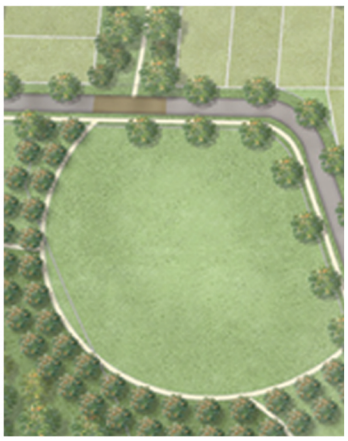
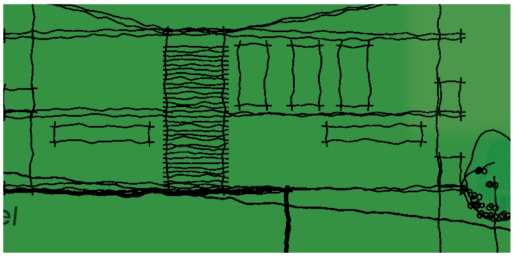
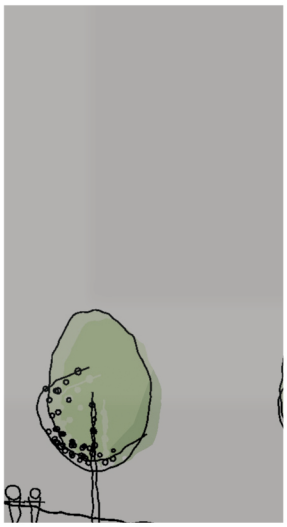
PLANIT CONSULTING

Preliminary Reveiw of Terrestrial Flora and Fauna Values

Sandalwood Drive, Bogangar
Lot 2 DP 821987




Prepared for Land and Property Management Authority by Planit Consulting Pty Ltd
April 2010

Important note for the Reader

This report is preliminary only. Further studies will need to be undertaken to ensure all relevant ecological issues are address.

A seven (7) part test of significance, in accordance with the Environmental Planning and Assessment Act 1979, will need to be undertaken to confirm likely impacts.

The outcome of further investigations that comprehensively address all constraints, balanced against the expected development outcomes as envisaged by the residential zoning of the land, will ultimately advise as to the most suitable form of development for the site.

It is important that any development of the site also include significant rehabilitation works. This rehabilitation should occur both on the subject land and also there should be consideration given to environmental offsets on adjacent or nearby Crown Land. Final rehabilitation requirements should also be addressed within the further environmental investigations.

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1.0 INTRODUCTION

Planit Consulting has been commissioned by the Land and Property Management Authority (LPMA) to prepare preliminary terrestrial flora and fauna assessment documentation over land situated at Sandalwood Drive, Bogangar (refer Figure 1). This report outlines the results of brief flora and fauna investigations and describes vegetation types, habitat associations and preliminary ecological values of the subject property. This information is intended to be utilized as a scoping document identifying potential ecological constraints associated with future intended development of the land. The preliminary constraints identified to date, when considered in association with scoping studies of additional disciplines (i.e. geotechnical, hydraulic, traffic, land use planning etc), should generate the framework for determining an appropriate pattern of development or use over the subject land.

2.0 SITE DESCRIPTION & LOCATION

The subject property incorporates the following allotment which is accessed via Sandalwood Drive and the Tweed Coast Road at Bogangar:

- Lot 2 on DP821987

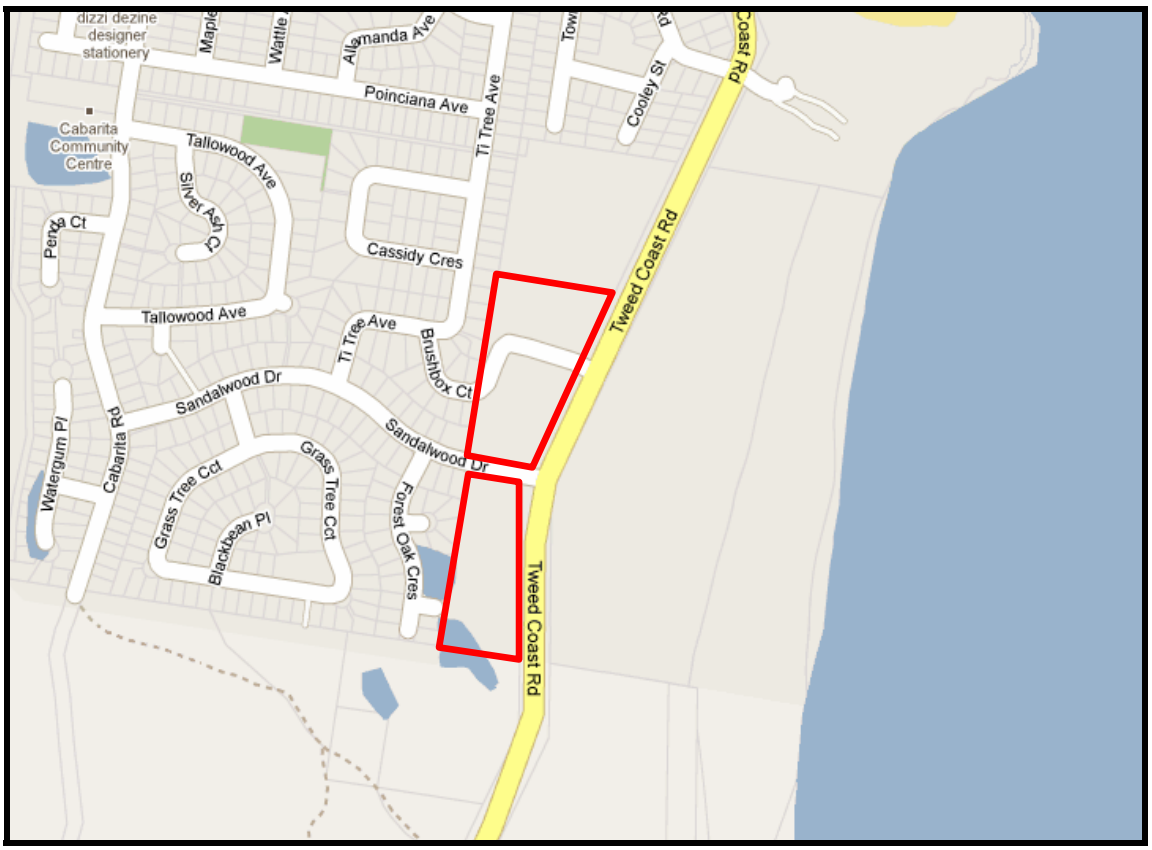


FIGURE 1: SITE LOCATION
SOURCE: GOOGLE MAPS, 2010

This allotment shall be hereafter referred to as '*the site*.' The site is trapezoidal in shape and is bordered by Tweed Coast Road (in the east), a school in the north, playing fields in the south and urban allotments along the western boundary. Improvements are absent excepting for walking trails and vehicle tracks mostly created through the northern half of the site. The westernmost areas also appear to be utilized as ad-hoc storage areas or gardens by adjacent residents.

The site is currently zoned 2(c) Urban Expansion under the Tweed Local Environment Plan (LEP) 2000. Under the Draft Tweed (LEP) 2010 (currently on exhibition for public comment) zoning proposed is R1 General Residential.

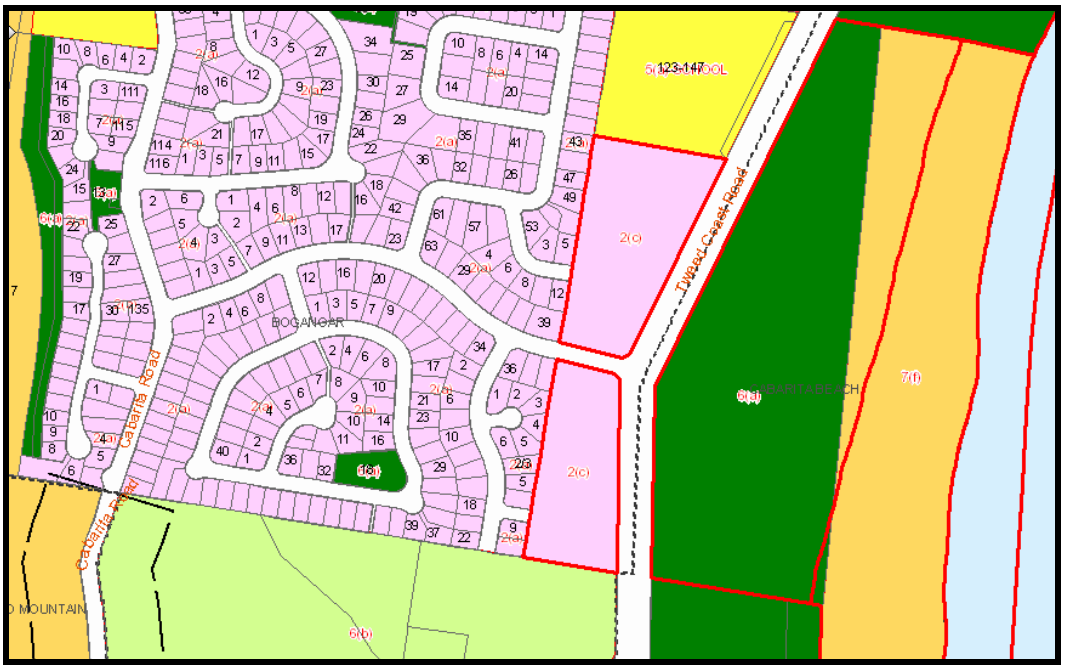


FIGURE 2: TWEED LEP MAP
SOURCE: http://www.tweed.nsw.gov.au/modules/propertymaster/default.aspx?page=wrapper&key=42378

2.1 EXISTING USE AND RESULTANT VEGETATION

The site is small in extent (~5.1ha) and is currently unimproved although it is considered likely that sand mining activities were performed during the 1950s and 1960s similar to nearby areas. The residual sandy soils have regenerated predominately with Dry Coastal Heath vegetation, a copse of Coastal Bloodwood Forest (north-eastern corner) and a copse of Broad-leaved Paperbark Forest (south-western corner). Minor areas are cleared of vegetation along the western boundary and have subsequently been re-established with common residential couch grasses.

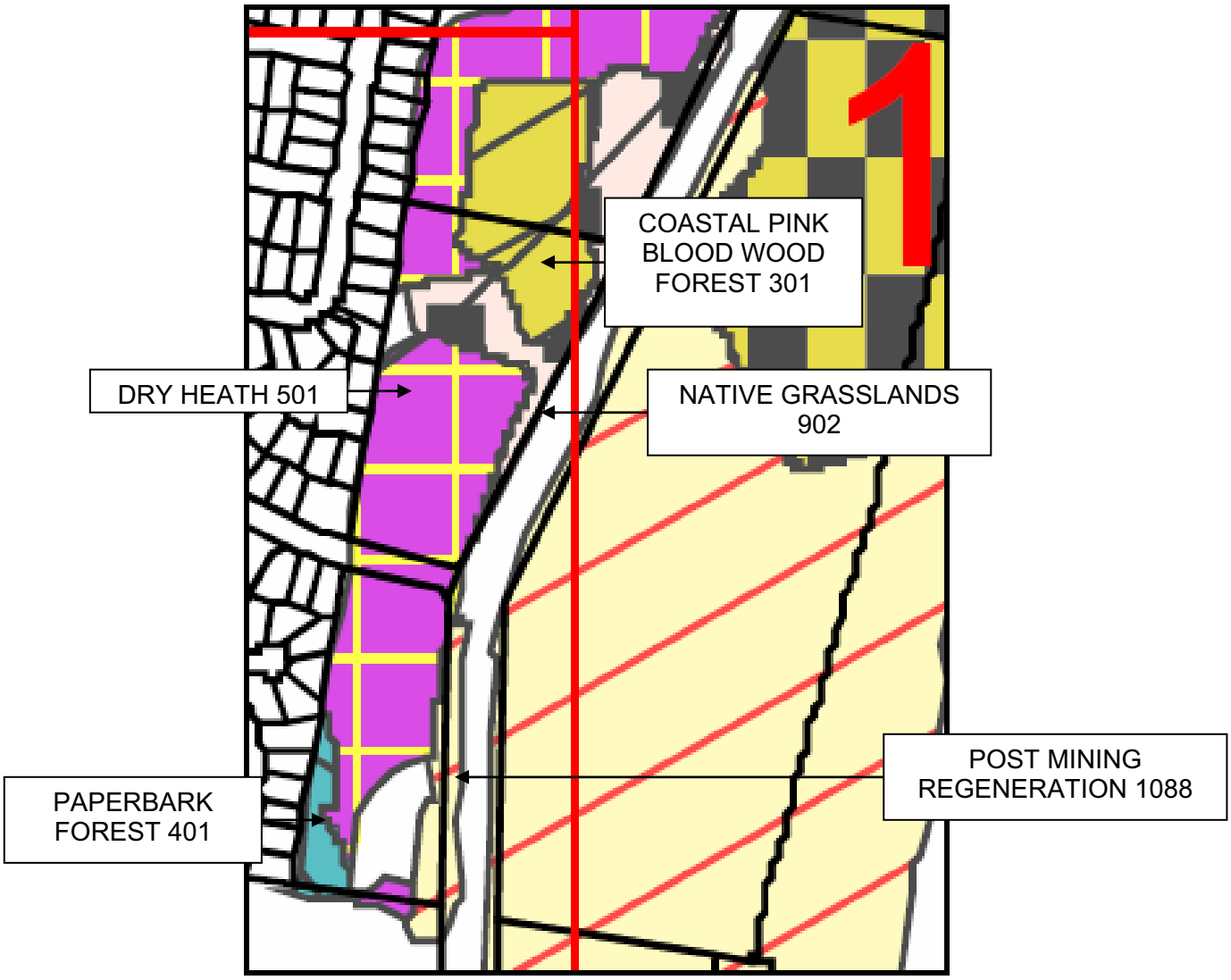


FIGURE 3: TWVMP MAP 2: VEGETATION TYPE
(SOURCE: TWEED VMP, 2004)

2.2 PROJECT DESCRIPTION

The project is yet to be defined as scoping studies are underway to determine site constraints and appropriate land uses. At this stage it is considered likely that the use will comprise a residential development.

2.3 SOIL LANDSCAPES

A review of Tweed VMP Map 5: Soils notes one soil landscape over the site:

Aeolian Soil Landscapes
Aeolian landscapes have accumulated by deposition of sand-sized particles by wind action. Aeolian landscapes include dunefields, dunes, blowouts, sand sheets and lunettes. This group consists of the following soil landscape units: Bogangar (bo), Kingscliff (ki) and Wooyung (wy). Pottsville (po) is considered an Aeolian/Swamp landscape.

FIGURE 4: 2009 AERIAL PHOTOGRAPH (SOURCE TSC)

Such areas are described in more detail within 'Soil Landscapes of the Murwillumbah Tweed Heads' (Morland, 1996) and mapped as three sub-units:

- Bogangar (bo): mapped in the central portions of the site

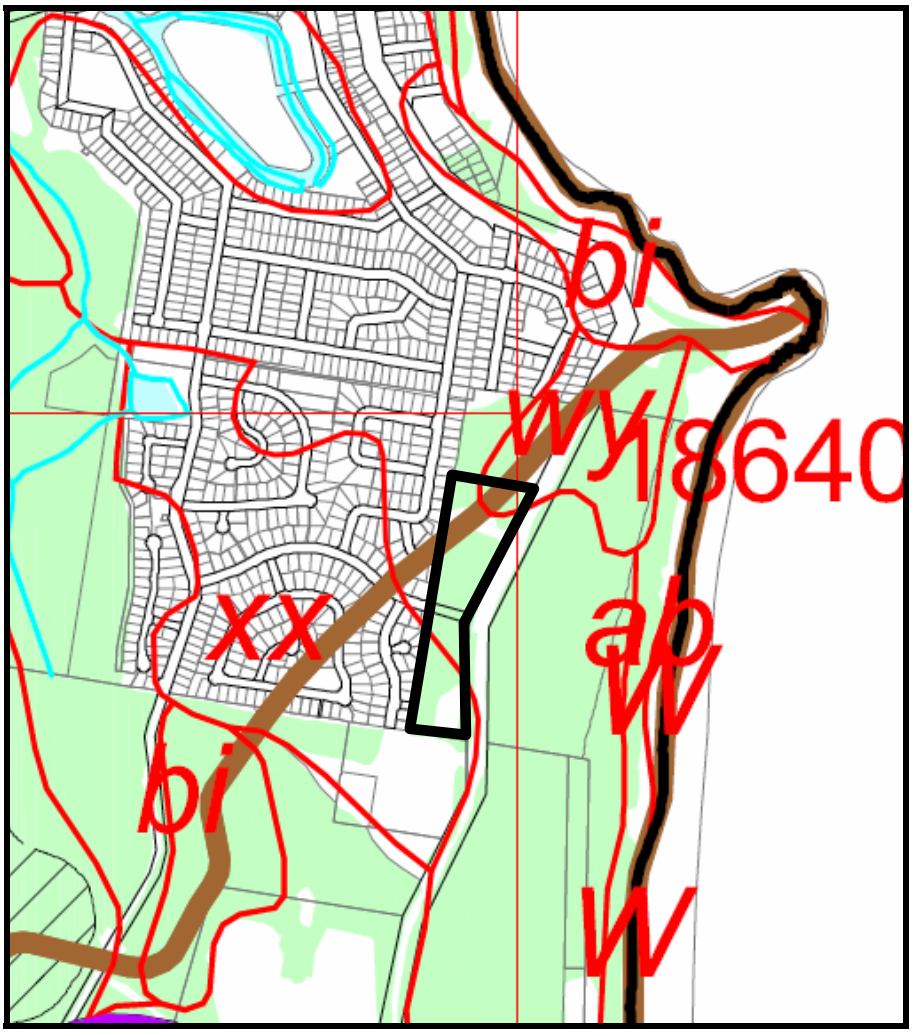
Location: The Bogangar landscapes are disturbed and generally reshaped and revegetated Holocene dunes flanking the Tweed-Byron Coast
Geology: Holocene dunes consisting of marine quartz sands forming the outer barrier system
Topography: Very disturbed outer barrier dune system. This soil landscape has been extensively mined and in many locations the original dune form has been obliterated. Slopes are 3-10%, relief is up to 10m and elevation is 5-10m.
Soils: Deep (>300cm), very disturbed Podzols (Uc2) and Siliceous Sands (Uc1.21). These dunes have been sand mined. Most of the mining was carried out during the 1950's and 1960s. As mining ceased, dunes were rehabilitated, including restructuring and revegetation. Landscape limitations consist of extreme wind erosion hazard on non-cohesive soils with high soil erodibility (Morand 1996; 149-150 + map).

