paola Rickard of LandPartners Limited. Ian has a Bachelor Degree in Applied Science, a certificate in bushland regeneration, and has 5 years experience in flora surveys and vegetation management issues. Ian has attended the "Planning for Bushfire Protection Short Course" held by the University of Technologies Sydney in 2007 and obtained relevant certification for the course.

Paola has a Graduate Diploma in Design for Bush Fire Prone Areas with Distinction from the University of Western Sydney and is a member of the Fire Protection Association Australia. Paola also has a Bachelor Degree in Applied Science, a Certificate in Bushland Regeneration, and is a member of the Australian Association Bush Regenerators. She has 15 years experience in flora surveys and vegetation management issues, and has been undertaking bushfire assessments since 2003. Paola has attended the "NSW Consulting Planners Bushfire Training Course" in Sydney in 2003 and has attended the "Planning for Bushfire Protection Short Course" held by the University of Technologies Sydney in 2007. She has obtained certification for the short course. Additionally, Paola has a 'Basic Bush Fire Awareness' certificate and has experience in fire control and planning while living on a rural land sharing community.

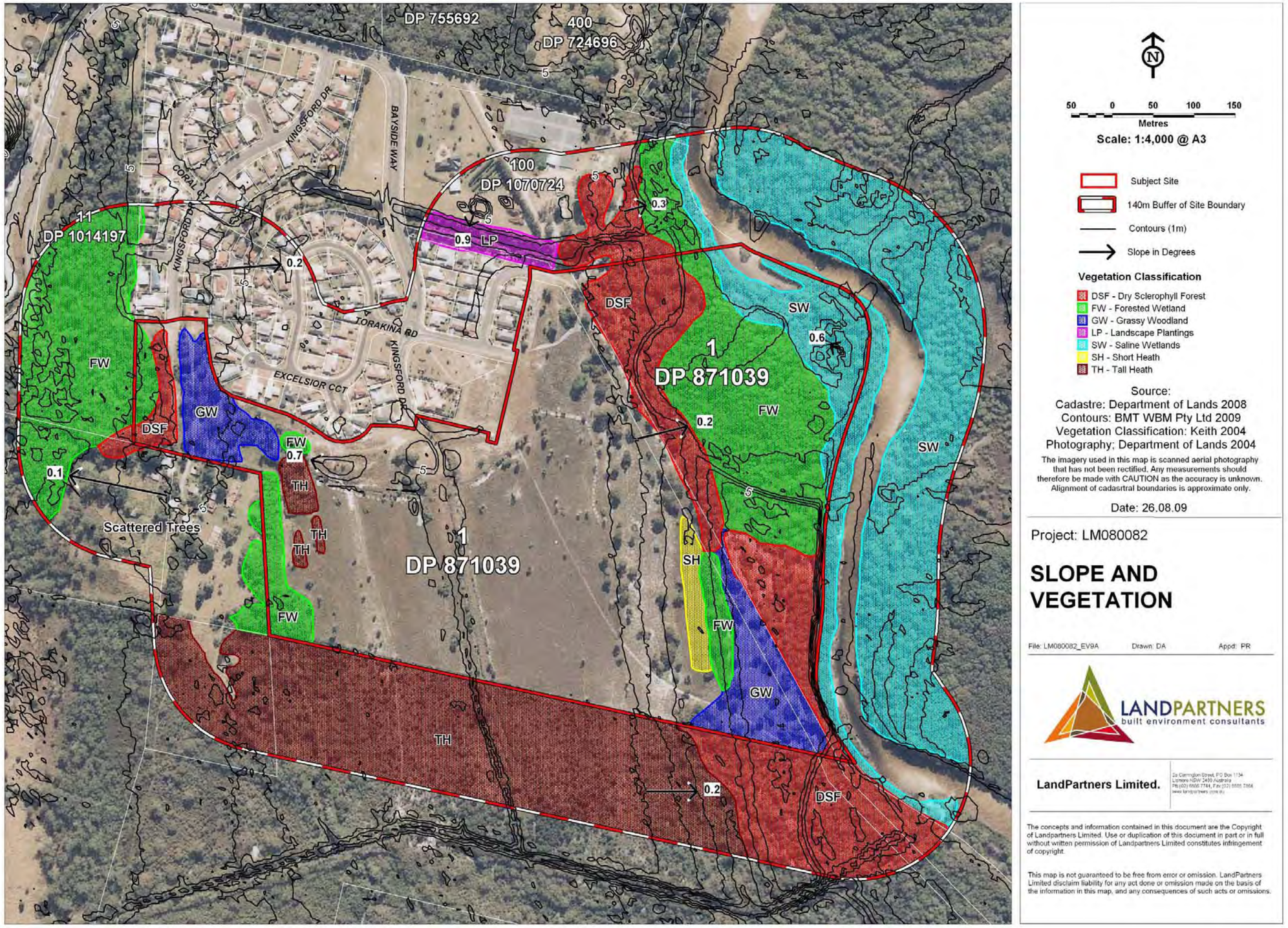


Figure 7. Slope & broad vegetation communities

3. Site Vegetation and Classification

3.1 Site Vegetation

The majority of the Site consists of slashed heath and/or grassland, with Swamp Forest communities largely prevalent in the east and west (refer to Plates 1 to 5).

Plate 1. The Site looking southwest - Slashed grassland/heathland surrounded by Heathland and Swamp Forest

Plate 2. The Site looking to the east

Plate 3. The Site looking to the southeast- Drainage lines crisscross the land.

Plate 4. The Bayside village is found immediately north of the Site.

Plate 5. The Site looking to the northeast

JWA recorded six (6) broad vegetation communities at the Site, as shown in Table 1 and Fig. 7.

