Our Ref: BS:TM:239312

14 December 2017

Modification Assessments
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

ATTENTION: EMMA BUTCHER

Dear Emma,

ADDITIONAL INFORMATION –REQUEST FOR SEARS – MP 05_0083 –SANDY BEACH NSW.

Reference is made to our request to obtain the Secretary's Environmental Assessment Requirements (SEARs) for land excluded from the Concept Approval for the Sandy Beach development; MP 05_0083 lodged on 7 July 2017 and subsequent discussions with your Director on 17 July 2017.

We have removed references to review flood levels and submit amended supporting documentation for your consideration.

Should you require any clarification please contact Trevor Carter or myself at our Hunter Office on 49785100.

Yours faithfully

Brett Stein
Senior Planner
ADW Johnson Pty Ltd
Hunter Office
N:\239312\Planning\SEARS\Sears Submission 14.12.2017\Cover Letter 141217.docx

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Planning

Working Beyond Expectations

Transitional Part 3A Project Supporting Document

Request for Secretary's Environmental Assessment Requirements (SEARs)

Development:
Residential Subdivision

Property:
Lot 22 DP 1070182 and
Lots 497 and 498 DP 227298
Pacific Highway, Sandy Beach North

Applicant:
Elite Construction NSW Pty Ltd

Date:
December 2017

Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Final	07/06/2017	Brett Stein	Craig Marler
B	Final	14/12/2017	Brett Stein	Craig Marler

Table of Contents

LIST OF FIGURES

1.0 Introduction

ADW Johnson Pty Ltd has been engaged by Elite Constructions NSW Pty Ltd to assist with development of the Sandy Beach residential development in Coffs Harbour.

The purpose of this document is to obtain the Secretary's Environmental Assessment Requirements (SEARs) for the preparation of further Environmental Assessment with respect to parts of the site excluded from the Concept Approval for the Sandy Beach development MP 05_0083.

Additionally we seek guidance on the potential to remove the requirement to transfer land as an addition to the Coffs Coast Regional Park and manage it as part of the community land.

It is intended that a 75W application to amend the concept plan approval will be lodged with the Department for consideration.

Specifically this supporting document provides the Secretary with the following information:

- A description of the site and locality;
- A description of the proposal; and
- A justification for the proposal.

2.0 Background

The subject site is located to the north of Sandy Beach within the Coffs Harbour Local Government Area.

In December 2010 Concept Plan Approval was issued for Part of The Sandy Beach North residential subdivision under Application No MP 05_0083. The approval did not include development within the areas described as Stage 6, Stage 2 and part of Stage 1 east of the extension of Ti-Tree Road as depicted below.

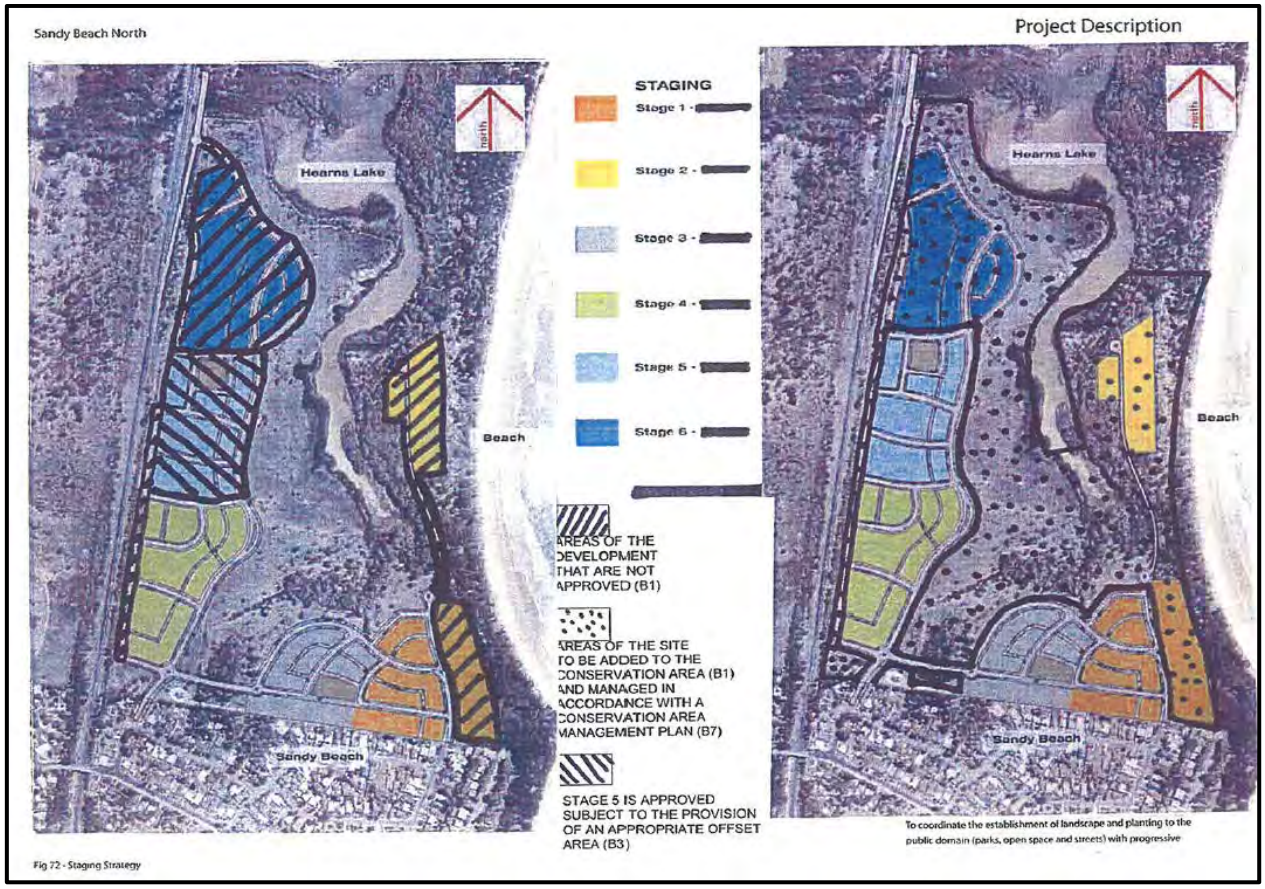

Figure 1: Approved Concept Plan.

A review of the vegetation on the site and current mapping from Coffs Harbour Council undertaken by Cumberland Ecology indicates there is scope to now include these lands as part of the approval.

The ecological review of the site indicates the constraints may not be as significant as were considered at the time of approval.

3.0 Characteristics of the Site & Locality

The site lies to the east of the Pacific Highway between the highway and the coast to the north of Sandy Beach. The site has an area of 49.5 hectares and includes the coastal dunes and includes Hearnes Lake and lagoon estuary. The site is relatively flat and contains pockets of open woodland, swamp sclerophyll forest and coastal saltmarsh. The following aerial photographs show the site location and an indication of vegetation cover.

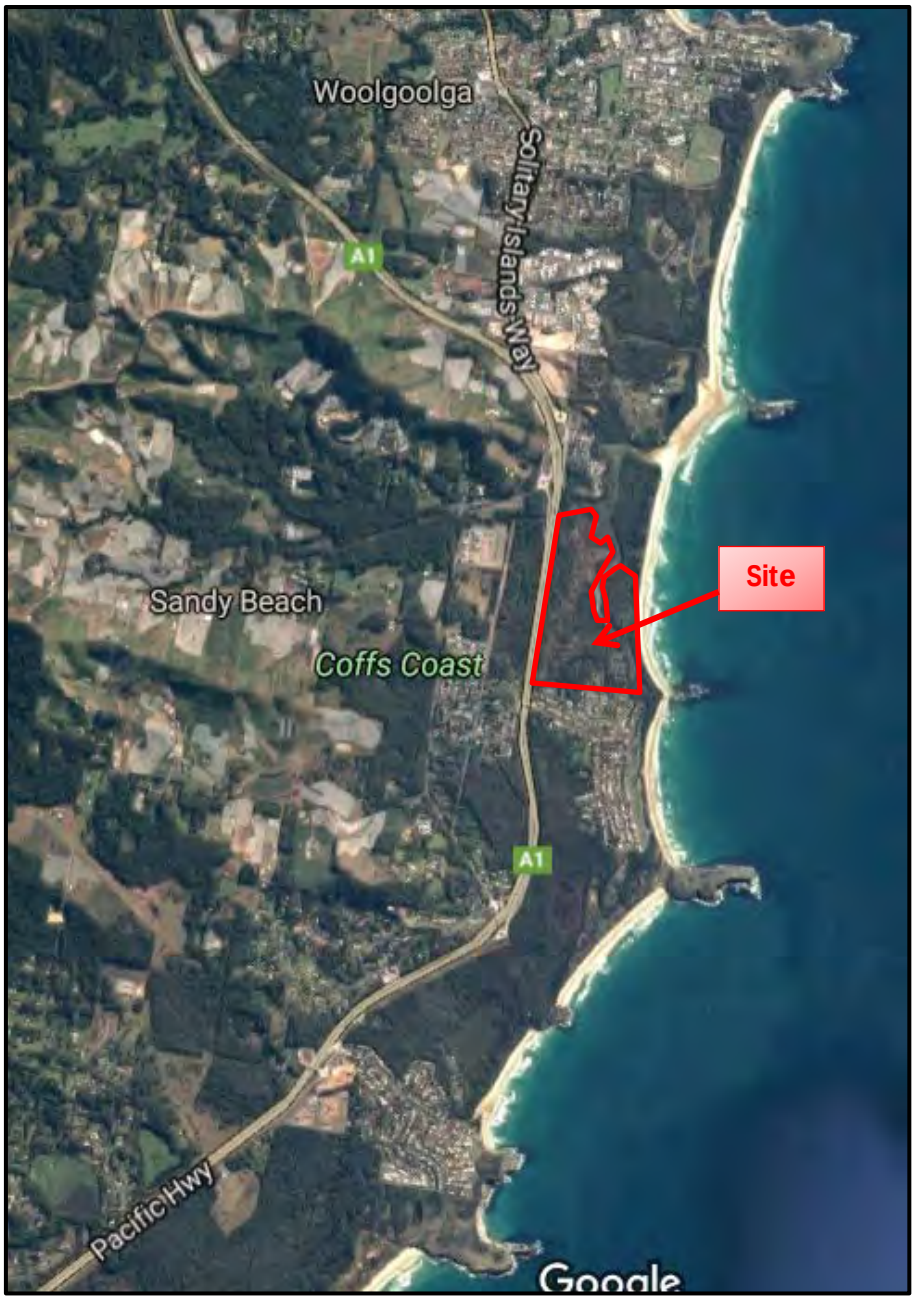

Figure 2: Aerial Photo of Site Locality.

Figure 3: Development Site.

4.0 The Proposal

It is proposed to submit a 75W Application to the Department of Planning and Environment seeking to allow development of those stages not approved in the Concept Approval, to clarify offset requirements for Stage 5, and delete the requirement for transfer of land as an additional to Coffs Coast Regional Park. A copy of the concept approval is included as **Appendix A**.

Specifically we will be seeking to amend the Concept Approval by:

- **Deleting Condition A2**

"A2 To avoid any doubt, this Concept Plan approval does not include any future development within the areas described as Stage 6, Stage 2 and that part of Stage 1 east of the extension of Ti Tree Road as depicted on the modified staging plan at schedule 3."

- **Deleting Condition B1**; which states:

" B1 The north west precinct (Stage 6) containing approximately 45 lots, the north eastern precinct (Stage 2) containing approximately 15 lots and the eastern edge of the southern precinct, east of the extension of Ti Tree Road (part of Stage 1) containing approximately 14 lots are not approved an this land is to be added to the Conservation Area."

- **Deleting Condition B3;**

"B3 Stage 5 is approved subject to the further requirements listed in C11."

- **Deleting Condition C11;**

"The future application for the residential subdivision of Stage 5 must include:

a) An assessment of the Stage 5 land to determine an appropriate offset for the development of this stage to the satisfaction of the Director General;
b) Proposed arrangements to secure an offset and the protection and management of that land for conservation purposes in perpetuity to the satisfaction of the Director General; and
c) Any offset is to be managed in accordance with a specific Conservation Area management Plan including details as per C10.

Note: this may include consideration of on site and off site offsets.

- **Deleting of Condition C13;**

C13 Prior to any construction or as otherwise determined by the Director-General, the proponent must provide evidence of an agreement for the dedication by the proponent to LPMA of approximately 6 ha of land as addition to the Coffs Coast Regional Park, as committed to by latter dated 27 October 2010. Once dedicated the proponent is not required to manage the land in accordance with the Conservation Management Plan.

Such agreement must outline the Proponents commitment to establish boundary fences and trails satisfactory to the needs of the LPMA prior to the land being added to the Regional Park. The proponent must ensure suitable funding for the amendment of existing reserve specific fire pest weed and management plans. The funding should be sufficient to ensure actions within the amended plans relevant to the new additions are able to be completed.

5.0 Justification for the Proposed Amendment to Concept Plan

The *Environmental Planning & Assessment Act 1979* (as amended) and the *Environmental Planning & Assessment Regulation 2000* constitute the principal planning legislation in NSW and provides the statutory framework for the assessment of this proposed development.

Schedule 6A of the Act provides transitional provisions for projects approved under Part 3 A of the Environmental Planning and Assessment Act. Clause 75W continues to apply for the purpose of modification of a concept plan approved before or after the repeal of part 3A.

The key reasons for deleting Stage 6, Stage 2 and part of Stage 1 from the original concept approval were due to consideration of ecological constraints.

The vegetation constraints on the site are not as significant as when considered at the time of approval. (Please refer to ecologist's correspondence in **Appendix B**). Further we believe the impacts of development of the previously excluded parts of the site can be mitigated by a combination of on-site and off- site vegetation offsets.

Updated ecological reports including an offset strategy will be submitted as part the 75W report.

It is important that development of the site achieves the right balance between environmental protection and provision of housing. In this context we believe additional housing could be delivered on the site without compromising ecological objectives.

The dedication of land as part of the Coffs Coast Regional Park and the associated funding requirements is considered unnecessary as the land proposed to be added to the Regional Park can be satisfactorily managed for conservation purposes without the need for additional fencing, trails and management plans.

6.0 Consultation

6.1 RELEVANT AGENCIES & OTHER AUTHORITIES

It is anticipated that consultation with a number of agencies will be required as part of the Secretary's Environmental Assessment Requirements. In particular consultation with NSW Office of Environment and Heritage and National Park and Wildlife Service will be required to develop an appropriate vegetation offset strategy.

Once the SEAR's are received Elite Construction will undertake consultation with all necessary stakeholders to inform the Environmental Assessment.

7.0 Conclusion

It is considered reasonable to reconsider the impacts of those stages of the Sandy Beach residential development, deleted from the Concept Plan approval, on the basis of the ecological constraints not being as significant as when previously considered and that the impacts of the development can be mitigated by a combination of on-site and off-site vegetation offsets and noting more recent changes to legislation.

The demand for housing in the region remains strong and the site has potential to deliver additional high quality housing. The proposed development is an extension to an existing developed area in a highly desirable location.

We look forward to receipt of SEARS at your earliest convenience.

Appendix A

CONCEPT APPROVAL

Concept Approval

Section 75O of the *Environmental Planning & Assessment Act 1979*

I determine:

(a) Pursuant to section 75O of the *Environmental Planning and Assessment Act 1979* (the Act) to approve the concept plan referred to in Schedule 1, subject to the terms of approval and modifications in Schedule 2 and the proponent's Statement of Commitments in Schedule 3; and

(b) Pursuant to section 75P(1)(b) of the Act, that approval to carry out the project shall be subject to Part 3A of the Act.

The modification and further assessment requirements are required to:

- Encourage the orderly future development of the site;
- Ensure adequate mitigation of environmental impacts of future development; and
- Ensure protection and restoration of threatened species and their habitat.

Anthony (Tony) Kelly MLC
Minister for Planning

Sydney 20 DEC 2010 2010.