- Wooyung (wy): mapped in the north-eastern portions of the site

Location: Pleistocen transgressive dunes that occur predominately inland of Wooyung and near Wommin Lake on the Tweed Byron Coast.
Geology: Transgressive Pleistocene dunes consisting of windblown quartz sand
Topography: Level to gently inclined dunes of extremely low relief. Generally have a linear shape parallel to coastline.
Soils: Deep (>300cm), very disturbed Podzols (Uc2.2, Uc2.3) (Morand 1996; 155-156 + map).

- Disturbed landscapes (xx): mapped in the southern portions of the site

Location: Numerous areas throughout the Murwillumbah-Tweed Heads region, particularly along the coastal strip. Much of this terrain consists of old sand mining sites and areas undergoing rapid urban development.
Geology: Quaternary beach and dune sands
Topography: Made land, which varies from level plains to undulating terrain which has been disturbed by human activity to a depth of at least 100cm (Morand 1996; 162-163 + map).



SOURCE: TWEED VMP MAP 5: SOIL LANDSCAPE, STEEP LAND AND DRAINAGE LINES MAPPING

2.4 EXISTING DRAINAGE

Currently the majority of site drainage is uncontrolled and is comprised of sheet flow during rainfall events. A broad depression exists within the southern portions of the site which ponds water during such events with a shallow soak also present in the southwestern corner which is occupied by aquatic flora species and fringed by Broad-leaved Paperbark.

2.5 AIMS OF STUDY

The aim of this report is to review the terrestrial flora and fauna habitat of the site and adjoining areas and to briefly examine the potential for the occurrence of threatened species, populations, their habitats or endangered ecological communities. In order to provide this information the following specific objectives are to:

- Review and describe the existing flora, vegetation communities, fauna assemblage and associated habitats of the site and adjoining areas,
- Determine the occurrence, or potential occurrence, threatened species, populations, their habitats or endangered ecological communities as a result of brief survey and literature review,
- Identify preliminary ecological constraints relevant to the future development or use of the land including potential presence of threatened species, populations, endangered communities, areas of high biodiversity, riparian corridors, wetlands, wildlife corridors, poorly conserved ecosystems etc
- Prepare ecological status analysis map

2.6 ENVIRONMENTAL LEGISLATIVE FRAMEWORK

Any future development or land-use change implemented on the site will be assessed by the local council pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979*. In addition to the *Environmental Planning and Assessment Act 1979*, other NSW legislation and planning policies are relevant to the protection of biodiversity, as outlined below:

Threatened Species Conservation Act 1995 - The Threatened Species Conservation Act outlines the protection of threatened species, communities and critical habitat in New South Wales. An independent Scientific Committee has been set up under the Act to determine which species, populations and ecological communities should to be listed as endangered, vulnerable or extinct under the act, and also to determine key threatening processes. Threatened biodiversity listed pursuant to the act occurring within the study area are considered in Section 5 of this report. The '7-part test of significance' pursuant to Section 5a of the *Environmental Planning and Assessment Act 1979* would also have to be considered in association with any future development application prepared.

Native Vegetation Act 2003 & Native Vegetation Regulation (2005) - This provides the framework for the Government's commitment to end broadscale clearing, to protect the health of land, rivers and wildlife in NSW. It also provides a framework of investment security and increased flexibility for farmers, rehabilitation to repair damaged rivers and restore over cleared landscapes, and provides powers to local

Catchment Management Authorities (CMAs) to make decisions in the best interests of the community. The native vegetation within the site is considered within Section 3 of this report.

State Environmental Planning Policy No. 44 (Koala Habitat Protection) - This Policy 'aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.' Koalas were not recorded on this site and generally unsuitable habitat for the species occurs. Notwithstanding, any future development application would be required to complete a SEPP 44 assessment.

State Environmental Planning Policy No. 26 (Littoral Rainforest) relates to development applications likely to damage or destroy littoral rainforest (rainforests in coastal areas) (EDO, 2007). No littoral rainforest communities are mapped or were observed on the site and it is considered that this policy will not be applicable to future site development.

State Environmental Planning Policy No. 14 (Coastal Wetlands) aims to preserve and protect coastal wetlands in the environmental and economic interest of the State. It does this by defining any development that involves clearing, draining or filling wetlands, or constructing levees on wetlands to be designated development (EDO, 2007). No mapped coastal wetlands occur over the site.

North Coast Regional Environment Plan — This plan provides local government with state and regional policy guidelines for the preparation of local environmental plans and for certain types of development. The plan sets the basis for new urban and rural development. The emphasis is on progress coupled with careful management. The NCRP and TSC LES prepared under its frameworks will be considered in detail within the future Town Planning Report prepared for the site.

The federal *Environment Protection and Biodiversity Conservation Act 1999* provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places-defined in the Act as matters of national environmental significance. At this stage there are no recorded matters of environmental significance expected to be significantly affected by future site development and, therefore, the provisions of this Act are not triggered. However, this can only be confirmed following the completion of a full flora and fauna survey conducted in accordance with approved guidelines.

2.7 DEFINITIONS, TERMINOLOGY AND NOMENCLATURE

For the purposes of this assessment the following definitions apply:

Site: refers to the extent of the lands forming the boundaries of this development application as described in Section 2.0

Study Area: refers to the site and additional areas which could be potentially affected by the development directly or indirectly. In this case the study area is considered to be that area incorporating the site and buffered by a zone of 50m (to allow for potential offsite impacts such as edge effects, silt deposition, transfer of dust from construction equipment travel on roadways, potential uncontrolled domestic animal predation from residential allotments created onsite etc).

FIGURE 6: MAP OF STUDY AREA

Locality: the area within a 10km radius of the centre of the site

Additional terminology associated with significance assessments (i.e. threatened species, populations, communities, threatening process, direct impacts, indirect impacts etc) and the factors of such assessments (i.e. 7-part test) are taken to be those existing within the Threatened Species Conservation Act 1995, Environmental Planning and Assessment Act 1979, and the DEC (2008) document entitled 'Threatened Species Assessment Guidelines: The Assessment of Significance.' Additional terms within the report which warrant the source of the definition have been specifically referenced in the text.

Nomenclature for all plant species contained within this document follow Harden (1992, 1993, 2000 & 2003) The Flora of NSW Volumes 1-4. Scientific names for plants are used primarily in the document to avoid any confusion associated with use of common or descriptive plan names.

Nomenclature for all animal species contained within this document follows those utilised by the Department of the Environment and Climate Change/National Parks and Wildlife Service (2010) in association with the Atlas of NSW Wildlife. Scientific names for fauna are used primarily in the document to avoid any confusion associated with use of common or descriptive animal names.

2.8 REPORT STRUCTURE

The structure and content of this flora and fauna assessment is as follows:

- Section 1: introductory statement
- Section 2: details the site description, location and outlines general background information relating to the project and this report including the aims and objectives
- Section 3: details the methodology for the brief flora survey and resultant species, community descriptions and mapping
- Section 4: details the methodology for brief fauna survey and resultant species records and descriptions of the recorded assemblage
- Section 5: describes and discusses the recorded & potentially occurring scheduled communities, populations and species of conservation significance
- Section 6: provides a summary of the areas of preliminary ecological significance as determined through this report and provides a preliminary map of ecological status.

3.0 VEGETATION ASSESSMENT

To classify and identify vegetation communities and species which occur on-site, the following methodology was applied:

- Desktop analysis including:

i. Review of Council's Planning Scheme Mapping & Associated Reporting (i.e. Tweed LEP 2000 Maps, Tweed VMP Maps 1-7)

ii. Review of existing vegetation community documentation to confirm dominant elements, forest descriptions and conservation status of mapped forested remnants/ecosystems including:

   - Forestry Commission NSW (1989) *Research Note 17: Forest Types in NSW*.
   - National Parks and Wildlife Service (1999) *Forest ecosystem classification and mapping for the upper and lower north east cra regions*. CRA Unit-Northern Zone.
   - DECC (2008) *BioMetric: Terrestrial Biodiversity Tool for the NSW Property Vegetation Planning System: Definitions of Vegetation Types for CMA Areas* (online @ http://www.environment.nsw.gov.au/projects/BiometricTool.htm)
   - Keith, D. (2004) *Ocean Shores to Desert Dunes*. The native vegetation of NSW. DECC, Hurstville.
   - Ecograph (2004) *Tweed Vegetation Management Strategy*. Ecograph, Limpinwood.
   - Sheringham, P.R., Dr. Benwell, A., Gilmour, P., Graham, M.S., Westaway, J., Weber, L., Bailey, D., & Price, R. (2008). *Targeted Vegetation Survey of Floodplains and Lower Slopes on the Far North Coast*. A report prepared by the Department of Environment and Climate Change for the Comprehensive Coastal Assessment. Department of Environment and Climate Change (NSW), Coffs Harbour, NSW.

iii. Review of threatened flora species and endangered ecological communities listed as occurring within the Murwillumbah (Qld - Southeast Hills and Ranges) CMA sub-region of the Northern Rivers CMA (http://threatenedspecies.environment.nsw.gov.au/tsprofile/cma_subregion_list.aspx?id=15

iv. Review of search of the Atlas of NSW Wildlife database within a search area 10km surrounding the site to review threatened plant records

v. Review of Environment Australia Protected Matters data within a search area 10km surrounding the site to review threatened plant records

vi. Review of SEPP Mapping (Coastal Wetlands, Littoral Rainforest) mapping to determine the indicative presence/absence of regional forest ecosystems reflective of wetland (marine, estuarine, riverine, lacustrine and/or palustrine) communities and/or Littoral Rainforests.

vii. Review of selected flora surveys previously undertaken in the locality including:

- James Warren & Associates (2003) *Analysis of Environmental Constraints Lot 156 Creek Street Hastings Point*.
- SKM (2003) *Cudgera Creek Road Ecological Assessment*.
- Idyll Spaces (2008) *Cudgen Lakes Sand Extraction Project: Flora Assessment* (Gales-Kingscliff Pty Ltd)
- Parsons Brinckerhoff (2008) *Upgrading the Pacific Highway. Banora Point Pacific Highway Upgrade Technical Paper 2-Ecological Assessment.* Report for NSW Roads and Traffic Authority.
- Glen Holmes & Associates (1993) *Biological Investigation for Proposed Residential Subdivision and Artificial Lake Adjacent to Tweed River, Tweed Heads (Lot 4 DP228424, Soorley Street)*. GH&A, Canungra.
- Planit (2008) *Terrestrial Flora and Fauna Assessment. Reyson's Land, Banora Point*. Planit, Kingscliff.
- Planit (2010) *Terrestrial Flora and Fauna Assessment Proposed Residential & Tourist Development Creek Street, Hastings Point Lot 156 on DP628026*. Planit, Kingscliff.

viii. Review of the following legislation to ensure the latest lists of threatened species and communities were noted as well as investigating the existence of any relevant recovery plans, threat abatement plans, key threatening processes or any preliminary determinations which may be applicable to the site and/or the proposed use/action:

- *Threatened Species Conservation Act (1995)*
- *Environment Protection and Biodiversity Conservation Act (1999)*

- Site survey including:

i. Random Meander/Diversity Searches:

Random searches within each vegetation community were undertaken recording all species observed was undertaken in accordance with Cropper (1993) and DEC (2004). Knowledge of known habitat of protected and uncommon floral species was utilized to target such species.

Searches were undertaken over 8 person hours on 15th and 16th April 2010.

The above survey techniques were developed in order to:

- Validate or modify existing vegetation mapping;
- Meet minimum Council and State Government vegetation/survey requirements;
- Identify floral species existing within the site;
- Measure and/or estimate Crown Cover (Walker and Hopkins, 1998, Nelder, 2004. EPA, 2005) to determine vegetation structure designations;
- Identify average height of canopy trees;
- Identify the incidence of senescent trees;
- Determine species dominance within ecologically dominant layer;
- Determine incidence of weed invasion and disturbance over the site and within vegetation strata;
- Determine incidence of species listed as endangered, vulnerable or rare under the *Threatened Species Conservation Act;*
- Determine incidence of species listed as endangered or vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*

Structural Analysis

In this instance the dominant stratum (shrub or tree) height was determined via tape measure or estimated occularly from the mean of two experienced observers. Height classes were then selected from classifications provided in Walker & Hopkins (in McDonald et al, 1998).

Crown cover % for the dominant layer was estimated using the mean of two experienced observers or measured via crown intercept method (Nelder et al, 2004, EPA, 2005). *Structural formation classes* were determined via an assessment of growth form and crown cover % information as per Walker & Hopkins (1998).

Table 1: Height Classes & Names for Various Growth Forms (sensu Walker & Hopkins, 1998: Table 15)

Height		Growth Form			
Height Class	**Height Range (m)**	**Trees, vines, palms**	**shrub, heath shrub, chenopod shrub, mallee (tree or shrub form), cycads**	**tussock grass, hummock grass, forbs, rushes, sedges, ferns, Xanthorrhoea**	**Sod grasses, mosses, lichens, liverworts**
9	>35.01	Extremely tall	N/A	N/A	N/A
8	20.01-35	Very Tall	N/A	N/A	N/A
7	12.01-20	Tall	N/A	N/A	N/A
6	6.01-12	Mid-high	Extremely tall	N/A	N/A
5	3.01-6	Low	Very tall	Extremely tall	N/A
4	1.01-3	Dwarf	Tall	Very tall	N/A
3	0.51-1	N/A	Mid-high	Tall	Extremely tall
2	0.26-0.5	N/A	Low	Mid-high	Tall
1	<0.25	N/A	Dwarf	Low	Low

Table 2: Structural formation classes defined by growth form and crown separation (Walker & Hopkins, 1998: Tables 14a & 17)

Crown Separation	*D Closed or dense*	*M Mid-dense*	*S Sparse*	*B Very sparse*	*I Isolated plants*	*L Isolated clumps*
Field criteria	*Touching - overlap*	*Touching - slight separation*	*Clearly separated*	*Well separated*	*Isolated*	*Isolated*
Crown separation ratio	<0	0-0.25	0.25-1	1-20	>20	>20
Crown Cover %	81-100%	52-81%	20-52%	0.2-20%	<0.2%	<0.2%
Growth Form	Structural Formation Classes					
T Tree	Closed forest	Open forest	Woodland	Open woodland	Isolated trees	Isolated clump of trees
M Tree mallee	Closed mallee forest	Open mallee forest	Mallee woodland	Open mallee woodland	Isolated mallee trees	Isolated clump of mallee trees
S Shrub	Closed shrubland	Shrubland	Open shrubland	Sparse shrubland	Isolated shrubs	Isolated clump of mallee shrubs
Y Mallee shrub	Closed mallee shrubland	Mallee shrubland	Open mallee shrubland	Sparse mallee shrubland	Isolated mallee shrubs	Isolated clump of mallee shrubs
Z Heath shrub	Closed heathland	Heathland	Open heath	Sparse heath	Isolated heath shrubs	Isolated clump of heath shrubs
C Chenopod shrub	Closed chenopod shrubland	Chenopod shrubland	Open chenopod shrubland	Sparse chenopod shrubland	Isolated chenopod shrubs	Isolated clump of chenopod shrubs

Table 3: Structural formation classes for ground covers (Walker & Hopkins, 1998: Table 14b))						
Crown class	*D Closed or dense*	*M Mid-dense*	*S Sparse*	*B Very sparse*	*I Isolated plants*	*L Isolated clumps*
Foliage cover	>70	30-70	10-30	<10	<1	<1
Growth Form	Structural Formation Classes					
G Tussock grass	Closed grassland	Grassland	Open grassland	Sparse grassland	Isolated grasses	Isolated clump of tussock grasses
H Hummock grass	Closed hummock grassland	Hummock grassland	Open hummock grassland	Sparse hummock grassland	Isolated hummock grasses	Isolated clump of hummock grasses
D Sod grass	Closed sod grassland	Sod grassland	Open sod grassland	Sparse sod grassland	Isolated sod grasses	Isolated clump of sod grasses
V Sedge	Closed sedgeland	Sedgeland	Open sedgeland	Sparse sedgeland	Isolated sedges	Isolated clump of sedges
R Rush	Closed rushland	Rushland	Open rushland	Sparse rushland	Isolated rushes	Isolated clump of rushes
F Forb	Closed forbland	Forbland	Open forbland	Sparse forbland	Isolated forbs	Isolated clump of forbs
E Fern	Closed fernland	Fernland	Open fernland	Sparse fernland	Isolated ferns	Isolated clump of ferns
O Moss	Closed mossland	Mossland	Open mossland	Sparse mossland	Isolated mosses	Isolated clump of mosses
L Vine	Closed vineland	Vineland	Open vineland	Sparse vineland	Isolated vines	Isolated clump of vines

It is noted that Qld EPA (2005) and Nelder et al (2004) have recently provided Structural formation Class Tables which vary slightly from Tables 1 and 2 above. This table is displayed below:

Table 4: Structural formation classes for woody plant communities qualified by height: (classes defined by growth form, height and cover) [sensu EPA, 2005]				
Foliage projective cover	70-100%	30-70%	10-30%	<10%
Crown separation	closed or dense	mid-dense	sparse	very sparse
Field criteria	touching-overlap	touching - slight separation	clearly separated	well separated
Crown separation ratio	<0	0-0.25	0.25-1	1-20
Crown cover %	81-100%	52-81%	20-52%	0.2-20%
Growth form	*Structural Formation Classes (qualified by height)*			
trees > 30m	tall closed-forest	tall open-forest	tall woodland	tall open-woodland
trees 10 – 30m	closed-forest	open-forest	woodland	open-woodland
trees < 10m	low closed-forest	low open-forest	low woodland	low open-woodland
shrubs 2 – 8m	closed-scrub	open-scrub	tall shrubland	tall open-shrubland
shrubs 1 – 2m	closed-heath	open-heath	shrubland	open-shrubland
shrubs <1m	-	-	dwarf shrubland	dwarf open-shrubland

The above methodology is considered to be reasonably consistent with the intent of the following documents:

- NSW Department of Infrastructure, Planning and Natural Resources (1997) *Interim Guidelines for Targeted and General Flora and Fauna Surveys under the Native Vegetation Conservation Act 1997*.
- NSWNPWS (2001) *The Community Biodiversity Survey Manual*. New South Wales National Parks & Wildlife Service.
- QLD Department of Environment and Heritage (1999) *Suggested Conservation Criteria for Development Assessment*.
- Gold Coast City Council (2004) *Guidelines for preparing Ecological Site Assessments during the Development Process (v1.1)*. G.C.C.C., Nerang.
- Shire of Maroochy (1997) *Flora and Fauna Assessment Requirements for Developments in Maroochy Shire*. M.S.C
- Brisbane City Council (1999) *Ecological Assessment Guidelines*. B.C.C.
- Walker, J. & Hopkins, M.S. (1998) Chapter 5: Vegetation in McDonald, R. C., Isbell, R.F., Speight, J.G., Walker, J. & Hopkins, M.S. *Australian Soil and Land Survey: Field Handbook Second Edition*. CSIRO Australia, Canberra.
- Nelder, V. J., Wilson, B.A., Thompson, E. J. & Dillewaard, H.A. (2004) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. EPA, Brisbane.
- DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft*. DEC, NSW.