Table 1. Vegetation communities at the Subject Site*

Community	Description
1	Swamp sclerophyll communities
2	Dry sclerophyll communities
3	Heath communities
4	Estuarine communities
5	Grassland
6	Scattered trees

*Source: JWA (2009)

Table 2 shows the vegetation types present on the site and their classification according to Table A2.1 of PBP (2006) as per Keith (2004) where relevant.

Table 2. Vegetation Description and Bush Fire Classification (PBP 2006)

Vegetation type	Vegetation classification* (as per Keith 2004)
Swamp sclerophyll communities	Forested Wetlands
Dry sclerophyll communities	Open Forest
Heath communities	Heathlands
Estuarine communities	Saline Wetlands
Grassland	Grassland
Scattered trees	Woodland

*based on Table A2.1 PBP

3.2 Surrounding Vegetation

The vegetation description for the areas considered a possible bushfire hazard for up to 140m from the Site boundary as per Keith (2004) is as follows (refer to Fig. 7):

- To the north-east and east: Forested Wetlands
- To the south: Heathlands (Tall Heath)
- To the west: Forested Wetlands
- To the south east: Open Forest

To the north of the site any vegetation occurring within the existing subdivision is considered managed vegetation (as defined by PBP).

4. Bushfire Protection Measures for Residential and Rural Residential Subdivision

4.1 Introduction

PBP states that it must be demonstrated that the proposal satisfies the broad aim and objective of PBP, the specific objectives for the development type and the performance criteria for the various proposed Bushfire Protection Measures (BPMs).

The specific objectives for 'residential and rural residential subdivision development' are:

- *Minimise perimeters of the subdivision exposed to the bush fire hazard. hourglass shapes, which maximise perimeters and create bottlenecks, should be avoided;*
- *Minimise bushland corridors that permit the passage of bush fire;*
- *Provide for the siting of future dwellings away from ridge-tops and steep slopes - particularly up-slopes, within saddles and narrow ridge crests;*
- *Ensure that separation distances (APZ) between a bush fire hazard and future dwellings enable conformity with the deemed- to-satisfy requirements of the BCA. In a staged development, the APZ may be absorbed by future stages;*
- *Provide and locate, where the scale of development permits, open space and public recreation areas as accessible public refuge areas or buffers (APZs);*
- *Ensure the ongoing maintenance of asset protection zones;*
- *Provide clear and ready access from all properties to the public road system for residents and emergency services; and*
- *Ensure the provision of and adequate supply of water and other services to facilitate effective firefighting.*

Additionally PBP (RFS 2006) identifies the performance criteria and acceptable solutions for the various proposed Bushfire Protection Measures (BPMs). The relevant BPMs criteria and acceptable solutions with regard to residential and rural residential subdivision development are outlined in Sections 4.2 to 4.6 of this report.

The following sections will also discuss and prescribe the acceptable solution or proposed alternative for each applicable BPMs.

4.2 Asset Protection Zones

4.2.1 General Requirement for Asset Protection Zones

Asset Protection Zones (APZs) are buffer areas between development and a fire hazard, which aim to protect human life and property. The APZ comprises an Inner Protection Area (IPA) and an Outer Protection Area (OPA). These areas will be managed to reduce the bushfire hazard. The general requirements for APZs are described in Tables 3 and 4 below.

Table 3. Inner Protection Area (IPA) General Requirements

Specifications and Management	
Location	The IPA extends from the edge of the OPA to the development.
Purpose	Ensures that the presence of fuel, which could become involved in fire, is minimised.
Depth	Varies from 10 to 100 metres.
Fuel Loading	Minimum fine fuel at ground level, which could be set alight by bushfire.
Vegetation Requirements	Do not touch or overhang the building; Are well spread out and do not form a continuous canopy; Are not species that retain dead material or deposit excessive quantities of ground fuel in a short period; and Are located far enough away from the house so that they will not ignite the house by direct flame contact or radiated heat emissions.
Uses Within the Area	Tennis courts, swimming pools and gardens are permitted. Woodpiles, wooden sheds, combustive material storage areas, large quantities of garden mulch, stacked flammable building materials are not permitted.
Maintenance	This Area should be regularly mowed and all fuel removed e.g. fallen branches, leaf build-up.

Table 4. Outer Protection Area (OPA) General Requirements

Specifications and Management	
Location	Located adjacent to the hazard. Originally the OPA would have formed part of the bushfire hazard but becomes an area where the fuel loadings are reduced.
Purpose	Reduction of fuel in this area substantially decreases the intensity of an approaching fire and restricts the pathway of crown fuels; reducing the level of direct flame, radiant heat and ember attack on the IPA.
Depth	Varies from 0 to 25 metres.
Fuel Loading	Fine fuel loads should be kept to a level where the fire intensity expected will not impact on adjacent developments. In the absence of any policy to the contrary, 8 tonnes per hectare of fuel is commonly used. In grasslands, fuel height should be maintained below 10 centimetres.
Vegetation Requirements	Any trees and shrubs should be maintained in such a manner that the vegetation is not continuous.
Maintenance	This Area should be regularly mowed and all excess fuels should be removed e.g. fallen branches, leaf build-up.

4.2.2 Prescribed Asset Protection Zones

Based on the predominant vegetation surrounding the proposed subdivision and according to the Asset Protection Zone Modelling Report (provided as Appendix A), the APZs prescribed in Table 5 are required.

