Pacific Pines
Ecological Assessment

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Pacific Pines
Ecological Assessment

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1 Introduction

1.1 Background

GeoLINK has been engaged by Petrac Pty Ltd to undertake an Ecological Assessment to support an application to the Department of Planning, made under Part 3A of the *Environmental Planning and Assessment Act 1979*, for the subdivision of the Pacific Pines Estate. The subdivision will provide approximately 500 residential lots and approximately 160 retirement lots. It will also include the provision of a retail precinct and neighbourhood centre/ facilities.

The Director-General of the Department of Planning has issued requirements in relation to the environmental assessment for this Part 3A application. In relation to ecology, the principle requirement of the Director-General is:

> *Conduct and document a comprehensive field survey in accordance with the draft Guideline for Threatened Species Assessment. Outline potential impacts on aquatic and terrestrial flora and fauna and their habitats (within the meaning of the Threatened Species Conservation Act 1995 and the Fisheries Management Act 1994), including the SEPP 26 littoral rainforest, Ballina Nature Reserve and SEPP 14 wetland areas, and identify consistency with the document Policy and Guidelines Aquatic Habitat Management and Fish Conservation 1999. Provide measures for their conservation and management, where relevant.*

The assessment provided herein addresses this requirement and includes a detailed flora and fauna assessment to address the following Acts:

- *Threatened Species Conservation Act 1995*;
- *Fisheries Management Act 1994*; and
- *Environment Protection and Biodiversity Conservation Act 1999*.

1.2 Study Area

The study area includes the site, Lot 234 DP 1104071, and any additional areas which are likely to be affected by the proposal, either directly or indirectly (refer to **Illustration 1.1**). The study area in this case covers a 5km radius around the site and includes North Creek; an extensive area of SEPP 14 wetland within the Ballina Nature Reserve, an area of SEPP 26 Littoral Rainforest (No. 39) to the north-west of the site.

1.3 Site

The site is the area directly affected by the proposal and is described as Lot 234 DP 1104071 Hutley Drive, Lennox Head (refer to **Illustration 1.2**). The site is located within Ballina Shire Council Local Government Area, approximately 1 km west of the coastal village of Lennox Head; 7 km north of Ballina and 18 km south of Byron Bay.

The site is cleared coastal land that is currently used for cattle grazing. It is located to the north of the existing stages of the Pacific Pines Estate and the majority of vegetation has been cleared in the past. There are however, some remnant stands of vegetation and natural and man-made drainage lines on the site.

1.3.1 Topography

The site is characterised by low lying land in the western portion, with elevations of approximately RL 2 m AHD, and hillsides in the eastern portion of the site, which rise to approximately RL 40 m AHD. This can be described as a natural amphitheatre. The highest part of the site is RL 50.5 m AHD and is located in the central northern portion (refer to **Illustration 1.3**).

1.3.2 Geology and Soils

The site falls within the 'disputed plain transferral landscape' and the 'Bangalow erosional landscape' (Morand 1994). The disputed plain soil landscape consists of basalt derived valley in-fills and alluvial fans forming gently inclined slopes. Relief is 10-30 m and slopes are generally 1-3%. This soil landscape is characterised by partly active and / or stable gullies, closed sod grassland and open sedgeland. The soils are highly plastic with low permeability, low wet bearing strength, high surface movement and permanently high watertables. This soil landscape is generally located along the two main gullies within the site.

The Bangalow soil landscape dominates the site and is characterized by low rolling hills on basalt. Relief is 40-100 m, elevation 100-150 m and slopes are generally 15-25%. The geological origin is Lamington volcanics: Lismore basalts – Tertiary basalts with bole and minor agglomerate.

1.3.3 Catchment Description

The site is located in the North Creek catchment. A ridge runs parallel to the coast to the east of the site. Runoff from the western side of this ridge drains through the site into North Creek. North Creek flows into the mouth of the Richmond River approximately 7km south (Warren 2003).

1.3.4 Conservation Reserves

Ballina Nature Reserve is located to the immediate south-west of the site. It covers 665 ha and is listed as State Environmental Planning Policy No. 14 Coastal Wetland No. 88. It contains mangroves, swamp sclerophyll forest and saltmarsh (refer to **Illustration 1.3**).

Lennox Head Reserve Trust (No. 97810) is located approximately 2 km north of the site within Lots 105 and 106 DP 755725 and is bisected by Ross Lane (refer to **Illustration 1.3**). The northern portion (Lot 105) is bordered on the western side by Fig Tree Hill Drive and the southern boundary of the southern portion (Lot 106) is bordered by Coopers Close. This reserve is dedicated to the preservation of native flora.

State Environmental Planning Policy No. 26 Littoral Rainforest No. 39 also exists to the immediate north-west of the site (refer to **Illustration 1.3**).

1.3.5 Landuse

Land uses within the study area include conservation, grazing, commercial, urban, residential development and recreation. The site is bordered to the north, east and south by residential properties. Recently constructed estates that surround the site include 'Lennox Meadows' Estate to the north, 'Warrawee' Estate to the east and the earlier stages of Pacific Pines to the south. Playing fields are located immediately west of the site. Ballina Nature Reserve (SEPP 14 Coastal Wetland No. 88) is located south-west of the site.

Illustration 1.1 Study Area

Illustration 1.2 Site

Illustration 1.3 Site Analysis

2 Proposed Development

2.1 Description of Works

The proposed Pacific Pines Estate will include:

- standard residential housing;
- areas of medium density housing;
- seniors living housing;
- areas of open space;
- commercial and community facilities;
- drainage infrastructure; and
- other associated infrastructure.

A Concept Plan outlining the proposed development is indicated in **Illustration 2.1**. The Part 3A application involves an application for Concept Plan approval for the whole of the site, together with a concurrent Project approval for Stage 1 of the proposed development.

2.2 Concept Plan

The key elements of proposal shown in **Illustration 2.1** include:

- The creation of a 'super lot', to be developed in the future to provide a Neighbourhood Centre. This centre will include a local-scale shopping centre and associated retail, small businesses, a tavern, a medical centre, and recreational, leisure and community facilities all clustered around a vibrant public domain that includes the existing pond as its main visual feature;
- The creation of a second 'super lot', to be developed for an Integrated Retirement Community. This lot is located immediately to the east of the existing pond, and will include a variety of retirement options, including assisted and independent living. It will also include on-site leisure, open space and recreational facilities;
- Residential areas containing approximately 500 lots of varying sizes to provide for a variety of housing densities and types, catering for a wide variety of needs within the community;
- Medium density housing precincts located in close proximity to facilities and services;
- Parks, footpath / cycleways and protected conservation areas, all provided to a high quality standard for use of existing and future residents in the locality;
- A long term management strategy to protect and enhance threatened species habitat on-site and in the local area, particularly concentrating on habitat for Hairy Joint Grass (*Arthraxon hispidus*); and
- A highly connected and permeable street network, accessed by a number of existing streets, including Hutley Drive, Montwood Drive, Stoneyhurst Drive and the future connection to Henderson Farm, located to the west.

The Neighbourhood Centre is designed as a main street, and will have shopping, small business, an arts/enterprise centre, medical centre, childcare centre, leisure, and community facilities clustered around the pond. The centre will be within walking distance for most future residents.

The retirement community is proposed on relatively flat ground at the base of the natural amphitheatre and contains highly walkable slow-speed streets, which integrate with the rest of the development. The retirement community facilities, apartments and assisted living centre directly front the pond.

The sports fields, which are currently under construction, will be completed and enhanced. Existing natural habitats are protected and an existing drainage line will be enhanced to create a new brook flowing through the retirement community. The brook will also link existing lines of remnant native vegetation in the east, and a natural spring, to the pond and the Ballina Nature Reserve to the west.

The majority of the remainder of the site will be subdivided to create a mix of residential lot sizes, with smaller lots located closer to the proposed neighbourhood centre, detached housing lots of around 600-800 m^2 throughout much of the site and larger lots of up to 1,500 m^2 located on steeper slopes.

2.3 Project Application

Project Approval is concurrently sought for Stage 1 of the project. This first stage involves the creation of a total of 59 lots. These include six 'super lots', which will be later developed for a Neighbourhood Centre, an Integrated Retirement Community and a medium density development lot; 49 conventional residential allotments, and three open space lots.

The lots will be serviced by a full range of water, sewer, electricity and telecommunication services. Stage 1 will also include the construction of a number of roads, parks and pedestrian links.

Approval will be pursued separately for the future development of the 'super lots'. The intended use of these lots is:

- Super lot 1 – neighbourhood shopping centre;
- Super lot 2 – tavern;
- Super lot 3 – child care;
- Super lot 4 – community centre / hall;
- Super lot 5 – retirement community; and
- Super lot 6 – medium density residential.

Illustration 2.1 Concept Plan

3 Methodology

3.1 Previous Assessment

A detailed flora and fauna assessment of the site was carried out in 2003 by James Warren and Associates (JWA), as part of an application made to the Department of Planning for a Master Plan approval under the provisions of *State Environmental Planning Policy No. 71 – Coastal Development* (Master Plan 22-12-2003, adopted by the Minister on 23 March 2006).

That assessment concluded that, on the basis of remnant and regrowth vegetation in the locality and other environmental conditions such as topography, soil and climate, the site would have originally supported the following types of vegetation:

- *the lower lying western parts of the site would have supported swamp sclerophyll forest. This community would have supported a rainforest shrub understorey, particularly on the margins and on elevated areas within the forest;*
- *the krasnozem soil slopes would have originally supported a dense cover of subtropical/ littoral rainforest. Williams et al (1984) notes that subtropical rainforest is a dense vegetation type with up to 60 species in the canopy including Booyongs (Argyrodendron spp.), Yellow Carabeen (Sloanea woollsii), Rosewood (Dysoxylum fraserianum), Figs (Ficus spp.) and Lilly Pillys (Acmena and Syzygium spp.). Littoral rainforest is a distinctive rainforest type of the coastal zone which includes characteristics of both subtropical and dry rainforests. Characteristic canopy species include Three-veined Cryptocarya (Cryptocarya triplinervis), Tuckeroo (Cupaniopsis anacardioides), Broad-leaved Lilly Pilly (Acmena hemilampra), Riberry (Syzygium luehmannii) and Beach Acronychia (Acronychia littoralis). Conifers such as Hoop Pine and Plum Pine are sometimes present within these stands. Given the intergrading of diverse swamp sclerophyll and rainforests the biotic diversity of this area would have been high* (Warren 2003).

JWA also undertook a detailed fauna assessment, carried out tests of significance relating to potential impacts on threatened species, assessed corridor values and impacts, and undertook a statutory koala assessment in accordance with *State Environmental Planning Policy No. 44 – Koala Habitat*.

JWA concluded that the Master Plan, as proposed, would not result in significant environmental impacts. The DGRs for the revised concept plan however requested an updated ecological assessment to be undertaken in accordance with DEC and DPI draft Guideline for Threatened Species Assessment (2005).

3.2 Report Methodology

The following methodology was adopted for this Ecological Assessment:

- Background review and literature review of previous assessments;
- Threatened species database searches, including:
  - Department of Environment and Climate Change Wildlife Atlas Flora Records;
  - Department of Environment and Climate Change Wildlife Atlas Fauna Records; and
  - Environment Protection and Biodiversity Conservation Database.
- Field surveys; and
- Ecological impact analysis.

3.3 Flora Surveys

As part of the previous assessment, the site was surveyed in November and December 2001 and August 2003 by JWA. A total of approximately 17 hours of survey were undertaken at that time. To build on this knowledge, comprehensive flora surveys were undertaken by GeoLINK throughout May and June 2007. A total of 42 person hours of survey were completed during this period.