3.1 VEGETATION SURVEY RESULTS

As a result of flora surveying four (4) vegetation communities were identified on site and are described separately below. Where possible, identified communities have been compared to recognized documents such as Forest Types in NSW (1989), CRA Forest Ecosystems (1999) and the Tweed VMP (2004).

Displayed vegetation maps have been compiled using Mapinfo geographic information system (GIS) software (Ver. 8.5). Information utilized has included:

- Provided site boundaries and aerial photographs.
- Tweed VMP (2004) vegetation community mapping (VMP MAP 2) boundaries rasterised and registered to property boundaries and aerial photographs
- Upper North East CRA Forest Ecosystem Layer metadata (online @ http://maps.environment.nsw.gov.au/terms.aspx?file=forest_ecosystems_upper_north_east.zip)
- Wetlands of New South Wales metadata (online @ http://maps.environment.nsw.gov.au/terms.aspx?file=nsw_wetlands.zip)

Vegetation survey was performed as outlined above with geo-referenced colour aerial photographs overlaid with contour plans, existing mapped vegetation boundaries and cadastre boundaries utilized for the initial recognition of community boundaries in the field and adjustments noted as necessary. Communities (refer below) were then transcribed directly into the GIS program utilizing the aerials, geological information and vegetation boundaries as a reference background. Where necessary vegetation boundaries were traversed with a hand held GPS (Garmin s72) and loaded into Mapinfo with existing boundaries rectified where necessary.

COMMUNITY 1: MID-HIGH/TALL DRY COASTAL HEATHLAND/SHRUBLAND [Z3/4M]

This community is present in the central portions of the site to the north and south of Sandalwood Drive and covers approximately 3.23ha. As described within the FCNSW (1994) the community is characterized by plants possessing small, xeromorphic and frequently sharp-pointed leaves over Aeolian sand deposits. These sand deposits are likely to have been reworked over time in association with the historical sand mining pattern within the Bogangar locality. It is approximated that the most recent clearing event over the area occupied by the community occurred between 1993 and 1996.

The dominant layer of the community is the shrub layer which is arranged in a dense to mid-dense arrangement of woody species in the 0.5-1.5m height range. Species encountered include Wallum Banksia (*Banksia aemula*), Tea-trees (*Leptospermum lavigatum, L. polygalifolium, L. trinervium*), Weeping Baeckea (*Baeckea frutescens*), *Homoranthus virgatus*, Wedding Bush (*Ricinocarpos pinifolius*), Wallum Heath (*Epacris pulchella*), Heath Aotus (*Aotus ericoides*), Wallum Geebung (*Persoonia virgata*), Guinea Flower (*Hibbertia linearis*), Parrot Pea (*Phyllota phylicoides*) and Midgenberry (*Austromyrtus dulcis*).

Emergent trees are scattered but stunted in growth with Coast Wattle (*Acacia sophorae*), Sweet Wattle (*Acacia suaveolens*), Corkwood (*Dubosia myoporoides*), Swampbox (*Lophostemon suaveloens*), Pink Bloodwood (*Corymbia intermedia*), Coastal Geebung (*Persoonia stradbrokensis*), She-oak (*Casuarina equisetifolia*), Macaranga (*Macaranga tanarius*), Coastal Banksia (*Banksia integrifolia*) and Tuckeroo (*Cupaniopsis anacardioides*) observed. Juvenile/regrowth Paperbark (*Melaleuca quinquenervia*) is also present adjacent the southern boundary of the site adjacent a large cleared circular area which is likely to be associated with previous mining activities.

The ground layer is characterized by exposed sands, leaf litter and grassy/strappy herbaceous species including Kangaroo Grass (*Themeda triandra*), Blady Grass (*Imperata cylindrica*), *Ischaemum triticeum*, Grass Tree (*Xanthorrhoea fulva*), Curly Sedge (*Caustis recurvata*), *Platysace ericoides* and Bracken (*Pteridium esculentum*), Variable Sword Sedge (*Lepidosperma laterale*). Several large, circular holes are evident which indicates that plant theft (likely grass trees) has previously occurred.

Equivalent vegetation communities

Forest Types in NSW 1989:	Code 223_Heath
CRA Forest Ecosystems 1999:	Code 64_Heath
Tweed VMP 2004:	Code 501_Dry Heathland/Shrubland Code 1008_Post-mining Regeneration
Biometric Vegetation Database NRCMA:	Coastal Heath on Sands of the North Coast
Keith (2004) Ocean Shores-Desert Dunes:	Wallum Sand Heaths
Sherringham et al (2008):	Assemblage 3(e) Wallum Banksia heath Community 39

COMMUNITY 2: LOW/MID-HIGH COASTAL *CORYMBIA INTERMEDIA* FOREST [T6/7M]

This community is present in the northeastern portions of the site adjacent to the Tweed Coast Road and covers approximately 4100m^2.

The canopy is almost exclusively comprised of stunted Pink Bloodwood (*Corymbia intermedia*) in the 5-7m height range with isolated specimens of Swampbox (*Lophostemon suaveolens*) also noted. The shrub layer is sparse over the majority of the community with the intrusion of some heath species on the southern and western boundaries where an ecotone is shared with Community 1 (described above). Several weed species are present on the eastern boundary which is shared with the road reserve of Tweed Coast Road.

The ground layer is grassy in nature and dominated by Blady Grass *(Imperata cylindrica*) with Kangaroo Grass (*Themeda triandra*), Whisky Grass (*Andropogon virginicus*), Flax Lilly (*Dianella caerulea*), Variable Sword Sedge (*Lepidosperma laterale*), Red Natal Grass (*Melinis repens*), Molasses Grass (*Melinis minutiflora*) and Cockatoo Grass (*Alloteropsis semialata*) noted.

Equivalent vegetation communities

Forest Types in NSW 1989:	Code 119_Scribbly Gum-Bloodwood (in part)
CRA Forest Ecosystems 1999:	Code 23_ Coast Range Bloodwood-Mahogany (in part)
Tweed VMP 2004:	Code 301_Coastal Pink Bloodwood Open Forest to Woodland

Biometric Vegetation Database NRCMA:	Pink Bloodwood open forest of the coastal lowlands of the North Coast
Keith (2004) Ocean Shores-Desert Dunes:	Coastal Dune Dry Sclerophyll Forests/ North Coast Dry Sclerophyll Forests
Sherringham et al (2008):	Assemblage 3(a) Open forests on Pleistocene sands Community 32

COMMUNITY 3: MID-HIGH/TALL SWAMP SCLEROPHYLL (*MELALEUCA QUINQUENERVIA*) OPEN FOREST [T6/7M]

This community is present in the southwestern corner of the site adjacent the existing residential development and covers ~3100m^2. The canopy is comprised principally of Broad-leaved Paperbark (*Melaleuca quinquenervia*) in the 8-15m height range. The canopy is highly fragmented via access trails, clearing along allotment boundaries and reduced to a single row of trees in several areas. Several environmental weed/ornamental trees are present at the northern end of the community including Jacaranda (*Jacaranda mimosifolia*), Bats Wing Coral Tree (*Erythrina crista-galli*) and Cocos Palm (*Syagrus romanzoffiana*). Native trees also sporadically occur including Moreton Bay Fig (*Ficus macrophylla*), Brown Kurrajong (*Commersonia bartramia*), Screw Pine (*Pandanus tectorius*), Tuckeroo (*Cupaniopsis anacardioides*), Pink Bloodwood (*Corymbia intermedia*), Macaranga (*Macaranga tanarius*), Corkwood (*Duboisia myoporoides*) and Soap Tree (*Alphitonia excelsa*).

The shrub layer varies depending on level of weed infestation and proximity to a small depression in the south of the community. In the south of the community where the depression occurs (which likely ponds water following significant rainfall events) semi-aquatic species such as Twig Rush (*Baumea rubiginosa; B. articulata*), Grey Rush (*Lepironia articulata*), Swamp Water Fern (*Blechnum indicum*), Knobbly Clubrush (*Isolepis nodosa*), Common Reed (*Phragmites australis*) and Tall Saw-sedge (*Gahnia clarkei*) dominate the lower strata.

External to the area which is intermittently ponded (in the southern portions of the community) the lower strata are dominated by environmental weeds, pasture/couch grasses and ornamental plantings. In such areas natural regeneration is likely suppressed by exotic species with disturbance also associated with slashing, previous clearing creating canopy breaks and apparent recreational/storage use by adjacent residents.

Equivalent vegetation communities

Forest Types in NSW 1989:	Code 31_ Paperbark
CRA Forest Ecosystems 1999:	Code112_Paperbark
Tweed VMP 2004:	Code 401_Broadleaved Paperbark Closed Forest to Woodland
Biometric Vegetation Database NRCMA:	Paperbark swamp forest of the coastal lowlands of the North Coast
Keith (2004) Ocean Shores-Desert Dunes:	Coastal Swamp Forests
Sherringham et al (2008):	Assemblage 2 Broad-leaved Paperbark–Swamp Oak–fern/sedge swamp sclerophyll forest Community 10

COMMUNITY 4: CLEARED AND DISTURBED AREAS + LOW CLOSED GRASSLAND [G1D]

This community occupies the western portions of the site between the heathland community and the adjacent residences. A maintained strip of mown couches dominates this area which is also occupied by garden species, materials storage and parked vehicles. It is likely that the space is utilized by adjacent residences for ancillary recreational uses.

Environmental weeds and pasture grasses are also common adjacent to the slashed/mown areas with patches of native grass (Blady Grass) and Bracken (*Pteridium esculentum*) also noted in the northern areas and adjacent to the Sandalwood Drive roadway. Regenerating native species are sporadically present.

This mapped area also incorporates a large circular cleared zone in the southern areas proximate to the sporting fields. This area is mostly bare and incorporates limited regrowth of paperbark, heathland plants and grasses. The area appears to be utilized for informal BMX activities. Review of previous aerial photographs indicates that this area ponds water following extended rainfall and the regular shape indicates the area is likely to have been formed in association previous mining or earthworks activities.

Equivalent vegetation communities

Forest Types in NSW 1989:	Code 216_Improved Pasture and Cropland Code 220_Cleared/Partially Cleared
CRA Forest Ecosystems 1999:	Code 173_Cleared/Partially Cleared
Tweed VMP 2004:	Code 1099_Substantially Cleared of Native Vegetation
Biometric Vegetation Database NRCMA:	No equivalent
Keith (2004) Ocean Shores-Desert Dunes:	No equivalent

3.2 REGIONAL SIGNIFICANCE & CONSERVATION STATUS

As discussed in Section 3.1 above, the mapped vegetation communities over the site can be partially or fully compared to the regional forest ecosystems defined within the 1999 CRA document. With regard to these forest types the Tweed VMP (2004) document provides the following information (refer Table 5):

NOTES:

Vegetation maps have been compiled using Mapinfo geographic information system (GIS) software (Ver. 8.5). Information utilized has included:

- Data provided by the consulting surveyor/engineer including contours, site boundaries and aerial photographs.
- Tweed VMP (2004) vegetation community mapping (VMP MAP 2) boundaries rasterised and registered to property boundaries and aerial photographs

Vegetation survey was performed as outlined (Section 3 of Report) with geo-referenced colour aerial photographs overlaid with contour plans, existing mapped vegetation boundaries and cadastre boundaries utilized for the initial recognition of community boundaries in the field and adjustments noted as necessary. Communities (refer Section 3 of Report) were then transcribed directly into the GIS program utilizing the aerials, contours, geological information and vegetation boundaries as a reference background.

Where necessary vegetation boundaries were traversed with a hand held GPS (Garmin s72) and loaded into Mapinfo with existing boundaries rectified where necessary.

VEGETATION COMMUNITY MAPPING

- COMMUNITY 1: MID-HIGH/TALL DRY COASTAL HEATHLAND/SHRUBLAND
- COMMUNITY 2: LOW/MID-HIGH COASTAL CORYMBIA INTERMEDIA FOREST
- COMMUNITY 3: MID-HIGH/TALL SWAMP SCLEROPHYLL (MELALEUCA QUINQUENERVIA) OPEN FOREST
- COMMUNITY 4: CLEARED AND DISTURBED AREAS + LOW CLOSED COUCH GRASSLAND [G1D]

FIGURE 7

TABLE 5: Vegetation Codes & Classification			Regional Conservation Status (based on CRA targets current to Feb 2002 sourced from Tweed VMP 2004)											
Site Vegetation Community Descriptions (refer Section 3.1 and Vegetation Community Map above)	**Tweed Vegetation Code**	**Tweed Vegetation Type**	**CRA Forest Ecosystem Code**	**CRA Forest Ecosystem**	**R & E Status**	**Pre 1750 UNE area (ha)**	**Current UNE area (ha)**	**Current Tweed area (ha; based on CRA Forest Ecosystem modelling)**	**Depletion Status (% remaining)**	**Percent Locally Endemic (Tweed area/UNE area)**	**target %**	**Percent Target Met (Feb 2002)**	**NPWS Private Lands Priority**	**Derived Regional Vegetation Status Code (based on CRA % Target Met and other info)**	**Additional Notes**
	Vegcode	**Vegtype**	**CRA_code**	**CRA_FE**	**RE_ status**	**1750 UNEha**	**UNE_ha**	**TWD_CRA _HA**	**Z_ remain**	**Z_Endem**	**Target_Z**	**Z_Target _Met**	**NPWS Priv**	**RegVegStat**	
COMMUNITY 1: MID-HIGH/TALL DRY COASTAL HEATHLAND/SHRUB LAND	501	Dry Heathland to Shrubland	64	Heath	V	-9999.0	9805.0	142	-9999.0	1.4	60	100	-	2	This community is not considered to be reflective of an endangered ecological community and is approximated to be regrowth in the 14-17 year timeframe **(to be confirmed).** Previously the area occupied by the community was utilsed for sand mining purposes **(to be confirmed).** Although the area was noted to be of relatively high botanical diversity, no threatened flora species were recorded. The community is considered to be adequately reserved within the Far North Coast Planning Area (Sherringham et al, 2008).
	1008	Post-mining regeneration	167	Introduced scrub	-	-9999.0	-9999.0	175	-9999.0	-9999.0	-9999.0	-9999.0	-	5	
COMMUNITY 2: LOW/MID-HIGH COASTAL CORYMBIA INTERMEDIA FOREST	301	Coastal Pink Bloodwood Open Forest to Woodland	74 23	Lowland Scribbly Gum (in part) Coast Range Bloodwood-Mahogany (in part)	V	6783	3496	560	51.5	16	60	88.6	Y	1	This community is not considered to be reflective of an endangered ecological community. The community is considered to be inadequately reserved within the Tweed VMP 2004.

COMMUNITY 3: MID-HIGH/TALL SWAMP SCLEROPHYLL (*MELALEUCA QUINQUENERVIA*) OPEN FOREST	401	Broad leaved Paperbark Closed Forest to Woodland	112	Paperbark	V	-9999.0	28577.0	1154.0	-9999.0	4.0	60.0	52.1	Y	1	This community is reflective, or partially reflective, of an endangered ecological community (i.e. the edaphic and topographical features of the coastal floodplain definition may not be met in this instance but the floristics are comparable). The community is considered to be inadequately reserved within the Tweed VMP 2004 and fairly reserved within the Far North Coast Planning Area (Sherringham et al, 2008).
COMMUNITY 4: CLEARED AND DISTURBED AREAS + LOW CLOSED COUCH GRASSLAND	1099	Substantially Cleared of Native Vegetation	173	Cleared-Partially Cleared	#N/A	-9999.0	-9999.0	2247	-9999.0	-9999.0	-9999.0	-99990		7	This community is primarily disturbed/ modified in association with previous and ongoing uses.

Definitions:

Tweed Vegetation Code/Type: Provides a forest type and code as per Tweed VMP 2004

CRA Forest Ecosystem Code: Provides a forest type ecosystem number as per *Forest Ecosystem Classification and Mapping for Upper and Lower Northeast CRA Regions 1999*

CRA Forest Type: Most analogous forest type compared to those listed within *Forest Ecosystem Classification and Mapping for Upper and Lower Northeast CRA Regions 1999*

Pre 1750 UNE Area: Extent of forest type present pre 1750 as listed within *Forest Ecosystem Classification and Mapping for Upper and Lower Northeast CRA Regions 1999*

Current UNE Area: Amount of forest type remaining as listed within *Forest Ecosystem Classification and Mapping for Upper and Lower Northeast CRA Regions 1999*

R & E Conservation Status: Application of JANIS (1997) criteria for the recognition of rare, endangered and vulnerable ecosystems as below:

Status	Description
Endangered	Where less than 10% of its former range or the total area has contracted to less than 10% of its former area, or where 90% of its area is in small patches which are subject to threatening processes and unlikely to persist.
Vulnerable	Where a reduction of 70% within a bioregional context and which remains subject to threatening processes or [which is] not depleted but subject to continuing and significant threatening processes which may reduce its extent.
Rare	Where its geographic distribution involves a total range of generally less than 10,000ha, a total area of generally less than 1000ha or patch sizes of generally less than 100ha, where such patches do not aggregate to significant areas.

Current Tweed Area: Extent area of forest type remaining within Tweed Shire

Depletion Status: % of current UNE forest area remaining from Pre 1750 area.