Table 5. Prescribed APZs

Vegetation Community	Aspect	Slope	Prescribed APZ (m)
Forested Wetland	east	Flat land	13m (IPA)
Tall Heath	south	Flat land	13m (IPA)
Forested Wetland	north-west	Flat land	13m (IPA)
Forested Wetland	south-west	Flat land	13m (IPA)
Forested Wetland	north-east	Flat land	13m (IPA)
Forest	south-east	Flat land	17m (9m IPA, 8m OPA)

The APZs prescribed in Table 5 and shown on Fig. 8 are to be implemented and the maintenance of the APZ for the life of the development would be subject to the creation of a positive covenant (where applicable) under s.88B or s.88E of the *Conveyancing Act 1919.*

The prescribed APZs are easily achieved within the proposed layout, are wholly contained within the residential zoned land and are mostly contained within the width of the perimeter road reserve (refer to Fig. 8). PBP identifies specific performance criteria and acceptable solutions with regard to APZs as shown in Table 6. Acceptances of solutions or proposed alternatives have been made as applicable.

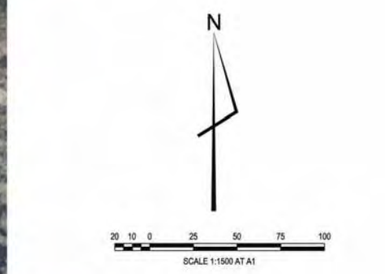
Table 6. Performance Criteria and Acceptable Solutions for APZs in Accordance with PBP and Applicable Compliance

Performance Criteria	Acceptable Solutions	Compliance or Alternative Solution
Radiant heat levels at any point on a proposed building will not exceed 29kW/m^2	• An APZ is provided in accordance with the relevant tables and figures of Appendix 2 of PBP. • The APZ is wholly within the boundaries of the development site. Exceptional circumstances may apply (see s. 3.3 of PBP)	• APZs comply with Appendix 2 of PBP and are contained wholly within the boundaries of the Site.
APZs are managed and maintained to prevent the spread of fire towards the building	• In accordance with the requirements of 'Standards for Asset Protection Zones' (RFS 2005).	• Any future APZ will be managed and maintained according to the requirement. Notably, the majority of the prescribed APZ are contained within the perimeter road
APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is negated	• The APZ is located on lands with a slope less than 18 degrees	• The Site is flat and no slopes of 18 degrees (or greater) occur.

4.2.3 Hazard Reduction and Maintenance of APZs

The following conditions should be maintained at the Site to ensure that APZs perform appropriately, and will be formalised via a Section 88B Instrument under the *NSW Conveyancing Act 1919* if required:

- All vegetation will be maintained in a fuel free condition;
- Controlled burning is not required. Manual fuel reduction will sufficiently reduce fuel loads surrounding the proposed development;
- All trees will be maintained so that a continuous canopy is not formed;
- All regrowth of shrubs and bushes will be removed.



WARNING NOTE:
This draft concept plan was prepared for the exclusive use of Codlea Pty Ltd as part of a preliminary assessment of site constraints and possible lot yield and as an aid to early discussions with Byron Shire Council and is not to be used for any other purpose or by any other person or corporation. The proposed development footprint, street layout and drainage pattern shown hereon are subject to detailed site assessment and also to the requirements of Byron Shire Council and any other authority which may have requirements under any relevant legislation. In particular, no reliance should be placed on the information on this plan for any financial dealings involving the land. LandPartners Limited accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this plan in contravention of the terms of this warning note. This note is an integral part of this plan.

Rev	Description	Des	Drw	Date	Appd
E	Amended Layout	KGB	GC	30.11.10	-
D	Amended Layout	KGB	GC	11.11.10	-
C	APZ Amended	KGB	GC	13.10.10	-
B	Layout Amended	KGB	GC	16.09.10	-
A	For Discussion	KGB	GC	07.09.10	-

DRAWING STATUS: Unless there is an approved signature in the space provided, this plan is not verified.
CAUTION: The information shown on this plan may be insufficient for some types of detailed design. LandPartners Limited should be consulted as to the suitability of the information shown herein prior to the commencement of any works based on this plan.

CODLEA Pty Ltd

BAYSIDE BRUNSWICK
PROPOSED URBAN SUBDIVISION
BAYSIDE WAY, BRUNSWICK HEADS
LOT 1 DP 871039

PROPOSED SUBDIVISION LOT LAYOUT AND MODERATE TO VERY HIGH TREE CONSERVATION SIGNIFICANCE WITH AERIAL OVERLAY

Scale: 1:1500 at A1 CAD file: LM080082-DR10E.dwg
Datum: AHD CivilCAD file: LM080082 Ver 5.ccx

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Sheet No.
1 of 1
Dwg. No. Revision
LM080082-DR10 E

Figure 8. Proposed concept plan layout and prescribed APZs. Note: APZs are wholly contained within the residential zoned land and are mostly contained within the width of the perimeter road reserve

4.3 Access

4.3.1 Public Roads

The main access to the Site is from Bayside Way, with Kingsford Drive to the west, and Torakina Road to the east. All of the current access roads comprise a two lane bitumen sealed surface. PBP identifies performance criteria and acceptable solutions with regard to public roads as shown in Table 7. Acceptances of solution or proposed alternative have been made as applicable.