3.3.1 Aerial Photographic Interpretation

Vegetation communities were delineated with the aid of aerial photographs. Isolated trees were also mapped and the species was confirmed in the field. Aerial Photographic Interpretation (API) allowed areas of potential habitat for targeted threatened species to be mapped which were then ground truthed in the field.

3.3.2 Random Meander Surveys

The 'random meander' method, as explained within the *Threatened Species Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft November 2004* (DEC 2004), was utilised to assess the vegetation present within the site following API. The identification of flora species were recorded in the field and those that required further clarification were collected and keyed out using relevant literature.

3.3.3 Targeted Threatened Flora Searches

Targeted searches were completed for all threatened species considered as possibly occurring within the site based on their preferred habitat. These surveys were incorporated into the random meander method and were mainly undertaken within the areas of littoral rainforest. Threatened woody vegetation was tagged and coded. Features such as the height and comments regarding the health and form were also recorded.

Targeted searches were undertaken for Hairy Joint Grass (*Arthraxon hispidus*) in May and June 2007. This species was not targeted in any previous surveys as it had not been recorded within the broader study area and little information was known about this species. Recent surveys outside the site recorded this threatened grass within areas of similar habitat. Aerial photographic interpretation was undertaken to identify areas of likely habitat for this species. Targeted surveys were therefore undertaken in the form of transects, which involve traversing the site on foot, recording the location of each clump of Hairy Joint Grass with a Global Positioning System (GPS).

3.4 Fauna Surveys

Fauna surveys were previously conducted across the site by JWA in 2000. These surveys included specialised bird, microchiropteran bat and amphibian surveys, using spotlighting, hair sampling and trapping techniques.

Additional fauna survey surveys were also completed by JWA in 2003 in response to requests by Ballina Shire Council for further information in relation to applications associated with the adjacent playing fields.

JWAs survey work included:

- targeted survey for the threatened Wallum Froglet (*Crinia tinnula*);
- targeted survey for the threatened Australasian Bittern (*Botaurus poiciloptilus*); and
- targeted survey for the threatened Grass Owl (*Tyto capensis*).

Additional threatened fauna species recorded in the wider Ballina area, and considered as having some likelihood of occurring within the site, are the Square-tailed Kite (*Lophoictinia isura*), Brolga (*Grus rubicundus*), White-eared Monarch (*Monarcha leucotis*), Black Bittern (*Ixobrychus flavicollis*) and the

Common Bentwing Bat (*Miniopterus schreibersii*). The Southern Myotis (*Myotis adversus*) has not been recorded from the site, but is considered likely to occur in the study area (JWA 2003).

JWA (2003) noted that searches were made for scats, bones, tracks, diggings and other signs of fauna presence. Extended rainy periods at the time provided excellent conditions for Wallum Froglets on the NSW North Coast. The site was visited on five occasions after sunset and in the morning. All ponds and wet grassland areas were investigated and call playback was completed using a hand-held tape recorder. Spotlighting and call playback for the Grass Owl was also completed over three nights in February 2003.

A targeted survey for Mitchell's Rainforest Snail was completed within Ballina Nature Reserve in 2000. The area searched was a small area of swamp sclerophyll forest with rainforest elements located on the eastern side of North Creek approximately 1km south of the site. This area provides the most suitable area of habitat for this species in the wider study area.

Given the thorough extent of survey work undertaken previously, full fauna surveys were not repeated in 2007.

3.5 Habitat Assessment

As it is recognised that not all species can be detected during fauna surveys, habitat assessments were undertaken to identify any potential habitats (especially for threatened species). Habitats were assessed to determine their value for native fauna species. This assessment was completed in conjunction with flora surveys. The assessment focused on identifying habitat features known to be associated with threatened species as well as other native fauna groups. Particular attention was paid to habitat features such as:

- vegetation structure;
- level of disturbance;
- mature trees with hollows, spouts, fissures and/or other suitable roosting/nesting places;
- presence of scats, bones, tracks, diggings, scratches, feed scars and pock marks;
- Koala food trees;
- presence of Glossy Black Cockatoo feed trees (Forest Oak and/or Black She-oak);
- presence of Yellow-bellied Glider feeding scars;
- condition, flow and water quality of drainage lines and bodies of water;
- areas of dense vegetation;
- hollow logs, debris and dense leaf litter;
- fruiting and blossoming flora species;
- vegetation connectivity and proximity to neighbouring areas of intact vegetation; and
- caves and man-made structures suitable for microchiropteran bat roost sites.

3.6 Survey Limitations

The site was comprehensively surveyed between 2000 and 2003. Additional habitat surveys and extensive flora surveys were undertaken in 2007. The most recent surveys were conducted towards the end of autumn, which is favourable for the identification of many flora species; however, as not all species flower or fruit during this period, some may have been overlooked. The timing of targeted surveys for Hairy Joint Grass was seen to be suitable despite this species beginning to die off for winter. Healthy specimens were observed as well as some yellowing specimens as they began to die off. The yellowing specimens proved easier to identify than the healthy green specimens. Additionally, while some species

may be present, they may have avoided detection due to their rarity, elusive nature or the sporadic utilisation of the study area.

4 Results

4.1 Flora Observations

Native vegetation on the site is dominated by a number of vegetation communities, including mid-high closed littoral rainforest, tall open Swamp Oak forest, tall open swamp sclerophyll forest, sedgeland / rushland and low closed grassland. The distribution of these dominant vegetation communities is shown in **Illustration 4.1**. The floristic and structural characteristics of these vegetation communities are described in **Sections 4.1.1**-**4.1.5**. A full list of native and exotic flora species observed within the site can be found in **Appendix A**.

Several isolated Moreton Bay Figs (*Ficus macrophylla*) are scattered throughout the site. These trees are significant to the local environment as they provide important microhabitats and act as islands for avifauna and arboreal mammals. Several of these trees appear to be quite old and may have local historical significance (refer to **Plate 4.1**).

Plate 4.1 Large Moreton Bay Fig (*Ficus macrophylla)*

4.1.1 Mid-high Closed Littoral Rainforest

Distribution of Community with the Site

This community mainly occurs within two elongated sections on elevated areas along an old fence line which runs north / south within the eastern portion of the site. Another elongated section also follows an existing fence further west (refer to **Illustration 4.1**).

Dominant Species

Tuckeroo	(*Cupaniopsis anarcardioides*)
Guioa	(*Guioa semiglauca*)
Green Bolly Gum	(*Neolitsea australiensis*)
Red Kamala	(*Mallotus philippensis*)
*Camphor Laurel	(*Cinnamomum camphora*)
*Lantana	(*Lantana camara*)

Note * denotes exotic species

Condition of Vegetation

The littoral rainforest vegetation is in a degraded state, with relatively low species diversity. The small, isolated pockets of littoral rainforest are fragmented, are subject to trampling by cattle and contain a significant portion of exotic species, mainly Camphor Laurel (*Cinnamomum camphora*). A significant proportion of this community also appears to consist of common regrowth species.

Conservation Significance

Littoral Rainforest in the NSW North Coast is listed as an Endangered Ecological Community (EEC) within Part 3 of Schedule 1 of the *Threatened Species Conservation Act 1995*. Littoral Rainforest is very rare as it occurs in many small stands and has been significantly fragmented due to coastal development. In total, it comprises less than one percent of the total area of rainforest in NSW. A seven-part test of significance has therefore been undertaken in accordance with Section 5A of the *Environmental Planning and Assessment Act* 1979 in order to determine if the proposed development is likely to have a significant effect on this community (refer to **Appendix B**).

The threatened species White Laceflower (*Archidendron hendersonii*) was recorded within the south-eastern section of Littoral Rainforest. Red Lilly Pilly (*Syzygium hodgkinsoniae*) and Arrow Head Vine (*Tinospora tinosporoides*) were also identified within the northern section of Littoral Rainforest. Seven-part tests have been undertaken for these threatened species identified on site.

As part of the Regional Forest Agreement (RFA) process in NSW, a Comprehensive Regional Assessment (CRA) of forest ecosystems was completed. Under the CRA classification, this community is best described as Forest Ecosystem 168 (Rainforest) (NPWS 1999). It must be noted that CRA does not provide for more detailed categorisation of rainforest, e.g. littoral rainforest.

Plate 4.2 Mid-high Closed Littoral Rainforest

Illustration 4.1 Vegetation Communities

4.1.2 Tall Open Swamp Oak Forest

Distribution of Community with the Site

The Swamp Oak forest community occurs as a fragmented patch to the north-east of the rainforest community, at the south-eastern end of the site (refer to **Illustration 4.1**).

Dominant Species

Swamp Oak	(*Casuarina glauca*)
Common Reed	(*Phragmites australis*)
Black Wattle	(*Acacia melanoxylon*)
*Camphor Laurel	(*Cinnamomum camphora*)
*Lantana	(*Lantana camara*)

Condition of Vegetation

The Swamp Oak forest is in a degraded state with a fragmented canopy dominated by Swamp Oak (*Casuarina glauca*) and Camphor Laurel (*Cinnamomum camphora*). The midstorey and understorey vegetation is relatively low in diversity and contains a significant proportion of exotic species. This community is also subject to trampling by cattle. This vegetation community is only approximately 0.3 ha in area and is therefore subject to edge effects.

Conservation Significance

Swamp Oak Floodplain Forest on the NSW North Coast is classified as an Endangered Ecological Community within Part 3 of Schedule 1 of the *Threatened Species Conservation Act 1995*. A seven-part test of significance has therefore been undertaken for this vegetation community (refer to **Appendix B**) in accordance with Section 5A of the *Environmental Planning and Assessment Act* 1979 in order to determine if the proposed development is likely to have a significant effect on this community.

Under the CRA classification, this community is analogous to Forest Ecosystem 143 (Swamp Oak) (NPWS 1999). RFA provides the following data on this ecosystem:

> *Pre 1750 there was 11165 hectares of this ecosystem in the upper north east section of the NSW North Coast Bioregion. 2883 hectares (25.8%) remains.*

Plate 4.3 Tall Open Swamp Oak Forest

4.1.3 Tall Open Swamp Sclerophyll Forest

Distribution of Community with the Site

This community occurs as a small patch in the low-lying south-western portion of the site, directly east of the water quality control pond.

Dominant Species

Broad Leaved Paper Bark	(*Melaleuca quinquenervia*)
Broad-leaved Cumbungi	(*Typha orientalis*)
*Camphor Laurel	(*Cinnamomum camphora*)
*Lantana	(*Lantana camara*)

Condition of Vegetation

The Swamp Sclerophyll Forest occurs over approximately 0.1ha and has relatively good diversity in relation to its size. A drainage line runs directly adjacent to this vegetation creating semi-inundated areas in the community and has resulted in macrophytes such as Cumbungi (*Typha orientalis*) infiltrating from the edges. Cattle also have access to this area of vegetation as trampling is evident around the fringes of the community.

Conservation Significance

Swamp Sclerophyll Forest on the NSW North Coast is classified as an Endangered Ecological Community within Part 3 of Schedule 1 of the *Threatened Species Conservation Act 1995*. A seven-part test of significance has therefore been undertaken for this vegetation community (refer to **Appendix B**) in accordance with Section 5A of the *Environmental Planning and Assessment Act* 1979 in order to determine if the proposed development is likely to have a significant effect on this community.