Percent Locally Endemic: % of current UNE forest area remaining within Tweed Shire

Target %: JANIS (1997) specified minimum benchmarks for the proportion of each forest ecosystem which should be protected within the CAR reserve system as follows:

- As a general criterion, 15% of the pre-1750 distribution of each forest ecosystem should be protected in the CAR reserve system;
- Where forest ecosystems are recognized as vulnerable, then at least 60% of their remaining extent should be reserved
- All remaining occurrences of rare and endangered forest ecosystems should be reserved or protected by other means as far as is practicable; and
- To ensure representativeness, the reserve system should, as far as possible, sample the full range of biological variation within each forest ecosystem, by sampling the range of environmental variation typical of its geographic range.

Target Met?: Describes whether the JANIS targets have been met by the National Parks Estate as at February 2002.
Derived Vegetation Status: Status of forest ecosystem within Tweed Shire per Table 3.4 TVMP 2004.

Figures and data sourced from TVMP 2004.

4.0 FAUNA ASSESSMENT

This section describes the site's fauna and associated habitat as identified through brief fauna surveying. The methodology applied to arrive at the species list is outlined and significant species have been identified where relevant. As this is a preliminary scoping exercise a full fauna survey has not yet been commissioned these results are to be considered interim in nature and not a full list of the assemblage of the site.

4.1 METHODOLOGY

- Desktop analysis including:

i. Review of Council's Planning Scheme Mapping & Associated Reporting (i.e. Tweed LEP 2000 Maps, Draft LEP Amendment No 21 Mapping, Tweed VMP Maps 1-7)

ii. Review of threatened fauna species and endangered populations listed as occurring within the Murwillumbah (Qld - Southeast Hills and Ranges) CMA sub-region of the Northern Rivers CMA (http://threatenedspecies.environment.nsw.gov.au/tsprofile/cma_subregion_list.aspx?id=15

iii. Review of search of the Atlas of NSW Wildlife database within a search area 10km surrounding the site to review threatened plant records

iv. Review of Environment Australia Protected Matters data within a search area 10km surrounding the site to review threatened plant records

v. Review of SEPP Mapping (Coastal Wetlands, Littoral Rainforest) mapping to determine the indicative presence/absence of regional forest ecosystems reflective of wetland (marine, estuarine, riverine, lacustrine and/or palustrine) communities and/or Littoral Rainforest habitats.

vi. Review of selected ecological surveys previously undertaken in the locality including:
   - James Warren & Associates (2003) *Analysis of Environmental Constraints Lot 156 Creek Street Hastings Point*.
   - SKM (2003) *Cudgera Creek Road Ecological Assessment*.
   - Idyll Spaces (2008) *Cudgen Lakes Sand Extraction Project: Flora Assessment* (Gales-Kingscliff Pty Ltd)
   - Parsons Brinckerhoff (2008) *Upgrading the Pacific Highway. Banora Point Pacific Highway Upgrade Technical Paper 2-Ecological Assessment.* Report for NSW Roads and Traffic Authority.
   - Glen Holmes & Associates (1993) *Biological Investigation for Proposed Residential Subdivision and Artificial Lake Adjacent to Tweed River, Tweed Heads (Lot 4 DP228424, Soorley Street)*. GH&A, Canungra.
   - Planit (2008) *Terrestrial Flora and Fauna Assessment. Reyson's Land, Banora Point*. Planit, Kingscliff.

- Planit (2010) *Terrestrial Flora and Fauna Assessment Proposed Residential & Tourist Development Creek Street, Hastings Point Lot 156 on DP628026*. Planit, Kingscliff.

vii. Review of the following legislation to ensure the latest lists of threatened species and communities were noted as well as investigating the existence of any relevant recovery plans, threat abatement plans, key threatening processes or any preliminary determinations which may be applicable to the site and/or the proposed use/action:

- *Threatened Species Conservation Act (1995)*
- *Environment Protection and Biodiversity Conservation Act (1999)*

- Field survey of the flora communities located within and immediately adjacent to the site (in accordance with Section 3 above) to review habitat values;
- The following fauna field survey methods were implemented during 15th-16th April 2010 in general accordance with the following:
  - DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft*. DEC, NSW.
  - NSWNPWS (2001) *The Community Biodiversity Survey Manual*. New South Wales National Parks & Wildlife Service.
  - Gold Coast City Council (2006) Planning Scheme Policy 8: *Guidelines for Ecological Assessments*. G.C.C.C., Nerang.
  - Shire of Maroochy (1997) *Flora and Fauna Assessment Requirements for Developments in Maroochy Shire*. M.S.C
  - Department of Land and Water Conservation (1997) *Interim Guidelines for Targeted and General Flora and Fauna Surveys under the Native Vegetation Conservation Act 1997*. NSWDLWC, Parramatta.
  - Brisbane City Council (1999) *Ecological Assessment Guidelines*. B.C.C.
  - Redland Shire's *Planning Scheme Policy 4-Ecological Impacts*

4.2.1 DIURNAL SURVEY

- Active searches were conducted for key habitat components and potential macro- and micro- habitat components for rare and threatened species;
- Binocular search and identification of all fauna heard or sighted;
- Opportunistic sightings/audible identifications were conducted and recorded whilst all survey works were being undertaken;
- Bird identification surveys were conducted in association with dawn and dusk activity and comprised walked transects through each vegetation community and stationary observations within selected locations;
- Passive digital recording was undertaken utilizing Songmeter TM in association with dawn and dusk chorus. The recorder was programmed to 'wake up' and record continuously for 15 minutes, 'sleep' for 15 minutes, begin recording for 15 minutes over a period of two hours (commencing at 6am and 4pm). Recordings were analyzed audibly by experienced ecologists and with Songscope

Bioacoustics software. All avifauna reference calls were sourced from reputable organisations such as Naturesound and BOCA;

- Ground track/trace survey was performed including:
  - Scat/pellet examination
  - Scratch/trace examination of trees
  - Diggings, burrow, trace and track examination
  - Humus/crevice examination
  - Examination and assessment of tree hollows, hanging bark, termite mounds, flowering and nesting trees

  Duration: The above investigations were undertaken over 8 hours on 15th-16th April 2010.

4.2.2 NOCTURNAL SURVEY

Nocturnal survey included the following survey techniques:

- Audible survey for calls, scratching and landings;
- Spotlighting utilising:
  - Short duration-long distance white light, and
  - Long duration-short distance red light

  Duration: Two researchers on one night for 120 minutes

- Naked eye observation utilising dawn/dusk/moon light for bats and fauna returning to potential nest/shelter areas.

  Duration: Two researchers on one night for 120 minutes

- Passive digital recording (for nocturnal birds, mammals and amphibians) was undertaken utilizing Songmeter TM. The recorder was programmed to 'wake up' and record continuously for 15 minutes, 'sleep' for 15 minutes, begin recording for 15 minutes over a period of three hours (commencing at 6.30pm). Recordings were analyzed audibly by experienced ecologists and with Songscope Bioacoustics software. All avifauna reference calls were sourced from reputable organizations such as Naturesound and BOCA;
  Duration: One night's recording (3 hours)
- Anabat detection system was utilized to record echolocation of microchirpteran bats at fixed points and along spotlighting transects. Recordings were undertaken in areas most likely to attract bat species including standing water, drainage lines, remnant edges, areas of flowering vegetation and sites of high insect activity. Calls were analyzed utilizing Analook 49j and accepted reference keys.

  Duration: One night's continuous recording between 1730 and 0600 hrs (12.5 recording hours).

4.2.3 SURVEY LIMITATIONS

Whilst the duration of flora surveys and inspections of the property are considered appropriate for the intended purpose of an ecological constraints scoping exercise, it was not practical to intensively search all areas of the site (~5ha). Additional undetected threatened or other native flora species may be present on the property (particularly within the heath community). Seasonal surveys would also be necessary to detect flora species that are dormant or inconspicuous for part of the year (i.e. from the Asteraceae, Orchidaceae, Cyperaceae, Poaceae etc). Some of these species (dormant or non flowering) may have been undetected or under-represented within the survey period. Further ungerminated seed of various species may have been present within the soil seed bank.

Whilst the sampling methodology of the fauna survey is considered appropriate for the intended purpose of an ecological constraints scoping exercise, it is acknowledged entire seasonal fauna assemblage is unlikely to be recorded. Sampling over extended timeframes and incorporating additional techniques required by the DECC (2004) guidelines would be necessary to support any application for development or vegetation clearing over the lands.

It is also accepted that although assessments of habitat and species ecology does provide an additional measure to anticipate the presence of species (as a surrogate for its actual observation), there is no absolute certainty to the absence of a species from marginal or potential habitat. Surveying over the winter period is likely to have under sampled reptiles and amphibians (due to reduced activity in cooler temperatures) and species which may be seasonal migrants (i.e. migrating north during winter to areas of warmer temperature).

Additionally, there may be some species that may utilise the habitats within the site but have remained undetected due to their rarity, elusive nature or the sporadic utilisation of the habitats (i.e. the Long-nosed Potoroo, Common Planigale and Dunnart are elusive species that are difficult to trap or observe directly; the Black-necked Stork, Powerful Owl, Spotted-tail Quoll and Red Goshawk may only visit an area occasionally within a much larger home-range; the Swift Parrot and Regent Honeyeater may only visit an area during peak flowering periods etc).

The conclusions of this report are therefore based upon data obtained through the brief survey which are likely to be incomplete. It is to be acknowledged that the survey implemented is inadequate to perform complete assessments of the fauna assemblage of the site or make conclusions regarding the presence or absence of threatened fauna. It should be acknowledged that site conditions, including the presence of threatened species, can change over time.

The above limitations have been taken into account and the likelihood of threatened such species occurring within the site assessed through habitat assessment, records of the species within the locality and aspects of species ecology (refer Section 5).

4.2.4 LICENCING

The following issued licences are relevant to the survey undertaken:

TABLE 6: RELEVANT LICENCES				
Authority	**Licence/Permit**	**Title**	**Expiration**	**Permit No.**
NSW DPI	Animal Research Authority	Fauna Surveying, Trapping & Release	30 June 2011	01/1537
NSW DPI	Animal Care & Ethics Committee	Fauna Surveying, Trapping & Release	30 June 2011	01/1537
NSW National Parks & Wildlife Service	Scientific Licence	Flora & Fauna	30 April 2010	S11892

4.3 HABITAT STRATIFICATION/ASSESSMENT

Prior to the commencement of the abovementioned survey works on site a broad habitat assessment was conducted in association with vegetation survey works. The purpose of this overview was to determine which species were likely to be present based on available habitat components and to target areas for detailed surveying of protected fauna species. The site incorporated the following broad habitat types as a result of previous land use, vegetation types (refer Section 3), surrounding uses and hydraulic regime:

HEATHLAND HABITAT

These areas incorporate the majority of the site and are separated into two discrete units due to Sandalwood Drive. A dense shrubland is present providing potential refuge for terrestrial species and friable soil suitable for burrowing species. Heavily flowering species are very common increasing the potential foraging habitat for nectarivarous birds and bats. The paucity of tree cover and absence of hollow-bearing trees limits the habitat potential for large forest birds, arboreal mammals and roosting sites for micro-bats.

No permanent water is present within the community limiting the potential for breeding populations of amphibians.

COASTAL BLOODWOOD HABITAT

This forest type is restricted to a very small patch in the NE corner of the site on a slightly elevated area which continues into the school holdings to the north. Bloodwood is present as an almost monospecific stand over a simplified lower strata of grasses. Some heath species are inter-dispersed on the western fringes and weeds are more common on the exposed eastern fringes adjacent the road way.

During peak flowering periods the bloodwoods are likely to provide foraging potential for avifauna although due to the low height, young age and absence of hollows the area is unlikely to be significant for arboreal mammals, nesting micro-bats or hollow dependent birds.

The reduced structural complexity of the lower strata and the relative isolation of the small community is considered to be a factor which may the potential presence of significant terrestrial fauna species.

SWAMP SCLEROPHYLL HABITAT

This habitat type is located in the SW corner of the site and is characterized by the dominance of Broad-leaved Paperbark. Generally the community is highly fragmented, impacted upon by weed growth and directly adjacent to residential dwellings limiting the potential for secretive/sensitive wetland avifauna species. The prolific flowering paperbark species is likely to attract numerous bird species during

peak flower along with flying fox species. Microbats are also likely to forage within the canopy gaps although roosting potential is low due to the absence of hollow-bearing trees.

During inspection although wetland flora was present (sedges/rushes) no standing water was noted and the soak is likely to be intermittent during rainfall within the southern most extent of the vegetation. A dense understorey favouring small terrestrial species is common in the south but reduces moving north as the community becomes high fragmented and restricted to a single row of trees in several areas.

MODIFIED/DISTURBED ENVIRONMENTS

These areas occur in the western portions of the site in association with grassland and generally cleared areas which buffer the adjacent residences from the more heavily vegetated areas of the site. Habitat values are considered to be low in this area.

Specific additional habitat features/elements are briefly identified in the below table:

TABLE 7: HABITAT ELEMENTS	
Habitat Element/Feature	**Comment**
Hollow bearing trees	Scarce
Presence of koala habitat and/or favoured koala trees	Absent
Presence of caves, culverts or disused buildings suitable for roosting of microchiropteran bat species	Absent
Presence of scratches or feeding scars on tree trunks	Absent
Presence of megabat roosting sites	Not recorded. A large flying fox roosting colony is known to occur on Tims Island north of the Barney Point Bridge (Banora Point).
Presence of creeklines, estuaries, mudflats, mangroves and/or riparian vegetation	Minor soak present in the southwest within the paperbark community.
Presence of dams, ponds, lakes and/or other natural or constructed permanent water sources	Absent. Temporary ponding is likely to occur within depressed sandy areas following rainfall.

TABLE 7: HABITAT ELEMENTS	
Habitat Element/Feature	**Comment**
Presence of dense understorey and ground cover vegetation	Dense cover occurs across most of the site in association with the Heathland Community.
Presence of deep leaf litter layer and/or debris (fallen logs etc)	Present in forested areas
Presence of fruiting flora species	Scarce across the site
Presence of flowering species	Typical prolific flowering trees (Melaleuca, Corymbia) occur in the SW and NE corners with heavily flowering heathland species dominating the central portions.
Presence of interconnected vegetation remnants (internal and external to site)	A minor (~40m in width) occurs to the south-west through the sporting field's site which ultimately connects to the Cudgen Nature Reserve habitats. On the remaining boundaries the site is bounded by urban development and roadways.
Presence of large stick nests indicative of raptor presence	Not recorded.
Presence of extensive forested (core) habitat with limited exposure to clearing, fragmentation or associated 'edge effects'	Absent. The site is relatively isolated by roadways and urban development with a high exposure to edge effects and a very low area to edge ratio. Barriers are also present surrounding the site limiting terrestrial fauna dispersal options.
Presence of rocky outcrops and/or extensive exposed rocky areas favouring reptile populations	Absent

In addition to the above the geographic and habitat features component of the DECC (2009) Biobank Tool for development sites was also assessed to assist in assessing geographic/habitat features which may indicate presence of certain species of threatened fauna:

TABLE 8: GEOGRAPHIC/HABITAT FEATURES	PRESENT WITHIN 40M OF SITE?
damp or swampy areas in rainforest, eucalypt or paperbark forest	Yes
Hollow-bearing trees, bridges, caves or artificial structures within 200 m of riparian zone	No
land below ~300 m in altitude, and containing rainforest and eucalypt forest/regrowth on soils derived from metasediments	No
land containing brackish or freshwater wetlands	Yes
land containing caves or similar structures	No
land containing rainforest, eucalypt, paperbark and/or mangrove forests	Yes
land containing rainforest, moist eucalypt or swamp forest	Yes
land containing riverine and subtropical rainforest	No
land within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter	Yes
land within 40 m of fresh/brackish/saline waters of larger rivers or creeks; estuaries, coastal lagoons, lakes and/or inshore marine waters	No
land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation or emergent aquatic vegetation	yes
land within 40 m of rainforest, coastal scrub, riparian or estuarine communities	Yes
land within 40 m of swamps, wet or dry heaths or sedge grasslands	Yes
littoral or riverine rainforest or regrowth	No
littoral rainforest, lowland rainforest or open forest	No
lowland subtropical rainforest in moist situations	No

TABLE 8: GEOGRAPHIC/HABITAT FEATURES	PRESENT WITHIN 40M OF SITE?
lowland subtropical rainforest or dry subtropical rainforest with Brush Box overstorey	No
lowland, riverine or littoral rainforest, including small remnants	No
poorly drained, infertile soils	No
rainforest or riparian areas	No
rainforest, eucalypt forest, heathland, marshland, grassland or rocky areas	Yes
riverine and subtropical rainforest	No
riverine or lowland subtropical rainforest	No
seasonally inundated paperbark swamps or forest red gum open forest	Yes
swampy or moist sites	Yes
wet eucalypt forest or edges of rainforest	No
land east of Nimbin in Richmond - Tweed (Qld - Scenic Rim) (Part A) CMA subregion	Yes
land east of Tyalgum in Richmond - Tweed (Qld - Scenic Rim) (Part A) CMA subregion	Yes
land north of Ballina in Clarence Lowlands CMA subregion	Yes
land north of Coraki in Clarence Lowlands CMA subregion	Yes
land north of Evans Head in Clarence Lowlands CMA subregion	Yes
land north of Richmond River in Clarence Lowlands CMA subregion	Yes
land north of the Gwydir Highway in Clarence Sandstones CMA subregion	Yes
land within 10 km of coast in Yuraygir CMA subregion	No
land within 15 km of eastern boundary of Richmond - Tweed A subregion in Richmond - Tweed (Qld - Scenic Rim) (Part A) CMA subregion	No
land within 20 km of Mt Nullum in Richmond - Tweed (Qld - Scenic Rim) (Part A) CMA subregion	No
land within 45 km of coast in Richmond - Tweed (Qld - Scenic Rim) (Part A) CMA subregion	Yes
land within 5 km of coast in Yuraygir CMA subregion	No