Table 7. Performance Criteria and Acceptable Solutions for Public Roads in Accordance with PBP and Applicable Compliance

Performance Criteria	Acceptable Solutions	Compliance or Alternative Solution
Firefighters are provided with safe all weather access to structures (thus allowing more efficient use of firefighting resources).	Public roads are two-wheel drive, all weather roads	**All proposed roads comply as required.**
Public road widths and design that allow safe access for firefighters while residents are evacuating an area.	Urban perimeter roads are two-way, that is, at least two traffic lane widths (Carriageway 8 m minimum kerb to kerb), allowing traffic to pass in opposite directions. Non perimeter roads comply with PBP Table 4.1 – Road widths for Category 1 Tanker (Medium Rigid Vehicle).	**The proposed road network complies as required.**
	The perimeter road is linked to the internal road system at an interval of no greater then 500 metres in urban areas.	**The proposed road network complies as required.**
	Traffic management devices are constructed to facilitate access emergency services vehicles.	**All proposed roads comply as required.**
	Public roads have a cross fall not exceeding 3 degrees.	
	All roads are through roads. Dead end roads are not recommended, but if unavoidable, dead ends are not more than 200 metres in length, incorporate a minimum 12 m outer radius turning circle, and are clearly sign posted as a dead end and direct traffic away from the hazard.	
	Curves of roads (other than perimeter roads) are a minimum inner radius of six metres and minimal in number, to allow for rapid access and egress.	**All proposed roads will comply as required.**
	The minimum distance between inner and outer curves is six metres.	
	Maximum grades for sealed roads do	

Performance Criteria	Acceptable Solutions	Compliance or Alternative Solution
	not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient. There is a minimum vertical clearance of four metres above the road at all times.	
The capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles. Roads that are clearly sign-posted (with easily distinguishable names) and buildings/properties that are clearly numbered.	The capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles (approximately 15 tonnes for areas with reticulated water, 28 tonnes or 8 tonnes per axle for all other areas). Bridges clearly indicate load rating. Public roads greater than 6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water for fire suppression. Public roads between 6.5 and 8 metres wide are No Parking on one side with the services (hydrants) located on this side to ensure accessibility to reticulated water for fire suppression.	All proposed roads will comply as required. No bridges are proposed. All proposed roads will comply as required.
There is clear access to reticulated water supply.	Public roads up to 6.5 metres wide provide parking within parking bays and locate services outside of the parking bays to ensure accessibility to reticulated water for fire suppression. One way only public roads are no less than 3.5 metres wide and provide parking within parking bays and locate services outside of the parking bays to ensure accessibility to reticulated water for fire suppression.	All proposed roads will comply as required.
Parking does not obstruct the minimum paved width	Parking bays are a minimum of 2.6 metres wide from kerb edge to road pavement. No services or hydrants are located within the parking bays. Public roads directly interfacing the bush fire hazard vegetation provide roll top kerbing to the hazard side of the road.	All proposed roads will comply as required.

4.3.2 Property Access Roads

Property access roads (i.e. driveways) will be required for all proposed lots and need to comply with Section 4.1.3 of PBP. Therefore, the proposed property access road will comply with acceptable solutions to address performance criteria of PBP (RFS 2006) where possible, as shown in Table 8. Acceptance of solutions or proposed alternatives has been made as applicable.

Table 8. Performance criteria for property access roads (as per PBP)

Performance Criteria	Acceptable Solutions	Compliance or Alternative Solution
Access to properties is provided in recognition of the risk to firefighters and/or evacuating occupants.	At least one alternative property access road is provided for individual dwellings (or groups of dwellings) that are located more than 200 metres from a public through road.	**No dwelling will be more than 200 metres from a public through road; therefore, no alternative property access is required.**
The capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles. All weather access is provided.	Bridges clearly indicates load rating and pavement and bridges are capable of carrying a load of 15 tonnes	**No bridges are proposed**
	Roads do not traverse a wetland or other land potentially subject to periodic inundation (other then flood or storm surge)	**N/A**
Road width and design enable safe access for vehicles	A minimum carriageway width of four metres for rural-residential areas, rural landholdings or urban areas with a distance of greater than 70 metres from the nearest hydrant point to the most external part of a proposed building (or footprint).	**Will comply as required where applicable.**
	In forest, woodland and heath situation, rural property access roads have passing bays every 200 metres that are 20 metres long by two metres wide, making a minimum trafficable width of six metres at the passing bay.	**N/A**
	A minimum vertical clearance of four metres to any overhanging obstructions, including tree branches.	**Will comply as required where applicable.**
	Internal roads for rural properties provide a loop road around any dwelling or incorporate a turning circle within a minimum 12 metre outer radius.	**N/A**
	Curves have a minimum inner radius of six metres and are minimal in number to allow for raid access and egress.	**Curves will comply with Acceptable Solution.**
	The minimum distance between inner and outer curves is six metres.	**Will comply with Acceptable Solution.**
	The crossfall is not more than 10 degrees.	**Will comply with Acceptable Solution if applicable.**

Performance Criteria	Acceptable Solutions	Compliance or Alternative Solution
	Maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degree for unsealed roads	All access roads are on level ground.
	Access to a development comprising more than three dwellings have formalised access by dedication of a road and not by right of way.	N/A

4.4 Water, Gas and Electricity Supply

Provision of services to the proposed development will comply with acceptable solutions to address performance criteria of PBP as shown in Table 9.