SCHEDULE 1

Application No.:	05_0083
Proponent:	Sydney NSW Property Consultants Pty Ltd
Approval Authority:	Minister for Planning
Land:	Lot 22 DP 1070182 and Lots 497 and 498 DP 227298, Pacific Highway and Pine Crescent, Sandy Beach, Coffs Harbour LGA.
Project:	Sandy Beach North residential subdivision including: • Community title residential subdivision; • Associated road, cycle and pedestrian traffic routes; • Indicative architectural concepts for six building types; • Landscape concept; • Noise attenuation barriers; • Recreational open space; • Ecological buffers and environmental protection areas; • Vegetation, habitat, bushfire and foreshore management concepts;; and • Stormwater management concept. Note: Not all aspects of the Concept Plan have been approved

DEFINITIONS

Act	means the *Environmental Planning and Assessment Act 1979.*
BCA	means Building Code of Australia.
Concept Plan	means the project as described in Schedule 1 and as modified by Schedule 2.
Council	means Coffs Harbour City Council.
DECCW	means the Department of Environment Climate Change and Water or its successors.
Department	means the Department of Planning or its successors.
Director-General	means the Director-General of the Department or his/her nominee.
Environmental Assessment	means the Environmental Assessment entitled *Concept Plan Application for Residential Subdivision Sandy Beach North, Pacific Highway Sandy Beach Volumes 1 and 2 prepared by Planning Workshop Australia and dated 17 March 2009.*
Conservation Area (CA)	means that part of the site outside the boundaries of the lakeside perimeter road of the southern and western precincts and identifed as Conservation Area (CA) as depicted in Schedule 3.
LPMA	means the Land and Property Management Authority or its successors.
Minister	means the Minister for Planning.
PCA	means a Principal Certifying Authority and has the same meaning as Part 4A of the Act.
Preferred Project Report	means the Preferred Project Report (PPR) entitled *Preferred Project Report MP 05_0083 Pacific Highway Sandy Beach North* prepared by Willana Associates Pty Ltd and dated August 2010 and addendum letter dated 27 October 2010.
Proponent	means Sydney NSW Property Consultants Pty Ltd or any party acting upon this approval.
Regulation	means the *Environmental Planning and Assessment Regulation 2000.*
Site	means the land identified in Schedule 1.

SCHEDULE 2

PART A – ADMINISTRATIVE CONDITIONS

Concept Plan Description

A1. Concept Plan approval only is granted to the project described generally below:
a) Community Title residential subdivision;
b) Associated road, cycle and pedestrian traffic routes;
c) Indicative architectural concepts for six building types;
d) Landscape concepts;
e) Noise attenuation barriers;
f) Recreational open space areas;
g) Rehabilitation of ecological buffers and environmental protection areas;
h) Vegetation, habitat and bushfire foreshore management concepts; and
i) Stormwater management concepts.

As modified by the modifications in Part B of Schedule 2.

Note: The proponent sought Concept Plan approval for community title subdivision of 280 lots. Due to environmental constraints, approval has not been granted to a scheme of this size. Modifications to the Concept Plan are detailed in Part B of this schedule.

A2. To avoid any doubt, this Concept Plan approval does not approve any future development within the areas described as Stage 6, Stage 2, and that part of Stage 1 east of the extension of Ti-Tree Road as depicted on the modified staging plan at Schedule 3.

Consistency of Future Development

A3. The proponent shall carry out the Concept Plan and all related future applications generally in accordance with the:
a) Environmental Assessment;
b) Preferred Project Report and addendum letter; and
c) The Statement of Commitments.

except for:
1) Any modification which may be necessary for the purpose of compliance with the BCA and any Australian Standard incorporated into the BCA; and
2) Otherwise provided by the modifications and further assessment requirements of this approval.

A4. In the event of any inconsistency between:
a) The modifications and further assessment requirements of this approval and the drawings/documents referred to in condition A3, the modifications and further assessment requirements of this approval shall prevail to the extent of the inconsistency; and
b) Any drawing/document listed in condition A3, the most recent document shall prevail to the extent of the inconsistency; and
c) The modifications and further assessment requirements of this approval and the Statement of Commitments, the modifications and further assessment requirements of this approval prevail to the extent of the inconsistency.

A5. If there is any inconsistency between this Concept Plan approval and any future application, this Concept Plan approval shall prevail to the extent of the inconsistency.

Limits of Approval

A6. This Concept Plan approval shall lapse five (5) years after the date the approval is endorsed by the Minister, unless works the subject of any related application are physically commenced, on or before that lapse date. The Director-General may extend this lapse date if the Proponent demonstrates to the satisfaction of the Director-General that the project remains current,

appropriate and reflective of the best use of the site at the date the approval would otherwise lapse.

A7. To avoid any doubt, this approval does not permit the construction of any component of the Concept Plan (including any clearing of vegetation).

PART B – MODIFICATIONS TO CONCEPT PLAN PURSUANT TO SECTION 75O(4) OF THE ACT

Note: In making the modifications as described in this schedule, the Minister has only granted Concept Plan approval to a community title subdivision of approximately 200 residential lots along the western and southern boundaries of the site.

Subdivision Layout

B1. The north western precinct (Stage 6) containing approximately 45 lots, the north eastern precinct (Stage 2) containing approximately 15 lots, and the eastern edge of the southern precinct, east of the extension of Ti-Tree Road (part of Stage 1) containing approximately 14 lots are not approved and this land is to be added to the Conservation Area (see Schedule 3).

B2. No roads, acoustic barrier walls or residential lots are to encroach into the 20 metre wide 7B Scenic Buffer zoned land that runs immediately parallel to the Pacific Highway road reserve along the western boundary of the site.

B3. Stage 5 is approved subject to the further requirements listed at C11.

Access

B4. The proposed direct connection to the Pacific Highway in the north-western corner of the site is not approved.

B5. Both Lots 497 and 498 DP 227298 are to be used for the access road from Pine Crescent to the site.

B6. The perimeter road on the lakeside of the development (refer Schedule 3) is to have a finished surface level of RL3.6m AHD. The construction of all roads is to be in accordance with the specifications of Coffs Harbour Council.

Environment

B7. All land within the Conservation Area is to be managed in accordance with a Conservation Area Management Plan (CAMP) (refer C10).

PART C - FURTHER ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Pursuant to section 75P(2)(c) of the Act, the following environmental assessment requirements apply with respect to future stages of the project:

Subdivision

C1. Each future application for subdivision is to include:

(a) subdivision plans to Council's specifications, that show as a minimum, the following:
   i. dimensions of proposed allotments;
   ii. location of all structures proposed and retained on site;
   iii. location and width of asset protection zones (APZ);
   iv. access points; and
   v. any easements, covenants or other restrictions either existing or required on the site.

(b) draft community management statement;

(c) design guidelines for future housing developed in consultation with Council;

(d) outline of landscaping using locally native species and taking into consideration bushfire safety and the knowledge of the traditional Aboriginal custodians;

(e) details of construction methods, including sensitive fauna clearance and re-location methods prior to vegetation removal, methods to protect vegetation to be retained and erosion and sediment control;

(f) stormwater management incorporating water sensitive urban design principles;

(g) roads constructed to Council's specifications; and

(h) demonstration of compliance with this approval.

Acid Sulfate Soils Management

C2. An Acid Sulfate Soils Management Plan describing methods for determining the presence of such soils and the proposed methods for dealing with such soils should they be encountered.

Wallum froglet

C3. Clarification of the nature and extent of Wallum froglet habitat, including details of protective measures to mitigate against impacts on this species.

Noise

C4. In order to determine appropriate noise attenuation measures, it must be demonstrated that a road traffic noise modelling and assessment has been undertaken in accordance with all relevant guidelines for traffic noise attenuation for residential dwellings.

Water Management

C5. In order to ensure the protection of groundwater quality and the water quality of Hearnes Lake:

a) A detailed groundwater assessment is to be undertaken to determine the pre-development groundwater levels and groundwater quality over the proposed development area and the contribution of groundwater to Hearnes Lake and coastal dunes (any groundwater monitoring bores are to be licensed under the *Water Act 1912* and *Water Management Act 2000)*;

b) base line water quality data within Hearnes Lake and underlying groundwater is to be established, as are the development of trigger levels;

c) monitoring of water quality within the underlying groundwater and stormwater treatment system within the proposed Hearnes lake is to be incorporated in the monitoring program in the draft Environmental Management System (EMS);

d) All stormwater to be discharged is to be treated and any stormwater discharge will have a neutral or beneficial impact on surface and groundwater water quality;

e) Water quality control devices are to be sited in such a way as to minimise their impact with the Conservation Area.

Access

C6. A traffic, parking and access assessment report is to be submitted which accurately assesses the impact of the proposal on the local road network using the traffic generation rates used in recent RTA household surveys. Consideration is to be given to providing safe connections for pedestrians and cyclists to the existing network, this should include appropriate traffic management treatments at conflict points and off-road facilities;

Aboriginal Cultural Heritage

C7. The applicant shall develop and implement an archaeological sub-surface investigation program in consultation with the Director-General, local Aboriginal community and DECCW to ascertain the location, nature, scale, and significance of the Aboriginal Cultural Heritage (ACH) values located within the potential archaeological deposits within the project area, particularly the areas identified as PAD 1, as detailed in the Aboriginal Archaeological report prepared by Mary Dallas Consulting, submitted with the EA.

The result of the program, including any proposed management recommendations should be made available to Registered Aboriginal stakeholders for discussion prior to any decision regarding their management being determined. This program should be implemented and finalised prior to determination of the first subdivision application.

Domestic Animals

C8. Future applications must demonstrate that the keeping of cats and dogs (with the exception of assistance animals, as defined under the *Commonwealth Disability Discrimination Act 1992)* within the site is prohibited and that all residential lots are to be encumbered to this effect with a Section 88B instrument under the *NSW Conveyancing Act 1919*.

Recycled Water Supply

C9. Future applications must include an assessment investigating the viability of providing dual reticulation to future housing lots.

Conservation Area Management Plan

C10. The Conservation Area Management Plan shall at a minimum include the following:

(a) dimensions and area of the Conservation Area;
(b) details of how rehabilitation of degraded areas within the Conservation Area is to occur;
(c) measures to address any archaeological artefacts/sites;
(d) measures to control weeds;
(e) measures to control feral dogs and cats;
(f) details of fencing and other measures to be provided to protect existing and future vegetation;
(g) details of measures to protect threatened species and endangered ecological communities;
(h) details of how the area is to be managed having regard to the Coffs Harbour Koala Plan of Management;
(i) bushfire management;
(j) measures to control public access within the conservation area to minimise damage;
(k) details of future management and funding arrangements for the area and measures to be implemented for the long term protection of the area, for example through dedication;
(l) consultation to be undertaken with Council, LPMA and DECCW;
(m) performance objectives detailing measurable performance and completion criteria;
(n) detailed planting species list, composition and density for each vegetation community and, for EECs to be rehabilitated, this is to include ground, mid and canopy species and species composition must be benchmarked against a reference EEC community;
(o) details on creek bank erosion management;
(p) timing and responsibilities;
(q) monitoring, reporting and adaptive management procedures; and
(r) developer maintenance period reflecting completion criteria.

Environmental Impact of Stage 5

C11. The future application for the residential subdivision of Stage 5 must include:

a) an assessment of the Stage 5 land to determine an appropriate offset for the development of this stage to the satisfaction of the Director General;

b) proposed arrangements to secure an offset and the protection and management of that land for conservation purposes in perpetuity to the satisfaction of the Director General; and

c) any offset is to be managed in accordance with a specific Conservation Area Management Plan including details as per C10.

Note: this may include consideration of both on-site and off-site offsets

Flood Floor Levels

C12. Future applications for dwellings are to demonstrate that the minimum floor levels for habitable rooms are RL 4.1m AHD. All residential lots are to be encumbered to this effect with a Section 88B instrument under the *NSW Conveyancing Act 1919.*

Dedication of Land

C13. Prior to any construction, or as otherwise determined by the Director-General, the Proponent must provide evidence of an agreement for the dedication by the Proponent to LPMA of approximately 6 ha of land as addition to the Coffs Coast Regional Park, as committed to by letter dated 27 October 2010. Once dedicated the Proponent is not required to manage the dedicated land in accordance with the Conservation Area Management Plan.

Such an agreement must outline the Proponent's commitment to establish boundary fences and trails satisfactory to the needs of LPMA prior to the land being added to the Regional Park. The proponent must ensure suitable funding for the amendment of existing reserve-specific fire, pest, weed and management plans. The funding should be sufficient to ensure actions within the amended plans relevant to the new additions are able to be completed.

Drainage

C14. A flooding and drainage assessment is to be undertaken to:

a) ensure that adequate provision is made for the drainage under the highway via the existing and extended culverts. The hydraulic performance and the degree of flood immunity provided by the highway or flood behaviour upstream of the highway is not to be affected; and

b) demonstrate that the proposed perimeter road/levee system is capable of draining stormwater form the site as well as protecting the future residential subdivision from regular inundation.

SCHEDULE 3

Sandy Beach North

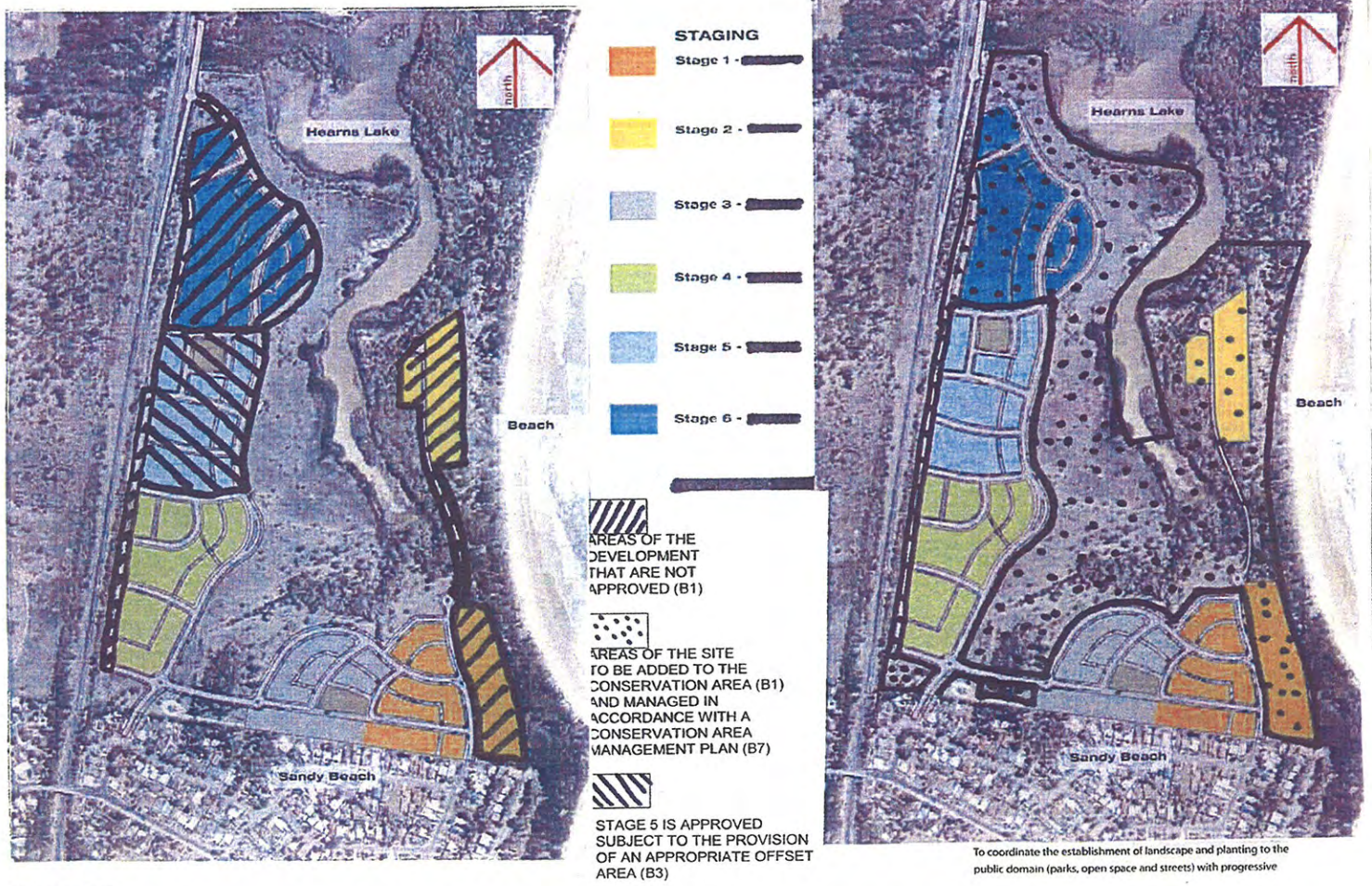

Fig 72 - Staging Strategy

To coordinate the establishment of landscape and planting to the public domain (parks, open space and streets) with progressive

Appendix B

ECOLOGIST CORRESPONDENCE

SANDY BEACH - COFFS HARBOUR

Vegetation Mapping and Threatened Flora Survey

For:

Dentons Australia Pty Ltd

November 2017

Final

PO Box 2474
Carlingford Court 2118

Report No. 17073RP1

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

Version	Date Issued	Amended by	Details
1	31 August 2017	DR/RM	First draft
2	16 November 2017	DR	Final

Approved by: David Robertson

Position: Director

Signed: 

Date: *16 November, 2017*

Table of Contents

Table of Contents *(Cont'd)*

List of Appendices

List of Tables

List of Figures

Chapter 1

Introduction

1.1 Purpose of Report

Cumberland Ecology has been requested by Dentons Australia Pty Ltd (Dentons) on behalf of Elite Constructions NSW Pty Ltd (the client) to undertake detailed ecological studies on approximately 50 ha of land located at Lot 22 DP 1070182 and Lots 497 and 498 DP 227298 located at the Pacific Highway and Pine Crescent, Sandy Beach (hereafter referred to as the 'subject site').