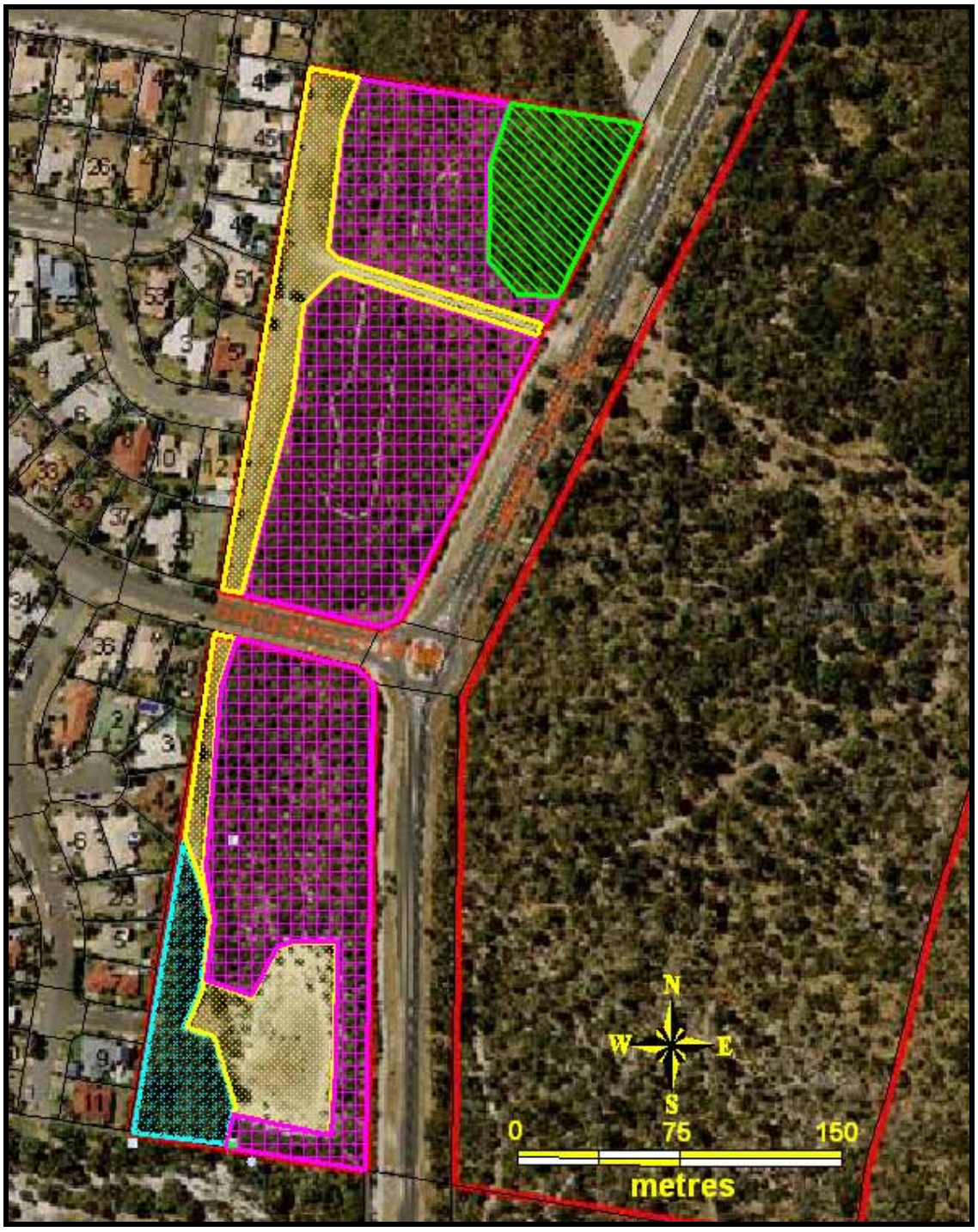


FIGURE 8: BROAD HABITAT STRATIFICATION

HEATHLAND HABITATS

COASTAL BLOODWOOD HABITATS

SWAMP SCLEROPHYLL HABITATS

MODIFIED/DISTURBED AREAS

4.3.1 SITE SURVEY RESULTS

The following section(s) list the fauna species recorded on the subject site during surveying and lists the methods by which each species was identified. Results are grouped by the Class of species recorded. Those techniques utilised to record fauna are listed below and correlate with the acronyms included within the Survey Methods column of the grouped Survey Results tables.

Survey Method Codes:

O	Direct Observation
SL	Direct Observation with Spotlight
Sc	Scat
C	Call (Audible) Detection and/or response to playback
HT	Hair tube/funnel
Scr	Scrape
Scrt	Scratch
Sh	Shell/Shell Fragment/Skeleton
Trk	Track/Trace
T	Trapped/hand captured
Ana	ANABAT Detection
Rk	Road-kill
PSA	Predator scat analysis
*	All birds were either directly observed through diurnal survey, spotlighting or call identification.
**	Introduced/feral species
***	Recorded in adjacent areas or circling overhead

MAMMALS

FAMILY	SCIENTIFIC NAME	COMMON NAME	METHOD
Canidae	***Canis lupus*	Dog	O, Trk, Sc
Felidae	***Felis catus*	Cat	O
Leporidae	***Oryctolagus cuniculus*	Rabbit	O
Macropodidae	*Macropus spp*	Unidentified Wallaby	Trk, Sc
Molossidae	*Tadarida australis*	White-striped Freetail	Ana
Peramelidae	*Isoodon spp*	Unidentified Bandicoot	Trk
Pteripodidae	*Pteropus alecto*	Black Flying-fox	SL
Vesptertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	Ana
Vesptertilionidae	*Miniopterus australis*	Little Bentwing	Ana

REPTILES

FAMILY	SCIENTIFIC NAME	COMMON NAME	METHOD
Agamidae	*Pogona barbata*	Bearded Dragon	O
Colubridae	*Boiga irregularis*	Brown Treesnake	SL
Scincidae	*Cryptoblepharus virgatus*	Wall Skink	O,T
Scincidae	*Ctenotus robustus*	Eastern Striped Skink	O,T
Scincidae	*Lampropholis delicata*	Grass Skink	O,T
Varanidae	*Varanus varius*	Lace Monitor	O

BIRDS*

Family	Species Name	Common Name
Acanthizidae	*Acanthiza lineata*	Striated thornbill
Acanthizidae	*Sericornis frontalis*	White-browed Scrub-wren
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-eagle***
Accipitridae	*Haliastur indus*	Brahminy kite***
Accipitridae	*Haliastur sphenurus*	Whistling kite***
Alceninidae	*Dacelo novaeguineae*	Laughing Kookaburra
Anatidae	*Anas superciliosa*	Pacific black duck
Ardeidae	*Egretta (Ardea) novaehollandiae*	White-faced heron
Artamidae	*Artamus leucorynchus*	White-breasted Woodswallow
Artamidae	*Cracticus nigrogularis*	Pied butcherbird
Artamidae	*Cracticus torquatus*	Grey butcherbird
Artamidae	*Gymnorhina tibicen*	Australian magpie
Artamidae	*Strepera graculina*	Pied Currawong
Cacatuidae	*Cacatua galerita*	Sulphur-crested cockatoo
Cacatuidae	*Cacatua roseicapilla*	Galah
Campephagidae	*Coracina novaehollandiae*	Black-faced cuckoo-shrike
Centropodidae	*Centropus phasianinus*	Pheasant Coucal
Charadriidae	*Vanellus miles*	Masked lapwing
Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola
Climacteridae	*Cormobates leucophaea*	White-throated treecreeper
Columbidae	*Ocyphaps lophotes*	Crested Pigeon
Coraciidae	*Eurystomus orientalis*	Dollarbird
Corvidae	*Corvus orru*	Torresian crow
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo
Dicruridae	*Dicrurus bracteatus*	Spangled drongo
Dicruridae	*Grallina cyanoleuca*	Magpie-lark
Dicruridae	*Rhipidura fuliginosa*	Grey fantail
Dicruridae	*Rhipidura leucophrys*	Willie wagtail
Estrildidae	*Neochimia temporalis*	Red-browed Finch
Eupetidae	*Psophodes olivaceus*	Eastern whipbird
Hirundinidae	*Hirundo neoxena*	Welcome swallow
Maluridae	*Malurus cyaneus*	Superb Fairy-wren
Maluridae	*Malurus lamberti*	Variegated Fairy-wren
Meliphagidae	*Anthochaera chrysoptera*	Little Wattlebird
Meliphagidae	*Entomyzon cyanotis*	Blue-faced honeyeater
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater
Meliphagidae	*Manorina melanocephala*	**Noisy miner
Meliphagidae	*Meliphaga lewinii*	Lewin's honeyeater
Meliphagidae	*Melithreptus lunatus*	White-naped honeyeater
Meliphagidae	*Philemon citreogularis*	Little Friarbird
Meliphagidae	*Philemon corniculatus*	Noisy friarbird
Meliphagidae	*Phylidonyris niger*	White-cheeked honeyeater
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush
Pachycephalidae	*Pachycephala rufiventris*	Rufous whistler
Pardalotidae	*Pardalotus striatus*	Striated pardalote
Podargidae	*Podargus strigoides*	Tawny Frogmouth
Psittacidae	*Trichoglossus chlorolepidotus*	Scaly-breasted lorikeet
Psittacidae	*Trichoglossus haematodus*	Rainbow lorikeet
Rallidae	*Porphyrio porphyrio*	Purple swamphen
Threskiornithidae	*Threskiornis molucca*	Australian white ibis
Timaliidae	*Zosterops lateralis*	Silvereye

AMPHIBIANS

FAMILY	SCIENTIFIC NAME	COMMON NAME	METHOD
Bufonidae	***Bufo marinus*	Cane toad	SL, O
Hylidae	*Litoria fallax*	Eastern Sedgefrog	C, SL
Hylidae	*Litoria carulea*	Green Treefrog	SL
Myobatrachidae	*Crinia signifera*	Beeping Froglet	C

4.4 DISCUSSION OF SURVEY RESULTS

4.4.1 BIRDS

Fifty-one (51) species of bird were recorded during surveys of the subject site. No species scheduled as vulnerable or endangered under the *Threatened Species Conservation Act 1995 were* recorded on the site during fauna survey works.

The majority of bird species recorded are diurnal species including:

- Nectar feeders (i.e. lorikeets, honeyeaters, friarbirds, etc)
- Insectivores which forage for invertebrates in the leaves, branches and bark of trees/shrubs, in the air spaces provided by canopy gaps, and amongst litter, woody debris and groundcovers (i.e. fairy wrens, whistlers, fantails, whipbird, treecreeper, tawny grassbird, cisticola etc)
- Large generalist omnivores (i.e. butcherbirds, magpies, crows etc)
- Coastal raptors (whistling kite, brahminy kite)
- Granivores (finches)

Subsequent to the fauna survey, it is considered that the site exhibits habitat favorable for nectarivarous birds (in association with heathland), common generalist species typically found within modified habitats (i.e. magpies, crows etc) and to a lesser extent forest/woodland birds. Waterbirds (ducks, swamp hen, spoonbill, heron, ibis etc) and frugivores (figbird, oriole, fruit-doves, pigeons, varied triller) were poorly represented due to an absence of favoured habitat.

The existence of substantial areas of heathland, riparian forest and eucalypt forest within the locality is likely the reason for the presence of a relatively diverse assemblage of avifauna encountered on the site.

The proximate Cudgen/Round Mountain Reserves and protected beach/dune areas encompass an altitudinal sequence of habitats rising from the ocean foreshore, Cudgen Lake and Cudgera Creek including mangroves, sedgelands, heathlands, swamp sclerophyll, dry sclerophyll and wet sclerophyll forest. Continuous habitat gradients such as this provide avifauna with a range of resources throughout the year and are likely to have importance in connecting breeding populations across the landscape. A wide diversity of avifauna moving through the locality (including the site) throughout the year is therefore likely to be encountered.

The recorded and potential occurrence of threatened bird species is discussed within Section 5 below.

4.4.2 MAMMALS

A total of eight (8) mammal species were recorded on the subject site. One species listed as vulnerable under the *Threatened Species Conservation Act 1995* were recorded on the site during fauna survey works. This species is discussed individually within the later sections of the report.

Ground-dwelling Mammals

All terrestrial mammals require vegetated cover for shelter and to facilitate movement. Small terrestrial mammals prefer areas within a complex vegetation structure which is dense within the lower strata and subsequently provides shelter/nesting sites and refuge from predators. Larger terrestrial mammals (larger wallabies, kangaroos) also generally require dense cover for refuge but tend to favour more open areas for grazing/feeding.

Suitable structural forest variation and/or dense understorey components were present over the majority of the site. Whilst trapping has not been undertaken at this stage it is considered possible that common species such as the native rats, melomys and bandicoots may be recorded. A future Elliott and pitfall trapping regime will also be required to determine the presence/absence of the threatened Planigale which has been previously recorded in the locality (Callaghan et al, 2005).

Several macropod scats were noted and whilst they were not sent away for identification it is considered likely that they are associated with the Red-necked Wallaby which is common in the local area.

Arboreal Mammals

Arboreal mammals previously noted to occur within the vicinity of the site are all noted to be hollow dependent with the exception of the Koala and the Ringtail Possum (which does utilize hollows but will also construct leaf dreys) (Strahan eds, 2002; Gibbons and Lindenmayer, 2002). It is widely accepted that a reduction in senescent trees is a limiting factor in hollow dependent arboreal mammal populations (Smith and Lindenmayer, 1998; Gibbons and Lindenmayer, 2002; Lindenmayer, 2002; Lunney, 1987).

Within the site there exists an absence of hollow bearing trees (HBT) with associated Eucalypt Woodland/Open Forest also scarce. The habitat value for hollow-dependent arboreal mammals is accordingly considered to be low with no species encountered during spotlighting.

Flying Mammals

One species of flying fox (Black) was recorded flying over and foraging within the site and is commonly encountered within the locality. No roosting was recorded onsite with a colony of flying foxes is noted to roost on Tims Island east of the Barney Point Bridge at nearby Banora Point. During peak flowering periods the threatened Grey-headed Flying-fox is likely to forage on site with the Common Blossom Bat also considered a potential occurrence although this potential is limited due to the scarcity of Coast Banksia (*Banksia integrifolia*), a favoured foraging resource.

Future targeted survey will be required to confirm the presence/absence and any resultant impact of development to these species.

Anabat Detection survey also recorded the following bat species on site:

- Little Bent-wing Bat
- Goulds Wattled Bat
- White-striped Freetail Bat

It is considered that the site contains a variety of suitable foraging spaces for recorded mircrochiropteran bats (i.e. the modified grassland areas and the space about the heathland provide 'uncluttered open space'; the ecotonal areas between the forest copses and the shrubland, and the fragmented canopy of the paperbark areas provide 'edge' space, the lower canopy zone of the two forest (bloodwood and paperbark) copses provides 'cluttered' space' [per Schnitzerler and Kalko, 2001]).

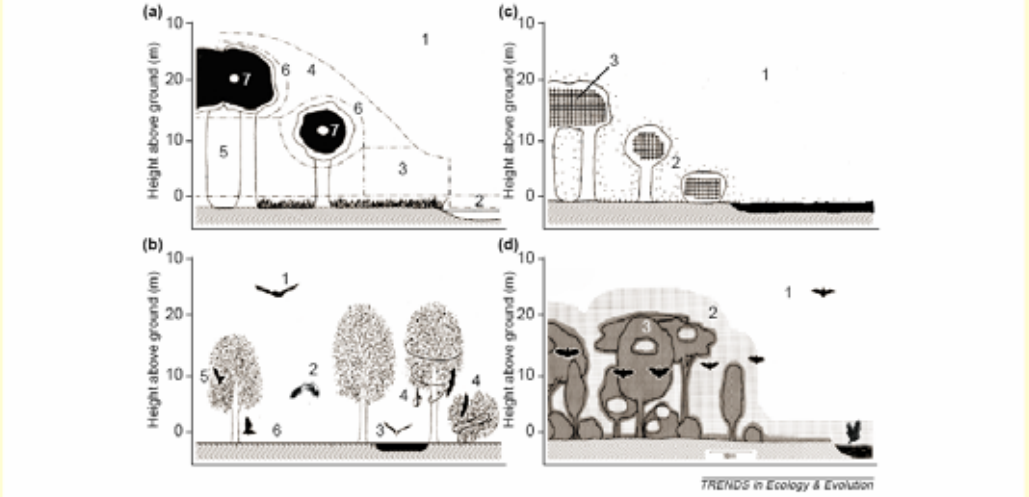


Fig. I. Characterization of foraging habitats of bats from key publications.: (a) Aldridge and Rautenbach [16]; (b) Neuwiler [17]; (c) Fenton [18]; and (d) Schnitzler and Kalko [12,13]. The origins of the diagrams [12,13,16–18] and the names of the different habitat types (labeled by numbers) are presented in Table I. Adapted, with permission, from [12,13,16–18].

Table I. Characterization of the foraging habitats of bats[a]

(a) Aldridge and Rautenbach [16]	(b) Neuweiler [17]	(c) Fenton [18]	(d) Schnitzler and Kalko [12,13]
1 Open areas	1 Above canopy	1 Open habitat	1 Uncluttered or open space
2 0.5 m above water 3 Over pasture 4 0.5 m away from canopy 5 Between trees	2 Open spaces between canopy 3 Over water surfaces		2 Background cluttered space or edge space
6 Surface of vegetation 7 Within vegetation	4 Close to and within foliage 5 Foliage 6 Ground	2 Edge habitats 3 Closed habitats	3 Highly cluttered or narrow space

[a]See Fig. I for pictorial representation of the different foraging habitats of bats.

FIGURE 9: REVIEW OF MICRO-BAT FORAGING HABITATS
(SOURCED FROM SCHNITZLER ET AL, 2003)

A review of the bats recorded on the site (and within the locality) indicates that tree cavities and caves/crevices are necessary for roosting/breeding. In addition to providing shelter, maternity places and retreats for hibernation, roosts are also important places for social interactions among bats. The availability of suitable roosts is therefore critical for the survival of forest bats (Herr, 1998). Within the site it is considered that cave/mine potential breeding sites are absent as are hollow bearing trees. Palm fronds which are suitable for species such as the Eastern Long-eared Bat are also absent, as are disused sheds which are potentially suitable for various species (i.e. Gould's Wattled Bat, Yellow-bellied Sheathtail Bat, Eastern Broad-nosed Bat).

TABLE 9: ROOSTING TYPES OF RECORDED MICRO-BATS*		
Species Name	**Common Name**	**Roost Type**
Minopterus australis	Little Bentwing Bat	Caves and mines, Tree Cavities
Chalinolobus gouldii	Gould's Wattled Bat	Tree cavities, occasionally buildings
Tadarida australis	White-striped Freetail Bat	Tree cavities

* sourced from Lumsden, 2004; Herr, 1998; DEC, 2005; Richards & Martin, 2001; Birt et al, 2001; Rhodes & Richards, 2008; Rohdes and Wardell-Johnson, 2006; Rhodes, 2006; Richards, Reardon and Pennay, 2008; Lumsden, Bennett and Silins, 2002; Aust. Museum, 1999; NPWS, 2004; Richards in Van Dyck and Strahan, 2008; Tidemann & Parnaby in Van Dyck and Strahan, 2008; Law and Anderson, 2000;

4.4.3 REPTILES

A total of six (6) reptile species were recorded on the subject site. No species listed as endangered or vulnerable under the *Threatened Species Conservation Act 1995 were* recorded on the site during fauna survey works.