Table 9. Performance criteria for water, gas and electricity supply (as per PBP)

Performance Criteria	Acceptable Solutions
Reticulated water supply areas Water supplies are easily accessible and located at regular intervals.	• Reticulated water supply to urban subdivisions uses a ring main system for areas with perimeter roads. • Fire hydrant spacing, sizing and pressures comply with AS2419.1 – 2005. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles. • Hydrants are not located within any road carriageway. • All above ground water and gas service pipes external to the building are metal, including, and up to any taps. • The provisions of parking on public roads are met.
Electricity Services Location of electricity services limits the possibility of ignition of surrounding bushland or the fabric of buildings. Regular inspection of lines is undertaken to ensure they are not fouled by branches.	• Where practicable, electrical transmission lines are underground. • Where overhead electrical transmission lines are proposed: - lines are installed with short pole spacing (30 metres), unless crossing gullies, gorges or riparian areas; and - no part of a tree is closer to a power line than the distance set out in accordance with the specifications in 'Vegetation Safety Clearances' issued by Energy Australia (NS179, April 2002).
Gas Services Location of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	• Reticulated or bottled is installed and maintained in accordance with AS1596 and the requirements of relevant authorities. Metal piping is to be used. • All fixed gas cylinders are kept clear of all flammable materials to a distance of 10 metres and shielded on the hazard side of the installation. • If gas cylinders need to be kept close to the building, the release valves are directed away from the building and at least 2 metres away from any combustible material, so that they do not act as a catalyst to combustion. Connections to and from gas cylinders are metal. • Polymer sheathed flexible gas supply lines to gas metres adjacent to buildings are not used.

4.5 Landscaping and Property Maintenance

Bushland vegetation provides the fuel which feeds wildfires; however, by providing adequate separation distance between the bush and buildings will effectively prevent the spread of bushfire. Still vegetation is not always the foe when it comes to bushfires and it is possible to use managed vegetation as a tool to reduce fire risk. According to many practitioners and researchers (Ramsay & Rudolph 2006; CFA 2004; RFS 2006; Queensland Government 2000; RFS 2008b), a well designed garden can reduce bushfire hazard near buildings. In summary, homes and garden can blend with the natural environment and be landscaped to minimise the impact of fire at the same time.

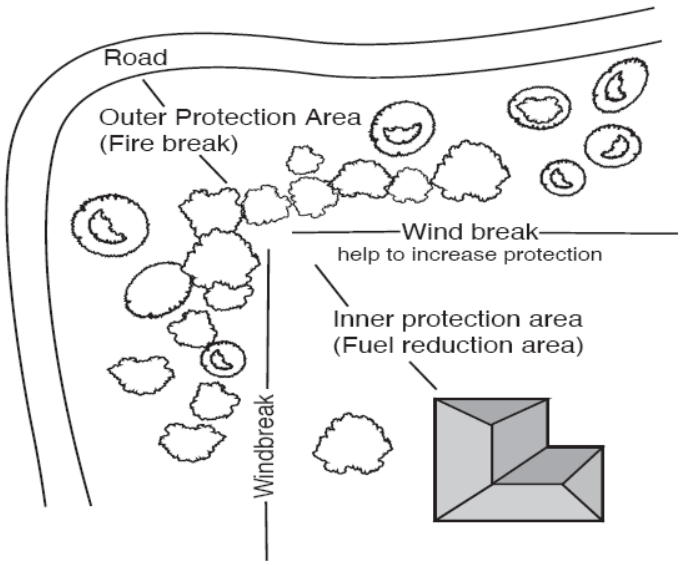

Figure 9. Example of landscaped design aimed at minimising the impact of fire. Source RFS (2008)

According to the RFS (2008), this can be achieved by providing an effective Asset Protection Zone (APZ) which incorporates features such as fire resistant plants, radiant heat barriers and windbreaks in the landscape layout as shown on Fig. 9. Following is summary of the key features required when using landscaping as tool to reduce bushfire risk (Ramsay & Rudolph 2006; RFS 2008b; RFS 2006):

- Plants with low flammability are selected (eg. broad leaves with high moisture and mineral content, smooth-trunk species with high branches, etc.)
- Vegetation does not provide a continuous path to the house
- Vegetation is located far enough away from the asset so that plants will not ignite the asset by direct flame contact or radiant heat emission
- Planted (or cleared) vegetation is into clumps rather than continuous rows
- Planted or retained species possesses attributes which makes them a good barrier against bushfire and wind attack
- Low branches are pruned two metres from the ground to prevent a ground fire from spreading into trees
- Lawn is planted and maintained around the house as this will slow the fire and reduce fire intensity. Alternatively, non-flammable pathways directly around the dwelling are provided

- Shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low-flammability plants and non flammable ground cover such as pebbles and crush tile
- Brush type fencing and planting "pencil pine" type trees next to buildings are avoided, as these are highly flammable.

Therefore, the features noted above and the principles listed in the following section are to be applied to the landscaping and property maintenance for the proposed dwelling.

4.5.1 Landscaping

The following principles, from PBP, will be incorporated into the landscaping design for any development of the Site; thus future landscaping shall:

- *Prevent flame impingement on dwellings;*
- *Provide a defendable space for property protection;*
- *Reduce fire spread;*
- *Deflect and filter embers;*
- *Provide shelter from radiant heat; and*
- *Reduce wind speed.*

The above can be achieved via appropriate species selection, plant location, plating density and ongoing maintenance.

4.5.2 Vegetation Management

Vegetation management is the responsibility if individual landowners and should, as per PBP, include:

- *Maintaining a low cut lawn;*
- *Keeping areas around the garden free of fuel;*
- *Utilising non-combustible fencing materials;*
- *Breaking up tree and shrub canopies by defining garden beds;*
- *Using non-flammable mulch;*
- *Ensuring tree branches do not overhang roofs;*
- *Ensuring tree canopies are not continuous; and*
- *Installing windbreaks in the direction from which fires are likely to approach.*

4.5.3 Property Maintenance

Property maintenance should, as per PBP, include:

- *Removal of material such as litter from the roof and gutters;*
- *Ensure painted surfaces are in good condition with decaying timbers being given particular attention to prevent the lodging of embers within gaps;*
- *Check pumps and water supplies are available and in working order;*
- *Driveways are in good condition with trees not being too close and forming an obstacle during smoky conditions;*
- *Check tiles and roof lines for broken tiles or dislodged roofing materials;*
- *Screens on windows and doors are in good condition without breaks or holes in flyscreen material and frames are well fitting into sills and window frames;*
- *Drenching or spray systems are regularly tested before the commencement of the fire season;*
- *Hoses and hose reels are not perished and fittings are tight and in good order;*
- *Doors are fitted with draught seals and well maintained;*
- *Mats are of non combustible material or in areas of low potential exposure; Woodpiles, garden sheds and other combustible materials are located downslope and well away from the house; and*
- *Trees and other vegetation in the vicinity of power lines and tower lines should be managed and trimmed in accordance with the specifications in "Vegetation Safety Clearances" issued by Energy Australia (NS179, April 2002).*

4.6 Siting, Design and Construction Standards

4.6.1 Siting & Design

According to PBP, the required performance criteria in regard to siting and design are that "Buildings are sited and designed to minimise the risk of bushfire attack".

The Acceptable Solution to meet these criteria is that "Buildings are designed and sited in accordance with the siting and design principles in Section 4.3.5 of PBP". These principles are summarised in Table 10. The application of the siting and design principles to the proposed development is also discussed in Table 10.

Table 10. Siting and Design Principles and their Application to the Proposed Development

Summary of Siting and Design Principles Outlines in s. 4.3.5 of PBP	Application of Principles in Reference to Proposed Development
The higher the building the greater its exposure of the building to radiant heat, wind turbulence and ember attack.	It is unknown what height future dwellings within the proposal area might be.
Avoid building on ridge tops and saddles. Build on level ground whenever possible.	All proposed lots provide dwelling sites on level ground.
Where buildings must be constructed on sloping land, they are built on cut-in benches.	N/A
Avoid raised floors, utilise concrete slabs	Construction types for future dwellings are unknown.
Some cladding material such as brickwork are more robust	N/A, as no dwellings are yet proposed. Cladding materials appropriate to Building Standard AS3959-1999 will be used on all dwellings.
Intricate forms of design can trap debris and influence wind turbulence. Re-entrant corners readily accumulate debris. Simplify the design of buildings to reduce the number of re-entrant corner. Provide more simplified rooflines.	N/A, as no dwellings are yet proposed. Future design should incorporate these principles.
Use of gutter on two storey buildings makes debris removal more difficult. Installation of leafless gutters enhances building performance	N/A, as no dwellings are yet proposed. It is recommended that future dwelling consider the installation of leafless gutters
The use of box gutters, flat roof and variation in the angle of the roof should be avoided	N/A, as no dwellings are yet proposed, however box gutters and flat roofs should be avoided.
Some design features can enhance the protection of a building, including limiting glazing on exposed façade and providing barriers (eg. BBQ areas, courtyards, fenced off areas for gardens and the like)	N/A, as no dwellings are yet proposed. Future design should incorporate these principles
Locate habitable buildings near the property entrance for easier access/egress entrance	Due to the small size of most lots, dwellings will have easy access to roads for access/egress.

4.6.2 Construction Standards

On the 1st May 2010, the RFS adopted the revised Standard, namely AS3959-2009 - construction of buildings in bushfire-prone areas through the Building Code of Australia (BCA) 2010. AS3959-2009 (Standards Australia 2009) was published on the 10th March 2009 and supersedes AS3959—1999 (Standards Australia 2001).

The new Standard key features include:

- the inclusion of requirements for six construction levels (up from three) or Bushfire Attack Levels (BAL) ranging from low to extreme;
  Note: NSW has made a State based variation to the BCA, which excludes BAL-FZ (Flame Zone) as a deemed-to-satisfy solution
- two options for determining the level of bushfire attack in a particular area;
- refinement of test methods for construction materials used in bushfire-prone areas, based on AS 1503.8;
- improved ember protection measures such as optional window shutters for designated areas; and
- provisions for non-exposed facades and attached structures such as garages (Standards Australia 2009).

In NSW, the BCA bush fire protection provisions are applied to (via a NSW State variation to the BCA) Class 1, 2, 3 buildings, Class 4 parts of buildings, some Class 10 structures and Class 9 buildings that are Special Fire Protection Purposes (SFPPs). The BCA 2010 references AS3959-2009 as the deemed-to-satisfy (DTS) solution for construction requirements in bushfire prone areas for NSW (RFS 2010a).

In order to clarify the NSW development approval process, the RFS has prepared an addendum to PBP, namely Addendum: Appendix 3 (RFS 2010b), which replaces the existing Appendix 3. The addendum aligns PBP Appendix 3 with the BCA DTS separation distance requirements for the Bushfire Attack Levels (BAL) of AS3959-2009. It also maintains ember protection consistent with current requirements (RFS 2010a). All development on bushfire prone land in NSW should comply with the requirements of this amended Appendix and other bushfire protection measures identified within PBP (RFS 2010b).