This report covers the first phase of the ecological studies, which involved updating baseline vegetation mapping and threatened plant species assessments. The purpose of this report is to:

- present the findings of the vegetation mapping and threatened species assessments; and
- compare and contrast the new data with pre-existing vegetation data for the site that was relied upon for guiding the existing approval for three or six development stages obtained under Part 3A of the *Environmental Planning and Assessment Act 1979* for residential development.

Overall, phase 1 ecological investigations have been broken down into four stages:

- Stage 1: finalise a detailed desktop review of documents provided by the Client and undertake a gap analysis assessment;
- Stage 2: undertake a brief site reconnaissance to clarify the habitats on site and to plan for implementation of a more detailed flora and fauna field investigation; and
- Stage 3: design and complete a detailed field survey; and
- Stage 4: Prepare updated flora baseline report.

The Stage 3 field surveys have been split into two stages,

- flora surveys, covering verification of vegetation mapping and threatened flora surveys; and
- fauna surveys covering general fauna surveys and threatened fauna surveys.

This report covers the flora survey component only, with fauna surveys to be undertaken and reported on at a later date.

1.2 Project Background

1.2.1 Subject Site

The subject site is approximately 50 ha of land located at Lot 22 DP 1070182 and Lots 497 and 498 DP 227298 located at the Pacific Highway and Pine Crescent, Sandy Beach. The subject site is bounded by the hind-side of the fore dune of Sandy Beach to the east, existing housing (Sandy Beach), to the south, the Pacific Motorway to the west and Hearns Lake to the north. Hearns Lake is a coastal estuary with an inlet that protrudes into the subject site from the north. The location of the subject site is shown in **Figure 1.1.**

The subject site operates as a small grazing property, and as such much of the vegetation has been modified, largely as a result of the removal of understorey vegetation, and replacement with exotic pasture grasses. Extensive regrowth following previous grazing is also likely to have occurred.

The subject site is located on the coastal plain, and is low-lying with many areas prone to inundation. More elevated areas occur along a hind-dune that occurs parallel to the fore dune along Sandy Beach. In addition to Hearns Lake, the subject site contains two drainage channels that drain from existing housing into Hearns Lake. While soils were not specifically assessed, the subject site contains coastal sands, peaty soils in swampy areas, saline soils around Hearns Lake, and grey mottled clays.

1.2.2 Concept Plan Approval

The majority of the subject site is currently zoned as a DM – Deferred Matter (i.e. Lot 22 DP 1070182) and a minor part as R2 – Low Density Residential (i.e. Lots 497 and 498 DP 227298) under the Coffs Harbour Local Environmental Plan 2013 (CH-LEP 2013).

Land mapped as Deferred Matters in the CH-LEP 2013 is still governed by the provisions of Coffs Harbour City Local Environmental Plan 2000 (CH-LEP 2000). The subject site is zoned mainly as Zone 2A – Low Density Residential and Zone 2E – Residential Tourist with minor areas zoned as Zone 7A – Environmental Protection (Habitat and Catchment) and Zone 7B – Environmental Protection (Scenic Buffer) in accordance with the CH-LEP 2000.

The subject site underwent a Concept Plan Approval in December 2010. The Concept Plan proposed six stages of residential development. The flora and fauna values and likely impacts of the proposal were evaluated in a series of reports prepared on behalf of the then proponent by Conacher Travers 2006, 2007a, 20907b) and Conacher Environmental Group (2008, 2010).

When considering the merits of the Concept Plan and its implications for flora and fauna, the then Department of Planning (DoP) relied heavily upon technical advice received from Geoff Sainty, a specialist peer reviewer retained by the Department (Sainty & Associates 2006).

That report, referred to hereafter as “the Sainty report” concluded that the majority of vegetation on the subject site comprised one or more endangered ecological communities. The Sainty report also provided recommendations for the use of buffers around significant vegetation and fauna habitats such as migratory waders habitats. The Department accepted much of the thrust of the Sainty report and only approved part of the proposed Concept Plan. That is, the Department approved stages 3, 4 and 5. However, stage 5 was approved subject to provision of appropriate biodiversity offsets. Proposed Concept Plan stages 1,2 and 6 were not approved by the Department.

At the time leading up to the approval, the Department appears to have disregarded some of the key conclusions of the then proponent’s ecological consultants, in favour of the recommendations of the Sainty report. The work done by the proponent’s ecological consultants was underpinned by detailed flora and fauna assessments on site. Flora work entailed plot based assessment of plant communities and subsequent mapping. In contrast the mapping provided in the Sainty report was based upon a limited site inspection, no vegetation plots and no targeted surveys for threatened flora.

The current work by Cumberland Ecology has been done to provide a rigorous new ecological study and to reappraise the ecological constraints for potential development in areas as evaluated by Conacher Travers, Conacher Environmental Group and Sainty and Associates.

1.3 Relevant Legislation

1.3.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as Matters of National Environmental Significance (MNES). Under the EPBC Act, any action (which includes a development, project or activity) that is considered likely to have a significant impact on MNES (including nationally listed threatened ecological communities and species, and listed migratory species) must be referred to the Australian Government Minister for the Environment (the Minister). The purpose of the referral is to allow a decision to be made about whether an action requires approval on a Commonwealth level. If an action is declared a “controlled action”, then Commonwealth approval is required.

1.3.2 Threatened Species Conservation Act 1995

The TSC Act is the key piece of legislation in NSW relating to the protection and management of biodiversity and threatened species. The TSC Act aims to protect and encourage the recovery of threatened species, populations and communities that are listed under the Act through threat abatement and species recovery programs.

The TSC Act requires consideration of whether a development (Part 4) or an activity (Part 5) is likely to significantly impact threatened species, populations, communities or their habitat. The potential impacts of any developments, land use changes or activities would need to

undergo an “Assessment of Significance” under Section 5A of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act).

If the results of an Assessment of Significance indicate that a development or activity is likely to significantly affect threatened species, populations or ecological communities, the Development Application (DA) must be accompanied by a Species Impact Statement (SIS), which is a detailed ecological study carried out in accordance with a set of assessment requirements issued by the Director-General of the National Parks and Wildlife Service.

The TSC Act will be repealed by the NSW *Biodiversity Conservation Act 2017* (BC Act) expected to come into effect on 25 August 2017. Assessments of potential impacts to and offsetting required for, endangered ecological communities, threatened species and populations is likely to be required following new methods set out in the draft regulations of the BC Act.

1.3.3 Noxious Weeds Act 1993

The Noxious Weeds Act 1993 provides a framework for the roles of government, private landholders and public authorities regarding the management of noxious weeds which may have an impact on the economy, community or environment. The aim of this legislation is to manage the negative impact of weeds by preventing, eliminating, or restricting significant weeds from spreading or establishing, and implementing effective management and monitoring of widespread noxious weeds.

1.3.4 Environmental Planning and Assessment Act 1979

The EP&A Act is the overarching planning legislation in NSW. This act provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the consideration of the environment and biodiversity values, which is addressed in Section 5A (significant effect on species, populations or ecological communities or their habitats) should a land use change be proposed. This includes threatened species, communities, habitat and processes as listed under the TSC Act and Fisheries Management Act 1994.

Pursuant to the EP&A Act, a number of State Environmental Planning Policies (SEPPs) have been implemented. These policies provide the planning criteria and development controls for specific environmental matters. SEPPs relevant to the subject site have been detailed in the following sections.

i. SEPP No. 14 – Coastal Wetlands

The aim of this policy is to ensure that the coastal wetlands are preserved and protected in the environmental and economic interests of the State. Under Section 6 of this policy, the Local Government Area (LGA) in which the proposed development is located will be the consent authority.

ii. Draft SEPP – Coastal Management

This is a draft SEPP that is currently under consultation, which will consolidate and update the existing SEPP 14 – Coastal Wetlands, SEPP 26 - Littoral Rainforests and SEPP 71 - Coastal Protection. This SEPP will aim to enforce the objectives of the Coastal Management Act 2016.

iii. SEPP No. 26 – Littoral Rainforests

The aim of this policy is to provide a mechanism for the consideration of applications for development that are likely to damage or destroy littoral rainforest areas with a view to the preservation of those areas in their natural state.

iv. SEPP 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 (*Phascolarctos cinereus*) to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline. This policy requires the preparation of plans of management before development consent can be granted in relation to areas of core Koala habitat by encouraging the identification of areas of core Koala habitat, and by encouraging the inclusion of areas of core Koala habitat in environment protection zones.

The subject site falls under the Coffs Harbour Council Koala Plan of Management (Lunney et al. 2009). Under the Coffs Harbour Council Koala Plan of Management (KPoM) areas may be defined as Primary, Secondary or Tertiary Koala Habitat, and includes a range of measures to protect and manage Koala habitat.

v. SEPP No. 71 – Coastal Protection

The aims of this Policy are to:

- Protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast;
- Protect and improve existing public access to and along coastal foreshores to the extent that this is compatible with the natural attributes of the coastal foreshore;
- Ensure that new opportunities for public access to and along coastal foreshores are identified and realised to the extent that this is compatible with the natural attributes of the coastal foreshore;
- Protect and preserve Aboriginal cultural heritage, and Aboriginal places, values, customs, beliefs and traditional knowledge;
- Ensure that the visual amenity of the coast is protected;
- Protect and preserve beach environments and beach amenity;

- Protect and preserve native coastal vegetation;
- Protect and preserve the marine environment of New South Wales;
- Protect and preserve rock platforms;
- Manage the coastal zone in accordance with the principles of ecologically sustainable development (within the meaning of section 6 (2) of *The Protection of the Environment Administration Act 1991*);
- Ensure that the type, bulk, scale and size of development is appropriate for the location and protects and improves the natural scenic quality of the surrounding area; and
- Encourage a strategic approach to coastal management.

Legend

Subject Site

Image Source:
Image © NearMap
(dated 02-05-2017)

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 200 400 600 800 m

I:\...\17073\Figures\RP1\20170613\Figure 1.1. Location Map

Figure 1.1. Location Map

Chapter 2

Stage 1 Literature Review and Gap Analysis

2.1 Literature Review and Gap Analysis Methods

A detailed review of previous studies undertaken at the subject site was undertaken. The list of studies provided for review is presented in **Table 2.1.** This detailed review aim at finding which the identified biodiversity values are within the subject site and assess the adequacy of the methodologies used.

We undertook a gap assessment with regards of the information gathered in the numerous previous investigations. The objective of the gap assessment was to identify further studies required to adequately collect data usable for proper and realistic ecological constraints to development present within the subject site.

Table 2.1 Brief Documents

Tab Number	Document	Date
Concept Plan Approval		
1	Concept Plan Approval (Application No 05_0083) for Sandy Beach North Residential Subdivision	20 December 2017
2	Plan of site showing approved stages with superimposed buffers prepared by ADW Johnson	19 April 2017
Planning Proposal		
3	Coffs Harbour City Council (2015) Planning Proposal: *Deferred Areas from Coffs Harbour Local Environmental Plan 2013 – Hearnes Lake/Sandy Beach, Emerald Beach and Moonee Beach Areas*	June 2015
4	Environmental Study prepared by Monteath & Powys Pty Ltd and David Broyd Consulting Services Pty Ltd	12 March 2015
5	Biodiversity Constraints Analysis: Deferred Areas Coffs Harbour City Council Draft LEP 2013 prepared by Niche Environment & Heritage	July 2014
6	Correspondence in relation to site survey	October 2013
7	Client submissions on proposed rezoning of Site	31 October 2012

Table 2.1 Brief Documents

Tab Number	Document	Date
		and 18 November 2015
Historical Studies / Reports / Plans		
8	Environmental Constraints Analysis prepared by Sainty & Associates	September 2006
9	Environmental Constraints and Development Potential Map prepared by Newnham Karl & Partners Pty Ltd	26 September 2006
10	Conacher Travers (2006) Appendix 16: Comments on environmental constraints analysis report, Lot 22 DP 1070182 Pacific Highway, Sandy Beach North. *In:* : Concept Plan Application and Environmental Assessment prepared on behalf of Sandy Shores Development Pty Ltd.	October 2006
11	Conacher Travers (2007a) Appendix 14: Koala Habitat Assessment. Report, *In*: Concept Plan Application and Environmental Assessment prepared on behalf of Sandy Shores Development Pty Ltd	April 2007
12	Conacher Travers (2007b) Appendix 6: Historical Land use Ecological Assessment. In: Concept Plan Application and Environmental Assessment prepared on behalf of Sandy Shores Development Pty Ltd.	May 2007
13	Conacher Environmental Group (2008) Ecological Survey and Assessment Report for Proposed Residential Development Lot 22 DP 1070182, Pacific Highway, Sandy Beach North.	September 2008
14	Conacher Environmental Group (2010) Comments on extent of Endangered Ecological Communities.	October 2010
15	Whelan Insites (2010) Ecological Constraints and Development Opportunities.	9 August 2010
16	Conacher Environmental Group (2013) Soil and Soil Landscape Investigations.	August 2013
E zones material		
17	Northern Councils E Zones Review Final Recommendations Report	October 2015
18	Section 117 directions for E zones and residential zones	1 July 2009

2.2 Stage 1: Literature Review and Gap Analysis Results

The following sub-sections present a summary of main findings with regards to ecological values of the subject site in previous studies.

2.2.1 Conacher Travers (2007a) Appendix 14: Koala Habitat Assessment. Report

i. Report Summary

The koala habitat assessment was prepared to address a key issue provided in the Director General's Requirements. The assessment was undertaken in accordance with the Coffs Harbour City Council (1999) Coffs Harbour Koala Plan of Management (CHKPOM) where small areas of the subject site are mapped as Secondary Koala Habitat.

Desktop assessment was undertaken taking into account results from previous field surveys undertaken by Conacher Travers on 15, 16 and 17 December 2003, 16 to 19 September 2004, 10 March 2005 and 12-15 October 2005. A total of 14 locations are provided in a map as part of the koala assessment.

The report indicates that there are four small areas of Secondary Koala Habitat and that these areas comprise a total of 7 ha within the subject site.

The author concluded that in spite of the subject site having trees identified in the CHKPO as preferred tree species, no evidence of koala occupation or koalas were detected within the subject site and that there is no likelihood of koala use of the subject site due to the subject site being isolated from other potential koala habitat areas within the 5km locality.

ii. Identified Gaps in Information

Although it is not clearly stated in the report, it is presumed that the field surveys at 14 locations were undertaken as part of previous koala assessments rather than surveys being undertaken specifically for this koala assessment.

The report makes reference to previous surveys undertaken in 2003, 2004 and 2005. References to reports where methodology and results from those previous surveys were reported are not included in the references section. It is noted that the report includes a full reference to only one previous report by Conacher Travers (2007) *Flora and Fauna Assessment Report Proposed Residential Development Part Lot 2 DP 813954 Pacific Highway, Sandy Beach North*. A search was done in six maps (https://maps.six.nsw.gov.au/) to locate Lot 2 DP 813954 failed to find that Lot/DP. It is unclear if Conacher Travers (2007) or other surveys mentioned in the report were undertaken for land outside the subject site. Therefore, it is uncertain whether the surveys listed to have taken place in 2003, 2004 and 2005 were in fact undertaken within the subject site.

The report indicates that there are four small areas of Secondary Koala Habitat and that these areas comprise a total of 7 ha within the subject site; however, these areas are not shown in figures included in the report.