This community is best described by Forest Ecosystem 112 (Paperbark) (NPWS 1999). The RFA provides the following data on this ecosystem:

- 28,577 hectares of this ecosystem type remains within the upper north-east section of the NSW North Coast Bioregion. The original extent (i.e. Pre 1750) has not been calculated;
- Paperbark communities have been identified as a priority for conservation on private land.

Plate 4.4 Tall Open Swamp Sclerophyll Forest

4.1.4 Sedgeland/Rushland

Distribution of Community with the Site

This community occurs in poorly drained areas below the 5m contour east from the water quality control pond.

Dominant Species

A Rush	*(Schoenoplectus validus)*
Common Spike-sedge	(*Eleocharis acuta*)
Swamp Rice Grass	(*Leersia hexandra*)
Swamp Foxtail	(*Pennisetum alopecuroides*)
*Paspalum	(*Paspalum dilatum*)

Condition of Vegetation

This community has been significantly disturbed due to cattle grazing and consists of common native swamp grasses and sedges, and weedy pasture species.

Conservation Significance

The conservation significance of these areas is high as freshwater swamp ecosystems are uncommon. Additionally, Hairy Joint Grass was recorded throughout this vegetation community, which is listed as vulnerable under the *Threatened Species Conservation Act 1995* and the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*. Hairy Joint Grass was not recorded above the 6.5m contour.

The conservation status of Sedgeland/Rushland communities has not been specifically discussed in the RFA. However, it is noted that swamp ecosystems are rare in the upper north east section of the NSW North Coast Bioregion.

Plate 4.5 Sedgeland/ Rushland

4.1.5 Low Closed Grassland

Distribution of Community with the Site

This community dominates the majority of the site. The majority of vegetation outside the littoral rainforest, swamp oak, swamp forest and sedgeland/rushlland communities consist of low closed grassland. This vegetation community generally occurs above the 5m contour and is grazed by cattle.

Dominant Species

*Paspalum	(*Paspalum dilatum*)
*Broad-leaved Paspalum	(*Paspalum wettsteinii*)
*Buffalo Grass	(*Stenotaphrum secundatum*)
*Kikuyu	(*Pennisetum clandestinum*)

Additional weed species include Fireweed (*Senecio madagascariensis)*, Scotch Thistle (*Onopordum acanthium)*, Paddy's Lucerne (*Sida rhombifolia)* and Narrow-leaved Cottonbush (*Gomphocarpus fruticosus)*.

Condition of Vegetation

These areas are heavily grazed and therefore highly disturbed. Few significant native species exist apart from isolated paddock trees such as Guioa (*Guioa semigaluca*) and Tuckeroo (*Cupaniopsis anacardioides*).

Conservation Significance

This majority of this vegetation community has low conservation value as it is highly disturbed due to intensive cattle grazing and dominated by weedy pasture species such as Kikuyu, Paspalum and Buffalo Grass.

Plate 4.6 Low Closed Grassland showing isolated paddock trees

4.2 Threatened Flora

4.2.1 Database Results

Records of threatened flora species, populations or ecological communities known to occur within a 5km radius of the site were obtained from the Department Environment and Climate Change Wildlife Atlas database. The search of Atlas identified seven threatened flora species occurring within the study area. Additionally, records of threatened plant species, communities or species habitat likely to occur within 5km of the study area were obtained from the Environment Protection Biodiversity Conservation (EPBC) Database. The EPBC database listed 15 threatened flora species as '*species habitat likely to occur within area*'.

The suitability of the site's habitat and likely occurrence of each of these listed species has been assessed in **Table 4.1**. The list of threatened species found within the database searches is provided in **Appendix C**.

Table 4.1 Threatened Flora Recorded in DECC Wildlife Atlas and EPBC Databases

Scientific Name	*Common Name*	*Status*		*Habitat Requirement*	*Suitability of Site Habitat*	*Potential Occurrence*
		TSC Act	*EPBC Act*			
Achronychia littoralis	Scented Acronychia	E	E	Littoral rainforest on sand	Moderate	Possible
Austromyrtus fragrantissima	Sweet Myrtle	E	E	Dry subtropical and riverine rainforest	Moderate	Possible
Archidendron herdersonii	White Laceflower	V	-	Riverine and lowland subtropical and littoral rainforest	High	**Known**
Cryptocarya foetida	Stinking Cryptocarya	V	V	Littoral rainforest, usually on sandy soils, mature trees also known on basalt soils	High	Possible
Davidsonia sp. Mullumbimby-Currumbin Ck	Smooth Davidson's Plum	E	E	Lowland subtropical rainforest and wet eucalypt forest, isolated trees in paddocks and cleared land	Moderate	Possible
Desmodium acanthocladum	Thorny Pea	V	V	Fringes of riverine subtropical and dry rainforest on basalt-derived soils at low elevations	Moderate	Possible
Diploglottis campbellii	Small-leaved Tamarind	E	E	Riverine and subtropical rainforest and Brush Box forest, some trees isolated in paddocks and roadsides	Moderate	Possible
Floydia praealta	Ball Nut	V	V	Riverine and subtropical rainforest, usually soils derived from basalt	Moderate	Possible

		Status				
Fontainea oraria	Coastal Fontainea	E	E	Regrowth littoral rainforest on steep stony basalt slopes within 1 km of the ocean	High	Possible
Macadamia tetraphylla	Rough-shelled Bush Nut	V	V	Subtropical rainforest usually near the coast	High	**Known**
Owenia cepiodora	Onion Cedar	V	V	Subtropical and dry rainforest	Moderate	Possible
Phaius australis	Southern Swamp Orchid	E	E	Swampy grassland or swampy forest	High	Possible
Randia moorei	Spiny Gardinia	E	E	Subtropical, riverine, littoral and dry rainforest, with Hoop Pine and Brush Box canopy	Moderate	Possible
Syzygium hodgkinsoniae	Red Lilly Pilly	V	V	Riverine and subtropical rainforest on rich alluvial or basaltic soils	High	**Known**
Syzygium moorei	Durobby	V	V	Subtropical and riverine rainforest	Moderate	Possible
Tinospora tinosporoides	Arrow Head Vine	V	V	Wetter subtropical rainforest, including littoral rainforest, on fertile, basalt-derived soils	High	**Known**

E = Endangered; V = Vulnerable

Note: Hairy Joint Grass (Arthaxon hispidus), although a listed species, was not recorded on either database as a target species in this area

Based on this assessment, targeted site surveys were undertaken. Four threatened flora species were identified within the littoral rainforest, including White Laceflower (*Archidendron hendersonii*), Red Lilly Pilly (*Syzygium hodgkinsoniae*), Rough-shelled Bush Nut (*Macadamia tetraphylla*) and Arrow Head Vine *(Tinospora tinosporoides*). The location of each of these records is shown within **Illustration 4.2**.

Seven-part tests of significance have been prepared for the threatened flora recorded during the field surveys. Seven-part tests have also been prepared for each of the threatened species recorded within the database searches as having a high possibility of occurring within the site. These tests of significance have been prepared in accordance with Section 5A of the *Environmental Planning and Assessment Act* 1979 in order to determine if the proposed work is likely to have a significant effect on these species (refer to **Appendix B**).

4.2.2 White Laceflower

White Laceflower is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995*. White Laceflower is a tree to 18 m tall, with light-brown bark. Its leaves are divided twice, into glossy hairless leaflets separated unequally by the midvein. Up to ten fragrant, fluffy creamy-white flowers

are bunched in heads. Woody orange pods develop, splitting and curling to reveal glossy black seeds displayed against the red or yellow interior of the pod (NPWS 2002).

One large White Laceflower and one smaller shrub were recorded within the upper slopes of southern linear Littoral Rainforest which runs in a north south direction. Specimens were confirmed by the Royal Botanic Gardens Sydney.

Plate 4.7 White Laceflower (*Archidendron hendersonii*)

Illustration 4.2 Threatened Species Records and Significant Ecological Features

4.2.2 Red Lilly Pilly

Red Lilly Pilly is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995* and also as Vulnerable within the *Environment Protection and Biodiversity Conservation Act 1999*. Red Lilly Pilly is a small tree to approximately 11m tall. It has paired, oval shaped or slightly elongated leaves which are approximately 8-15cm long, with a short blunt point at the tips. The flowers are off-white, fluffy and honey scented, about 25mm in diameter, and are held in clusters at the ends of stems. The fruit are 4cm in diameter, round and bright red. A thin layer of flesh, with a distinctive smell like that of an ashtray, encloses a single large seed (NPWS 2002).

One small tree was recorded within the northern portion of the linear Littoral Rainforest which runs in a north south direction. This species is also known from the SEPP 26 Littoral Rainforest to the north-west of the site.

4.2.3 Rough-shelled Bush Nut

Rough-shelled Bush Nut is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995* and also as Vulnerable within the *Environment Protection and Biodiversity Conservation Act 1999*.

The Rough-shelled Bush Nut is a small to medium sized tree, usually densely bushy, growing to 18m tall. The leaves are 7-25cm long and oblong or slightly lance-shaped. The leaf margins are toothed and prickly (NPWS 2002).

Numerous trees and seedlings (approximately 58 specimens) were recorded within the Littoral Rainforest, regrowth rainforest along Hendersons Lane and several isolated specimens in the north western corner. Specimens were tagged, coded and observations such as approximate height and health were recorded for each specimen observed. This information will be useful for future monitoring of this species within the site. The foliage of many specimens showed evidence of browsing by cattle (refer to **Plate 4.5**). Specimens ranged from trees of approximately 9m in height to seedlings only 10cm in height. Rough-shelled Bush Nut is also known from the SEPP 26 Littoral Rainforest to the north-west of the site.

Plate 4.8 Rough-shelled Bush Nut (*Macadamia tetraphylla*)

4.2.4 Arrow Head Vine

Arrow Head Vine is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995* and also as Vulnerable within the *Environment Protection and Biodiversity Conservation Act 1999*. This species was recorded from one patch of linear Littoral Rainforest in the central / north-western section of the site (refer to **Illustration 4.2**).

Arrow Head Vine is a tall woody climber. The triangular leaves with broadly notched bases give the plant its common name, though leaf-shape varies through to oval. The leaves are thick, stiff, glossy, and are mostly 8-13cm long. The leaf stalk is 5-12cm long, with a swelling at each end, and a characteristic twist or angle at its junction with the stem. Male and female flowers are borne on separate plants, and are small and inconspicuous in long branched clusters. The fleshy fruits are produced in groups of three (NPWS 2002).

Plate 4.9 Arrow Head Vine (*Tinospora tinosporoides*)

4.2.5 Hairy Joint Grass

Hairy Joint Grass is listed as Vulnerable pursuant to both the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* and the New South Wales *Threatened Species Conservation Act 1995*.

Cardno (2007) note that Hairy Joint Grass is a slender, creeping grass with branching to semi-erect purplish stems that form roots at the node. The species is distinguished by a hispid (having bristly hairs) leaf sheath 1-3cm long and leaf margins that are fringed with long, white hairs. A 'Species Profile' is provided within **Appendix C** of **D**. Hairy Joint Grass is generally considered to be a perennial, the species life-cycle can be comparable to an annual plant, where individuals arise from seed during spring, flower in autumn and die off in winter. **Plates 4.10** and **4.11** indicate Hairy Joint Grass in different stages of its lifecycle.

This cryptic grass appears to have avoided detection in the local area as it was not previously recorded within the site during field surveys by JWA or within the Department of Environment and Climate Change Wildlife Atlas database search. Hairy Joint Grass was first recorded during a site inspection with Ballina Shire Council's ecologist in May 2007. Background research was then undertaken to obtain records of

populations within the Lennox Head area, Far North Coast of NSW, NSW, SE QLD and Australia (refer to **Appendix C** of **D**).