Table 2.4.3 of AS3959-2009 (Standards Australia 2009, p. 30) determines the category of bushfire attack according to the vegetation formation of the hazard and the distance from the hazard (refer Appendix B). Set back distance to a given vegetation increases with slope steepness and available fuel load because slope and fuel load are determining factors in calculating fire intensity. Additionally, when flame characteristics are computed with slope, distance and height of radiation receiving point, the Radiant Heat Flux can be calculated for a receiver. Thus, setback distances can be calculated to achieve a given Radiant Heat Flux threshold. The applicable Bushfire Attack Levels or BAL are as follows:

- **BAL–LOW** = risk is **very low**; no specific construction requirements
- **BAL–12.5** = risk is **low**, there is a risk of ember attack; construction elements are expected to be exposed to a radiant heat flux not greater then 12.5kW/m^2
- **BAL-19** = risk is **moderate**, there is a risk of ember attack and burning debris ignited by windborne embers, and a likelihood of exposure to radiant heat; construction elements are expected to be exposed to a radiant heat flux not greater then 19kW/m^2
- **BAL-29** = risk is **high,** there is an increased risk of ember attack and burning debris ignited by windborne embers, and a likelihood of exposure to an increased level of radiant heat; construction elements are expected to be exposed to a radiant heat flux not greater then 29kW/m^2
- **BAL-40* =** risk is **very high,** there is a much increased risk of ember attack and burning debris ignited by windborne embers, and a likelihood of exposure to a high level of radiant heat, and some likelihood of direct exposure to flames from the fire front; construction elements are expected to be exposed to a radiant heat flux not greater then 40kW/m^2

*BAL-40 in AS 3959-2009 generally corresponds to the construction requirements set in Level 3 Construction Standard under AS 3959-1999.

Note: *An Alternative Solution will be required if the building exceeds the specification of BAL-40 of AS 3959 (i.e.>40 kW/m2) in which case it is considered to be within the 'Flame Zone'. NSW has made a State based variation to the BCA. This variation excludes BAL-FZ (Flame Zone) as a deemed-to-satisfy solution.*

The APZs recommended in Section 3 of this report for the residential subdivision assume a Construction Standard of BAL-40. However, Bushfire Attack Levels (BAL) decrease with increased separation from hazard. Therefore, the BAL prescriptions that will apply to future buildings at the Site will range from BAL-40 for those dwellings closest to the hazardous vegetation through to BAL-12.5 and to no construction requirements for those lots where the separation to the hazard is greater than 100 m. **This can only be accurately calculated when individual dwelling are proposed for each approved site, and a bushfire assessment in accordance with s.79BA of the EP&A Act will be required to determine the applicable Construction Standard for each proposed dwelling.**

5. Recommendations & Compliance

As discussed, PBP states that it must be demonstrated that the proposal satisfies the broad aim and objective of PBP, the specific objectives for the development type and the performance criteria for the various proposed Bushfire Protection Measures (BPMs).

This assessment demonstrates that the proposed Development Application satisfies such requirements **provided that the following is complied with and implemented**:

- The acceptable solutions or proposed alternatives **prescribed in Sections 4.2 to 4.6**, in particular:
  - The APZs prescribed on Table 5 and shown on Fig. 8.
  - APZs are to be managed in accordance with the requirements of 'Standards for Asset Protection Zones' (RFS 2008)
  - The access requirements outlined in Section 4.3
  - The landscaping and property maintenance principles outlined in Section 4.6.

In conclusion, this Assessment demonstrates that if the prescribed provisions are implemented, the proposed Development Application complies with the specific objectives for the development type and the performance criteria for the various proposed Bushfire Protection Measures in accordance with PBP.

Therefore, the requirements of PBP 2006 have been addressed according to he Director General's requirements (issued 28.07.08, item 5.4) made under part 3A of the *Environmental Planning and Assessment Act 1979*.

6. References

CFA 2004, *Living in the Bush – Bushfire Survival Plan Handbook*, CFA Headquarters, East Burwood, Victoria.

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James Warren & Associates, 2009, *Ecological Assessment Lot 73 DP851902 Bayside Way, Brunswick Heads*. A report to Codlea Pty Ltd.

Keith, D., A., 2004, *Ocean Shores to Desert Dunes,* Department of Environment and Conservation (NSW), Hurstville NSW.

Queensland Government, 2000, *Protecting Your Home against Bushfire Attack,* Department of Communication and Information, Local Government, Planning and Sport.

Ramsay, C & Rudolph, L 2006, *Landscape and Building Design for Bushfire Areas*, CSIRO Publishing.

Rural Fire Service (RFS) 2006, *Planning for Bush Fire Protection 2006,* Rural Fire Service in cooperation with the Department of Planning, Sydney.

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http://www.rfs.nsw.gov.au/file_system/attachments/State/Attachment_20060130_7DE0A145.pdf

Standards Australia 2001, *Construction in Bushfire Prone Areas – AS3959-1999 (amended 2001)*, Standards Australia International.

Appendices

Appendix A – APZs Modelling Reports

ASSET PROTECTION ZONE MODELLING REPORT

For Site Located At: **Bayside Way**
Created By: **RFS APZ Calculator**

1. User's Inputs

Development Purposes: **Residential Subdivision**

Local Government Area: **Byron**

In Alpine Areas: **No**

Vegetation: **Forests**

Effective Slope (degree): **0** (level)

2. Program's Settings

Flame Width (m) : **100**

Flame Angle (degree): **62** (determined by the built-in algorithm)

Flame Temperature (K) : **1090**

Flame Emissivity: **0.95**

Surface Available Fuel Load (t/ha): **20**

Overall Fuel Load (t/ha): **25**

Fire Danger Index: **80** (Fire Weather Area: Far North Coast)

Relative Humidity (%): **25**

Ambient Temperature (K): **308**

Heat of Combustion (kJ/kg): **18600**

Elevation of Receiver (m): **6.83** (determined by the built-in algorithm)

3. Program Outputs

Asset Protection Zone (m): **17** (IPA=9m, OPA=8m)

Rate of Fire Spread (km/h): **1.92** (Noble et al., 1980)

Fire Intensity (kW/m): **24800**

Transmissivity: **0.852** (Fuss and Hammins, 2002)

Flame Length (m): **15.48** (RFS PBP, 2001)