2.2.2 Conacher Travers (2007b) Appendix 6: Historical Land use Ecological Assessment

i. Report Summary

A desktop assessment was undertaken to evaluate whether the condition of vegetation communities within the subject site might be close to pre-European occupation. Vegetation community data used were collected by the Conacher Travers (2006) *Flora and Fauna Assessment Proposed Residential Development Part Lot 2 DP 813954 Pacific Highway Sandy Beach*. That study was not provided for review and a search in six maps for the Lot/DP failed to produce results, it is unknown if that report was prepared for land at a different site or to the subject site under a historical Lot/DP. The following was found therein:

- Aerial photography analysis suggested that European occupation and intensified land use of the subject site commenced since the 1940s.
- Historical land uses within the subject site for the prior between 1900 to 2007 included agricultural clearing, minor to intense grazing and sand mining.
- Natural vegetation within the subject site and prior to European occupation would likely consisted of Coastal Lowlands of the NSW mid-north Coast, which was a mosaic of estuarine and freshwater sedgelands/wetlands, coastal wet heaths, and swamp forests.
- It was concluded that the subject site was likely to have contained five broad vegetation community associations prior to European settlement. These vegetation communities were:
    - Coastal Eucalypt Forest
    - Swamp Sclerophyll Forests
    - Wet/Wallum Heaths;
    - Dry Coastal Heaths; and
    - Sedgelands.
- The majority of the vegetation communities within the subject site had been impacted due to historical land uses.
- A number of stands of remnant vegetation have retained a relatively high degree of natural integrity such as:

- Wallum/Wet Heaths have retained their natural structural characteristics and exhibit relatively undisturbed floristic assemblages without significant incursion of exotic weed species.

- Sedgelands have retained their natural structural characteristics and exhibit relatively undisturbed floristic assemblages without significant incursion of exotic weed species.

ii. Identified Gaps in Information

No gaps were identified.

2.2.3 Conacher Environmental Group (2008) Ecological Survey and Assessment Report

i. Report Summary

This ecological study was prepared to address the Director General's Requirements result of the Concept Plan submission which resulted in the Concept Plan Approval (20 December 2010) This study was undertaken for Lot 22 DP 1070182, which comprises most of the subject site.

The following summarises ecological findings of the report:

- The subject site comprises approximately 49 ha.

- A proposed development was proposed including residential dwellings, commercial precinct, pedestrian walkways/cycleways, water management facilities, environmental protection areas and environmental buffers.

- Environmental protection areas were those identified as ecologically sensitive areas were identified at Hearnes Lake and its near shore areas, including riparian areas associated with Hearnes Lake.

- Ten vegetation communities were identified within the subject site:

  - Low Forest (*Banksia* dominated);

  - Forest (*Eucalypt* dominated);

  - Swamp Sclerophyll Forest;

  - Eucalypt/Swamp Sclerophyll Transition Forest;

  - Sandplain Forest (*Melaleuca* / *Corymbia* dominated);

  - Wet Heath;

  - Wallum Heath;

- Sedgeland;
- Disturbed Woodland; and
- Sandplain Forest (*Melaleuca* / Mesophyllic sp. dominated).

➢ Two Endangered Ecological Communities (EEC) were found:

- Coastal Saltmarsh; and
- Swamp Sclerophyll Forest on Coastal Floodplains.

➢ Threatened flora results include:

- Ten threatened flora species were assessed as having suitable and/or sub-optimal habitat within the subject site. These species were: *Allocasuarina defungens, Amorphospermum whitei, Chamaesyce psammogeton, Eleocharis tetrquetra, Lindsaea incisa, Phaius australis, Quassia* sp. (Moonee Creek), *Senna acclinis, Sophora tomentosa* and *Thesium australe*.
- At request of a Coffs Harbour City Council officer, targeted surveys for *Diuris* sp. aff. *chrysantha* (Byron Bay) were undertaken. Specimens similar were found and positively identified by royal Botanic Gardens as *Diuris* sp. aff. *chrysantha* (North Coast), rather than the threatened Byron Bay species.
- No threatened flora species was found during targeted field surveys.

➢ Seven threatened fauna species were found:

- Wallum Froglet (*Crinia tinnula*);
- Black-necked Stork (*Ephippiorhynchus asiaticus*);
- Osprey (*Pandion haliaetus*);
- Glossy Glack-Cockatoo (*Calyptorhynchus lathami*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

➢ No threatened flora species were identified.

➢ The proposed development includes use of 27.8 ha as part of the proposed development footprint and 20.7 ha will be retained as conservation areas.

- An Ecological Site Management Strategy was proposed to be put in place to manage and protect the EEC and areas including habitat for Threatened Fauna Species.

ii. Identified Gaps in Information

Diuris sp. aff. *chrisantha* (Byron Bay Diuris) is currently listed as Endangered under the TSC Act.

2.2.4 Sainty and Associates (2006)

The Flora Constraints Analysis for Sandy Beach North (Lot 22 DP 1070182) was undertaken by Sainty and Associates Pty Ltd in September 2006. The Sainty report was commissioned by the then Department of Planning (DoP) for independent evaluation of the Concept Plan and its implications for flora and fauna for the site. The report concluded that the majority of vegetation on the subject site comprised one or more endangered ecological communities (**Figure 2.1**) yet no plot survey data for the determination, and demarcation, of the vegetation types were offered.

The Sainty report was based upon a limited site inspection, no vegetation plots and no targeted surveys for threatened flora. The report does not have a methodology section and the site descriptions provided appear to be subjectively attained through traversing the site and delineating community types by canopy species.

The vegetation classification maps of Councils Draft Vegetation Conservation Strategy that the Sainty report relies heavily upon do not correspond to the vegetation actually present on the site (refer to Chapter 4). The description of the large vegetated area along the western edge of the site parallel to the Pacific Highway is a key example of this oversight, where the lack of plot data in the report lead to incorrect determination of the number and type of communities present. Despite lacking field data upon which to base conclusions, the Sainty Report stated that the entire site was largely vegetated by EECs of differing disturbance history - “The majority of the coastal floodplain west and south of the Hearnes Lake estuary supports swamp sclerophyll forest and woodland dominated principally by Broad-leaved Paperbark (*Melaleuca quinquenervia*) with scatted Swamp Mahogany (*Eucalyptus robusta*) and copses of Swamp Oak (*Casuarina glauca*). Much of this floodplain vegetation is in very poor condition due to prior land use practices”.

The Sainty report also provided recommendations for the use, and width, of buffers around significant vegetation and fauna habitats such as migratory waders habitats (**Figure 2.2**). The report does not utilize any site specific surveys or assessment of proposed impact mitigation measures in their determination of the arbitrary buffer widths stated. So the buffer widths have not been determined on the basis of specific site characteristics including site zoning, they do not incorporate any scientific assessment or justification, fail to incorporate any provision or consideration of ongoing management responsibilities and have not undertaken an appropriate assessment in relation to the requirements of the EP&A Act.

Surveys of the site commissioned by the then proponent for the Concept Plan entailed plot based assessment of plant communities and vegetation mapping. The mapping provided in The Conacher Environmental Group (2008) mapped two EECs on parts but not all of the subject land. The EECs were not mapped across much of the then proposed stages 5 and 6 of the Concept Plan (**Figure 2.3**). The reports reviewed indicate that the subject site contains a range of coastal vegetation communities including estuarine and freshwater sedgelands/wetlands, coastal wet heaths, and Swamp Forests, although there appears to be no consistency in classification. The Conacher Environmental Group (2008) lists two Endangered Ecological Communities under the TSC Act as occurring within the subject site, while other studies do not make mention of the occurrence of EECs. None of the reports make mention of ecological communities listed under the EPBC Act.

Figure 2.1. Vegetation Communities of the Subject Site (Sainty, 2006)

Figure 2.2. Constraints Map (Sainty, 2006)

Legend

- Subject Site
- Not Approved
- Approved subject to the provision of an offset

Original Development Stages

- Stage 1
- Stage 2
- Stage 3
- Stage 4
- Stage 5
- Stage 6
- Road

Image Source:
Image © NearMap
(dated 2-05-2017)

Data Source:
Sainty and Associates Pty Ltd (2006).
Environmental Constraints Analysis
Lot 22 DP 1090182, Pacific Highway,
Sandy Beach North.

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 50 100 150 m

I:\...\17073\Figures\RP1\20170825\Figure 2.3. Original Development Stages

Figure 2.3. Original Proposed Development Stages

Chapter 3

Methods: Flora and Vegetation Communities Assessment

3.1 Database Analysis

Database analysis was conducted for the locality using both the NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife (OEH 2017a) and the Commonwealth Department of the Environment and Energy (DoEE) Protected Matters Search Tool (DoEE 2017). The locality is defined as the area within a 5 km radius of the subject site. The Atlas of NSW Wildlife Database search was used to generate records of threatened flora species listed under the TSC Act within the locality of the subject site. The Protected Matters Search Tool generated a list of Matters of National Environmental Significance listed under the EPBC Act potentially occurring within the locality of the subject site. The lists generated from these databases were reviewed against available knowledge of the subject site (i.e. existing reports reviewed in Chapter 2), in conjunction with the abundance, distribution and age of records, to ascertain the likelihood of occurrence of threatened species within the subject site. The PlantNET (Botanic Gardens Trust 2017) database was also used to search for rare or threatened Australian plants (ROTAP) within a 5 km radius of the subject site.

3.2 Flora Survey

Flora surveys were undertaken within the subject site by Cumberland Ecology between 30 May 2017 and 2 June 2017 by Cumberland Ecology ecologists Dr Trevor Meers and Dr Adriana Corana Mothe. Surveys included vegetation mapping, plot survey and targeted threatened flora searches. Further details of each of the survey methods are provided below.

All vascular plants recorded or collected were identified using keys and nomenclature provided in Flora of New South Wales (Harden 1990, 1991, 1992, 1993). Where known, taxonomic and nomenclatural changes have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2017).

3.2.1 Vegetation Mapping

Vegetation Mapping was undertaken to a fine scale, consistent with vegetation classification detailed in the Development of a Fine-scale Vegetation Map for the Coffs Harbour Local Government Area (OEH 2012) (Vegetation Mapping for the Coffs Harbour LGA). This mapping was undertaken in a four step process:

- Walk through the entire subject site to determine the vegetation associations within the subject site;
- Review of the noted vegetation associations against descriptions in Vegetation Mapping for the Coffs Harbour LGA, to determine the best fit vegetation communities;
- Detailed plot surveys in each vegetation community/vegetation polygon noted (further details of the plot survey and site stratification are provided below); and
- Mark up of boundaries between vegetation units based on field observations and aerial imagery.
- Vegetation Communities within the Vegetation Mapping for the Coffs Harbour LGA were compared against Plant Community Types (PCTs) within the NSW Vegetation Classification and Assessment module of the NSW Vegetation Information System.

3.2.2 Credit Calculations

i. Plot Survey

A total of 33 detailed plots were surveyed, ensuring that each mapped vegetation polygon contained at least one detailed plot. Where there was a variation in the condition or floristics within the same polygon additional plots were surveyed.

Assessment of native vegetation (ecosystem credits) within each plot was undertaken in accordance with the latest methods of the BC Act, using the following methods:

- BC Act plots for full floristic metrics as required to determine vegetation community (data not entered into the Credit Calculator);
- Plot and transect survey to determine the site value score (data to be entered into the Credit Calculator – if applicable).

The BioBanking Assessment Methodology (BBAM) utilises ecological communities as a surrogate for general biodiversity values. They are referred to as Plant Community Types (PCTs). The names used for PCTs in a BioBanking Assessment are selected from the NSW Vegetation Information System (VIS) Classification database compiled by OEH.

For the purposes of assigning PCTs to the native vegetation communities present within the subject site, a full floristic plot (20 m x 20 m) was conducted in accordance with Section 5.2.1.7 of the BBAM (OEH, 2014a). Plot and transect surveys (20m x 50 m area) were also conducted in accordance within Section 5.3.2 of the BBAM for the purposes of determining site value scores (OEH, 2014a). The location of vegetation plots is provided in **Figure 3.1.**

3.2.3 Threatened Flora Species Survey

Targeted threatened flora searches via random meanders were undertaken for threatened flora species known from the locality and considered to have potential to occur. Minimum requirements for survey are for two observers to conduct a 30 minute random meander within a stratification unit (habitat type) (DEC (NSW), 2004). The number of 30 minute searches is dependent on area and is equivalent to at least:

- One 30 minute search per <2 ha;
- 2 x 30 minute searches per 2-50 ha;
- 3 x 30 minute searches per 51-250 ha; and
- 5 x 30 minute searches per 251-500 ha.

Given the species identified in searches and the habitat types observed within the subject site, searches were concentrated on areas considered likely to contained threatened fauna species. These incuded:

- Littoral rainforest or areas containing littoral rainforest species in the mid-layer/shrub layer; and
- Wet heath/wallum heath, or areas with a heathy/shrubby undertorey.

3.3 Verification of Listed Ecological Communities

3.3.1 Threatened Species Conservation Act 1995

The vegetation communities identified in Vegetation Mapping for the Coffs Harbour LGA, were assessed against Endangered Ecological Communities (EECs) listed under the TSC Act. Vegetation communities were assessed against final determinations for potentially occurring EECs available from OEH (Adam 2011a-d) as well as listing advices and conservation advice prepared by the Department of Environment and Climate Change. For EECs considered to occur on the coastal floodplain, the 100 year flood level (as defined by Coffs Harbour City Council Flood Mapping) was used to define the upper extent of these communities.

3.3.2 Environment Protection and Biodiversity Conservation Act 1999

The vegetation communities identified in Vegetation Mapping for the Coffs Harbour LGA, were assessed against Threatened Ecological Communities (TECs) listed under the EPBC Act. Vegetation communities were assessed against listing advices or SPRAT Profiles for potentially occurring TECs available from the DoEE.

3.4 Limitations

The vascular flora of the locality is well known based upon a sizeable database of past records and various published reports. The surveys by Cumberland Ecology added to the existing database and helped to provide a clear indication of the likelihood that various species occur, or are likely to occur within the subject site. The data obtained from database assessment and surveys of the subject site provided an appropriate level of information to support this assessment.

The weather conditions at the time of the flora surveys were generally favourable for plant growth and production of features required for identification of most species. Shrubs, herbs and creepers were readily identifiable in most instances. However, it is expected that not all flora species present would have been recorded during surveys. In particular spring flowering orchids or geophytes were not likely to be present, and some summer flowering grasses may not have had the seed heads or flowers required for identification.

Despite this, it is considered that sufficient information has been collected to assess the conservation significance of the flora, condition and viability of vegetation communities. An assessment of the likelihood of occurrence of threatened flora species recorded within the locality of the subject site in the database searches was undertaken to supplement the flora survey. However, should the presence of *Diuris* sp. aff. *chrysantha* (Byron Bay) require further determination (this species is not visible above ground in summer or autumn), surveys for this species will need to be undertaken in spring (plants emerge in late winter).

Chapter 4

Results: Flora and Vegetation Communities Assessment

4.1 Vegetation Communities

A total of 14 Vegetation Communities as described in the Vegetation Mapping for the Coffs Harbour LGA were identified within the subject area. These occur across the following broad vegetation formations as detailed in the Vegetation Mapping for the Coffs Harbour LGA:

- Rainforest (littoral rainforest);
- Dry sclerophyll forest;
- Freshwater wetlands;
- Forested wetlands; and
- Saline wetlands (mangroves and saltmarsh).

These 14 Vegetation Communities are detailed in **Table 4.1,** which includes full name and code according to the Vegetation Mapping for the Coffs Harbour LGA, area in hectares, a brief description including dominant species, details of the soil/land form where the Vegetation Community was observed, and a brief overview of the general condition. A map showing the distribution of these Vegetation Communities is provided as **Figure 4.1.**

Nearly all Vegetation Communities have been disturbed through past clearing and grazing. This has predominantly resulted in the removal of the shrub layer and replacement of the ground layer by exotic grass species (mostly *Paspalum* species) to varying extents. For example several Vegetation Communities that previously would have had a ground layer dominated by sedges now contain a mixture of sedges and exotic grasses to varying extents. In most areas the canopy remains intact despite modification of the understorey by grazing. Regrowth also appears to have occurred in some areas, and as such the extent of vegetation is more extensive than noted in previous assessments. Despite this, for the majority of Vegetation Communities little regeneration of canopy species was observed, most likely due to grazing. Two Vegetation Communities were observed to also be present in a substantially modified form as a result of clearing, now existing as scattered trees with an open woodland structure (derived open woodlands), with the understorey converted to exotic pasture. Several areas have been entirely cleared and have been replaced by exotic pasture grasses mixed with a smaller component of native grasses and forbs. Such areas contain the occassional isolated tree, mostly of Broad-leaved Paperbark (*Melaleuca quinquenervia*).