Hairy Joint Grass (*Arthraxon hispidus*) was identified within areas of sedgeland / rushland and low closed grassland. As shown within **Illustration 4.2** there are two main locations of Hairy Joint Grass within the site. These are located within the north-western portion of the site and the central section to the east of the Water Quality Control Pond. The location of Hairy Joint Grass appears to be restricted by ground water and competition with other grasses. It was observed within damp areas (edges of wet / dry, not saturated) amongst Swamp Ricegrass (*Leersia hexandra*) and Swamp Foxtail (*Pennisetum alopecuroides*).

A management strategy has been devised to provide actions that will be implemented in order to compensate for the loss of, or any adverse effects on, Hairy Joint Grass populations resulting from the proposed development. Cardno (2007) note that the overall objectives of the management strategy will be achieved through:

- on-site population retention and enhancement within the proposed open space reserves;
- off-site population retention and enhancement of Hairy Joint Grass populations within the proposed open space reserve linkage to the west and north-west of the site; and
- regional surveying and mapping of known and potential Hairy Joint Grass habitat.

The proposed management strategy will incorporate a significant amount of monitoring and research into effective management of Hairy Joint Grass populations as well as contributing to a number of Priority Actions for the recovery of Hairy Joint Grass as identified by DEC (2005).

Plate 4.10 Hairy Joint Grass (*Arthraxon hispidus*)

Plate 4.11 Hairy Joint Grass (*Arthraxon hispidus*) - browned off for winter

4.2.6 ROTAP

Two species listed as a 'Rare or Threatened Australian Plant' (ROTAP) were identified during field surveys. These are Smooth Scrub Turpentine (*Rhodamnia maideniana*) and Southern Quassia (*Quassia* sp. *A*).

Two small clumps of Smooth Scrub Turpentine were recorded within an area of regrowth rainforest in the north eastern portion of the site. The status of Smooth Scrub Turpentine is 2RC, which means that its geographic range in Australia is less than 100 km, it is rare but without any current identifiable threat and at least one population is within a national park or conservation reserve. However, the reserved population size is not accurately known.

Two specimens of Southern Quassia (*Quassia* sp. A) were recorded within areas of regrowth rainforest in the north western portion site along Henderson Lane. The status of Quassia is 2E, which means that its geographic range in Australia is less than 100km and that it is at serious risk of disappearing from the wild if current landuse and threats continue.

4.3 Fauna Observations

The following assessment is based on and builds upon work undertaken by James Warren and Associates (2003). As indicated above, no additional targeted fauna species have been undertaken, given the extent of work previously undertaken.

4.3.1 Habitat Assessment

Site habitats were assessed by JWA and GeoLINK to determine their value for native fauna species. This assessment was completed in conjunction with the previous flora survey. The assessment focused on identifying habitat features known to be associated with threatened species and other native fauna groups. Notes were recorded regarding the occurrence of these habitat features and the results are listed in **Table 4.2**. These features are components of the environment that, if present, will encourage fauna or indicate that fauna may be abundant.

Table 4.2 Habitat Features

Habitat Feature	*Indicator*	*Score*	*Comment*
Claw Marks on Trees	Claw marks on trees indicate the presence of arboreal mammals, mainly mammals such as Possums, Gliders and Koalas	0	No claw marks were observed. Forested vegetation communities are quite isolated from other continuous areas of vegetation, which reduces the potential use by arboreal mammals.
Scats	A range of animal faeces may be recorded indicating the presence of certain animals	1	Scats of Swamp Wallaby and European Hare were observed
Tracks	A range of animal tracks in the soil may be recorded indicating the presence of certain animals	1	Few tracks were observed, mainly from wallabies
Tree Hollows	Tree hollows provide shelter and roosting areas of avifauna and arboreal mammals	0	No significant tree hollows were observed
Rocky Outcrops	Rocky outcrops are preferred by certain fauna	1	Few rocky outcrops are present on the upper slopes
Animal Diggings	A range of animal diggings in the soil may be recorded indicating the presence of certain animals	1	Diggings made by Feral Pig were observed within the grassland and sedgeland / rushland. Feral Pigs tend to disturb the vegetation to expose soil
Burrows	Fauna can be identified by the types of burrows present	1	Several burrows mode by European Hare were observed
Leaf Litter	Large amounts of leaf litter often indicates ample invertebrate activity and shelter for small animals	1	The majority of the understorey within the Littoral Rainforest is bare ground and weeds due to cattle trampling
Bodies of Water	Fauna are often attracted to water bodies to drink, spawn or forage	3	The site contains a water quality control pond, numerous open drains, a freshwater spring and North Creek is located approximately 500m west of the site.
Stags and Logs	Dead trees and branches often provide shelter and form hollows for fauna to live or hide	1	No large stags were observed, some fallen logs were present in the Littoral Rainforest and Swamp Forest vegetation communities
Extent of Good Vegetation Structure	An area with a large extent of good vegetation structure will encourage fauna	1	Areas of littoral rainforest and swamp forest remnants have a degraded vegetation structure due to their fragmented nature and impacts from cattle trampling and weed invasion
Diversity of Flora Species	A broad flora species diversity provides a large range of food sources and habitat available for fauna	2	Sections of the littoral rainforest are well structured and contain a number of threatened species, however other sections of forested vegetation are trampled by cattle and dominated by weed species

Habitat Feature	Indicator	Score	Comment
Understorey and Ground Cover	Dense understorey or ground cover such as thick grass provides shelter for small ground dwelling fauna	1	Some tussocky grasses are located within the lower sections of the site. These areas of thick sedges and rushes provide potential habitat for ground dwelling fauna. The understorey of the swamp forest and littoral rainforest are quite sparse due to cattle trampling and weed invasion
Connectivity	Areas that are connected to other areas of vegetation provide a corridor for movement and can accommodate large numbers of fauna	1	Significant areas of forested vegetation exist immediately west of the site to the west in Ballina Nature Reserve and to the north west in SEPP 26 Littoral Rainforest. Patches of vegetation within the site however are fragmented and isolated due to past land use practices and current cattle grazing

0 *Nil*
1 *Low Occurrence*
2 *Medium Occurrence*
3 *High Occurrence*

North Creek Habitat

A survey of habitats in and adjacent to North Creek was undertaken by JWA on 13 June 2002, during the high tide, and on 9 December 2002. Vegetation and habitat features were assessed along North Creek from approximately 200 m upstream of the site to approximately 100 m downstream.

North Creek is generally fringed by a narrow band of mangroves with Swamp Oak (*Casuarina glauca*) on the landward side. The Swamp Oak Forest is generally disturbed and subject to cattle grazing with isolated occurrences of Broad-leaved Paperbark (*Melaleuca quinqueneriva*) and Figs (*Ficus* spp.). Land is generally cleared for pasture to within 10-20 m of the creek. The understorey consists of native and introduced grasses and weeds with small areas of sedges and rushes. The banks of North Creek itself are typically steep and sparsely vegetated. The length of North Creek to the immediate west of the Water Quality Control Pond is dominated by Common Reed (*Phragmites australis*) with Common Rush (*Juncus usitatus*) and various grasses. Isolated occurrences of Groundsel (*Baccharis halimifolia*), Mangrove Fern (*Acrostichum speciosum*) and juvenile Swamp Oak (*C. glauca*) also occur throughout. Isolated occurrences of River Mangrove (*Aegiceras corniculatum*) and Black Mangrove (*Bruguiera gymnorrhiza*) occur along the eastern most part of the drain. Grey Mangrove (*Avicennia marina*) to 8m occurs on the landward side of the River Mangrove. Isolated occurrences of Black Mangrove occur amongst the River Mangrove. A number of small clear areas contain bare mud, Saltwater Couch (*Paspalum vaginatum*) and Mangrove Fern. Within approximately 50 m of North Creek, the mangroves form an impenetrable thicket over the drain.

Along the banks of North Creek, dense stands of River Mangrove with emergent Grey Mangrove occur within 30-40 m of the creek. As is typical of the upper reaches of estuarine creeks in the region, the banks of North Creek itself are fringed by River Mangrove to 3m with Grey Mangrove to 12 m on the landward side. Black Mangrove is present throughout. This length of North Creek is a well-defined steep-sided channel approximately 25-30 m wide. The banks are muddy and are not undercut. No areas of saltmarsh were observed. Important microhabitats for aquatic fauna include the creek itself, the creek bed, the muddy banks and the floor of the mangrove forest. These areas provide habitat for estuarine fish species, freshwater and marine fish and crustaceans, molluscs and other invertebrates.

4.3.2 Targeted Threatened Fauna Surveys

Targeted surveys were undertaken by JWA using call playback techniques for the Wallum Froglet (*Crinia tinnula*). Targeted surveys were also conducted for Australasian Bittern (*Botaurus poiciloptilus*). Spotlighting and call playback surveys were completed for the Grass Owl (*Tyto capensis*) over three nights in February 2003. A targeted survey for Mitchell's Rainforest Snail was also completed within Ballina Nature Reserve in 2000. The area searched was a small area of swamp sclerophyll forest with rainforest elements located on the eastern side of North Creek located approximately 1 km south of the site. This area provides the most suitable area of habitat for this species in the wider study area.

4.3.3 General Fauna Surveys

Fauna recorded during general surveys of the site and neighbouring areas of SEPP 14 wetland bordering North Creek are listed within **Appendix D**.

Amphibians

Common amphibian species likely to occur within the site include Peron's Tree Frog (*Litoria peronii*), Tusked Frog (*Adelotus brevis*), Striped Marsh Frog (*Limnodynastes peronii*) and the Red-backed Toadlet (*Pseudophryne coriacea*).

The most important amphibian habitats are located within low-lying areas of the site. These areas are flooded on a regular basis and appear to be fed by a spring. The acidic nature of the soil in the sedgeland/ rushland area makes these communities potential habitat for the Wallum Froglet (*Crinia tinnula*). Several drainage lines run though grassland areas also provide suitable habitat for amphibians where they are not subject to saline influence.

Reptiles

Common reptile species considered likely to occur within the site include the Eastern Water Dragon (*Physignathus lesueurii*), Wall Skink (*Cryptoblepharus virgatus*) and the Grass Skink (*Lampropholis guichenoti*).

Fallen logs and rocky areas in rainforest patches may provide suitable sheltering habitat for reptiles. The transition area between forested vegetation communities and grassland provides a suitable combination of shelter, tall grass for movement and exposed areas for sunning to suit a range of reptile species.

Birds

Common bird species considered likely to occur within the site include Brown Thornbill, White-throated Gerygone, White-bellied Sea Eagle, Brahminy Kite, Whistling Kite, Azure Kingfisher, Kookaburra, Wood duck, White-faced heron, White-breasted woodswallow, White-bellied cuckoo shrike, Cicadabird, Masked Lapwing, White-headed Pigeon, Crested Pigeon, Bar-shouldered Dove, Peaceful Dove, Brown Pigeon, Dollarbird, Pied Butcherbird, Grey Butcherbird, Pallid Cuckoo, Common Koel, Channel-billed Cuckoo, Spangled Drongo, Australian Kestrel, Magpie Lark, Variegated Fairy-wren, Little Wattlebird, Lewin's Honeyeater, White-cheeked Honeyeater, Little Friarbird, Noisy Friarbird, Rainbow Bee-eater, Grey Shrike-thrush, Red-browed Finch, Tawny Frogmouth, Galah, Eastern Rosella, Scaly-breasted Lorikeet, Rainbow Lorikeet and the Black Winged Stilt.