Expected Radiant Heat Exposure (kW/m^2)**: 29**

Assessment Date: **20/8/2009** Modelled By: **Paola Rickard**

ASSET PROTECTION ZONE MODELLING REPORT

For Site Located At: **Bayside Way**
Created By: **RFS APZ Calculator**

1. User's Inputs

Development Purposes: **Residential Subdivision**

Local Government Area: **Byron**

In Alpine Areas: **No**

Vegetation: **Forested wetlands**

Effective Slope (degree): **0** (level)

2. Program's Settings

Flame Width (m) : **100**

Flame Angle (degree): **63** (determined by the built-in algorithm)

Flame Temperature (K) : **1090**

Flame Emissivity: **0.95**

Surface Available Fuel Load (t/ha): **15**

Overall Fuel Load (t/ha): **20**

Fire Danger Index: **80** (Fire Weather Area: Far North Coast)

Relative Humidity (%): **25**

Ambient Temperature (K): **308**

Heat of Combustion (kJ/kg): **18600**

Elevation of Receiver (m): **5.24** (determined by the built-in algorithm)

3. Program Outputs

Asset Protection Zone (m): **13** (IPA=13m, OPA=0m)

Rate of Fire Spread (km/h): **1.44** (Noble et al., 1980)

Fire Intensity (kW/m): **14880**

Transmissivity: **0.862** (Fuss and Hammins, 2002)

Flame Length (m): **11.76** (RFS PBP, 2001)

Expected Radiant Heat Exposure (kW/m^2)**: 29**

Assessment Date: **20/8/2009** Modelled By: **Paola Rickard**

ASSET PROTECTION ZONE MODELLING REPORT

For Site Located At: **Bayside Way**
Created By: **RFS APZ Calculator**

1. User's Inputs

Development Purposes: **Residential Subdivision**

Local Government Area: **Byron**

In Alpine Areas: **No**

Vegetation: **Tall heath**

Effective Slope (degree): **0** (level)

2. Program's Settings

Flame Width (m) : **100**

Flame Angle (degree): **63** (determined by the built-in algorithm)

Flame Temperature (K) : **1090**

Flame Emissivity: **0.95**

Surface Available Fuel Load (t/ha): **25**

Overall Fuel Load (t/ha): **25**

Vegetation Height (m): **3**

Wind Speed (km/h): **45**

Relative Humidity (%): **25**

Ambient Temperature (K): **308**

Heat of Combustion (kJ/kg): **18600**

Elevation of Receiver (m): **5.18** (determined by the built-in algorithm)

3. Program Outputs

Asset Protection Zone (m): **13** (IPA=13m, OPA=0m)

Rate of Fire Spread (km/h): **4.17** (Catchpole et al., 1998)

Fire Intensity (kW/m): **53816**

Transmissivity: **0.862** (Fuss and Hammins, 2002)

Flame Length (m): **11.63** (Byram, 1959)

Expected Radiant Heat Exposure (kW/m^2)**: 29**

Assessment Date: **20/8/2009** Modelled By: **Paola Rickard**

Appendix B – Determination of Bushfire Attack Level (BAL)

TABLE 2.4.3 - DETERMINATION OF BUSHFIRE ATTACK LEVEL (BAL)—FDI 80 (1090 K) (Standards Australia 2009, p. 30)

Vegetation classification	Bushfire Attack Levels (BALs)				
	BAL—FZ	BAL—40	BAL—29	BAL—19	BAL—12.5
	Distance (m) of the site from the predominant vegetation class				
	All upslopes and flat land (0 degrees)				
A. Forest	<16	16–<21	21–<31	31–<42	42–<100
B. Woodland	<10	10–<14	14–<20	20–<29	29–<100
C. Shrubland	<10	10–<13	13–<19	19–<27	27–<100
D. Scrub	<7	7–<9	9–<13	13–<19	19–<100
E. Mallee/Mulga	<6	6–<8	8–<12	12–<17	17–<100
F. Rainforest	<6	6–<9	9–<13	13–<19	19–<100
	Downslope >0 to 5 degrees				
A. Forest	<20	20–<27	27–<37	37–<50	50–<100
B. Woodland	<13	13–<17	17–<25	25–<35	35–<100
C. Shrubland	<11	11–<15	15–<22	22–<31	31–<100
D. Scrub	<7	7–<10	10–<15	15–<22	22–<100
E. Mallee/Mulga	<7	7–<9	9–<13	13–<20	20–<100
F. Rainforest	<8	8–<11	11–<17	17–<24	24–<100
	Downslope >5 to 10 degrees				
A. Forest	<26	26–<33	33–<46	46–<61	61–<100
B. Woodland	<16	16–<22	22–<31	31–<43	43–<100
C. Shrubland	<12	12–<17	17–<24	24–<35	35–<100
D. Scrub	<8	8–<11	11–<17	17–<25	25–<100
E. Mallee/Mulga	<7	7–<10	10–<15	15–<23	23–<100
F. Rainforest	<11	11–<15	15–<22	22–<31	31–<100
	Downslope >10 to 15 degrees				
A. Forest	<33	33–<42	42–<56	56–<73	73–<100
B. Woodland	<21	21–<28	28–<39	39–<53	53–<100
C. Shrubland	<14	14–<19	19–<28	28–<39	39–<100
D. Scrub	<9	9–<13	13–<19	19–<28	28–<100
E. Mallee/Mulga	<8	8–<11	11–<18	18–<26	26–<100
F. Rainforest	<14	14–<19	19–<28	28–<39	39–<100
	Downslope >15 to 20 degrees				
A. Forest	<42	42–<52	52–<68	68–<87	87–<100
B. Woodland	<27	27–<35	35–<48	48–<64	64–<100