Table 4.1 Summary of Vegetation Communities (as per the Vegetation Mapping for the Coffs Harbour LGA) within the subject area

Code and Area (ha)	Vegetation Community	Structure and Dominant Species	Land-form/soils	General Condition
CH_RF07 (0.12 ha)	Coastal Exposed Dune Littoral Rainforest	Littoral rainforest dominated by *Ficus rubinigosa* and *Endiandra sieberi*. Abundant vines such as *Cissus sterculiifolia* and *Flagelleria indica*. Abundant understorey shrubs such as *Syzygium oleosum* and *Acmena smithii*	Occurs on sandy soil on the lee side of coastal sand dunes	Small area with some weed invasion, including garden escapes
CH_DOF06 (2.16 ha)	Lowlands Swamp Box - Paperbark -Red Gum Dry Forest	Open forest to woodland *of Eucalyptus tereticornis* and *Melaleuca quinquenervia*, with *Lophostemon suaveolens* in sub-canopy. Ground layer includes *Lomandra longifolia, Pteridium esculentum* and *Hibbertia scandens*	Occurs on sandy loams, on slight rises on the coastal floodplain	Ground layer largely replaced by exotic pasture grasses
CH_DOF06 (1.09 ha)	Lowlands Swamp Box - Paperbark -Red Gum Dry Forest – Derived Open Woodland	Open woodland of *Eucalyptus tereticornis* and *Melaleuca quinquenervia* over a ground layer of exotic grasses	Occurs on sandy loams, on slight rises on the coastal floodplain	Consists of scattered trees, with groundlayer largely replaced by exotic grasses
CH_DOF08 (1.43 ha)	Coastal Sand Bloodwood-Banksia Forest	Open forest to woodland of *Corymbia intermedia* and *Banksia integrifolia*. Mid layer includes littoral rainforest species such as *Cupaniopsis anacardiodes* and *Acronychia imperforata*	Occurs on sand on hind-dune	Appears to be good condition,but has open ground layer due to grazing
CH_FW03 (6.46 ha)	Coastal Wallum Baumea Sedgeland	Sedgeland of *Baumea* species and *Cyperus* species, with a small shrub layer of *Callistemon pachyphyllus* in some areas. *Melaleuca quinquinervia* occurs as a scattered emergent, often as a shrub or small tree. Some areas are open sedgelands devoid of trees, which may be a result of past clearing.	Occurs on waterlogged areas often with peaty soil	Some areas in good condition. Other areas extensively cleared and grazed, resulting in reduction on sedge cover in the ground layer. Regrowth of *Melaleuca*

Table 4.1 Summary of Vegetation Communities (as per the Vegetation Mapping for the Coffs Harbour LGA) within the subject area

Code and Area (ha)	Vegetation Community	Structure and Dominant Species	Land-form/soils	General Condition
				quinquenervia is occurring
CH_FW05 (0.95 ha)	Coastal Wallum Paperbark Wet Shrubland	Wallum heath containing *Allocasuarina littoralis, Notolaea ovata* and species of *Banksia, Melaleuca, Leptospermum, Leucopogon, Pultenaea* and *Hibbertia*.	Occurs on pale grey clays on the northern edge of Hearnes Lake	Has been extensively cleared, now restricted to a narrow strip around the northern edge of Hearns Lake
CH_FrW01 (3.81 ha)	Coastal Paperbark Swamp Oak Floodplain Forest	Open forest of *Melaleuca quinquenervia* and *Casuarina glauca*. *Parsonsia straminaea* climbs into the subcanopy. *Blechnum indicum* and sedges dominate the ground-layer	Occurs on swampy areas with humic soils	Some areas in good condition. Other areas extensively grazed, while canopy is intact, ferns and sedges in the groundlayer have been replaced by exotic grasses
CH_FrW02 (3.36 ha)	Coastal Swamp Mahogany Forest	Open forest containing *Corymbia intermedia, Eucalyptus robusta, Eucalyptus resinifera, Melaleuca quinquenervia* and *Lophostemon suaveolens*. Mid layer includes *Eleocarpus reticulatus* and *Acronychia imperforata.*	Occurs on flat areas between the hind-dune and Hearnes Lake on sandy soils	Generally in good condition
CH_FrW04 (4.89 ha)	Coastal Paperbark Sedgeland Dominated Forest	Open forest of *Eucalyptus tereticornis, Melaleuca quinquenerva* and *Casuarina glauca.* Groundlayer contains *Gahnia clarkei, Baumea* species and other sedges	Occurs on low-lying areas on sandy loam soils, some areas likely to undergo temporary inundation	Ground layer of sedges has largely be replaced by exotic pasture grasses
CH_FrW04	Coastal Paperbark	Open woodland *of Eucalyptus tereticornis, Melaleuca*	Occurs on low-lying areas on	Consists of scattered trees,

Table 4.1 Summary of Vegetation Communities (as per the Vegetation Mapping for the Coffs Harbour LGA) within the subject area

Code and Area (ha)	Vegetation Community	Structure and Dominant Species	Land-form/soils	General Condition
(4.89 ha)	Sedgeland Dominated Forest – Derived Open Woodland	*quinquenervia* and *Casuarina glauca* over a ground layer of exotic grasses	sandy loam soils, some areas likely to undergo temporary inundation	with groundlayer largely replaced by exotic grasses
CH_FrW05 (1.88 ha)	Coastal Paperbark Swamp Box Littoral Forest	Open forest containing *Melaleuca quinquenervia, Casuarina glauca, Lophostemon suaveolens* and *Banksia integrifolia*. Littoral rainforest species occur in the subcanopy and ocassionally enter the canopy.	Low-lying areas on sandy soil, behind sand dunes	Canopy intact, but groundlayer has been largely replaced by exotic grasses
CH_FrW09 (11.30 ha)	Coastal Wallum Swamp Mahogany Siebers Paperbark Forest	Woodland containing *Eucalyptus robusta, Melaleuca quinquenervia, Lophostemon suaveolens* and *Angophora costata*, over a subcanopy of *Melaleuca sieberi*. Ground layer includes *Ptilothrix deusta* and *Entolasia* species	Level plains near Pacific Motorway on grey clay soils	Some areas contain a dense shrub layer, but in other places the shrub layer has been removed, but canopy remains intact. The ground layer is still largely dominated by native grasses
CH_FrW10 (2.02 ha)	Swamp Oak Forested Wetland	Open forest of *Casuarina glauca* with *Parsonsia straminaea* climbing into the subcanopy. *Gahnia clarkei* is prominent in the groundlayer	Occurs adjacent to artificial drainage channels that drain into Hearns Lake	This community has resulted from the construction of artificial drainage channels, but condition is good overall
CH_FrW11 (1.35 ha)	Estuarine Paperbark Twig-rush Forest	Tall shrubland of *Melaleuca quinquenervia* and occassionally *Casuarina glauca* over a dense ground layer of *Baumea juncea*	Occurs on brackish humic soils around the fringes of	In good condition overall, but occassionally impacted

Table 4.1 Summary of Vegetation Communities (as per the Vegetation Mapping for the Coffs Harbour LGA) within the subject area

Code and Area (ha)	Vegetation Community	Structure and Dominant Species	Land-form/soils	General Condition
			Hearns lake, beyond the tidal influence	by cattle
CH_SW01 (0.09 ha)	Estuarine Mangrove Forest	Closed shrubland dominated by *Avicennia marina. Phragmites australis* also occurs as does *Baumea juncea* at the edge of the community	Occurs in tidal areas in a narrow band around the northern shore of Hearnes Lake	Occurs as a very narrow fringe, but overall in good condition
CH_SW02 (1.35 ha)	Estuarine Twig Rush Saltmarsh	Sedgeland almost entirely dominated by *Baumea juncea*. *Casuarina glauca* and/or *Melaleuca quinquenervia* rarely occur as emergent shrubs	Occurs around the fringes of Hearnes lake, sometimes into water, soils are brackish humic soils	In good condition, but appears to have been occassionally impacted by cattle
No code (3.11 ha)	Derived Grasslands	Derived mixed exotic/native grasslands. Typically dominated by *Paspalum* sp. but may include native grasses such as *Entolasia* sp., *Oplismenus* sp., *Sporobolus elongatus* and *Microleana stipoides.* Sparsely scattered trees of *Melaleuca quinquenervia* occassionally occur	Clays or sand depending on location	Poor condition, largely dominated by exotic grasses, due to past clearing and grazing

The 14 Vegetation Communities listed in the Vegetation Mapping for the Coffs Harbour LGA are equivalent to Plant Community Types (PCTs) listed in the NSW Vegetation Classification and Assessment module of the NSW Vegetation Information System. The equivalent PCTs are shown in **Table 4.2** below.

Table 4.2 Equivalent Plant Community Types under the NSW Vegetation Classification

Coffs Harbour LGA Vegetation Community	Equivalent Plant Community Type(s)
CH_RF07 Coastal Exposed Dune Littoral Rainforest	Tuckeroo – Bird's Eye Alectryon – Beach Acronychia Littoral Rainforests of the NSW North Coast and South Eastern Queensland Bioregions (NSW75-49)
CH_DOF06 Lowlands Swamp Box - Paperbark -Red Gum Dry Forest	Forest Red Gum – Swamp Box – Prickly-leaved Tea-tree shrubby open forest on floodplains of the lower Richmond River valley, South Eastern Queensland Bioregion (NSW700-66)/Forest Red Gum – Swamp Box shrubby open forest on floodplain edges in the lower Richmond River valley, South Eastern Queensland Bioregion (NSW700-488)
CH_DOF08 Coastal Sand Bloodwood-Banksia Forest	Pink Bloodwood – Brush Box open forest on coastal dunes and sand plains, South Eastern Queensland Bioregion and NSW North Coast Bioregion (NSW700-467)
CH_FW03 Coastal Wallum Baumea Sedgeland	Soft Twig Rush - Swamp Water Fern - Common Reed swamp and marshland on coastal sand and alluvial floodplain, NSW North Coast Bioregion (NSW1000-1950)
CH_FW05 Coastal Wallum Paperbark Wet Shrubland	Swamp Mahogany – Sieber's Paperbark (*Melaleuca sieberi*) shrub/sedge swamp forest on low lying sandy areas, South Eastern Queensland Bioregion and NSW North Coast Bioregion (NSW700-334)
CH_FrW01 Coastal Paperbark Swamp Oak Floodplain Forest	Red-fruit Saw-sedge – Coral Fern Sedgeland of North Coast Wallum duneslopes and open depressions, South Eastern Queensland Bioregion and NSW North Coast Bioregion (NSW888-10)
CH_FrW02 Coastal Swamp Mahogany Forest	Swamp Mahogany – Willow Bottlebrush – Broad-leaved Paperbark forested wetland of the Coffs Harbour area, NSW North Coast Bioregion (NSW700-477)
CH_FrW04 Coastal Paperbark Sedgeland Dominated Forest	Giant Sedge sedgeland of sandy alluvium of the lower and mid-north coasts, South Eastern Queensland Bioregion and NSW North Coast Bioregion (NSW700-643)
CH_FrW05 Coastal Paperbark Swamp Box Littoral Forest	Broad-leaved Paperbark – Brush Box – Swamp Box swamp sclerophyll forest on clays of coastal plains and sub-coastal hills of the NSW North Coast Bioregion and the South Eastern Queensland Bioregion (NSW700-476)
CH_FrW09 Coastal Wallum Swamp	Swamp Mahogany – *Melaleuca sieberi* shrub/sedge swamp

Table 4.2 Equivalent Plant Community Types under the NSW Vegetation Classification

Coffs Harbour LGA Vegetation Community	Equivalent Plant Community Type(s)
Mahogany Siebers Paperbark Forest	forest on low lying sandy areas, South Eastern Queensland Bioregion and NSW North Coast Bioregion (NSW700-334)
CH_FrW10 Swamp Oak Forested Wetland	Swamp Oak – Sea Rush swamp forest on saline coastal swamps and flats of the South Eastern Queensland Bioregion and NSW North Coast Bioregion (NSW700-681)
CH_FrW11 Estuarine Paperbark Twig-rush Forest	Broad-leaved Paperbark – Bare Twig Rush swamp sclerophyll open forest or shrubland of coastal swamps in the NSW North Coast Bioregion and the South Eastern Queensland Bioregion (NSW1000-1936)
CH_SW01 Estuarine Mangrove Forest	Grey Mangrove – River Mangrove low open or closed forest or shrubland of intertidal flats, NSW North Coast Bioregion and the South Eastern Queensland Bioregion (NSW700-686)
CH_SW02 Estuarine Twig Rush Saltmarsh	Twig Rush saltmarsh of estuaries, NSW North Coast Bioregion and South Eastern Queensland Bioregion (NSW1000-1937)

4.2 Threatened Ecological Communities listed under the *Environment Protection and Biodiversity Conservation Act 1999*

Areas consistent with two TECs listed under the EPBC Act were found to be present within the subject site. These TECs, their listing status, and the area covered by each, are:

- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (Littoral Rainforest and Coastal Vine Thickets) (listed as Critically Endangered) (0.12 ha); and
- Subtropical and Temperate Coastal Saltmarsh (Listed as Vulnerable) (4.08 ha).

A detailed list of communities making up these EECs together with justification for inclusion in these listings is provided in the following sections. A map showing the distribution of each EEC is provided as **Figure 4.3.**

4.2.1 Littoral Rainforest and Coastal Vine Thickets of Eastern Australia

The Littoral Rainforest and Coastal Vine Thickets TEC is represented by a single Vegetation Community:

- CH_RF07 Coastal Exposed Dune Littoral Rainforest

According the listing advice for this TEC (Threatened Species Scientific Committee 2008) this community:

- the minimum size of a patch needs to be 0.1 ha; and
- the cover of transformer weed species is 70% or less; and
- the patch must have:
    - at least 25% of the native plant species diversity characteristic of this ecological community in that bioregion; or
    - at least 30% canopy cover of one rainforest canopy (either tree or shrub) species (excluding *Banksia* and *Eucalyptus* species that may be part of the ecological community).

The small area (0.12 ha) of CH_RF07 continues beyond the subject area onto adjacent sand dunes, and as such meets this minimum area requirement. Only one transformer weed (*Asparagus plumosus*) had significant cover, but at 10% cover this patch still meets the listing criteria. While the Vegetation Community falls well short of the required species richness, the canopy cover of rainforest species for this Vegetation Community was 80% and as such this meets the criteria for this TEC.

Three other Vegetation Communities; CH_FrW05 Coastal Paperbark Swamp Box Littoral Forest, CH_DOF08 Coastal Sand Bloodwood-Banksia Forest and CH_FrW02 Coastal Swamp Mahogany Forest, contain littoral rainforest species in the shrub layer, or occassionally in the canopy. The highest cover of rainforest species in any layer for these Vegetation Communities was 10% within the canopy of CH_FrW05. As such these Vegetation Communities are not consided to be Coastal Exposed Dune Littoral Rainforest.

4.2.2 Subtropical and Temperate Coastal Saltmarsh

The Subtropical and Temperate Coastal Saltmarsh TEC is represented by two Vegetation Communities:

- CH_SW02 Estuarine Twig Rush Saltmarsh; and
- CH_FrW11 Estuarine Paperbark Twig Rush Forest

The conservation advice (Threatened Species Scientific Committee 2013) for Subtropical and Temperate Coastal Saltmarsh states that where the ecological community intergrades with an adjacent community, such as seagrass, mangroves, paperbark (*Melaleuca* spp.) and *Casuarina* spp. swamp, or freshwater marshes, then in this ecotone region, if 50% or more of the groundcover/understorey is comprised of coastal saltmarsh vegetation it is considered to be the ecological community. Although CH_FrW11 contained emergent *Melaleuca quinquenervia* and/or *Casuarina glauca*, at most locations ≥50% of the ground cover was dominated by *Baumea juncea,* and as such this community is included in the Subtropical and Temperate Coastal Saltmarsh TEC. However CH_SW01 Estuarine Mangrove Forest

contained ≤50% of the ground layer of *Baumea juncea* (the ground layer was mostly exposed mud or water), and as such has been excluded from this TEC.