JWA (2003) states that the diversity of habitats available in the study area provides opportunities for a range of bird species. As stated within **Table 4.2**, the site, however, generally lacks blossom producing vegetation for nectar-feeding birds, and lacks nesting opportunities for birds that nest in hollow bearing trees. The presence of fruiting rainforest species provides habitat for frugivorous species, although the food supply in these habitats is not plentiful.

The mangrove community fringing North Creek provides good habitat for the Mangrove Honeyeater and Collared Kingfisher, although the site occurs towards the southern limit of the range of these species. North Creek contains several important roost sites for shorebirds (Holmes and Associates 1995). The nearest roost site recorded by Holmes and Associates is located approximately 2.5 km south of the site. The study by Holmes and Associates did not include areas of North Creek upstream of Chinaman's Island, approximately 3.5 km to the south of the site. Shorebirds are not known to roost in this area of North Creek. North Creek also contains several important foraging areas for shorebirds. The study area does not support significant areas of suitable foraging habitat for shorebirds, but it is likely that small numbers of shorebirds occasionally forage within the study area.

Mammals

Common mammal species considered likely to occur within the site include the Rabbit (*Oryctolagus cuniculus*), Common Brushtail Possum (*Trichosurus vulpecula*), Common Ringtail Possum (*Pseudocheirus peregrinus*) and the Black Rat (*Rattus rattus*).

As noted within **Table 4.2**, the site lacks old growth and hollow bearing trees. Nesting opportunities for arboreal mammals and bats that require tree hollows is therefore very limited. JWA (2003) states that a large proportion of the site is likely to be too wet to provide optimal habitat for many ground-dwelling mammals, although some species, such as the Swamp Rat (*Rattus lutreolus*) prefer such habitats.

4.4 Threatened Fauna

A search was undertaken of the Department of Environment and Climate Change Wildlife Atlas database covering a 5km radius around the study area. Fifty two threatened fauna species were recorded within this area under the *Threatened Species Conservation Act 1995* (TSC Act). A search of the Environment Protection and Biodiversity Conservation database listed 26 threatened fauna species or their habitat as occurring within the search area.

The suitability of habitat within the study area and, therefore, the potential occurrence of the threatened species are listed in **Table 4.3**. The list of threatened species found within the database searches is provided in **Appendix C**.

Assessments of potential occurrence are based on the field survey, a review of previous assessments completed in the study area and knowledge of the ecological requirements of threatened fauna species known from the locality. Potential occurrences are discussed as either possible, likely or unlikely occurrences.

Table 4.3 Threatened Fauna Recorded in DECC and EPBC Databases

Scientific Name	*Common Name*	*Status*		*Habitat Requirement*	*Suitability of Site Habitat*	*Potential Occurrence*
		TSC Act	EPBC Act			
Amaurornis olivaceus	Bush-hen	V	-	Coastal wetlands from mangroves, lagoons and swamps, to river margins and creeks running through rainforest	Moderate	Possible
Anseranas semipalmata	Magpie Goose	V	-	Shallow wetlands (<1 m deep), large swamps and dams with dense growth of rushes or sedge	Moderate	Possible

		Status				
Botaurus poiciloptilus	Australasian Bittern	V	-	Permanent freshwater wetlands with tall dense vegetation, particularly bulrushes and spikerushes	**High**	**Known**
Burhinus grallarius	Bush Stone-curlew	E	-	Lightly timbered open forest and woodland, and partly cleared farmland with woodland remnants, preferring areas with dry leaf-litter, fallen timber and sparse ground cover	Low	Unlikely
Calidris alba	Sanderling	V	-	Low beaches of firm sand, often near reefs and occasionally inlets and tidal mudflats	Low	Unlikely
Calidris tenuirostris	Great Knot	V	-	Tidal mudflats, sandy ocean shores, inland freshwater or salt lakes	Low	Unlikely
Gygis alba	White Tern	V	-	Oceanic islands, tropical and subtropical seas	Low	Unlikely
Sterna albifrons	Little Tern	E	-	Coastal waters, bays, shallow inlets, salt or brackish lakes	Low	Unlikely
Sterna fuscata	Sooty Tern	V	-	Tropical and subtropical seas, islands, cays	Low	Unlikely
Haematopus fuliginosus	Sooty Oystercatcher	V	-	Rocky headlands, rocky shelves, beaches and offshore islands	Low	Unlikely
Haematopus longirostris	Pied Oystercatcher	V	-	Open beaches, inter-tidal flats, sandbanks and occasionally rocky headlands	Low	Unlikely
Limicola falcinellus	Broad-billed Sandpiper	V	-	Tidal mudflats in coastal estuaries and lagoons, mudflats adjacent to mangroves for feeding	Low	Unlikely
Xenus cinereus	Terek Sandpiper	V	-	Tidal mudflats, estuaries, shores and reefs of offshore islands and coastal swamps	Low	Unlikely
Charadrius leschenaulti	Greater Sand Plover	V	-	Wide sandy beaches, mangroves, saltmarsh, mudflats and exposed reefs	Low	Unlikely
Charadrius mongolus	Lesser Sand Plover	V	-	Mudflats, wide sandy beaches, estuaries and tidal areas in mangroves	Low	Unlikely
Esacus neglectus	Beach Stone-curlew	E	-	Tidal flats at the mouth of estuaries or on open beaches	Low	Unlikely

		Status				
Puffinus carneipes	Flesh-footed Shearwater	V	-	Marine, nest on Lord Howe Island in forests on sandy soils from Ned's Beach to Clear Place, with smaller colonies below Transit Hill and at Old Settlement Beach	Low	Unlikely
Ephippoorhynchus asiaticus	Black-necked stork	E	-	Swamps, mangroves, mudflats, dry floodplains	Moderate	Possible
Grus rubicundus	Brolga	V	-	Shallow swamps, floodplains, grasslands	Moderate	Possible
Irediparra gallinacea	Comb-crested Jacana	V	-	Among vegetation floating on slow-moving rivers and permanent lagoons, swamps, lakes and dams	Moderate	Possible
Lichenostomus fasiogularis	Mangrove Honeyeater	VV	-	Mangrove forest, also near coastal forests and woodlands including casuarina and paperbark swamps	Moderate	Possible
Limosa limosa	Black-tailed Godwit	V	-	Tidal mudflats, sandspits, swamps, shallow river-margins and reservoirs	Moderate	Possible
Pandion haliaetus	Osprey	V	-	Forage for fish in fresh, brackish or saline waters of rivers, lakes, estuaries with suitable nesting sites nearby	Moderate	Possible
Phoebetria regina	Sooty Albatross	V	V	This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea, and rarely occurs in continental shelf waters	Low	Unlikely
Pterodroma solandri	Providence Petrel	V	-	Marine, nests on the tops of Mount Gower and Mount Lidgbird and to a less extent, on the lower slopes of the mountains	Low	Unlikely
Rostratula australis	Australian Painted Snipe	E	V	Well-vegetated shallows and margins of wetlands, dams, sewage ponds, wet pastures, marshy areas, irrigation systems, lignum, tea-tree scrub, and open timber	High	Likely
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V	-	Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains	Low	Unlikely
Ptilinopus regina	Rose-crowned Fruit-Dove	V	-	Subtropical and dry rainforest, moist eucalypt forest and swamp forest	Moderate	Possible

		Status				
Pezoporus wallicus wallicus	Eastern Ground Parrot	V	-	Heathland and sedgeland within or adjacent to swamps	Moderate	Possible
Stictonetta naevosa	Freckled Duck	V	-	Permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. In drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds	Moderate	Possible
Tyto capensis	Grass Owl	V	-	Tall grass, including grass tussocks in swampy areas, grassy plains, swampy heath, cane grass, sedges on floodplains	High	Likely
Tyto novaehollandiae	Masked Owl	V	-	Dry eucalypt forest and woodlands	Low	Unlikely
Podargus ocellatus	Marbled Frogmouth	V	-	Subtropical rainforest spending most time in deep, wet sheltered gullies	Low	Unlikely
Potorous tridactylus	Long-nosed Potoroo	V	-	Cool temperature rainforest at altitudes to 1500 m, moist and dry forests, wet heathland with dense layer of grasses, ferns, vines or shrubs, with occasional open areas	Low	Unlikely
Phascolarctos cinereus	Koala	V	-	Appropriate food trees in forests and woodlands, and treed urban areas	Low	Unlikely
Planigale maculata	Common Planigale	V	-	Rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas with surface cover close to water	Moderate	Possible
Pteropus alecto	Black Flying-fox	V	-	Remnants of coastal subtropical rainforest or swamp forest	High	Likely
Pteropus poliocephalus	Grey-headed Flying fox	V	V	Conspicuous camps in lowland rainforest and swamp forest	**High**	**Known**
Megaptera novaeangliae	Humpback Whale	V	V	Oceanic and coastal waters worldwide	Nil	Nil
Miniopterus australis	Little Bent-wing bat	V	-	Moist eucalypt forest, rainforest and dense coastal scrub	High	Likely
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	Forest or woodland, roost in caves, old mines and stormwater channels	Low	Unlikely
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Roosts in tree hollows, little known about its habitat	Low	Unlikely

		Status				
Myotis adversus	Large-footed Myotis	V	-	Bodies of water from rainforest streams to large lakes and reservoirs	Moderate	Possible
Nyctophilus bifax	Eastern Long-eared Bat	V	-	Lowland subtropical rainforest and wet and swamp eucalypt forest, extending to adjacent moist eucalypt forest	Moderate	Possible
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Woodland, moist and dry eucalypt forest to rainforest	**High**	**Known**
Syconycteris australis	Common Blossom-bat	V	-	Littoral rainforest and feed on flowers in adjacent heathland and paperbark swamps	High	Likely
Thersites mitchellae	Mitchell's Rainforest Snail	E	Critically E	Lowland subtropical rainforest and swamp forest on alluvial soils	Moderate	Possible
Crinia tinnula	Wallum Froglet	V	-	Acid paperbark swamps and sedge swamps of the coastal 'wallum' country	Moderate	Possible
Litoria aurea	Green and Golden Bell Frog	E	V	Vegetation in and around permanent swamps, lagoons and farm dams	Moderate	Possible
Litoria olongburensis	Olongburra Frog	V	V	Paperbark swamps and sedge swamps of the coastal 'wallum' country	Moderate	Possible
Caretta caretta	Loggerhead Turtle	E	E	Ocean dwellers, females come ashore to lay eggs during warmer months	Nil	Nil
Chelonia mydas	Green Turtle	V	V	Ocean-dwelling species spending most of its life at sea, scattered nesting records along the NSW coast	Nil	Nil
Dermochelys coriacea	Leathery Turtle	V	V	Occurs in inshore and offshore marine waters, occasional breeding records from NSW coast, including between Ballina and Lennox Head in northern NSW	Low	Unlikely

E = Endangered; V = Vulnerable

As indicated above, the vegetation within the study area provides suitable habitat for a variety of species preferring wetland/swamp and littoral rainforest communities. Areas adjacent to the site, near North Creek, offer significant swamp sclerophyll and mangrove habitat for many threatened species listed within **Table 4.3**.

JWA (2003) notes that additional threatened fauna species recorded in the wider Ballina area and considered as having some likelihood of occurring in the study area are the Square-tailed Kite

(*Lophoictinia isura*), White-eared Monarch (*Monarcha leucotis*), Black Bittern (*Ixobrychus flavicollis*) and the Common Bentwing Bat (*Miniopterus schreibersii*).