Within the site a variety of lizards and snakes were recorded all of which are considered to be common species. The majority of individuals were encountered within heathland which provides suitable dense ground cover for refuge. Several skinks were also encountered along roadways and gutters as these areas provide suitable basking sites.

One individual of snake only was recorded although temperatures were typically low during the autumn surveying period. Additional snake species may be encountered during the more active summer months.

4.4.4 AMPHIBIANS

Three (3) species of native frog and one (1) introduced toad were recorded on the subject site. No species listed as endangered or vulnerable under the *Threatened Species Conservation Act 1995* were recorded on the site during fauna survey works.

The cane toad was recorded across all habitat types and noted in highest abundance proximate to street lights and residential areas. The remaining frog species are considered common and/or generalist species which are typical to modified environments. The absence of standing water on or adjacent to the site is considered a significant factor in the reduced diversity of amphibians encountered.

Cooling temperatures associated with early winter is also likely to be a factor associated with reduced amphibian vocalizing in the local area. "Studies on the environmental correlates of breeding in amphibians have indicated that reproductive activity can covary with a number of meteorological factors. Most commonly, changes in reproduction have been found to be liked to increases in temperature (e.g., Einem and Ober, 1956: Licht. 1969), rainfall (Balinskv. 1969; Telford and Eyson, 1990; Krupa, 1994) or a combination of both (Storm, 1960; Humphries, 1979; Okuno, 1985).

However, reproductive activity may also be affected by other factors such as variation in light intensity (Savage, 1961; Rabb and Rabb, 1963), barometric pressure (Blankenhorn, 1972) or wind intensity (Robertson, 1986). Reliance on environmental cues to initiate breeding can result in significant variation in the reproductive period fiom year to year, with the times of onset of suitable conditions varying among years (Dankers, 1977; Mac Nally 1983; Ritke *et al.,* 1992):" [in Lemckert, 2001: 625).

Generally it is accepted that native frog activity is reduced over the winter period (excluding a few species such as Crinia's) and not ideal for frog surveys (although information generated can be useful for a seasonal baseline). DECC (2009) notes that many frogs become less active at lower temperatures, making conditions less suitable for surveys. In this regard it is recommended within this report that a follow-up survey be undertaken in spring-summer during times which are likely to generate greater amphibian activity in the locality (refer Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna: Amphibians).

The recorded frog species recorded can be attributed to adult and breeding habitat guilds (per Ecotone, 2007) based upon habitat information (Cogger, 1992; Robinson, 1998; Barker et al, 1995) and breeding information (Anstis, 2002, Tyler, 1999).

TABLE 10: FROG HABITAT GUILDS

Species	Common Name	Adult Habitat	Breeding Habitat
Crinia signifera	Clicking Froglet	Ground	Permanent-temporary pools/lentic. Highly adaptable. Flooded ditches, streams, grassland or permanent ponds and dams.
Litoria caerulea	Green Treefrog	tree frog & ground	Ephemeral pool/lentic. Highly adaptable. Roadside ditches, flooded grassland. Ponds, swamps and water troughs.
Litoria fallax	Eastern Sedgefrog	tree frog & ground	Permanent-temporary pools/lentic. Dams, ponds and swamps especially those with emergent reeds.

5.0 DISCUSSION OF RECORDED & POTENTIALLY OCCURRING SCHEDULED COMMUNITIES, POPULATIONS AND SPECIES OF CONSERVATION SIGNIFICANCE

5.1 ENDANGERED ECOLOGICAL COMMUNITIES

SWAMP SCLEROPHYLL FOREST ON COASTAL FLOODPLAINS OF THE NSW NORTH COAST, SYDNEY BASIN AND SOUTH EAST CORNER BIOREGIONS

This EEC is described by the scientific committee (online @ http://www.environment.nsw.gov.au/determinations/SwampSchlerophyllEndSpListing.htm) as follows:

> Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). Swamp Sclerophyll Forest on Coastal Floodplains generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community is typically open forest, although partial clearing may have reduced the canopy to scattered trees. In some areas the tree stratum is low and dense, so that the community takes on the structure of scrub. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. Typically these forests, scrubs, fernlands, reedlands and sedgelands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water (e.g. Pressey 1989a).

It is considered that Vegetation Community 3 (Mid-high/Tall Swamp Sclerophyll [*Melaleuca quinquenervia*] Open Forest) located within the SW corner of the site is partially reflective of the above listed EEC as described by the Scientific Committee. The community has dominance of Paperbark within the canopy, is situated in a low lying areas (~<5mAHD) but according to geological mapping (Morland, 1996) is located disturbed or aeolian soil landscapes.

Review of Gales Holdings Pty Ltd VS Tweed Shire Council (NSWLEC 209, 2008) notes that:

> *As with the Scientific Committee's description of Freshwater Wetlands, the description of Swamp Sclerophyll Forest has three components: an edaphic component ("humic clay loams and sandy loams"), a topographical component ("waterlogged or periodically inundated alluvial flats and drainage lines") and a locational component ("associated with coastal floodplains"). [106]*

The court in this instance held that the soils described in the applicable soil landscapes of Kingscliff Aeolian sand sheets establish that the soils are not humic clay loams or sandy loams, nor are they associated with such soils. For this reason the court held that the edaphic component of the EEC determination was not met and thus not an EEC.

NOTE:

The above comments with regard to geological profiling are made in 'lay' terms and have not been examined by an expert in the relevant field of geology and soil processes. This is explained from the viewpoint that in certain circumstances the location of an EEC within a landscape and the geology/soils upon (i.e. edaphic, topographic and locational factors) which it is located can be a significant determining factor in defining the EEC regardless of floristic or habitat value. Readers are directed to Gales Holdings Pty Ltd VS Tweed Shire Council (NSWLEC 209, 2008) in this regard.

However, for the purposes of this report Community 3 is not considered as an EEC and analyzed according.

5.2 ENDANGERED POPULATIONS

Endangered populations are listed under Schedule 1, Part 2 of the *Threatened Species Conservation Act 1995*. No endangered populations are considered to occur on or proximate to the study area with the closest being the 'Cobaki Lakes and Tweed Heads West population of the Long-nosed Potoroo *Potorous tridactylus* (Kerr 1792) in the Tweed local government area.' Future development of the site is considered unlikely to impact upon this population.

5.3 THREATENED FLORA SPECIES

No flora species listed as endangered or vulnerable under Schedules 1 and 2 of the *Threatened Species Conservation Act 1995* were observed on the site. Further survey during flowering/fruiting periods will be necessary to confirm the absence of threatened species.

A search of the *NPWS 'Atlas of NSW Wildlife' [2010]* has determined that eighteen species of threatened flora have been previously recorded within the locality (search area 153.52376, -28.39237, 153.62376, -28.29237). Active searches throughout the occurring vegetation communities throughout the site were undertaken to locate the presence or absence of these species which are tabulated below.

Based on habitat assessment and the known distribution of these species within the NENSW bioregion, 8 of these species are considered unlikely to be present within the site. It is considered that suitable or potential habitat occurs for 10 of the listed species, however, they were not detected during preliminary field survey.

TABLE 11: POTENTIALLY OCCURING THREATENED FLORA

Species Name	Preferred Habitat	TSCA Status	Expected Impact
Acacia bakeri	In or near lowland subtropical rainforest, in adjacent eucalypt forest and in regrowth. (DECC, 2005)	V	Not recorded. Favoured habitat considered to be absent.
Acronychia littoralis	Littoral rainforest on sand (Hauser & Blok, 2002; Williams, Harden & McDonald, 1984; Floyd, 1989).	E1	Not recorded. Marginal habitat present in association with sandy substrates, however, favoured habitat associated with littoral rainforest is absent.

Species Name	Preferred Habitat	TSCA Status	Expected Impact
Arthraxon hispidus	"In NSW and Queensland, Hairy-joint Grass is found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps (Queensland CRA/RFA Steering Committee, 1997, 1998; DECC NSW, 2005), as well as woodland (Queensland Herbarium, 2008). In south-east Queensland, Hairy-joint Grass has also been recorded growing around freshwater springs on coastal foreshore dunes, in shaded small gullies, on creek banks, and on sandy alluvium in creek beds in open forests (Queensland CRA/RFA Steering Committee, 1997, 1998), and also with bog mosses in mound springs (Queensland Herbarium, 2008)" [Department of the Environment, Water, Heritage and the Arts 2008:1-2]	V	Not recorded. Potential habitat is present across the site in association with coastal sands. Further survey is recommended for this species.
Cassia brewsteri var.marksiana	Littoral and riverine rainforest, and in regrowth vegetation on farmland and along roadsides. (DECC., 2005)	E1	Not recorded. Marginal habitat present in association with sandy substrates, however, favoured habitat associated with littoral rainforest is absent.
Davidsonia johnsonii	Lowland subtropical rainforest and wet eucalypt forest at low altitude (below 300m). Many trees are isolated in paddocks and on roads in former rainforest habitats.(NSW Dept. Env.&Con., 2005)	E1	Not recorded. Favoured habitat considered to be absent.
Dendrocnide moroides	Occurs in lowland rainforest, especially in gaps or other disturbed sites. (NSW Dept. Env. & Cons., 2005)	E1	Not recorded. Favoured habitat considered to be absent.
Desmodium acanthocladum	This species is known from dry rainforest and the fringes of riverine subtropical rainforest in the Lismore area, and there are also records from near Grafton, Coraki, Casino and the Mount Warning area (DEC, 2005).	V	Not recorded. Favoured habitat considered to be absent.
Drynaria rigidula	Usually found in rainforest, but also in moist eucalypt and Swamp Oak forest (DEC, 2005).	E1	Not recorded. Favoured habitat considered to be absent.
Elyonurus citreus	Within NSW this species grows in sandy soils near rivers or along the coast in wallum areas or sand dunes from localities south of Casino, north-west of Grafton, near Cudgen Lake on the Tweed coast and in Yuraygir National Park (DECC, 2005 online @ http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10267)	E1	Not recorded. Potential habitat is present across the site in association with coastal sands. Further survey is recommended for this species.

Species Name	Preferred Habitat	TSCA Status	Expected Impact
Geodorum densiflorum	This orchid is found in dry sclerophyll forest, often on coastal sand, at lower altitudes, north from the Macleay River on the north coast of NSW (NPWS, 2004 online at http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Geodorum+densiflorum +a+terrestrial+orchid+-+endangered+species+listing)	E1	Not recorded. Potential habitat is present across the site in association with shrublands and forest copses on coastal sands. Further survey is recommended for this species.
Hedyotis galioides Syn *Oldenlandia galioides*	This species is known from the margins of seasonally inundated wetlands in paperbark swamps and Forest Red Gum (*E.tereticornis)* Woodlands (NSW Dept. Env. & Cons., 2005). In north-east NSW it is known from Whiporie State Forest south of Casino and one location in the Tweed district (DECC, 2005 online @ http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10397)	E1	Potential habitat is present in the SW corner of the site in association with the swamp sclerophyll forest. Further survey for this species is recommended.
Lindsaea brachypoda	This fern occurs in very moist habitats in subtropical or warm-temperate rainforest or palm forest (NPWS, 2002: 11).	E	Not recorded. Favoured habitat considered to be absent.
Lindsaea fraseri	Poorly drained, infertile soils in swamp forest or open eucalypt forest, usually as part of a ferny understorey. In NSW it is known only from two areas - near Hastings Point on the Tweed coast and in the Pillar Valley east of Grafton (DEC, 2005 online @ http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10481)	E1	Not recorded. Potential habitat is present in the SW corner of the site in association with the swamp sclerophyll forest. Further survey for this species is recommended.
Ochrosia moorei	This species occurs within riverine and lowland subtropical rainforest (NSW Dept. Env.&Con, 2005)	E2	Not recorded. Favoured habitat considered to be absent.
Peristeranthus hillii	In NSW this orchid is restricted to coastal and near-coastal environments, particularly Littoral and Lowland Rainforest north from Port Macquarie (DEC, 2005)	V	Not recorded. Marginal habitat present in association with sandy substrates, however, favoured habitat associated with littoral and lowland rainforest is absent.
Randia moorei	Subtropical, riverine, littoral and dry rainforest. In NSW, Hoop Pine and Brush Box are common canopy species (NPWS, 2002).	E1	Not recorded. Marginal habitat present in association with sandy substrates, however, favoured habitat associated with littoral rainforest is absent.
Syzygium moorei	Subtropical and riverine rainforest at low altitude. Often occurs as isolated remnant paddock trees (NPWS, 2002).	V	Not recorded. Marginal habitat present in association with sandy substrates, however, favoured habitat associated with littoral and/or subtropical rainforest is absent.

Species Name	Preferred Habitat	TSCA Status	Expected Impact
Xylosma terrae-reginae	This species is known from six populations in NE NSW north of LIsmore where it occurs in association with Littoral and Sub-tropical Rainforest (NPWS, 2004).	E1	Not recorded. Favoured habitat considered to be absent.

5.4 THREATENED FAUNA SPECIES

A search of the *NPWS 'Atlas of NSW Wildlife' [2010]* has determined that thirty-six species of threatened fauna have been previously within the locality (search area 153.52376, -28.39237, 153.62376, -28.29237).

During surveys of the subject site one of these species were recorded:

Species	Location Recorded
Little Bentwing Bat	Recorded via anabat on study site.

A review of available habitats and the ecology of the database listed species (i.e. range, preferred habitat, home range etc) indicate that it is unlikely that all of these previously recorded species in the locality would rely on the habitats of the subject site or be significantly affected by any proposed development of the site.

Subsequently several such threatened species are considered unlikely to be significantly affected by a future development of the site for one or more of the following reasons:

- Core/favoured habitats were not recorded in the study area
- Resources used by the species are unlikely to be adversely affected or only likely to be minimally affected by a future proposal.

Details of such species requirements and reasons for not considering impacts to these species further are contained within the below table. A number of threatened species have been excluded from discussion in the below table where they are considered reasonably unlikely occurrences and impacts are unlikely to be occasioned as a result of the proposal due to the following:

- Being a marine reptile or mammal (i.e. whale, turtle, seal)
- Being a pelagic seabird, wader bird or inter-tidal zone coastal bird (i.e. tern, godwit, oystercatcher)

For species considered a potential occurrence (based upon distribution, database recording, suitable habitat present etc) or which were recorded within or directly adjacent the site during the survey period and for which it is considered that the species may be affected by a future development proposal (i.e. impact on feeding, roosting, nesting, behaviour and associated habitat), the seven-part test of significance is to be performed in association with any future development proposals. Such proposals should seek to retain important recorded and potential habitats for threatened fauna species and mitigate impacts associated with development on the ecology of listed threatened fauna.

TABLE 12: POTENTIAL OCCURRENCE OF THREATENED FAUNA			
Species	**Potential occurrence based upon known habitat and range**	**Notes**	**Potential for the species or associated habitat to be impacted upon by proposal**
Osprey (*Pandion haliaetus*)	Unlikely	This species is associated with waterbased habitats including estuaries, coastal wetlands, rivers and streams. The Osprey is predominately a coastal raptor frequenting estuaries, bays, inlets, islands and rocky cliffs within all Australian states except for Tasmania and sporadically within Victoria (DEC, 2005; NPWS, 2002). It is noted however, that the species sometimes inhabits inland islands (Pizzey and Knight, 1997; Readers Digest, 2002). Within suitable environment it usually constructs a nest in an overhanging large tree or upon elevated man made structures such as platforms or telegraph poles. The species preys almost exclusively on fish by usually hunting alone and traversing the water's surface for prey which it secures by swooping over the waters surface or plunging below (Readers Digest, 2002; Clancy, 2005). Studies of prey middens on Lizard Island within the Great Barrier Reef also noted that occasional Terns and crustaceans are sourced for food (Smith, 1985). Whilst expansive favoured habitat for the osprey occurs in the locality (in association with the foreshore and river estuary), the species is unlikely to frequent the habitats of the site given an absence of preferred nesting trees and habitat for prey species.	At this stage it is considered that this species is unlikely to be significantly affected by future development.
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	Unlikely	Limited potential occurs for the Glossy Black Cockatoo to frequent the site due to the paucity of eucalypt forest/woodland containing foraging materials (*Allocasuarina* spp.) and suitable nesting trees (large hollow within a live or dead Eucalypt: 10-20m, Depth: 40-120cm, Entry: ~21cm: Inside Dia: ~23cm (Forshaw, 1981; Gibbons & Lindenmayer, 2002)).	At this stage it is considered that this species is unlikely to be significantly affected by future development.