4.3 Endangered Ecological Communities under the *Threatened Species Conservation Act 1995*

A total of five EECs listed under the TSC Act were identified in the subject site. These are, (with area in hectares shown):

- Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions (Littoral Rainforest) (0.12 ha);
- Subtropical Coastal Floodplain Forest of the NSW North Coast Bioregions (Subtropical Coastal Floodplain Forest) (1.78 ha);
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (Swamp Sclerophyll Forest) (8.56 ha);
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (Swamp Oak Floodplain Forest) (1.40 ha); and
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions (Coastal Saltmarsh) (2.81 ha).

A detailed list of Vegetation Communities making up these EECs together with justification for inclusion in these listings is provided in the following sections. A map showing the distribution of each EEC is provided as **Figure 4.2**.

4.3.1 Littoral Rainforest

The Littoral Rainforest EEC is represented by a single Vegetation Community:

- CH_RF07 Coastal Exposed Dune Littoral Rainforest

Littoral Rainforest is generally a closed forest, the structure and composition of which is strongly influenced by proximity to the ocean. The plant species in this EEC are predominantly rainforest species with evergreen mesic or coriaceous leaves (Adam 2011a). Within the subject site this Vegetation Community consisted of a small patch (0.12 ha) dominated by a large Rusty Fig (*Ficus rubinigosa*) together with Hard Corkwood (*Endiandra sieberi*), over a diverse shrub layer of littoral rainforest species. There was also a diversity of vine species, some of which climbed into the canopy.

Three other Vegetation Communities; CH_FrW05 Coastal Paperbark Swamp Box Littoral Forest, CH_DOF08 Coastal Sand Bloodwood-Banksia Forest and CH_FrW02 Coastal Swamp Mahogany Forest, contain littoral rainforest species in the shrub layer, or occassionally in the canopy, but do not meet the definition of the Littoral Rainforest EEC. This is because sclerophyllous species (species of *Banksia, Casuarina, Corymbia,*

Eucayptus, Lophostemon and *Melaleuca*), dominate the canopy (i.e. are not just emergents) in these communities (Adam 2011a).

4.3.2 Subtropical Coastal Floodplain Forest

The Subtropical Coastal Floodplain Forest is represented by one Vegetation Community:

- CH_DOF06 Lowlands Swamp Box – Paperbark - Red Gum Dry Forest.

The most widespread and abundant dominant trees in this EEC include Forest Red Gum (*Eucalyptus tereticornis*), Grey Ironbark (*E. siderophloia*), Pink Bloodwood (*Corymbia intermedia*) and, north of the Macleay floodplain Swamp Box (*Lophostemon suaveolens*) (Adam 2011b).

With the subject site CH_DOF06 formed an open forest to woodland dominated by *Eucalyptus tereticornis*, with occassional *Melaleuca quinquenervia.* CH_FrW04 also contains *Eucalyptus tereticornis*, as a minor component of the canopy, with *Melaleuca quinquenervia* and Swamp Oak (*Casuarina glauca*) dominant. Subtropical Coastal Floodplain Forest is considered to have a mixed eucalypt canopy, often with *Lophostemon suaveolens*; and have a relatively low abundance or sub-dominance of *Casuarina* and *Melaleuca* species; and a relatively low abundance of Swamp Mahogany (*Eucalyptus robusta*) (Adam 2011b). As such, only CH_DOF06 is included in this community, with CH_FrW04 is included in the Swamp Scleropyll Forest EEC.

This EEC is associated with clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces 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 (Adam 2011b). As such only areas of this vegetation community below the 100 year flood level (as defined by Coffs Harbour City Council Flood Mapping) are included in this EEC.

4.3.3 Swamp Sclerophyll Forest

The Swamp Sclerophyll Forest EEC is represented by eight Vegetation Communities:

- CH_FW04 Coastal Wallum Baumea Sedgeland;
- CH_FW05 Coastal Wallum Paperbark Wet Shrubland;
- CH_FrW01 Coastal Paperbark Swamp Oak Floodplain Forest;
- CH_FrW02 Coastal Swamp Mahogany Forest;
- CH_FrW04 Coastal Paperbark Sedgeland Dominated Forest;
- CH_FrW05 Coastal Paperbark Swamp Box Littoral Forest;
- CH_FrW09 Coastal Wallum Swamp Mahogany Sieber's Paperbark Open Forest; and

- CH_FrW11 Estuarine Paperbark Twig-rush Forest

These Vegetation Communities differ considerably in their structure and floristics, from *Eucalyptus robusta* and *Melaleuca quinquenervia* co-dominated forests, wallum heath/wet heath, to sedgelands with emergent *Melaleuca quinquenervia.* In nearly every community *Melaleuca quinquenervia* is present as a dominant or co-dominant species, varying in structure from a canopy tree to a shrub. According to the Final Determination (Adam 2011c), 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 tall reedland or sedgeland, where trees are very sparse or absent.

The ECC is restricted to floodplains, which 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 (Adam 2011c). As such only areas below the 100 flood level (as defined by Coffs Harbour City Council Flood Mapping) are included in this EEC. The soils within this EEC are usually waterlogged, stained black or dark grey with humus, and show little influence of saline ground water (Adam 2011c). Such soils include humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains (Adam 2011c). Such soils and land-forms are present within most of the communities forming this EEC, as detailed in **Table 4.1.**

According to the Final Determination (Adam 2011c) the most widespread and abundant dominant trees include *Eucalyptus robusta* and *Melaleuca quinquenervia*. Other trees may be scattered throughout at low abundance or may be locally common at few sites, including Willow Bottlebrush (*Callistemon salignus**),*** *Casuarina glauca*, Red Mahogany (*Eucalyptus resinifera* subsp. *hemilampra*), and *Lophostemon suaveolens*. A layer of small trees may be present, including Green Wattle *Acacia irrorata*, Lilly Pilly (*Acmena smithii*), Blueberry Ash (*Elaeocarpus reticulatus*), Cheese Tree (*Glochidion ferdinandi*). Shrubs include Sydney Golden Wattle (*Acacia longifolia*), Hop Bush (*Dodonaea triquetra*), Sandpaper Fig (*Ficus coronata*) and *Melaleuca* species. Occasional vines include Common Silkpod (*Parsonsia straminea*) and Snake Vine (*Stephania japonica*). The groundcover is composed of abundant sedges, ferns, forbs, and grasses including *Gahnia clarkei*, Bracken (*Pteridium esculentum*), Blue Flax Lily (*Dianella caerulea*), Native Violet (*Viola hederacea*), Spiny-headed Mat-rush (*Lomandra longifolia*), Bordered Panic (*Entolasia marginata*) and Blady Grass (*Imperata cylindrica*). On sites downslope of lithic substrates or with soils of clay-loam texture, species such as Black She-oak (*Allocasuarina littoralis*), *Banksia oblongifolia*, Hairpin Banksia (*Banksia spinulosa var. collina*), and *Ptilothrix deusta* may also be present in the understorey. The species listed above were found to be present within these communities to varying extent (refer to **Appendix A** for a full species list), indicating that much of the vegetation within the subject site is consistent with this EEC.

Two Vegetation Communities CH_FW04 and CH_FrW04 have undergone partial clearing reducing the canopy to scattered trees (derived woodland). It is noted in the final determination (Adam 2011c), that partial clearing may reduce the canopy of this EEC to scattered trees. In the case of CH_FW04 the natural structure of this Vegetation Community is a sedgeland with *Melaleuca quinquenervia* occurring as a scattered emergent. As such,

areas with canopy removed are still likely to be this EEC if the groundlayer is intact. While many sedges appear to have been removed by grazing in this community, native sedges, herbs and grasses still dominate the ground-layer with exotic species forming ≤10% of the ground layer. Derived Open Woodlands of CH_FrW04 been severely impacted by past clearing and grazing, flood mitigation and drainage works, weed invasion and adjacent urban development and in addtion to a reduction in the canopy, exotic species dominate 50% of the ground layer. Much of the Derived Open Woodland of CH_FrW04 occurs above the 1:100 year flood level, as as such only 0.13 ha is potentially Swamp Sclerophyll Forest EEC. Advice should be obtained from OEH as to at what level of degradation this community is no longer considered to be an example of the Swamp Sclerophyll Forest EEC.

4.3.4 Swamp Oak Floodplain Forest

The Swamp Oak Floodplain Forest is represented by a single Vegetation Community

- CH_FrW10 Swamp Oak Forested Wetland.

Within the subject site this Vegetation Community is restricted to the fringes of artificial drainage channels that drain from existing housing to Hearnes Lake. It is distinguished from other adjacent communities by the dominance of *Casuarina glauca,* with *Melaleuca quinquenervia* only occurring as isolated individuals. On the north coast of NSW, expansion of *Melaleuca quinquenervia* and *Casuarina glauca* into open floodplain swamps has been attributed to artificial drainage (Adam 2011d) and this may have occurred in the subject site since previous assessments.

This EEC is 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 (Adam 2011d). As such only areas of CH_FrW10 below the 100 year flood level (as defined by Coffs Harbour City Council Flood Mapping) are considered to be EEC. However CH_FrW10 occurs adjacent to artificial drainage lines, and as such the entirety of this Vegetation Community is likely to be prone to flooding during significant rainfall events.

4.3.5 Coastal Saltmarsh

The Coastal Saltmarsh EEC is represented by two Vegetation Communities:

- CH_SW01 Estuarine Mangrove Forest; and
- CH_SW02 Estuarine Twig Rush Saltmarsh

Twig Rush (*Baumea juncea)* is the dominant species within this EEC within the subject site. This species is considered an upper saltmarsh species (Hughes 2011).

While areas dominated by mangrove are not typically part of the Coastal Saltmarsh EEC, occasional scattered mature Grey Mangrove (*Avicennia marina*) trees do occur through saltmarsh at some sites, and *Avicennia* seedlings may occur throughout saltmarsh. In

brackish areas dense stands of tall reeds (*Phragmites australis*, *Bulboschoenus* spp., *Schoenoplectus* spp., *Typha* spp.) may occur as part of the community (Hughes 2011). Within CH_SW01 Estuarine Mangrove Forest, *Avicenna marina* occurred as a narrow fringe (typically a single row of trees) adjacent to *Baumea juncea*, often with *Phragmites australis*. As such, we have included this community as part of the Coastal Saltmarsh EEC.

4.4 Plot Survey

4.4.1 Stratification

The number of plots in each Vegetation Community is shown in **Table 4.3** below. This shows that the largest area to be represented by a single plot was 3.81 ha for CH_FrW01 Coastal Paperbark Swamp Oak Floodplain Forest. In contrast, CH_FrW11 Estuarine Paperbark Twig-rush Forest is over represented with four plots for just 1.35 ha. This Vegetation Community occurred in several small patches along the edge of Hearnes Lake, and as such four polygons of this Vegetation Community were sampled. The average plot to area ratio was one plot for every 1.42 ha of vegetation.

Table 4.3 Number of plots for each Vegetation Community with area in hectares shown

Vegetation Community	Area (ha)	Plots	No. of Plots per Ha
CH_RF07 Coastal Exposed Dune Littoral Rainforest	0.12	Q8	0.12
CH_DOF06 Lowlands Swamp Box - Paperbark-Red Gum Dry Forest	2.16	Q15	2.16
CH_DOF06 Lowlands Swamp Box - Paperbark-Red Gum Dry Forest - derived open woodland	1.09	Q13	1.09
CH_DOF08 Coastal Sand Bloodwood-Banksia Forest	1.43	Q4	1.44
CH_FW04 Coastal Wallum Baumea Wetland	6.46	Q14, Q17, Q20, Q22	1.61
CH_FW05 Coastal Wallum Paperbark Wet Shrubland	0.95	Q29, Q30	0.47
CH_FrW01 Coastal Paperbark Swamp Oak Floodplain Forest	3.81	Q10	3.81
CH_FrW02 Coastal Swamp Mahogany Forest	3.36	Q3, Q7	1.12
CH_FrW04 Coastal Paperbark Sedgeland Dominated Forest - derived open woodland	1.92	Q12	1.92
CH_FrW04_Coastal Paperbark Sedgeland Dominated Forest	4.89	Q5, Q11, Q16, Q18	1.22
CH_FrW05 Coastal Paperbark Swamp Box Littoral Forest	1.88	Q6, Q9, Q33	0.63

Table 4.3 Number of plots for each Vegetation Community with area in hectares shown

Vegetation Community	Area (ha)	Plots	No. of Plots per Ha
CH_FrW09 Coastal Wallum Swamp Mahogany Siebers Paperbark Forest	11.30	Q24, Q27, Q32	3.76
CH_FrW10 Swamp Oak Forested Wetland	2.02	Q23	2.02
CH_FrW11 Estuarine Paperbark Twig-rush Forest	1.35	Q1, Q21, Q28, Q31	0.34
CH_SW01 Estuarine Mangrove Forest	0.09	Q26	0.09
CH_SW02 Estuarine Twig Rush Saltmarsh	2.73	Q2, Q19, Q25	0.91
Derived mixed exotic/native grassland	3.11	no plots	-
Total	**46.38**	**33 plots**	**1.42 (average)**

4.5 Flora Species

4.5.1 General Flora

A total of 234 plant species were recorded within the subject site. This included 176 indigenous native species and 56 introduced species including garden escapes. The dominant families were grasses (Poaceae) (34 species), sedges (Cyperaceae) (22 species) and myrtles (Myrtaceae) (18 species).

The full list of flora species within the subject site is provided in **Appendix A**.

4.5.2 Threatened Flora

A total of 20 threatened species listed under the TSC Act and/or the EPBC Act were identified as having the potential to occur within the subject site. A further three ROTAP species were identifed from a search of the Plantnet database as having the potential to occur. A further two species were identified as having the potential to occur base on previous reports/local knowledge.

No threatened species were identified within the subject site. However as noted in **Section 3.4,** conditions were not suitable for the detection of most spring flowering terrestrial orchid species and no terrestrial orchid species were detected during the current survey. Three terrestrial orchid species are unlikely to have been detectable, but have limited if any records in the locality. These species are:

- *Diuris* sp. aff. *chrysantha* (Byron Bay) (Endangered under TSC Act, with no local records)
- *Cryptostylis hunteriana* (Vulnerable under the EPBC Act with no local records); and
- *Corybas undulatus* (ROTAP with one local record);

Searches of these species would need to be undertaken in spring when plants are more likely to be detectable.

Clarification is also required regarding the taxomic relationship between the Endangered (TSC Act status) Byron Bay Diuris (*Diuris* sp. aff. *chrysantha* (Byron Bay)) and *Diuris* sp. aff. *chrysantha* (North Coast). Previous targeted surveys (Conacher Environmental Group 2008) for *Diuris* sp. aff. *chrysantha* (Byron Bay) deteced specimens that were positively identified by royal Botanic Gardens as the latter species within the subject site.

A further four threatened plant species were considered to have to potential to occur with an assessment of the likelihood of occurance of all threatened species identified provided in **Appendix B**. One additional ROTAP species (*Olearia stillwelliae*) is also considered to have the possibility of occurring, as there is a record to the north of Hearns Lake. This species was not detected during surveys. The four threatened species were also not detected, and an assessment of each provided below.

i. Acronychia littoralis

Scented Acronychia (*Acronychia littoralis*) (Endangered under the TSC Act and EPBC Act) occurs sporadically in coastal areas (<2 km from the sea) in sub-littoral rainforest, usually in transitional zones between littoral rainforest and swamp sclerophyll forest, littoral and coastal cypress pine communities or on the margin of littoral forest and cleared land. This species is considered to be of hybrid origin with parents including *A. imperforata, A. wilcoxiana* and *A. oblongifolia*. While there are no local records of A*. littoralis,* both *A. imperforata, A. wilcoxiana* were observed together within the subject site. Searches however did not identify plants consistent with *A. littoralis.*

ii. Niemeyera whitei

Rusty Plum *(Niemeyera whitei)* (Vulnerable under the TSC Act) occurs in gully, warm temperate or littoral rainforests and the adjacent understorey of moist eucalypt forest. *Niemeyera whitei* occurs on poorer soils in areas below 600 metres above sea level. While littoral rainforest is present in the subject site, the area of suitable habitat is small (0.12 ha) and was throughly searched. As such this species in not considered to be present in the subject site.

iii. Quassia sp. *Moonee Creek*

Moonee Quassia (*Quassia* sp. Moonee Creek) is listed as Endangered under the TSC Act and Endangered under the EPBC Act (as *Samadera* sp. Moonee Creek). *Quassia* sp. Moonee Creek occcurs as an understorey shrub most commonly in moist shrubby open eucalypt

forest on slopes or riparian rainforest gullies, and occasionally in dry open forest with a heathy understorey. Areas of swamp sclerophyll forest with a heathy understorey (CH_FrW09) could be marginal habitat for this species, however in much of this Vegetation Community the heathy understorey had been removed for grazing, with a small area remaining with an intact understorey. This area was searched for this species and it was not detected. *Quassia* sp. Moonee Creek is therefore considered to have only a small chance of being present in the subject site.

iv. Senna acclinis

Rainforest Cassia (*Senna acclinis*) is listed as Endangered under the TSC Act. Senna acclinis occurs in coastal districts and adjacent tablelands from the Illawarra to Queensland. *Senna acclinis* grows on the margins of subtropical, littoral and dry rainforests. The small area (0.12 ha) of suitable littoral rainforest habitat was throughly searched for this species and no adult plants were detected. Numerous seedlings of the similar weed species Winter Cassia (*Senna pendula* var. *glabrata*) were however detected throughout the subject site. Given the similarity of the two species it is possible that some seedlings are *Senna acclinis*. However in the absence of adult plants this is considered only a small possibilty, unless adult plants are present in adjacent areas of littoral rainforest.