JWA (2003) reported that the Australasian Bittern (*Botaurus poiciloptilus*), which is listed within Schedule 2 of the *Threatened Species Conservation Act 2005*, was recorded in the Water Quality Control Pond area by Ballina Shire Council's ecologist in 2002. Greater Broad-nosed Bat was recorded during surveys by JWA in 2000.

4.5 Aquatic Fauna

An assessment has been conducted to determine the likelihood of occurrence of species listed as vulnerable or endangered on the *Fisheries Management Act 1994* (refer to **Table 4.4**).

Table 4.4 Aquatic Species listed within NSW *Fisheries Management Act 1994*

Scientific Name	*Common Name*	*Status*	*Habitat Requirement*	*Likelihood of Occurrence*
Archaeophya adamsi	Adams Emerald Dragonfly	V	Small creeks with gravel or sandy bottoms, in narrow, shaded riffle zones with moss and rich riparian vegetation south of Newcastle	Nil
Bidyanus bidyanus	Silver Perch	V	River and lake habitats, especially the upper reaches of rivers and their tributaries south of Lauchlan River, fast-flowing waters of Murray-Darling	Very Low
Branchinella buchananensis	Buchanans Fairy Shrimp	V	Temporary (intermittently inundated) salt lakes in north-western NSW	Very Low
Carcharodon carcharias	Great White Shark	V	Oceanic inshore waters around rocky reefs and islands, and often near seal colonies, temperate waters of all oceans	Nil
Epinephelus daemelii	Black Cod	V	Caves, gutters and beneath bommies on rocky reefs in oceanic waters	Very Low
Macquaria australasica	Macquarie Perch	V	Bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation in the Murray Darling Basin	Very Low
Nannoperca australis	Southern Pygmy Perch	V	Slow-flowing and still waters in vegetated areas in small streams, lakes, billabongs and other types of wetlands in south-western NSW, Murrumbidgee and Murray River systems	Very Low
Austrocordulia leonardi	Sydney Hawk Dragonfly	E	Slow-flowing water in rocky rivers with steep sides that provide shady resting areas south of Sydney	Nil
Carcharias taurus	Grey Nurse Shark	E	Inshore coastal waters with sandy-bottomed gutters or rocky caves in the vicinity of inshore rocky reefs or islands, temperate waters of all oceans except eastern Pacific	Nil

Scientific Name	Common Name	Status	Habitat Requirement	Likelihood of Occurrence
Craterocephalus fluviatilis	Murray Hardyhead	E	Edges of slow-flowing lowland rivers and in lakes, billabongs and backwaters amongst aquatic weeds, in both fresh and quite saline waters in inland parts of south-eastern Australia	Nil
Maccullochella ikei	Eastern Freshwater Cod	E	Isolated tributaries of Clarence River in clear, flowing streams with rocky beds and deep holes. Areas with boulders or large woody debris. Nymboida and Mann Rivers in Clarence River drainage. Population also known from Rocky Creek Dam near Dunoon (JWA 2003).	Very Low
Maccullochella macquariensis	Trout Cod	E	Close to cover and in relatively fast currents, especially in fairly deep water close to the bank, over bedrock, boulder and gravel substrates and often congregate around snags. Smaller fish are found among boulders while larger individuals inhabit deep holes with boulder or snag cover between rapids. Recorded from Murrary River, Victoria, southern NSW and ACT.	Very Low
Nannoperca oxleyana Whitley	Oxleyan Pygmy Perch	E	Swamps, creeks and lakes of coastal 'wallum' (Banksia-dominated coastal heath), which are usually acidic, with low salinity and low conductivity, and are often darkly stained. Amongst emergent vegetation or near vertical or undercut banks. Closest records to the study area are from Evans Head.	Very Low
Notopala sublineata	River Snail	E	Freshwater of flowing rivers throughout the Murray-Darling system	Nil
Pristis zijsron	Green Sawfish	E	Muddy or sandy-mud soft bottom habitats in inshore areas. They also enter estuaries, where they have been found in very shallow water	Possible
Thunnus maccoyii	Southern Bluefin Tuna	E	Oceanic waters on the seaward side of the continental shelf	Nil

A seven-part test has been completed for the Green Sawfish (refer to **Appendix B**).

5 Impact Assessment

5.1 Impacts on Vegetation Communities

The proposed development will require the clearance of areas of vegetation for the construction of dwellings, roads and associated infrastructure. The proposed Concept Plan illustrates that the site layout has been designed to allow for the retention and embellishment of most stands of native forested vegetation, including mature figs and threatened plant species (refer to **Illustration 2.1**).

Estimations of the areas of vegetation to be lost as a result of the proposed development are shown in **Table 5.1**.

Table 5.1 Areas of vegetation communities to be directly removed as a result of the proposed development

Vegetation Community	*Approximate Area of Vegetation Community within Site*	*Approximate Area of Vegetation Community to be Directly Removed*
Littoral Rainforest	1.9 ha	Nil
Regrowth Rainforest/ Camphor Laurel	0.4 ha	Nil
Swamp Oak Forest	0.3 ha	Nil
Swamp Sclerophyll Forest	0.1 ha	0.1 ha
Sedgeland/ Rushland	8.5 ha	6.7 ha
Low Closed Grassland	64.7 ha	53.6 ha

The two main elongated areas of littoral rainforest, which occur within the eastern portion of the site, are to be dedicated as open space. They will be rehabilitated and buffered in order to prevent impacts on this vegetation community. Another elongated section of littoral rainforest located in the central northern portion of the site, which also follows an existing fence line, will be incorporated into residential lots. Restrictions on the title of lots in this area will be used to protect these areas of rainforest vegetation, which cover approximately 0.2 ha. Areas of rainforest regrowth will also be incorporated into residential lots.

The Swamp Oak Forest will not be removed as a result of the proposed development. This area will be dedicated as open space and, similarly to the littoral rainforest will be rehabilitated and buffered. Areas of Hairy Joint Grass will be enhanced around this vegetation community.

The 0.1 ha patch of Swamp Sclerophyll Forest will be entirely removed by the proposed development. As previously stated, this small remnant is highly edge affected, cattle have full access and it is highly degraded. This community type is widely distributed in Ballina Nature Reserve.

Sedgeland / rushland covers approximately 8.5 ha of the site, within the central portion. This vegetation community occurs within the lowest elevated areas of the site and as a result approximately 6.7 ha will be directly removed as a result of the proposed development. Approximately 1.8 ha will be reserved within the open space area. As this vegetation community contains the threatened Hairy Joint Grass, a

management strategy has been devised to enhance this species and vegetation community offsite (refer to **Appendix E** of **Part 3A Application**).

The majority of the site (approximately 65 ha) is classified as low closed grassland. The majority of vegetation to be lost (approximately 53.6 ha) consists of low closed grassland dominated by pastoral species and weeds. This vegetation community is highly disturbed and has little conservation value.

5.2 Impacts on Threatened Flora

Impacts on the individual stems of threatened flora recorded within the site are shown in **Table 5.2.**

Table 5.2 Impacts on Threatened Flora

Scientific Name	*Common Name*	*Records in Study Area*	*Impact from Proposed Development*
Macadamia tetraphylla	Rough-shelled Bush Nut	A total of 58 specimens were recorded within the site. These were recorded within the littoral rainforest and several isolated stems were recorded within grassland in the far north-western corner of the site.	All recorded stems are to be retained. The majority of stems will be reserved within open space. However, the few specimens in the north-western section of the site will be located within residential lots and protected by the use of covenants. Open space areas will buffer retained specimens and provide additional habitat for dispersal. Development of areas of the site represents a loss of suitable dispersal areas.
Syzygium hodgkinsoniae	Red Lilly Pilly	One small tree was recorded within the north-eastern linear section of littoral rainforest.	This specimen will be retained within the littoral rainforest. Open space areas will buffer retained specimens and provide additional habitat for dispersal.
Archidendron hendersonii	White Laceflower	One large White Laceflower and one smaller shrub were recorded within the upper slopes of southern linear Littoral Rainforest which runs in a north / south direction.	This specimen will be retained within the littoral rainforest. Open space areas will buffer retained specimens and provide additional habitat for dispersal.
Tinospora tinosporoides	Arrow Head Vine	This vine was recorded within one patch of linear Littoral Rainforest in the central north-western section of the site.	This specimen will be protected by a covenant and retained within the littoral rainforest in residential lots.
Arthraxon hispidus	Hairy Joint Grass	Hairy Joint Grass was recorded throughout the sedgeand / rushland community below the 6.5 m contour within two main locations; in the north-western portion of the site and the central section to the east of the Water Quality Control Pond. The area of potential habitat suitable for Hairy Joint Grass is approximately 7.9 ha.	Approximately 5.8 ha of habitat potentially suitable for Hairy Joint Grass will be removed as a result of the proposed development. 2.1 ha will be retained within open space.

Several ROTAP species, described within **Section 4.2.6,** will also be retained within areas of littoral rainforest as open space or retained within residential lots. Two small clumps of Smooth Scrub Turpentine *(Rhodamnia maideniana)* recorded within an area of regrowth rainforest in the north eastern portion of the site and will be located within residential lots. The residential lots within the vicinity of this species will be larger than average in order to accommodate this vegetation.

Two specimens of Southern Quassia (*Quassia* sp. A) were recorded within areas of regrowth rainforest in the north western portion site along Henderson Lane. These will be located within residential lots.

One small clump of Pinkheart (*Medicosma cunninghamii)* was recorded within the northern linear section of littoral rainforest. This species is regarded as 'regionally significant' and will be retained. Open space areas will buffer the retained specimen and provide additional habitat for dispersal. Development of the site represents a loss of suitable dispersal areas.

Two isolated Moreton Bay Figs (*Ficus macrophylla*) will all be retained and buffered. Weed removal will be undertaken within these areas and they will be dedicated as open space.

In addition to the direct loss of vegetation as a result of the proposed development, **Table 5.3** outlines other potential impacts that may result from the proposed development and measures to minimise these impacts.