Black-necked Stork (*Ephippiorhynchus asiaticus*)	Unlikely	The species is generally associated with wetlands, mudflats, mangroves, swamps and floodplains while it may also sometimes be found in open woodland environs where a grassy understorey is present (NPWS, 2002, Readers Digest, 2002; DEC, 2005). Irrigated lands are also occasionally a foraging resource and it has also been recorded foraging in artificial wetlands of sewerage treatment plants (ERM, 2001). Favoured habitat for the species is considered to be absent from the site.	At this stage it is considered that this species is unlikely to be significantly affected by future development.
Koala (*Phascolarctos cinereus*)	Unlikely	This species primarily occurs within Eucalypt Forest and Woodlands containing a suitable density of favoured food trees within coastal eastern and southeastern Australia. The suitability of forest and woodland communities as habitat for Koalas is influenced by the size and species of trees present, soil nutrients, climate, rainfall and the size and disturbance history of the habitat patches (Reed *et al*. 1990 in NPWS, 1999). Suitable habitat (eucalypt woodland/forest) is scarce on the site with potential foraging trees also absent.	At this stage it is considered that this species is unlikely to be significantly affected by future development.
Little Bentwing Bat (*Miniopterus australis*)	Recorded	This species utilises well-timbered habitats including rainforest, *Melaleuca* swamps and dry sclerophyll forests where it It feeds on insects within the canopy and requires caves, mines, stormwater drains and/or tree hollows to roost (Strahan eds, 2002). Potential habitat for the species occurs in association with the Coastal Bloodwood and Paperbark Forest communities although the species is also considered likely to forage over the heathland areas. The species is, however, considered unlikely to breed on the site given an absence of suitable roosting sites.	Recorded. A future 7-part test performed should be performed for this species
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Likely	This species forages on a variety of fruits, flowers and pollen. It occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps (Eby 1995). It additionally utilises cultivated fruit crops and urban gardens. All vegetated areas of the site represent potential habitat for this species and it is considered a likely occurrence during flowering periods.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species

Common Planigale (*Planigale maculata*)	Possible	This species is known to inhabit a broad range of habitats incorporating a dense ground cover layer including rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas (Redhead in Strahan, 2002; Lewis, 2005). In northern NSW, it has been suggested that their distribution often corresponds with the low lying flat and undulating areas of the coastal plains often near intensively settled areas (Gilmore and Parnaby 1994 in Lewis, 2005). A small population of the species has been recently recorded on the northern banks of the Cobaki Broadwater in association with Swamp Mahogany/Brushbox Forest (Ecopro, 2004; Lewis Ecological Surveys, 2004). Potential habitat is considered to occur in association with Heathland which includes a dense lower strata. Elliott trapping, pitfall trapping and hair funnelling within these areas would be required to determine the presence or absence of this species. It is noted that the species occurs within the Koala Beach landholdings to the south of the site.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species
Regent Honeyeater (*Xanthomyza phrygia*)	Unlikely	The Regent Honeyeater is mostly recorded within box-ironbark eucalypt and riparian associations incorporating River She-oak on the inland slopes of the Great Dividing Range (Menkhorst et al, 1999; NPWS, 1999). Only three key breeding regions are known [north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region] although non-breeding flocks have been recorded in flowering coastal Swamp Mahogany and Spotted Gum forests particularly on the central coast and occasionally on the upper north coast (DEC. 2005; Menkhorst et al, 1999). Diet is mostly reliant on nectar from 16 species of Eucalypt and two species of Mistletoe although the preferred sources are three species of eucalypt; Red Ironbark, White Box and Yellow box (Webster & Menkhorst 1992; NPWS, 1999; Menkhorst et al, 1999). Favoured habitat for the species is considered to be absent from the site.	At this stage it is considered that this species is unlikely to be significantly affected by future development.
Rose-crowned Fruit Dove (*Ptilinopus regina*)	Unlikely	This species generally occurs within sub-tropical rainforest, camphor laurel and occasionally wet sclerophyll and swamp forests which contain suitable fruiting species for foraging (DEC, 2005; Recher et al, 1995). As an obligate frugivore a high proportion of fruiting species (figs, lillipillis, laurels etc) is necessary and as such rainforest habitats are favoured. The species is considered a partial migrant and moves north in autumn/winter and returning in spring/summer to breed (Recher et al, 1995). Preferred rainforest/wet sclerophyll habitat is absent from the site with individual fruiting trees also scarce.	At this stage it is considered that this species is unlikely to be significantly affected by future development.

White-eared Monarch (*Monarcha leucotis*)	Unlikely	This species generally occurs within Coastal/Subtropical/Littoral Rainforests and occasionally Eucalypt/Riparian Forest, Mangroves and Swamp Sclerophyll with mesomorphic understorey along the eastern coast of Australia from Cape York to the Tweed River (Readers Digest, 2002; DEC, 2005). The Tweed Birds Observers (2005) do note that the species has been sighted along the Terranora Broadwater (online @http://www. bigvolcano. com.au/custom/birdos/media/brochure/brochure.htm). It has also been recorded within Mangrove habitats within the Tugan Bypass study area (Ecopro, 2004). Favoured habitat for the species is considered to be absent from the site.	At this stage it is considered that this species is unlikely to be significantly affected by future development.
Bush-hen (*Amaurornis olivaceus*)	Unlikely	This species favors coastal rivers and inlets from the Clarence River, north. It prefers densely overgrown margins of permanent terrestrial freshwater wetlands such as creeks and rivers, billabongs, ponds, swamps, waterholes, dams, lakes and roadside ditches (Muranyi and Baverstock, 1996). Three Bush-hens were recorded from Swamp Mahogany Forest in areas NE of the Cobaki Broadwater in association with fauna survey works undertaken in association with the Tugan Bypass SIS (Ecopro, 2004). PB (2008) has also recorded the bush hen at Banora Point within early regrowth rainforest west of Martinelli Avenue. Marginal habitat for this species is considered to occur in the SW corner of the site in association with the Paperbark Forest. The absence of extensive areas of standing water, high levels of fragmentation and limited extent (~3100m^2) indicates that the area is unlikely to represent a significant area of habitat.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species
Beach Stone-curlew (*Esacus neglectus*)	Unlikely	This species is distributed throughout coastal western, northern and eastern Australia from Norwest Cape to the Manning River (Readers Digest, 2002). Within this area it utilised open beaches, islands, reefs and sand/mudflats (NPWS, 2005; 1999; 2002) where it forages on crabs and other hard shelled marine invertebrates (Readers Digest, 2002). Suitable habitat for the beach curlew is considered to be absent from the site.	At this stage it is considered that this species is unlikely to be significantly affected by future development.

Grass Owl (*Tyto capensis*)	Unlikely	This species is generally recorded within tussock-grasslands but has also been noted to occur within heathland, swamps, coastal dunes, tree-lined creeks, treeless plains, mangrove fringes, grassy gaps between trees and crops and sugar cane plantation (Garnett and Crowley 2000; Pizzey and Knight, 1997). Within these habitats it sources a wide range of prey including birds, insects and terrestrial mammals. However, it feeds predominately on rodents and its population numbers can fluctuate wildly with the rise and fall of prey populations (Olsend and Doran, 2002). The fall of primary prey species following plague events (during which owl breeding increases) can result in widespread dispersal by the Owls with starvation also noted as the forage base reduces (Debus et al, 1998). Within the site it is considered that the Heathland and Paperbark Forest represent potential habitat for the grass owl. However these areas were traversed and inspected during survey with no nests or individuals of the species noted.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species
Southern Myotis (*Myotis adversus*)	Possible	The Myotis roosts within caves, tunnels, hollow-bearing trees, bridges, buildings and dense tree foliage always in close proximity to permanent water (NPWS, 2002; Richards, 2002). It forages over waterbodies where it scoops insects and small fish from the water surface or catches insects aerially (DEH, 2005; Menkhorst, 1996; Richards, 2002). It has been recorded foraging over small creeks, coastal rivers, estuaries, lakes and inland rivers (Law & Anderson, 1999) and other smaller waterbodies including farm dams (Law et al, 1998). Whilst favoured waterbodies/riparian habitats are absent the species may cross the site as part of regular movement patters. Potential roosting sites are considered to be absent.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species
Wallum Froglet (*Crinia tinnula*)	Possible	This species of wallum frog is found along drainage lines in sub-coastal wet heath, in acid paperbark (*Melaleuca*) swamps, and sedge swamps associated with sandy coastal plains (but rarely from around coastal lakes) and low slopes below 40m altitude and above areas of tidal influence (Ehmann, 1997; Meyer et al, 2006). "The swamps in which wallum frog species breed are typically oligotrophic (i.e. nutrient poor), tannin-stained and acidic (pH < 6.0). These attributes may render wallum frog breeding habitat unsuitable for related species (i.e. the common sedgefrog *Litoria fallax*, striped rocketfrog *L. nasuta*, clicking froglet *C. signifera* and beeping froglet *C. parinsignifera*). This could explain why wallum frog species and related species seldom occur together" (Ingram and Corben, 1975; Straughan, 1966 in Myer et al, 2006: 16). Potential habitat is considered to occur in the south-western portions of the site in association with Paperbark Forest (Community 3) which contains a low-lying swampy area of rushes/sedges. The absence of permanent water may be a limiting factor in this area and the species was not observed vocalizing on the site during brief inspection.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species

Wallum Sedge-frog (*Litoria olongburensis*)	Possible	This species is known from ephemeral wetlands and acid swamps containing sedgeland, banksias (wallum) and melaleuca forest/woodland within the coastal sandy zones of NE NSW and SE QLD (DEH, 2005; NPWS, 2002). During wet periods the frog can be found on emergent vegetation (rushes, sedges, ferns) whilst during drier periods it may be found at the base of such vegetation (DEH, 2005). Potential habitat is considered to occur in the south-western portions of the site in association with Paperbark Forest (Community 3) which contains a low-lying swampy area of rushes/sedges. The absence of permanent water may be a limiting factor in this area and the species was not observed vocalizing on the site during brief inspection.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species
Bush Stone-curlew (*Burhinus grallarius*)	Possible	This species is widespread throughout predominately coastal Australia where its preferred habitat consists of open forest-woodlands containing a grassy understorey with fallen timber and leaf litter (Readers Digest, 2002; NPWS, 2006). Foraging however, has been noted to occur over a broader spectrum of habitats including paddocks, grasslands, domestic areas (gardens, sports fields, [golf courses, residential areas pers. obs] etc), estuarine areas (mudflats, saltmarsh, mangrove forest, swamp oak, melaleuca forest) (NPWS, 1999; 2006). As the species utilizes a wide range of habitats (including modified residential areas) it is considered that the site represents potential habitat. Favoured grassy woodland areas are, however, limited to a very small area in the NW corner (~4100m^2).	Further survey for this species is recommended. A future 7-part test performed should be performed for this species
Eastern Long-eared Bat (*Nyctophilus bifax*)	Possible	This species of bat inhabits lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest with coastal rainforest and patches of coastal scrub particularly favoured (DEC, 2005; NPWS, 2002). Roosting occurs within tree-hollows, under bark and/or palm fronds and within dense foliage with a seasonal shift in roost sites from rainforest edges (summer) to the rainforest interior (winter) (NPWS, 2002; Parnaby in Strahan, 2002; Lunney et al, 1995). Potential habitat for this species is present on the site in association with the Heathland and southwestern Paperbark Forest. The site is considered unlikely to represent a significant breeding area given an absence of potential roost sites.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species

Collared Kingfisher (*Todiramphus chloris*)	Unlikely	This species is recorded in coastal Australia from Shark Bay to the Clarence River where it is almost exclusively associated with mangrove and estuarine areas (NPWS, 2005; Readers Digest, 2002). Suitable habitat for the Collared Kingfisher is considered to be absent from the site.	At this stage it is considered that this species is unlikely to be significantly affected by future development.
Magpie Goose (*Anseranas semipalmata*)	Unlikely	This species favours coastal wetlands and swamps with prolific reed/sedge growth mostly within northern Australia (NPWS, 2002; Tulloch et al, 1981). Breeding is confined to the northern areas in association with large floodplains of creeks/rivers generally within 80km of the coast (Frith and Davies, 1961). Dense sedge/rush growth within shallow waters in these locations is favoured for nest formation (Tulloch et al, 1981; Bayliss and Yeoman, 1990). Foraging within grazed paddocks and breeding within constructed stormwater wetlands has also been observed at Carrara on the Gold Coast (pers. obs.). It is considered that the site does not represent favoured habitat for the species (as a result of an absence of extensive swamps/lagoons).	At this stage it is considered that this species is unlikely to be significantly affected by future development.
Black Bittern (*Ixobrychus flavicollis*)	Unlikely	The species is widely distributed throughout the coastal regions of Australia but is more common in the northern extent of the country. Within its distribution, the species shows a preference for densely vegetated areas within terrestrial and aquatic wetlands. It has been recorded from a variety of vegetation types (including grassland, mangroves, wet sclerophyll forest, rainforest) where permanent water is present (Marchant & Higgins, 1990; Simpson & Day, 1996; NPWS, 2001). In northern NSW black bitterns are most often recorded in riparian habitats along fresh or brackish streams, although the species is also known to utilise drains, permanently inundated swamp forest, and freshwater wetlands (Sandpiper Ecological Surveys, 2003). Marginal habitat for this species is considered to occur in the SW corner of the site in association with the Paperbark Forest. The absence of extensive areas of standing water, high levels of fragmentation and limited extent (~3100m^2) indicates that the area is unlikely to represent a significant area of habitat.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species

Wompoo Fruit Dove (*Ptilinopus magnificus*)	Unlikely	This species is confined to mature rainforest and adjacent wet sclerophyll environments in eastern Australia from Cape York to around Coffs Harbour. As an obligate fruigivore it requires a high availability of fruiting materials which it generally feeds on in the high canopy (Recher et al, 1995). Preferred rainforest/wet sclerophyll habitat is absent from the site with individual fruiting trees also scarce.	At this stage it is considered that this species is unlikely to be significantly affected by future development.
Long-nosed Potoroo (*Potorous tridactylus*)	Possible	Long-nosed Potoroos are generally restricted to areas with an annual rainfall greater than 760 mm where they inhabit dry and wet sclerophyll forests and woodland with a heathy understorey (Johnson in Strahan, 2002; DEC, 2005). The preferred habitat in north eastern NSW is dry and wet open shrubland (Mason 1997, DEC, 2005, Johnston in Strahan, 2002). In all habitats the species requires relatively thick groundcover growing on friable soils (Bennett, 1993). Within these areas the Potoroo digs for its food the main component of which is hypogeal fungi with other important items including hard-bodied arthropods, vascular plant tissues, seeds and fleshy fruits (Bennett & Baxter, 1989; Claridge et al, 1993). It is also noted that a small, disjunct population of Potoroos exists in a small area of Crown land between the northern shore of Cobaki Broadwater and the NSW-Queensland border (Bali et al, 2003; Ecopro, 2004; Warren & Associates, 1992; Hero, 2001). The extensive 2003 survey undertaken by Bali et al notes that "within the Cobaki area, potoroos were most frequently trapped in Scribbly Gum Mallee Heathland followed by, Tree Broom Heathland, Scribbly Gum/Swamp Mahogany Forest, Black She-oak Heathland, Swamp Mahogany Forest and Scribbly Gum Forest. Our results suggest that potoroos prefer Scribbly Gum Mallee Heathland with an understorey of sedges and grasses such as *Restio* spp., *Lomandra* spp. and *Gahnia* spp., which is found along both sides of the Cobaki Lakes" (Bali et al, 2003: 16). It is considered that favoured habitat is present on the site in association with the Heathland community. Traversal of this area failed to record the species although deployment of cage traps and hair funnels couple with a spotlighting regime would be necessary to confirm the presence/absence of this species. The common traversal of the site by local residents, noted presence of domestic animals and dispersal barriers created by urban development and roadways does limit the potential use of this site by potoroos.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species

Spotted-tail Quoll (*Dasyurus maculatus*)	Unlikely	The species has been recorded from a wide range of habitats such as rainforest, open forest, woodland, coastal heathland, and inland riparian forest (Edgar and Belcher, 2002; Forest Practices Board, 2002). Additional habitat requirements include suitable den sites (such as hollow logs, tree hollows, rock outcrops or caves) and an abundance of food (such as birds and small mammals) (NSWNPWS, 1999; Edgar & Belcher, 2001; Belcher, 2000; Jones & Ross, 1996). Habitat range for males has been estimated to be as large as 2000-2200 hectares per individual, while for females, which are more protective of their dens, this value is considerably less at between 700-850 hectares per individual (Belcher, 2000; NPWS, 1999). Population density is therefore naturally quite low and has been estimated at 1 individual per 3 km^2 even within optimal 'core' habitat (Jones & Rose, 1996). A review of the NPWS Wildlife Atlas database indicates a recent (2004) recording of the species to the west within the Cudgen Nature Reserve. If this record is accurate and a population persists within the sub-region it is considered possible that the site would fall within the extensive home range of the species. Cage trapping, hair funneling and nocturnal surveying works would be necessary to confirm the presence/absence of the species. It is considered that the small size of the site, restricted vegetation corridors linking into the site and the proximity to urban development and major roadways limit the potential for the quoll to occur. Certainly the habitats available on the site would be insufficient to support a single individual of the species based upon reviewed scientific literature.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species
Common Blossom Bat (*Syconycteris australis*)	Possible	This species is one of the smallest members of the flying fox family (Pteropodidae) and is considered to be a specialist pollen feeder favouring Banksia, Melaleuca, Callistemon and certain species of Eucalypt (Strahan eds, 2002). Required habitats include Coastal rainforest, heathlands and Melaleuca swamps. Roosting is noted to occur in Littoral Rainforest with foraging occurring in proximate heathland and melaleuca forest primarily on the flowers of Banksia integrifolia (Law, 1993; 1994; 1996) It is noted that the Blossom Bat is commonly recorded in the coastal area including at Koala Beach to the south (Hannah & Lewis, 2007) with significant habitat plantings also occurring at Casuarina Beach. Although Banksia integrifolia was present in low abundance alternate potential foraging species were very common and favoured habitats (Heathland and Paperbark Forest) established. A series of spotlighting and harp trapping surveys would be required to determine the presence/absence of this species.	Further survey for this species is recommended. A future 7-part test performed should be performed for this species

5.5 CRITICAL HABITAT

Critical habitat listed under the *Threatened Species Conservation Act 1995* includes:

- Bomaderry zieria within the Bomaderry bushland
- Eastern Suburbs Banksia Scrub Endangered Ecological Community
- Wollemia nobilis (the Wollemi pine)
- Gould's Petrel
- Little penguin population in Sydney's North Harbour
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve

The proposed development is unlikely to impact upon any of these declared critical habitats.

5.6 FAUNA CORRIDORS/LINKAGES

Wildlife corridors can be defined as 'retained and/or restored systems of (linear) habitat which, at a minimum enhance connectivity of wildlife populations and may help them overcome the main consequences of habitat fragmentation' (Wilson & Lindenmayer, 1995). Corridors can assist ecological functioning at a variety of spatial and temporal scales from daily foraging movements of individuals, to broad-scale genetic gradients across biogeographical regions (Parsons Brinkerhoff, 2005).

Corridors serve a number of different functions in terms of biodiversity conservation including:

- providing increased foraging area for wide-ranging species
- providing cover for movement between habitat patches, particularly for cover dependent species and species with poor dispersal ability and enhancing the movement of animals through sub-optimal habitats
- reducing genetic isolation by maintaining continuity between sub-populations in a metapopulation and thereby preventing and /or reversing localised extinction
- facilitating access to a mix of habitats and successional stages to those species which require them for different activities (for example, foraging or breeding)
- providing refuge from disturbances such as fire
- providing habitat in itself (Wilson, A. & Lindenmayer 1995; Lindenmayer, 1994; Bennett, 1999).