4.5.3 Noxious Weeds

Six of the exotic plant species recorded within the subject site are listed as Declared Noxious Weeds under the NSW *Noxious Weeds Act 1993* in the Coffs Harbour Shire Council LGA. These include Asparagus Fern (*Asparagus aethiopicus*), Climbing Asparagus Fern (*Asparagus plumosus*), Annual Ragweed (*Ambrosia artemisiifolia*), Groundsel Bush (*Baccharis halimifolia*), Bitou bush (*Chrysanthemoides monilifera* ssp. *rotunda*), Lantana (*Lantana camara*) and Fireweed (*Senecio madagascarensis*). Of these weed species *Asparagus aethiopicus A. plumosus, Chrysanthemoides monilifera* ssp. *rotunda, Lantana camara* and *Senecio madagascarensis* are also Weeds of National Significance.

The most abundant exotic plant species are exotic grasses introduced for pasture. These mostly include *Paspalum* species (*P. conjugatum, P. distichium, P. mandiocanum* and *P. orbiculare*) as well as Signal Grass (*Urochloa decipiens*) and Buffalo Grass (*Stenotaphrum secundatum*) Overall with the exception of exotic grass species, weed abundance was low within the subject site, probably due to grazing on some weed species. However a number of garden escapes were noted, particularly within the south of the subject site close to existing housing. Such species included Bougainvillea (*Bougainvillea glabra*), Angel's Trumpets (*Brugmansia suaveolens*), Oleander (*Nerium oleander*), Senegal Date Palm (*Phoenix reclinata*), and Sweet Viburnum (*Viburnum odoratissimum*), in addition to other species.

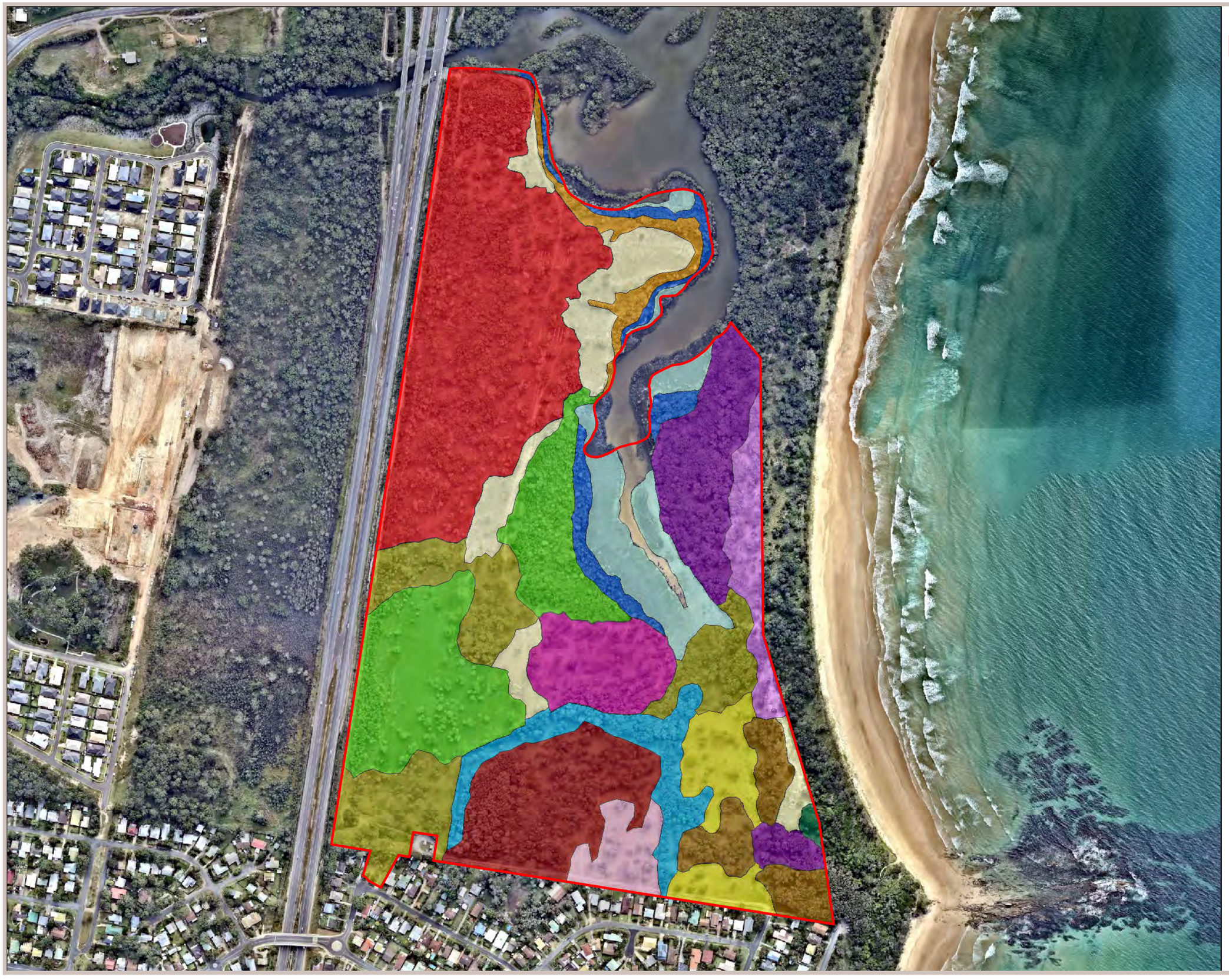

Figure 4.1. Ground-truthed mapping of Vegetation Communities

Figure 4.2. Mapping of Endangered Ecological Communities under the TSC Act

Figure 4.3. Mapping of Endangered Ecological Communities and Original Proposed Development Stages

Chapter 5

Conclusion

5.1 Conclusion

The subject land includes vegetation that is endangered, and also supports other habitats of conservation significance associated with the wetland. Endangered ecological communities listed by the Commonwealth and the State do occur, but do not occur across the subject land. No threatened plant species were detected on the subject site.

The vegetation mapping by Cumberland Ecology reveals that the vegetation classification map of Sainty Report is flawed, inaccurate and inappropriately delineates vegetation communities on the subject site. As a consequence the Sainty report overstates the conservation significance of the vegetation on the subject land – particularly in the three development stages that were not granted approval by the DoP.

The Sainty report is flawed for a number of reasons, including but not limited to:

- The senior author only visited the subject land for a brief period;
- The report was not based on plot-based data collected on site;
- The report did not entail mapping of any flood contours and so made no reference to the 1:100 year flood line when determining that the majority of the subject site comprises flood plain EECs; and
- The report did not provide any detailed analysis that would support the reasons for identification of flood plain EECs across the majority of the subject land.

The DoP approval has apparently reflected and placed considerable weight on the Sainty report. Consequently, the decision not to approve stages 1, 2 and 6 on the basis of ecological constraints associated with the presence of endangered ecological communities was flawed.

The new botanical information provided by Cumberland Ecology provides a significantly different picture of the ecological constraints of the original Concept Plan.

Appendix A

Flora Species List

Table A.1 List of flora species recorded within the subject site, listed by family name

Family	species name	Common name	Native/Exotic
Acanthaceae	*Avicennia marina*	Grey Mangrove	N
Acanthaceae	*Hygrophila polysperma*	Indian Swampweed	E
Adoxaceae	*Viburnum odoratissimum*	Sweet Viburnum	E
Alismataceae	*Alisma plantago-aquatica*	Water Plantain	N
Amaryllidaceae	*Crinum pedunculatum*	Swamp Lily	N
Apiaceae	*Apium prostratum* var. *filiforme*	Sea celery	N
Apiaceae	*Centella asiatica*	Indian Pennywort	N
Apiaceae	*Hydrocotyle bonariensis*	Large-leaved Pennywort	E
Apiaceae	*Hydrocotyle tripartita*	Pennywort	N
Apiaceae	*Hydrocotyle verticillata*	Shield Pennywort	N
Apocynaceae	*Asclepias curassavica*	Red-head Cotton Bush	E
Apocynaceae	*Gomphocarpus physocarpus*	Balloon Cotton Bush	E
Apocynaceae	*Marsdenia rostrata*	Milk Vine	N
Apocynaceae	*Nerium oleander*	Oleander	E
Apocynaceae	*Parsonsia straminea*	Common Silkypod	N
Araceae	*Syngonium podophyllum*	Arrowhead Vine	E
Araliaceae	*Polyscias elegans*	Celery Wood	N
Araucariaceae	*Araucaria cunninghamii*	Hoop Pine	N
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm	N
Arecaceae	*Phoenix reclinata*	Senegal Date Palm	E
Asparagaceae	*Asparagus aethiopicus*	Asparagus fern	E
Asparagaceae	*Asparagus plumosus*	Climbing Asparagus fern	E
Asteraceae	*Ageratum houstonianum*	Blue Billygoat Weed	E
Asteraceae	*Aster subulatus*	Wild Aster	E
Asteraceae	*Baccharis halimifolia*	Groundsel Bush	E
Asteraceae	*Bidens pillosa*	Cobbler's Pegs	E
Asteraceae	*Calyptocarpus vialis*	Creeping Cinderella Weed	E
Asteraceae	*Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush	E
Asteraceae	*Cirsium vulgare*	Spear Thistle	E
Asteraceae	*Conyza canadensis*	Canadian Fleabane	E
Asteraceae	*Gamochaeta calviceps*	Silky Cudweed	E
Asteraceae	*Hypochoeris radicata*	Cat's Ear	E
Asteraceae	*Lagenophora gracilis*	Slender Lagenophora	E
Asteraceae	*Vernonia cinerea*		N

Table A.1 List of flora species recorded within the subject site, listed by family name

Family	species name	Common name	Native/Exotic
Blechnaceae	*Blechnum indicum*	Bungwall	N
Callitrichaceae	*Callitriche muelleri*		N
Caryophyllaceae	*Cerastium glomeratum*	Mouse-ear Chickweed	E
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak	N
Casuarinaceae	*Casuarina glauca*	Swamp Oak	N
Celastraceae	*Elaeodendron australe*	Red Olive Plum	N
Commelinaceae	*Commelina cyanea*		N
Convolvulaceae	*Dicondra repens*	Kidney Weed	N
Convolvulaceae	*Ipomoea cairica*	Coastal Morning Glory	E
Convolvulaceae	*Polymeria calycina*		N
Cyatheaceae	*Cyathea cooperi*	Scaly Tree Fern	N
Cyperaceae	*Baumea arthrophylla*	Twig-rush	N
Cyperaceae	*Baumea articulata*	Jointed Twig-rush	N
Cyperaceae	*Baumea juncea*	Twig-rush	N
Cyperaceae	*Baumea rubiginosa*	Twig-rush	N
Cyperaceae	*Carex maculata*		N
Cyperaceae	*Chorizandra cymbaria*		N
Cyperaceae	*Cyperus eglobosus*	a sedge	N
Cyperaceae	*Cyperus haspan*	a sedge	N
Cyperaceae	*Cyperus polystachyos*	a sedge	N
Cyperaceae	*Cyperus* sp.	a sedge	N
Cyperaceae	*Eleocharis equisetina*		N
Cyperaceae	*Eleocharis minuta*		E
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	N
Cyperaceae	*Fimbristylis nutans*	Nodding Fringe-sedge	N
Cyperaceae	*Fuirena ciliaris*		N
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge	N
Cyperaceae	*Gahnia sieberiana*	Red-fruit Saw-sedge	N
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge	N
Cyperaceae	*Leptocarpus tenax*		N
Cyperaceae	*Ptilothrix deusta*	Horned sedge	N
Cyperaceae	*Schoenoplectus subulatus*		N
Cyperaceae	*Schoenus brevifolius*	Zig-zag Bog-rush	N
Dennstaedtiaceae	*Pteridium esculentum*	Bracken Fern	N
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower	N

Table A.1 List of flora species recorded within the subject site, listed by family name

Family	species name	Common name	Native/Exotic
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower	N
Dilleniaceae	*Hibbertia vestita*	Hairy Guinea Flower	N
Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash	N
Ericaceae	*Epacris pulchella*	Swamp Heath	N
Ericaceae	*Leucopogon lanceolatus*	a Beard Heath	N
Ericaceae	*Leucopogon leptospermoides*	a Beard Heath	N
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush	N
Euphorbiaceae	*Glochidion ferdinandi* var. *ferdinandi*	Cheese Tree	N
Euphorbiaceae	*Phyllanthus tenellus*	Hen and Chickens	E
Euphorbiaceae	*Phyllanthus virgatus*		N
Fabaceae	*Acacia irrorata*	Green Wattle	N
Fabaceae	*Acacia longifolia* var. *sophorae*	Coastal Wattle	N
Fabaceae	*Acacia suaveolens*	Sweet Wattle	N
Fabaceae	*Bossiaea ensata*		N
Fabaceae	*Gompholobium pinnatum*	Pinnate Wedge-pea	N
Fabaceae	*Macroptilium lathyroides*	Phasey Bean	E
Fabaceae	*Mirbelia rubiifolia*	Heathy Mirbelia	N
Fabaceae	*Pultenaea retusa*	Notched Bush-pea	N
Fabaceae	*Pultenaea villosa*	Hairy Bush-pea	N
Fabaceae	*Senna pendula* var. *glabra*	Winter Cassia	E
Flagellariaceae	*Flagellaria indica*	Supplejack	N
Goodeniaceae	*Dampiera stricta*		N
Goodeniaceae	*Dampiera sylvestris*	Forest Dampiera	N
Goodeniaceae	*Glycine clandestina*	Twining Glycine	N
Goodeniaceae	*Goodenia bellidifolia* ssp. *argentea*	a Goodenia	N
Goodeniaceae	*Goodenia rotundifolia*	Round-leaved Goodenia	N
Goodeniaceae	*Velleia paradoxa*	Spur Velleia	N
Haloragaceae	*Gonocarpus micranthus*	Creeping Raspwort	N
Hypericaceae	*Hypericum gramineum*	Small St John's Wort	N
Iridaceae	*Patersonia fragilis*	Swamp Iris	N
Juncaceae	*Juncus kraussii* ssp. *australiensis*	Sea Rush	N
Juncaceae	*Juncus usitatus*	Common Rush	N
Juncaceae	*Juncus continuus*	a rush	N
Lauraceae	*Cassytha filiformis*	Dodder Laurel	N
Lauraceae	*Cassytha glabella*	Dodder Laurel	N

Table A.1 List of flora species recorded within the subject site, listed by family name