Table 5.3 Impacts and Amelioration

Impact	***Management Measures***
Increased introduction and establishment of weeds	
Weeds may be introduced to the study area during construction of the proposed development. Disturbance to the site creates opportunities for weeds to colonise.	▪ Vegetation will be established on site as street trees and landscape plantings. These will be native species appropriate to the site; ▪ Vegetation removed during construction clearing will be retained and mulched for later use on the site. This will prevent the introduction of weeds from seeds in mulch brought in from elsewhere; and ▪ A Vegetation Management Plan will be prepared for the site that addresses weed management. Weeds should be controlled in landscaped areas and areas of retained vegetation. Known environmental weeds such as Camphor Laurel within areas of Littoral Rainforest should be gradually removed by stem injection.
Loss of organic material	
The removal of vegetation from the site represents the loss of organic material from the site.	▪ Vegetation removed during the clearing process should be retained and mulched for later use on site; ▪ Top soil will be stockpiled and reused; and ▪ The mulch should be used in landscape plantings on the site.
Physical damage during construction	
Individual trees and clumps of trees retained on site may be damaged during the construction process. Animals may be killed or injured during the clearance of vegetation.	▪ Areas of vegetation to be retained will be clearly delineated with temporary fencing during works; ▪ A Vegetation Management Plan will be prepared for the site that addresses management of retained areas of vegetation; and ▪ Trees to be removed will be monitored by personnel (with wildlife caring qualifications) immediately prior to, and during removal to ensure that no animals are 'directly' impacted by the works. Any trees containing fauna will be retained until the species leaves the site or the nests have

Impact	*Management Measures*
	been vacated. If any animals are injured during the proposed works, they will be immediately transported to a wildlife carer for rehabilitation and release.
Impacts on wetland vegetation	
Construction activities on the site have the potential to impact on wetland vegetation through the release of sediment or nutrients into wetland areas, disturbance of acid sulphate soils or physical damage. Occupation of the site increases the potential for disturbance of wetland vegetation communities through the dumping of garden waste or other refuse in wetland areas and/or the escape of garden plants. Residents accessing environments in the wetland or along North Creek may lead to increased traffic through wetland areas. It should be noted that the occupation of the residential estate to the south of the proposed development does not appear to have resulted in increased traffic through wetland areas.	▪ The boundary of the wetland area should be clearly delineated to prevent vehicles or persons entering the wetland area. Fencing may be required to discourage the dumping or storage of materials within the wetland area. A sediment control plan should be implemented to prevent the input of sediment into the wetland area; ▪ Educational signage will be erected to educate residents about the significance of the wetland; ▪ Residents should be made aware of the need to dispose of waste materials in accordance with Council regulations; and ▪ The adjoining wetland area should be monitored for signs of impacts resulting from occupation of the proposed development.
Impacts on plant reproduction	
Clearance of areas of the site represents a loss of habitat available for dispersal for plants and will reduce visits by pollination and dispersal vectors.	▪ Retained areas of vegetation will be rehabilitated and buffered; ▪ Areas of rainforest vegetation will continue to provide a series of stepping stones for dispersal and pollination vectors; and ▪ A Vegetation Management Plan should be prepared for the site that addresses embellishment plantings.
Altered fire regimes	
Occupation of the site may increase the risk of fire in the surrounding bushland.	▪ Restrictions will be placed on the use of fires during dangerous weather periods.
Direct loss of habitat	
The proposed development may result in the loss of habitat for fauna species.	▪ The most significant areas of habitat in the site are the forested communities; ▪ Large figs and the rainforest will be retained and rehabilitated to provide additional habitat; and ▪ Landscape plantings should include a majority of species that will provide forage habitat for nectarivorous and frugivorous birds and bats.

5.3 Edge Effects

Edge effects include a diverse array of physical and biotic changes associated with the abrupt, artificial margins of forest fragments (Laurance 1997). The edge exposes remaining forest areas to increased wind velocities and light radiation, which have the potential to alter forest structure and existing microclimates (Andrews 1990; Laurance 1997). The effects of edges can lead to changes in species composition by creating habitats that favour flora and fauna species capable of invading and colonising disturbed habitats (Goosem and Marsh 1997; Laurance 1997; Andrews 1990).

The vegetation remnants within the site are small and several are narrow therefore susceptible to edge effects. Camphor Laurel is dominant on the edges of the areas of Littoral Rainforest as a result of this edge effect. The proposed buffers around the forested communities will reduce edge effects. Cattle will also be removed from site and regeneration works will be undertaken to enhance and expand these remnant areas from their current state.

5.4 Corridor/ Migratory Route

Fauna corridors are described as vegetation communities that allow the movement of fauna between connected landscape elements (Soule and Gilpin 1991). Corridors provide dispersion routes for migrating animals with large foraging or breeding ranges. Corridors are also particularly important for small remnants that do not support large viable populations.

The site consists of coastal agricultural land that is currently used for cattle grazing and the majority of vegetation has been cleared. The site however, contains several isolated remnant stands of vegetation. The retention and embellishment of patches of littoral rainforest will provide important 'stepping stones' for mobile species.

Ballina Nature Reserve provides a large tract of continuous vegetation located to the immediate south-west of the site. Due to the fragmented nature of the vegetation remnants within the site, no significant band of vegetation exists linking these areas to this Nature Reserve. The proposed development will provide somewhat increased opportunities for movement between Ballina Nature Reserve and habitat to the east of the site, through the provision of open space areas and the retention of the existing east / west drainage line (or brook). There are currently few vegetated areas suitable for fauna movement to the immediate east of the site. The proposed Hairy Joint Grass Management Strategy (refer to Appendix E of Part 3A Application) will include works to plant and enhance a vegetated link off-site which will be protected in perpetuity by Environmental Protection Zoning and public ownership. This corridor will aim to facilitate fauna movement.

5.5 Water Quality Impacts in North Creek

Greenloaning Biostudies (2003) have undertaken water quality monitoring in drains leading into North Creek. This monitoring program is designed to assess any alterations in water quality associated with the development of the water quality control pond. Background sampling indicates that the water quality of the site is variable and some parameters such as pH are consistently outside the prescribed limits. Greenloaning Biostudies (2003) suggest that '*contributing factors to poor water quality and/or low pH levels are likely to include the disturbed nature of the site, naturally acidic nature of the swamp system previously occurring and running of domestic stock*'.

Stormwater management within the proposed development is likely to result in an improvement in water quality entering North Creek. The results of the monitoring program should be regularly assessed so that further stormwater management measures can be implemented if the water quality of release waters fall below acceptable levels.

6

Statutory Considerations

6.1 State Environmental Planning Policies

6.1.1 State Environmental Planning Policy No. 14 – Coastal Wetlands

SEPP 14 aims to ensure that coastal wetlands are preserved and protected in the environmental and economic interests of the State. SEPP 14 No. 88 is located to the immediate south-west of the site and extends from Ross Lane in the north to Cumbalum in the south. It covers 665 ha and contains mangroves, swamp sclerophyll forest and saltmarsh. SEPP 14 No. 87 also occurs approximately 2 km to the north of the site.

The proposed development has been designed to minimise impacts on this coastal wetland. Sports fields, a water quality control pond and internal roads will separate residential development from the wetland areas, providing significant buffers. Stormwater management measures have been designed to ensure that all site run-off is captured and treated prior to discharge to the wetland. Modelling of the stormwater treatment proposals indicates that an improvement of approximately 30-60% can be expected post-development, compared with existing water quality (see engineering report of Ardill Payne and Partners).

6.1.2 State Environmental Planning Policy No. 26 – Littoral Rainforest

SEPP 26 aims to provide a mechanism for the consideration of applications for development likely to damage or destroy littoral rainforest areas with a view to the preservation of those areas in their natural state.

The north-western corner of the site occurs within the designated 100 m buffer to SEPP 26 No. 39. This buffer area will be rehabilitated with endemic rainforest species.

6.1.3 State Environmental Planning Policy No. 44 – Koala Habitat Protection

SEPP 44 encourages the conservation and management of natural vegetation areas that provide habitat for Koalas to ensure permanent free-living populations will be maintained over their present range. Under SEPP 44, potential koala habitat is defined as areas of native vegetation where the trees listed in Schedule 2 of the SEPP constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. The site is isolated to the north, east and south by residential development which reduces the suitability of koala habitat. A number of criteria in the SEPP are addressed below.

Does the land occur in a Local Government Area identified in Schedule 1?

Yes - the site is located in the Ballina Shire Local Government Area, which is listed in Schedule 1.

Does the land to which the development application applies have an area greater than 1 hectare?

Yes - the land has an area of approximately 80 ha.

Does the site contain areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15 percent of the total number of trees in the upper or lower strata of the tree component?

No koala feed trees listed within Schedule 2 of SEPP 44 are present within the site. The vegetation components of the study area mainly comprise rainforest and grassland. The site therefore does not

contain areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15 per cent of the total number of trees in the upper or lower strata of the tree component.

Is the land potential Koala habitat?

The land is not considered to be potential Koala habitat as defined in the Planning Policy as none of the species listed under Schedule 2 of SEPP 44 occur within the site.

Is there core habitat on the land?

The land is not considered to be core Koala habitat as defined in the Planning Policy.

Is there a requirement for the preparation of a Plan of Management for identified core Koala habitat?

There is no potential or core Koala habitat within the site therefore a Plan of Management specific to the area is not required.

6.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* provides for the listing and protection of flora and fauna species considered to be at risk of extinction. Section 5A of the *Environmental Planning and Assessment Act, 1979* provides a link between the Act and the assessment of development proposals, and sets out the factors to be considered in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities and hence if a Species Impact Statement (SIS) is required.

Listed species identified as being located on the site, or having a reasonable likelihood of being located on the site, have been identified above. Seven-part tests for the significance of impacts on these species are contained in **Appendix B**. The tests conclude that, given the nature of the site, the development proposal and the mitigation measures incorporated into the proposal, there is unlikely to be any significant detrimental impact on any threatened species, population or its habitat.

6.3 Environment Protection and Biodiversity Conservation Act 1999

Under the *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act 1999), any action that has, or is likely to have, a significant impact on matters of National Environmental Significance (NES) or other aspects of the environment, such as on Commonwealth land, may progress only with approval of the Commonwealth Minister for the Environment under Part 9 of the EPBC Act 1999. The matters of national environmental significance and Commonwealth land are considered in **Table 6.1** in relation to the proposal. See **Appendix C** for results of the EPBC Act database search.

Table 6.1 Commonwealth Environmental Impact Assessment

	Factor	***Impact***
a	***Any Environmental Impact on a World Heritage Property?***	
	The proposal will not impact on any World Heritage Property as no such properties exist within a 5 km radius of the works.	Nil
b	***Any Environmental Impact on National Heritage Places?***	
	The proposal will not impact on any National Heritage Places as no such places exist within a 5 km radius of the works.	Nil
c	***Any Environmental Impact on Wetlands of International Importance?***	

	Factor	Impact
	The proposal will not impact on any Wetlands of International Importance as no such places exist within a 5 km radius of the works.	Nil
d	***Any Environmental Impact on Commonwealth Listed Threatened Species or Ecological Communities?***	
	Hairy Joint Grass (*Arthraxon hispidus*) is listed as 'vulnerable' under the Act. As highlighted above, this species has been recorded within the site and approximately 7.9 ha of suitable habitat is located on the site. The development proposal will result in the removal of a large portion of this habitat, with a management strategy proposed involving some on-site retention associated with further research into the species and off-site habitat enhancement works. This mitigation strategy is summarised below, and contained in full in **Appendix C** of **D**.	Negative (short term) Positive (long term with implementation of management strategy)
e	***Any Environmental Impact on Commonwealth Listed Migratory Species?***	
	The habitats for 39 migratory species have been recorded within a 5 km radius of the locality. This includes 13 migratory marine species which would not be affected by the proposed works. Several of the migratory species are terrestrial birds which are relatively common throughout the region i.e., Blackfaced Monarch, Satin Flycatcher, Rufous Fantail, and White-throated Needletail. Latham's Snipe (*Gallinago hardwickii*) is a migratory wetland bird listed within the EPBC Act. This species was recorded by Warren (2003) roosting in low lying areas of the site. Suitable habitat however exists in more open areas of Ballina Nature Reserve and in grassland areas throughout the Shire. Extensive environmental protection measures will be employed to prevent pollutants entering the water way. It is not expected that the proposed works will have a direct impact on Commonwealth listed migratory species.	Nil
f	***Does Any Part of the Proposal Involve a Nuclear Action?***	
	The proposal does not involve a nuclear action.	Nil
g	***Any Environmental Impact on a Commonwealth Marine Area?***	
	It is unlikely that the proposal will impact on any Commonwealth Marine Areas due to the strict mitigation measures to be employed however the proposed works are located within three nautical miles of the coast and are therefore within a Commonwealth Marine Area.	Nil
h	***Any Environmental Impact on Commonwealth Land?***	
	The proposal is not expected to impact on Commonwealth Land; however one area of Commonwealth Land exists within a 5 km radius of the site, which is Telstra infrastructure.	Nil

Given the listing of Hairy Joint Grass as Vulnerable, the development proposal was referred to the Department of Environment and Water Resources in July 2007.