How species use the corridor network will depend largely on the home and activity ranges of the species, their habitat requirements and the ecological characteristics of the corridor. For example, some large or mobile species may make direct movements through the corridor network, moving from one patch of habitat to another. These direct movements may be on the scale of a foraging expedition or a migration (Bennett 1990b). Other species may have movements by single individuals punctuated by pauses in the corridor, which can last anything from a small foraging or resting bout to weeks and even months. If the corridor contains sufficient resources to maintain a population, then continuity through the corridor may be through gene flow through the resident population (Bennett 1990b; Wilson, A. & Lindenmayer 1995).

For example a mobile species with a large home range (i.e. koala) may regularly traverse a corridor to move between favoured feeding grounds or in attempt to access mates, whereas a species with a comparably minor home range (i.e. antechinus) may spend its entire life within a portion of the same corridor.

It is noted that the southern portions of the site are nominated as being located within a regional corridor (obtained from the NPWS website 27 April 2010) which links Cudgen NR North and Cudgen NR South.

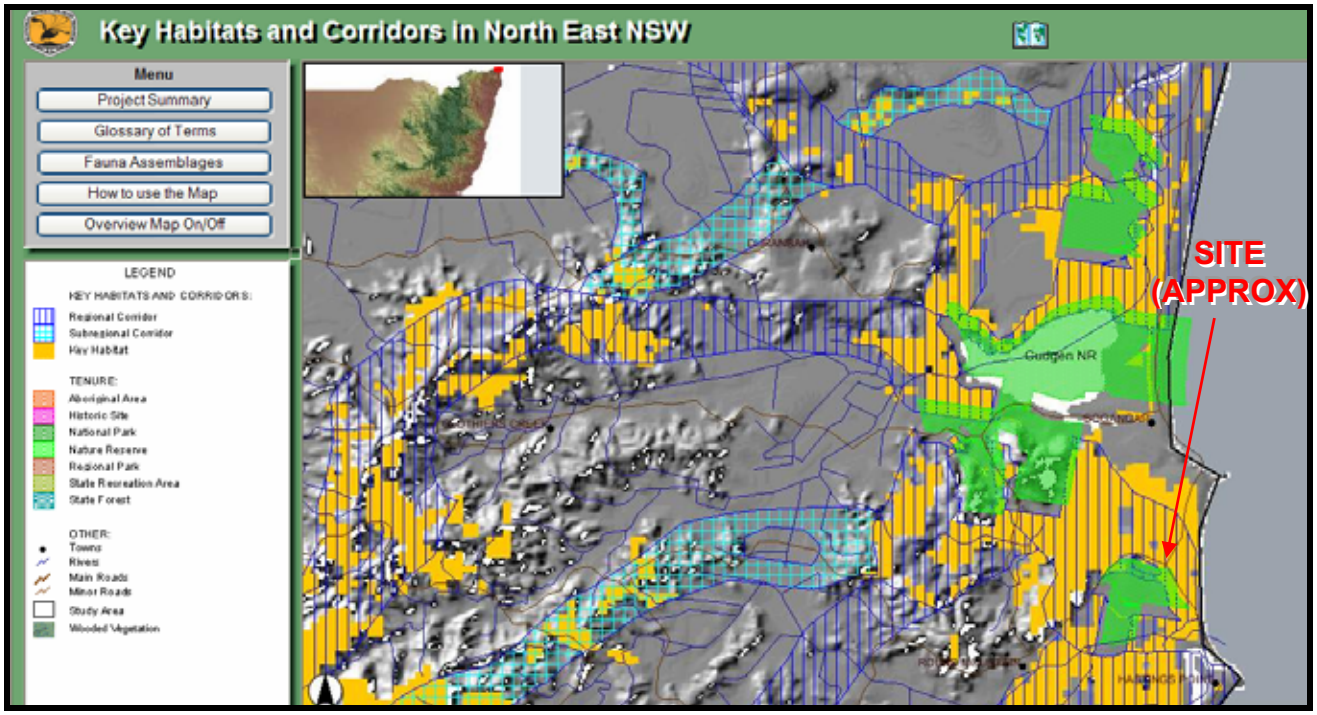


FIGURE 10: KEY HABITATS AND CORRIDORS MAP
(SOURCE: HTTP://MAPS.NATIONALPARKS.NSW.GOV.AU /KEYHABS/DEFAULT.HTM)

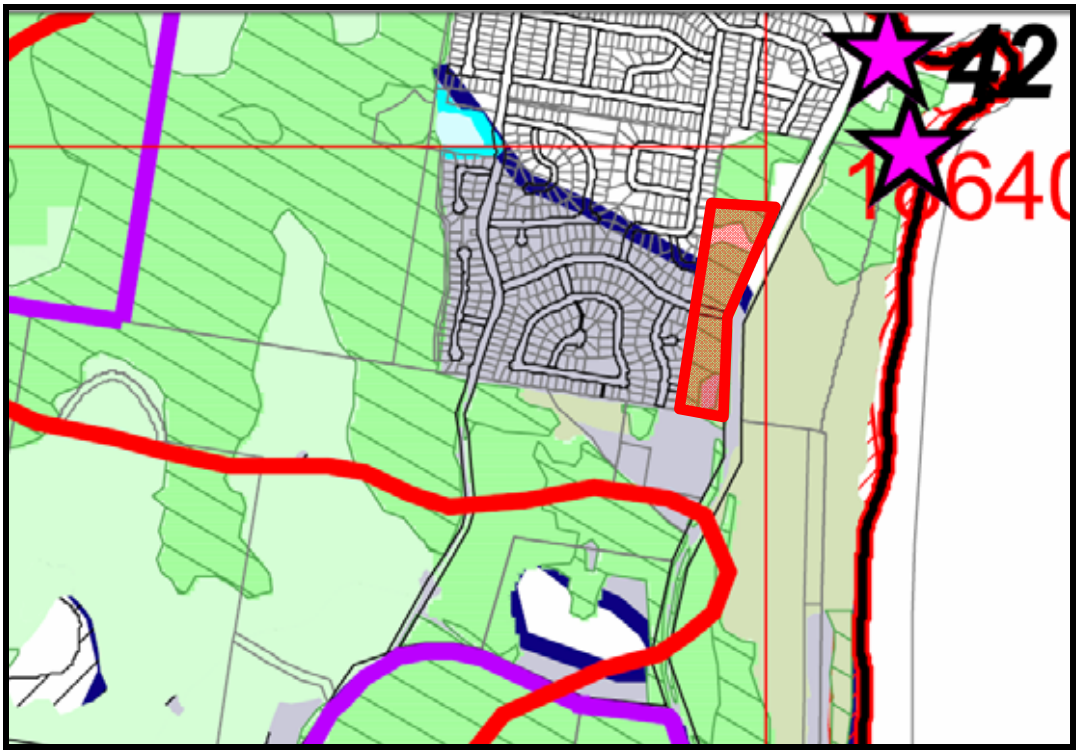


FIGURE 11: TWEED VMP MAP 7: REHABILITATION PRIORITIES

Following an initial review it is considered that significant terrestrial fauna movement corridors through the site are absent due to the following:

- The northern boundary has for a long period been fenced with >2m cyclone fencing to separate the site from the adjacent school lands;
- Lands to the west of the site have been developed for urban purposes since the mid-1990s;
- A roadway (Sandalwood Drive) traverses the site;
- A major roadway forms the eastern boundary of the site;
- Sports fields occur directly to the south of the site with a small buffer of regenerating coastal vegetation (mapped as 1099: Substantially Cleared of Native Vegetation on Map 2 of the TVMP).

It is considered that the above dispersal barriers would limit significant terrestrial fauna immigration to or emigration from the site.

5.7 WETLANDS AND WATERWAYS

The site is not mapped as containing any 'drainage lines' on TVMP (2004) Map 5: Soil Landscapes, Steep Land and Drainage Lines. Similarly the site is not mapped as containing any SEPP 14 wetlands.

However, appendix 7 of the TVMP (2004) notes that communities analogous to Vegetation Type 401: Broadleaved Paperbark Closed Forest/Woodland are reflective of wetland communities. Investigation of the mapped area (referred to as Community 3: Mid-High/Tall Swamp Sclerophyll (*Melaleuca quinquenervia*) Open Forest in this report) reveals a minor palustrine wetland area with canopy cover of paperbark and a rush/sedge zone within a low lying depression in the very southern portions of the mapped area. No stored water was noted at the time of survey and it is considered that the area would periodically store water during prolonged periods of rainfall.

A large cleared depression is also present at the south of the site which incorporates juvenile heath species and paperbark which is also likely to pond water following extended rainfall.

6.0 REVIEW OF ECOLOGICAL VALUES

The purpose of this report is to review existing environmental mapping and perform a preliminary ground-truthing exercise to determine ecological values and potential constraints to developing the site for its intended purpose (in this instance a residential development). Areas typically considered to have high ecological value (and subsequent constraints to development or activities) include, but are not limited to areas with confirmed:

- Presence of endangered ecological communities;
- Presence of declared critical habitat;
- Presence of endangered populations (and associated habitat);
- Presence of threatened fauna (and associated habitat) species;
- Presence of threatened flora (and associated habitat) species;
- Presence of inadequately reserved vegetation communities (within UNE region);
- Presence of SEPP 14 Wetlands, SEPP 44 habitat or SEPP 26 Littoral Rainforests;
- Presence of riparian associations, creek lines, wetlands (marine, estuarine, riverine, lacustrine and/or palustrine) and associated habitat;
- Presence of habitats of high flora and/or fauna diversity;
- Presence of significant (regional or sub-regional) fauna corridors/linkages.

The presence or absence (or discussion regarding further data/information requirements) of the above listed constraints are contained within the preceding sections of this report. A summary of the main points is presented below and discussed by Vegetation Community type to provide a definable boundary to each area. Each community is given an ecological status code (low to very high to enable comparison with Tweed VMP, 2004) based upon the works performed to date:

<u>COMMUNITY 1: MID-HIGH/TALL DRY COASTAL HEATHLAND/SHRUBLAND</u>

- This community is considered to be reflective of Tweed VMP (2004) 501_Dry Heathland/Shrubland and 1008_Post-mining Regeneration. Several areas have been previously mapped as 902_Native Grassland although these areas also incorporate regenerated heath species and are incorporated into the Heathland description for the purposes of this report

- The community appears to be regrowth in nature and a review of previous aerial photographs indicates the site was cleared during the mid-1990s. In the 1950s-60s the site was likely to have been modified for sand mining and has rehabilitated over time similar to other allotments of the Bogangar locality

- Dry Coastal Heathland/Post-mining Regeneration vegetation communities cover ~575ha of the Tweed Shire (TVMP, 2004)

- The community is not considered to be reflective of an endangered ecological community

- Whilst being of limited extent in Tweed Shire this community is considered to be adequately reserved within the Far North Coast Planning Area/Upper North East CRA Region (Sherringham et al, 2008; TVMP, 2004)

- Typical to coastal heath vegetation this community exhibits a diverse assemblage of flora species

- No threatened plant species were recorded although further surveys are required to confirm the presence/absence of such species

- No threatened fauna species were recorded although further surveys are required to confirm presence/absence. Potential habitat is present for seven of the species discussed in Section 5.4 although the presence of all these species is considered unlikely. Targeted survey for the planigale and blossom bat is a high priority as they have been recorded in nearby areas and this community provides potential habitat

- The community is not considered to represent a significant terrestrial wildlife corridor.

Ecological Status: Moderate-high

(a combined status is provided in this instance as the community is partially reflective of 501_Dry Heathland/Shrubland [Regional Vegetation Type Status 2] and 1008_Post-mining Regeneration [Regional Vegetation Type Status 5]).

COMMUNITY 2: LOW/MID-HIGH COASTAL *CORYMBIA INTERMEDIA* FOREST

- This community is considered to be reflective of Tweed VMP (2004) Code 301_Coastal Pink Bloodwood Open Forest to Woodland

- Coastal Pink Bloodwood vegetation communities cover ~54ha of the Tweed Shire (TVMP, 2004)

- The community is not considered to be reflective of an endangered ecological community

- This community is considered to be inadequately reserved within the Far North Coast Planning Area/Upper North East CRA Region (TVMP, 2004)

- No threatened plant species were recorded although further surveys are required to confirm the presence/absence of such species

- No threatened fauna species were recorded although further surveys are required to confirm presence/absence. Potential habitat is present for two of the species discussed in Section 5.4

- The community is not considered to represent a significant terrestrial wildlife corridor.

Ecological Status: Very High

COMMUNITY 3: MID-HIGH/TALL SWAMP SCLEROPHYLL (*MELALEUCA QUINQUENERVIA*) OPEN FOREST

- This community is considered to be reflective of Tweed VMP (2004) Code 401_Broadleaved Paperbark Closed Forest to Woodland
- Broad-leaved Paperbark vegetation communities cover ~1131ha of the Tweed Shire (TVMP, 2004)
- This community is reflective, or partially reflective, of an endangered ecological community (i.e. the edaphic and topographical features of the coastal floodplain definition may not be met in this instance but the floristics are comparable).
- This community is considered to be inadequately reserved within the Upper North East CRA Region (TVMP, 2004) and fairly reserved within the Far North Coast Planning Area (Sherringham et al, 2008);
- The community is considered representative of a palustrine wetland community although inundation is likely to be temporary and periodic and the community is heavily fragmented and disturbed (weed invasion) in the northern portions
- No threatened plant species were recorded although further surveys are required to confirm the presence/absence of such species
- One threatened fauna species (Little Bentwing Bat) was recorded although further surveys are required to confirm presence/absence of other threatened fauna. Potential habitat is present for nine of the species discussed in Section 5.4 although the presence of all these species is considered unlikely. Targeted survey for the planigale and blossom bat is a high priority as they have been recorded in nearby areas
- The community is not considered to represent a significant terrestrial wildlife corridor.

Ecological Status: Very High

COMMUNITY 4: CLEARED AND DISTURBED AREAS + LOW CLOSED COUCH GRASSLAND

- This community is considered to be reflective of Tweed VMP (2004) Code 1099_Substantially Cleared of Native Vegetation
- The community has been cleared of remnant vegetation
- Substantially cleared of native vegetation designated areas cover ~59563ha of the Tweed Shire (TVMP, 2004)
- The mapped area is not considered to be reflective of an endangered ecological community
- No threatened plant species were recorded although further surveys are required to confirm the presence/absence of such species

- No threatened fauna species were recorded although further surveys are required to confirm presence/absence. The area is unlikely to provide habitat for threatened fauna although the southern portions which appear to pond water during extended rainfall periods must be surveyed during suitable conditions for wallum frog species

- The community is not considered to represent a significant terrestrial wildlife corridor.

Ecological Status: Low

NOTES:

Vegetation maps have been compiled using Mapinfo geographic information system (GIS) software (Ver. 8.5). Information utilized has included:

- Data provided by the consulting surveyor/engineer including contours, site boundaries and aerial photographs.
- Tweed VMP (2004) vegetation community mapping (VMP MAP 2) boundaries rasterised and registered to property boundaries and aerial photographs

Vegetation survey was performed as outlined (Section 3 of Report) with geo-referenced colour aerial photographs overlaid with contour plans, existing mapped vegetation boundaries and cadastre boundaries utilized for the initial recognition of community boundaries in the field and adjustments noted as necessary. Communities (refer Section 3 of Report) were then transcribed directly into the GIS program utilizing the aerials, contours, geological information and vegetation boundaries as a reference background.

Where necessary vegetation boundaries were traversed with a hand held GPS (Garmin s72) and loaded into Mapinfo with existing boundaries rectified where necessary.

PRELIMINARY ECOLOGICAL STATUS

- MODERATE-HIGH
- VERY HIGH
- VERY HIGH
- LOW

N.B. this plan is prepared as a preliminary scoping document only and is not intended as a detailed ecological constraints analysis of the subject land. No responsibility will be accepted by the authors for any other use or interpretation from that discussed. The plan is only to be utilised in conjunction with the attached report.

7.0 SUMMARY & CONCLUSIONS

Planit Consulting have been engaged by LPMA to undertake a preliminary terrestrial flora and fauna assessment of a property zoned for residential purposes located at Sandalwood Drive, Bogangar. The assessment has included the following:

- Survey, ground truthing and mapping of vegetation communities and determining preliminary ecological status reflective of reference reports and onsite condition
- Brief survey for faunal species including an assessment of the site's habitats and likelihood of threatened species occurrence
- Preliminary survey and assessments for threatened flora and fauna species, populations and endangered ecological communities
- Providing a flora and fauna assessment report identifying preliminary areas of ecological significance and subsequent development constraints to allow further investigation of development and land use scoping exercises over the land.

The next phase of the scoping exercise should be undertaken in association with other disciplines (i.e. hydraulic, geotechnical, land-use planning etc) to ensure, through a reiterative design process, that future development designs do not encroach into areas identified as being ecologically significant.

Recommendations regarding the protection and avoidance of impacts, management of threatening processes (weeds, pest animals, water quality etc), and restoration of degraded areas to promote the long-term viability of vegetation retention areas should incorporated within the final report which will support a development application to the local council. As all nominated habitats of the site (some of which may be impacted on by a proposed development) are at this preliminary stage nominated as 'moderate' to 'very high' ecological status vegetation clearing offsets should also be addressed.

A Section 5A analysis in accordance with the *Environmental Planning and Assessment Act 1979* (the '7-Part Test of Significance') will also need to be conducted for the recorded endangered ecological communities, threatened flora and fauna species plus additional species which are considered possible occurrences on site and may have the potential to be impacted as a result of the final development design proposed. The final report should also incorporate SEPP assessments relevant to Koala Management, Littoral Rainforest and Coastal Wetlands.

8.0 ATTACHMENTS

ATTACHMENT 1: PRELIMINARY ECOLOGICAL CONSTRAINTS MAP
ATTACHMENT 2: PRELIMINARY VEGETATION COMMUNITY MAP

ATTACHMENT 1

PRELIMINARY ECOLOGICAL STATUS MAP

NOTES:

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PRELIMINARY ECOLOGICAL STATUS

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- LOW

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ATTACHMENT 2

PRELIMINARY VEGETATION COMMUNITY MAP

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VEGETATION COMMUNITY MAPPING

COMMUNITY 1: MID-HIGH/TALL DRY COASTAL HEATHLAND/SHRUBLAND

COMMUNITY 2: LOW/MID-HIGH COASTAL CORYMBIA INTERMEDIA FOREST

COMMUNITY 3: MID-HIGH/TALL SWAMP SCLEROPHYLL (MELALEUCA QUINQUENERVIA) OPEN FOREST

COMMUNITY 4: CLEARED AND DISTURBED AREAS + LOW CLOSED COUCH GRASSLAND [G1D]

N
W
E
S
0
75
150
metres