Family	species name	Common name	Native/Exotic
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	E
Lauraceae	*Cryptocarya triplinervis*	Three-veined Cryptocarya	N
Lauraceae	*Endiandra sieberi*	Hard Corkwood	N
Lindsaeaceae	*Lindsaea linearis*	Screw Fern	N
Lobeliaceae	*Lobelia stenophylla*		N
Lobeliaceae	*Pratia purpurascens*	White-root	N
Lomandraceae	*Lomandra longifolia*	Wattle Mat-rush	N
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush	N
Lomariopsidaceae	*Nephrolepis cordifolia*	Fishbone Fern	N
Loranthaceae	*Amyema congener*	A mistletoe	N
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	N
Lythraceae	*Cuphea carthagenensis*	Columbian Waxweed	E
Malvaceae	*Sida acuta*	Spiny-head Sida	E
Meliaceae	*Dysoxylum mollissimum* ssp. *molle*	Red Bean	N
Menispermaceae	*Stephania japonica*	Snake Vine	N
Moraceae	*Ficus coronata*	Sandpaper Fig	N
Moraceae	*Ficus rubinigosa*	Rusty Fig	N
Moraceae	*Maclura cochinchinensis*	Cockspur Thorn	N
Myrtaceae	*Acmena smithii*	Common Lillypilly	N
Myrtaceae	*Angophora costata*	Smooth-barked Apple	N
Myrtaceae	*Callistemon pachyphyllus*	Wallum Bottlebrush	N
Myrtaceae	*Callistemon salignus*	Weeping Bottlebrush	N
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood	N
Myrtaceae	*Eucalyptus pilularis*	Blackbutt	N
Myrtaceae	*Eucalyptus resinifera* ssp. *hemilampra*	Red Mahogany	N
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany	N
Myrtaceae	*Eucalyptus signata*	Scribbly Gum	N
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	N
Myrtaceae	*Leptospermum juniperinum*	Prickly Tea-tree	N
Myrtaceae	*Leptospermum liversidgei*	Olive Tea-tree	N
Myrtaceae	*Lophostemon suaveolens*	Swamp Box	N
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark	N
Myrtaceae	*Melaleuca sieberii*	Sieber's Paperbark	N
Myrtaceae	*Melaleuca thymifolia*	Thyme Honey-myrtle	N
Myrtaceae	*Melaleuca nodosa*	Prickly Paperbark	N

Table A.1 List of flora species recorded within the subject site, listed by family name

Family	species name	Common name	Native/Exotic
Myrtaceae	*Syzygium oleosum*	Blue Lilly Pilly	N
Nyctaginaceae	*Bougainvillea glabra*	Bougainvillea	E
Nymphaceae	*Nymphaea capensis*	Blue Waterlily	E
Ochnaceae	*Ochna serrulata*	Mickey Mouse Plant	E
Oleaceae	*Notelaea longifolia*	Large Mock Olive	N
Oleaceae	*Notelaea ovata*	a mock olive	N
Oleaceae	*Notelaea venosa*	Large-leaved Mock-olive	N
Onagraceae	*Ludwigia peploides*	Water primrose	N
Oxalidaceae	*Oxalis corniculata*	Creeping Oxalis	E
Oxalidaceae	*Oxalis pes-caprae*	Oxalis	E
Passifloraceae	*Passiflora edulis*	Passionfruit	N
Passifloraceae	*Passiflora suberosa*	Corky Passionflower	E
Passifloraceae	*Passiflora tarminiana*	Banana Passionfruit	E
Philydraceae	*Philydrum lanuginosum*	Frogsmouth	N
Phormiaceae	*Dianella caerula*	Blue Flax-lily	N
Plantaginaceae	*Veronica plebeia*	Trailing Speedwell	N
Poaceae	*Ambrosia artemiisifolia*	Annual Ragweed	E
Poaceae	*Andropogon virginicus*	Whiskey grass	E
Poaceae	*Aristida* sp.	a wire-grass	N
Poaceae	*Axonopus compressus*	Broad-leaf Carpet Grass	E
Poaceae	*Axonopus fissifolius*	Narrow-leaf Carpet Grass	E
Poaceae	*Capillipedium spicigerum*	Scented-top Grass	N
Poaceae	*Cymbopogon refractus*	Barbed-wire Grass	N
Poaceae	*Cynodon dactylon*	Couch Grass	E
Poaceae	*Entolasia marginata*	Bordered Panic	N
Poaceae	*Entolasia stricta*	Wiry Panic	N
Poaceae	*Eragrostis brownii*	Brown's Love-grass	N
Poaceae	*Eragrostis leptostachya*	Drooping Love-grass	N
Poaceae	*Eragrostis tenuifolia*	Elastic grass	E
Poaceae	*Imperata cylindrica*	Blady Grass	N
Poaceae	*Ischaemum australe*		N
Poaceae	*Leersia hexandra*	Swamp Rice-grass	N
Poaceae	*Microleana stipoides*	Weeping Grass	N
Poaceae	*Oplismenus aemulus*	Australian Basket Grass	N
Poaceae	*Oplismenus imbecillis*	Creeping Beard Grass	N

Table A.1 List of flora species recorded within the subject site, listed by family name

Family	species name	Common name	Native/Exotic
Poaceae	*Ottochloa gracillima*		N
Poaceae	*Panicum effusum*	Hairy Panic	N
Poaceae	*Paspalum conjugatum*	Sour Grass	E
Poaceae	*Paspalum distichium*	Water Couch	E
Poaceae	*Paspalum mandiocanum*	Broad-leaved Paspalum	E
Poaceae	*Paspalum orbiculare*	Ditch Millet	E
Poaceae	*Phragmites australis*	Common Reed	N
Poaceae	*Sacciolepis indica*	Indian Cupscale Grass	N
Poaceae	*Senecio madagascarensis*	Fireweed	E
Poaceae	*Sporobolus elongatus*	Slender Rat's Tail Grass	N
Poaceae	*Sporobolus pryamidalis*	Parramatta Grass	E
Poaceae	*Sporobolus virginicus*	Salt-water Couch	N
Poaceae	*Stenotaphrum secundatum*	Buffalo grass	E
Poaceae	*Urochloa decipiens*	Signal Grass	E
Poaceae	*Zoysia macrantha*	Prickly Couch	N
Polygalaceae	*Polygala paniculata*	Polygala	E
Polypodiaceae	*Platycerium bifurcatum*	Elkhorn fern	N
Primulaceae	*Myrsine variabilis*		N
Proteaceae	*Banksia integrifolia* ssp. *integrifolia*	Coast Banksia	N
Proteaceae	*Banksia oblongifolia*	Fern-leaf Banksia	N
Proteaceae	*Banksia spinulosa* var. *collina*	Hairpin Banksia	N
Proteaceae	*Hakea actities*	Prickly Hakea	N
Proteaceae	*Hakea laevipes*	a Hakea	N
Proteaceae	*Persoonia stradbrokensis*		N
Ranunculaceae	*Ranunculus inundatus*	River Buttercup	N
Restionaceae	*Empodisma minus*	Spreading Rope-rush	N
Rosaceae	*Rubus parviflorus*	Native Raspberry	N
Rubiaceae	*Psychotria loniceroides*	Hairy Psychotria	N
Rubiaceae	*Richardia brasiliensis*	White Eye	E
Rutaceae	*Acronychia imperforata*	Beach Acronychia	N
Rutaceae	*Acronychia wilcoxiana*	Silver Aspen	N
Rutaceae	*Boronia parviflora*	Swamp Boronia	N
Rutaceae	*Melicope elleryana*	Melicope	N
Rutaceae	*Murrayea paniculata*	Orange Jessamine	E
Sapindaceae	*Alectryon coriaceus*	Beach Birds-eye	N

Table A.1 List of flora species recorded within the subject site, listed by family name

Family	species name	Common name	Native/Exotic
Sapindaceae	*Cupaniopsis anacardioides*	Tuckaroo	N
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush	N
Sapindaceae	*Guioa semiglauca*	Guioa	N
Schizaeaceae	*Schizaea bifida*	Forked Comb Fern	N
Selaginellaceae	*Selaginella uliginosa*	Swamp Selaginella	N
Smilacaceae	*Smilax australis*	Wait-a-while	N
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsaparilla	N
Solanaceae	*Brugmansia suaveolens*	Angels Trumpets	E
Solanaceae	*Duboisia myoporoides*	Corkwood	N
Solanaceae	*Solanum nigrum*	Blackberry Nightshade	E
Solanaceae	*Solanum seaforthеanum*	Brazilian Nightshade	E
Solanaceae	*Solanum torvum*	Devil's Fig	N
Stackhousiaceae	*Stackhousia viminea*	Slender Stackhousia	N
Strelitziaceae	*Strelitzia nicolai*	Giant Bird of Paradise	E
Thelypteridaceae	*Christella dentata*	Binung	N
Thymelaeaceae	*Pimelea linifolia* ssp. *linifolia*	Slender Rice-flower	N
Thymelaeaceae	*Wikstroemia indica*	Tie-bush	N
Verbenaceae	*Lantana camara*	Lantana	E
Violaceae	*Viola banksii*	Native Violet	N
Violaceae	*Viola hederacea*	Native Violet	N
Vitaceae	*Cayratia clematidea*	Native Grape	N
Vitaceae	*Cissus antarctica*	Water Vine	N
Vitaceae	*Cissus hypoglauca*	Water Vine	N
Vitaceae	*Cissus sterculiifolia*	Yaroong	N
Xanthorrhoeaceae	*Xanthorrhoea fulva*	Grass Tree	N

Appendix B

Likelihood Assessment for Threatened Flora Species

Table B.1 Likelihood Assessment

Species Name	Common Name	TSC Act Status	EPBC Act Status	Records	Habitat	Likelihood
Acronychia littoralis	Scented Acronychia	E	E	0	Occurs in coastal areas (<2 km from the sea) in sub-littoral rainforest, usually in transitional zones between littoral rainforest and swamp sclerophyll forest, littoral and coastal cypress pine communities or on the margin of littoral forest and cleared land.	Possible, suitable habitat and parents of this hybrid species were observed, however there are no local records. Species was not detected
Allocasuarina defungens	Dwarf Heath Casuarina		E	0	Found in coastal areas of wet to dry, dense, low, closed heathland	Unlikely as no local records, small areas of wallum heath/wet heath are present in the subject site. Species was not detected
Allocasuarina thalassoscopica		ROTAP	E	0	Found in graminoid low heath, on coastal flats or on rhyolite or granite outcrops close to the coast. The EPBC Act listed species is restricted to Mt Coolum on the Sunshine Coast in south-eastern Qld and known from only a single site that covers about 8.2 ha.	Unlikely - subject area is outside of the location of the EPBC Act listed species
Arthraxon hispidus	Hairy-joint Grass	V	V	0	A moisture and shade-loving grass, found in or on the edges of rainforest and in wet eucalypt forest, often near	Unlikely, as no local records. Species is threatened by overgrazing and intoduction of

Table B.1 Likelihood Assessment

Species Name	Common Name	TSC Act Status	EPBC Act Status	Records	Habitat	Likelihood
					creeks or swamps.	exotic grasses such as *Paspalum*, threats that could have resulted in the loss of this species from the subject site
Boronia umbellata	Orara Boronia	V	V	1	Grows as an understorey shrub in and around gullies in wet open forest.	Unlikely, no areas of wet sclerophyll forest present
Chamaesyce (Euphorbia) psammogeton	Sand Spurge	E		3	Uncommon on sand dunes near the sea.	Unlikely, subject site does not include frontal coastal dunes
Corybas undulatus	Tailed Helmet Orchid	ROTAP		1	Widespread in coastal and near-coastal regions in moist areas of sclerophyll forest but rarely common, north from Jervis Bay.	Possible. Conditions at time not suitable for detection of these species
Cryptostylis hunteriana	Leafless Tounge Orchid		V	0	The species occurs mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. It prefers open areas in the understorey of forests. The soils include moist sands and moist to dry clay loam.	Unlikely, although suitable habitat is present, there are no local records. Conditions at the time of survey were not suitable for detection of this species.
Cynanchum elegans	White-flowered Wax-flower		E	0	Recorded from rainforest gullies, scrub and scree slopes; from the Gloucester district to the Wollongong area and	Unlikely, no rainforest gullies, scrub and scree slopes within the subject site

Table B.1 Likelihood Assessment

Species Name	Common Name	TSC Act Status	EPBC Act Status	Records	Habitat	Likelihood
					inland to Mt Dangar.	
Diuris sp. aff. *chrysantha* (Byron Bay)	Byron Bay Diuris	E		0	Known from a single location only, at Byron Bay in north-east NSW. Only about 20 plants have been recorded.	Unlikely, plants in the subject site have been confirmed to be the similar species *Diuris* sp. aff. *chrysantha* (North Coast).
Hicksbeachia pinnatifolia	Red Boppel Nut	V	V	1	Occurs as an understorey tree in subtropical rainforest, regrowth rainforest, moist eucalypt forest and Brush Box forest	Unlikely, subject site does not contain subtropical rainforest, regrowth rainforest or wet sclerophyll forest
Macadamia integrifolia	Macadamia Nut		V	0	Grows in drier types of subtropical rainforest preferring partially open areas such as rainforest edges, north from Currumbin in Qld. It is not known to occur naturally in the wild in NSW.	Unlikely, no suitable rainforest habitat present.
Macadamia tetraphylla	Rough-shelled Bush Nut	V	V	2	Generally occurs in subtropical rainforest and complex notophyll vineforest, at the margins of these forests and in mixed sclerophyll forest. It occurs in restricted habitat, growing on moderate to steep hillslopes on alluvial soils at well-drained sites.	Unlikely - no areas of suitable rainforest habitat present
Marsdenia longiloba	Slender Marsdenia	E	V	26	Found in subtropical and warm	Unlikely, subject site does not

Table B.1 Likelihood Assessment

Species Name	Common Name	TSC Act Status	EPBC Act Status	Records	Habitat	Likelihood
					temperate rainforest, lowland moist or open eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops	contain subtropical and warm temperate rainforest or wet sclerophyll forest
Niemeyera (Amorphospermum) whitei	Rusty Plum, Plum Boxwood	V		73	Found in gully, warm temperate or littoral rainforests and the adjacent understorey of moist eucalypt forest. Occurs on poorer soils in areas below 600 metres above sea level.	Possible as littoral rainforest present, but restricted to a small area that was throughly searched. Species not detected
Olearia stilwelliae		ROTAP		3	Grows in dry sclerophyll forest on sandy soil; from Coaldale (north of Grafton) south to Woolgoolga	Possible, one record is immediately to the north of Hearns Lake
Parsonsia dorrigoensis	Milky Silkypod		E	0	Found in subtropical and warm-temperature rainforest, on rainforest margins, and in moist eucalypt forest up to 800 m, on brown clay soils.	Unlikely, subject site does not contain subtropical and warm temperate rainforest or wet sclerophyll forest
Phaius australis	Southern Swamp Orchid	E	E	1	Associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest and often where Broad-leaved Paperbark or Swamp Mahogany are found. Typically restricted to the swamp-forest margins,	Unlikely, suitable habitat present but heavily disturbed by grazing. Cattle are known to eat the flowering parts of orchids and severely impact on important orchid microhabitats

Table B.1 Likelihood Assessment

Species Name	Common Name	TSC Act Status	EPBC Act Status	Records	Habitat	Likelihood
					where it occurs in swamp sclerophyll forest (Broad-leaved Paperbark/Swamp Mahogany/Swamp Box), swampy rainforest (often with sclerophyll emergents), or fringing open forest.	through trampling
Plectranthus cremnus		ROTAP			Occurs in shallow sandy soils in rocky coastal headlands of North Coast.	Unlikely, no rocky coastal headlands within the subject site
Pultenaea maritima	Coast Headland Pea	V		12	Occurs in grasslands, shrublands and heath on exposed coastal headlands and adjoining low coastal heath	Unlikely, no coastal headlands with grasslands or shrublands within the subject site
Quassia (Samadera) sp. Moonee Creek (J.King s.n. Nov. 1949)	Moonee Quassia	E	E	51	Occurs as an understorey shrub most commonly in moist shrubby open eucalypt forest on slopes or riparian rainforest gullies, and occasionally in dry open forest with a heathy understorey	Possible, small areas of swampy open forest with a heathy understorey are present in the subject site, but have largely been modified by removal of the understorey for grazing. As such suitable habitat is limited and the species was not detected
Senna acclinis	Rainforest Cassia	E		3	Occurs in coastal districts and adjacent tablelands from the Illawarra to	Possible, littoral rainforest is present within the subject site.

Table B.1 Likelihood Assessment

Species Name	Common Name	TSC Act Status	EPBC Act Status	Records	Habitat	Likelihood
					Queensland. Grows on the margins of subtropical, littoral and dry rainforests.	Seedlings assumed to be the introduced species *Senna pendula* could be this species. No adult plants observed
Sophora tomentosa	Silverbush	E		8	Occurs on recent sands on frontal coastal dunes. Grows on beaches and in beach forest at elevations slightly above mean sea level	Unlikely, subject site does not include frontal coastal dunes
Thesium australe	Austral Toadflax	V	V	12	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.	Unlikely, no grasslands on coastal headlands within the subject site
Zieria prostrata	Headland Zieria	E	E	28	This species has a very restricted distribution near Coffs Harbour. It is known only from four headlands along a three kilometre stretch of coastline within Moonee Beach Nature Reserve and occupies a total area of less than 1 ha. Grows mainly in exposed southerly aspects on these headlands	Unlikely, no coastal headlands within the subject site

Status: E = Endangered, V = Vulnerable