By letter dated 29 August 2007, the Department advised the proponents that the action is considered to be 'controlled' under the provisions of the Act. A 'bi-lateral agreement' is in place between the Commonwealth and State Governments regarding the assessment of controlled activities where the proposal also requires approval under Part 3A of the *Environmental Planning and Assessment Act 1979*. Pursuant to this agreement, assessment of significance under the EPBC Act will, in effect, defer to the assessment of significance undertaken under the Threatened Species Conservation Act.

Notwithstanding this, the EPBC Act referral documentation contains an assessment of the significance of likely impacts for the Hairy Joint Grass, prepared by Cardno. That assessment concludes that, given the nature of the local population and the mitigation measures proposed, development of the site is not likely to have a significant impact on Hairy Joint Grass. The Commonwealth deemed the development to be a Controlled Action and is subject to the provisions of a Bilateral Agreement.

Subsequent to the preparation of the referral documentation, Cardno have prepared a Management Strategy for the Hairy Joint Grass (refer to **Appendix E** of **Part 3A Application**). The overall objective of that Strategy is to compensate for the displacement of Hairy Joint Grass populations that will result from the urban development of the site.

This overall objective will be achieved through the implementation of the following Management Actions:

- on-site population retention and enhancement within the proposed Open Space Reserve;
- off-site population retention and enhancement of Hairy Joint Grass populations within the proposed Open Space Reserve linkage to the west and north-west of the site; and
- regional surveying and mapping of known and potential Hairy Joint Grass habitat.

On-site retention and enhancement of Hairy Joint Grass populations will be achieved within the proposed open space network that links the littoral rainforest and spring in the east of the site to the existing pond through retention and embellishment of an existing watercourse. In all, approximately 2.1ha of the Hairy Joint Grass habitat will be retained, with the development designed to ensure that existing conditions are not altered in this area.

This on-site retention will provide:

- compensation for displacement of populations elsewhere on the site;
- opportunities for short and long term monitoring and research to increase the current understanding of the species biology, ecology and appropriate management; and
- development of source populations for seed and/or seedling translocation trials to be conducted on and off the site.

The intention of the off-site retention and enhancement proposals is to establish an off-site reserve system to provide for:

- establishment of a self-sustaining system that reflects pre-existing vegetation types and ecotones that are considered to constitute natural Hairy Joint Grass habitat in the locality;
- creation of a habitat linkage between areas of protected vegetation that occur to the west and north of the site; and
- restoration of biodiversity values that have been lost in the locality through past land management practices.

Land to the north and west of the site has been subject to broad-scale vegetation clearance in the past and currently supports a mosaic of pasture paddocks, sugar cane crops and urban development. Consequently, native vegetation to the north of the site has been reduced to remnant patches that are physically isolated from larger tracts of intact vegetation held within the Ballina Nature Reserve. In this regard, the proposed off-site reserve system will provide a vegetated linkage between Hairy Joint Grass populations identified on a parcel of Council owned land to the west of the site and Hairy Joint Grass habitat associated with the SEPP 14 Wetland within the northern section of the adjoining Henderson Farm. The potential also exists for the proposed reserve to include, or provide linkage to, a small remnant of SEPP 26 Littoral Rainforest adjoining the north-western corner of the site.

It is envisaged that Hairy Joint Grass habitat on the Council-owned land will eventually be dedicated to the State Government as an addition to the adjoining Ballina Nature Reserve. In this regard, it is noted that a

specific management objective pursuant to the Ballina Nature Reserve Plan of Management is to '*enhance the viability of habitats by encouraging vegetation corridors off the Reserve where possible*'. The development of the off-site reserve in general accordance with this strategy will therefore contribute to broader biodiversity conservation measures and the ecological value of the adjoining Ballina Nature Reserve.

The Hairy Joint Grass Management Strategy (**Appendix E** of **Part 3A Application**) provides further detail as to how this off-site reserve will be embellished using seedlings of the species collected from areas within the site. The strategy also outlines a range of research and investigation measures that will be undertaken to ensure the success of both on-site and off-site retention and to add to the current knowledge of the species, which is sparse at best. Eventually, this research would lead to the development of a local recovery plan for this species.

6.4 Fisheries Management Act 1994

Section 220ZZ of the *Fisheries Management Act 1994* lists the factors (7 point test of significance) to be considered when determining whether a proposed development is likely to have a significant effect upon threatened species, populations or ecological communities, and their habitats, therefore determining if a Species Impact Statement is required. This assessment is also a requirement under Section 5C of the EP&A Act. This assessment mirrors the provisions of the *Threatened Species Conservation Act 1995* (TSC Act), and complements the TSC Act by dealing with issues relating to fish and marine vegetation, both of which are excluded from consideration under the TSC Act.

Green Sawfish inhabit muddy or sandy-mud soft bottom habitats in inshore areas. They also enter estuaries, where they have been found in very shallow water. Green Sawfish was the only aquatic species assessed within **Section 4.5** as having a possible likely occurrence. A seven-part test has been completed for the Green Sawfish (refer to **Appendix B**). This assessment of significance concluded that it is highly unlikely that the proposed development will have a significant impact on this species.

7 Environmental Management

7.1 Mitigation Measures

Below is a summary of mitigation measures that can be implemented to reduce the potential impacts resulting from the proposed works. The primary mitigation measure is contained in the Hairy Joint Grass Management Strategy outlined in **Appendix E** of **Part 3A Application**. Implementation of this strategy will not only minimise and mitigate impacts on this species on the site, but will result in increased areas of habitat for the species in the local area and result in a range of positive biodiversity outcomes.

In addition to the Hairy Joint Grass Management Strategy, the key mitigation measures are:

- the boundary of the areas of vegetation to be retained will be clearly flagged to ensure no unnecessary clearing occurs;
- the health of threatened species will be recorded and regularly monitored;
- weeds removed during rehabilitation works will be disposed of in an approved location (council rubbish tip) off-site to reduce the risk of spreading weeds to neighbouring areas;
- a spill containment kit, including equipment to address terrestrial and aquatic spills, will be kept on site at all times. Staff will also be trained in the effective deployment of the spill containment kit;
- vehicle, machinery and any stockpile materials will be placed in a bunded area at least 5m from the drip line of trees to be retained;
- refuelling of equipment and vehicles will only occur in an appropriately bunded area or off-site (e.g. at a depot);
- all rubbish and wastes will be collected and disposed of or recycled during and upon completion of the works;
- cleared vegetative material will be mulched / chipped and safely stockpiled;
- injured animals will be reported to WIRES for immediate care;
- plant operators will be educated with regard to the retention of priority habitat areas (eg. open space reserves containing Hairy Joint Grass and Littoral Rainforest) and native flora and fauna species within the works site;
- trees to be removed will be monitored by personnel with wildlife caring qualifications immediately prior to, and during removal to ensure that no animals are 'directly' impacted by the works. Any trees containing fauna will be retained until the species leaves the site or the nests have been vacated. If any animals are injured during the proposed works, they will be immediately transported to a wildlife carer for rehabilitation and release; and
- erosion and sedimentation controls (such as silt fences or soil berms) will be implemented in appropriate locations around the site including stockpiles, downslope of all unprotected disturbed areas and drainage lines prior to the commencement of works to capture any sediment passing from the site and kept functional to the end of the project;
- to limit the spread of sediment by vehicle movements, soils will not be transported unless 'spadeable' i.e. the soil is not in a free flowing state and all construction equipment will be washed down at the end of each day before moving off site;
- surfaces of existing roads that are used as access by contractors will be kept free of foreign materials, dirt and other foreign matter at all times; and
- speed limits will be reduced and traffic movement minimised.

8

Conclusions

The Pacific Pines site has been comprehensively surveyed and targeted searches were completed for all threatened species considered possible occurrences in the study area. The site consists largely of grazing land with low-lying areas characterised by sedgeland/ rushland and elevated areas dominated by grassland. The slopes are largely cleared but contain several mature figs. Five broad vegetation communities were recorded including littoral rainforest, swamp oak forest, swamp sclerophyll forest, sedgeland/ rushland and low closed grassland. Three of these vegetation communities (Littoral Rainforest, Swamp Oak Floodplain Forest, Swamp Sclerophyll Forest) are listed as Endangered Ecological Communities within Part 3 of Schedule 1 of the *Threatened Species Conservation Act 1995*. Five threatened flora species listed within *Threatened Species Conservation Act 1995* were recorded, Rough-shelled Queensland Nut (*Macadamia tetraphylla*), Red lilly pilly (*Syzygium hodgkinsoniae*), White Laceflower (*Archidendron hendersonii*), Arrow Head Vine (*tinospora tinosporoides*) and Hairy Joint Grass (*Arthraxon hispidus*). Four of these were also listed as Vulnerable within the Environmental Protection and Biodiversity Conservation Act 1999.

Fauna surveys on the site and in the adjacent area of wetland recorded seven amphibian species, five reptile species, 41 birds and eleven mammal species. Three threatened fauna species were recorded on site including the Australasian Bittern, Grey-headed Flying-fox and the Greater Broad-nosed bat.

The proposed development has been designed to retain mature figs and the majority of forested communities including Littoral Rainforest and Swamp Oak Forest. Threatened rainforest plants will generally be retained within areas of open space and protected by buffers. Several threatened flora species (Arrow Head Vine and several Rough-shelled Bush Nut) occur along fencelines and will be retained at the rear of residential lots (protected by covenant).

Hairy Joint Grass (*Arthraxon hispidus*) was identified within two main areas of sedgeland / rushland and low closed grassland. The proposed works will result in the removal of approximately 5.8 ha of Hairy Joint Grass habitat. Approximately 2.1 ha of Hairy Joint Grass Habitat will be reserved within the open space area. The proposed Concept Plan for the site includes a long term management strategy to protect and enhance threatened species habitat on-site and in the local area, particularly concentrating on habitat for Hairy Joint Grass (*Arthraxon hispidus*). This management strategy has been devised to provide actions that will be implemented in order to compensate for the loss of, or any adverse effects on, Hairy Joint Grass populations resulting from the proposed development. The proposed management strategy will incorporate a significant amount of monitoring and research into effective management of Hairy Joint Grass populations as well as contributing to a number of Priority Actions for the recovery of Hairy Joint Grass as identified by DEC (2005). Implementation of the strategy will ensure a sustainable local population of the species, protected in perpetuity by Environmental Protection Zoning and public ownership.

A small area in the north-western corner of the proposed development area occurs within the 100 m buffer zone of a neighbouring area of SEPP 26 Littoral Rainforest. This area will be set aside as open space and planted as a buffer to the SEPP 26 area. SEPP 14 No. 88, which covers 665 ha, is located to the immediate south-west of the site. The proposed development has been designed to minimise impacts on this coastal wetland. Sports fields, a water quality control pond and internal roads will separate residential development from the wetland areas, providing significant buffers. Stormwater management measures have been designed to ensure that all site run-off is captured and treated prior to discharge to the wetland.

Modelling of the stormwater treatment proposals indicates that an improvement of approximately 30-60% can be expected post-development, compared with existing water quality.

Section 5A assessments have been completed for the threatened flora and fauna species recorded within the site for the existing three endangered ecological communities; one aquatic species; and three threatened fauna species known to occur within the site. The assessments conclude that the impacts of the proposed development will be unlikely to result in the local extinction of any of these species.

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Project Team

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