JWA PTY LTD
Ecological Consultants
ABN 56 066 448 879

REVISED
ECOLOGICAL ASSESSMENT

20 North Creek Road, Lennox Head
Lot 1 on DP 517111

A Report Prepared for
Ballina Island Developments

MARCH 2019

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Rw9	27.02.19	Adam McArthur	AM	Adam McArthur	AM
Rw10	04.03.19	Adam McArthur	AM	Adam McArthur	AM

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1 INTRODUCTION

1.1 Background

JWA Pty Ltd has been engaged by Ballina Island Developments to complete a revised Ecological Assessment for 20 North Creek Road, Lennox Head. The site is formally referred to as Lot 1 DP 517111.

JWA previously prepared an Ecological Assessment report (2017) for a proposed residential development over the subject land, which included an area in the north eastern quadrant of the site which had been earmarked by Ballina Shire Council (BSC) for use in the realignment of North Creek Road. However, it is understood that Council no longer requires this land, and therefore the subdivision layout for the site has been redesigned for efficient use of the site. The report was updated in 2018 to assess any further ecological impacts that may result from the expanded development layout and to respond to issues raised by BSC in a pre-lodgement meeting held on the 24th April 2018 (refer **Section 1.6**). Further updates have now been completed in response to a BSC request for further information dated 21st December 2018 which resulted in amendments to the proposed stormwater treatment system on the subject site.

It should be noted that whilst the *Biodiversity Conservation Act 2016* (BC Act) commenced on the 25th August 2017, the NSW Government established transitional arrangements related to biodiversity assessment for the various categories of development approval that were underway at the time or had already been made. These arrangements are set out in the Biodiversity *Conservation (Savings and Transitional) Regulation 2017*. In this regard, as the development application was lodged prior to the 25th February 2018 (i.e. the end of the transitional period), the previous legislation – the *Threatened Species Conservation Act 1995* (TSC Act) - will apply.

It is also noted that the State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP) came into effect on the 3rd April 2018 and updates and consolidates into one integrated policy SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5. of the Standard Instrument – Principal Local Environmental Plan. These policies are now repealed. However, as the development application was lodged prior to the 3rd April 2018, the previous legislation will apply.

The assessment has involved the following:

- Mapping and ground truthing vegetation units and determining their conservation status;
- Searching for and recording Threatened and regionally significant plant species;
- Determining the suite of Threatened fauna that occurs in the locality;
- Assessing the habitat value of the site for Threatened species;
- Assessing habitat provided by the site in relation to adjacent habitat and making an assessment of the corridor value of the site; and

- Addressing statutory requirements including State Environmental Planning Policy No. 44 (SEPP 44 – Koala Habitat Protection), Section 5a of the TSC Act and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act).

1.2 Locality

The Locality is defined as the area within a 10km radius of the Subject site. The Locality therefore extends from South Ballina in the south to Broken Head in the north and from Teven in the west to Lennox Head in the east (**FIGURE 1**).

Prominent features in the locality include the town of Ballina and town ship of Lennox Head, the coastline and Pacific Ocean, Richmond River, Emigrant Creek (and Emigrant Creek Dam), and Deadman's Creek.

Dominant habitat types within the locality include; rainforest and regrowth rainforest communities, swamp sclerophyll forest, eucalypt forest and intertidal communities. Land uses within the locality include agriculture (primarily sugar cane), grazing, conservation, residential, commercial and tourism.

There are three (3) dedicated conservation reserves in the locality:

- Ballina Nature Reserve, an area of 721 hectares to the west of the Subject site;
- Broken Head Nature Reserve, an area of 98 hectares to the north of the Subject site; and
- Richmond River Nature Reserve, an area of 256 hectares, south of the Subject site.

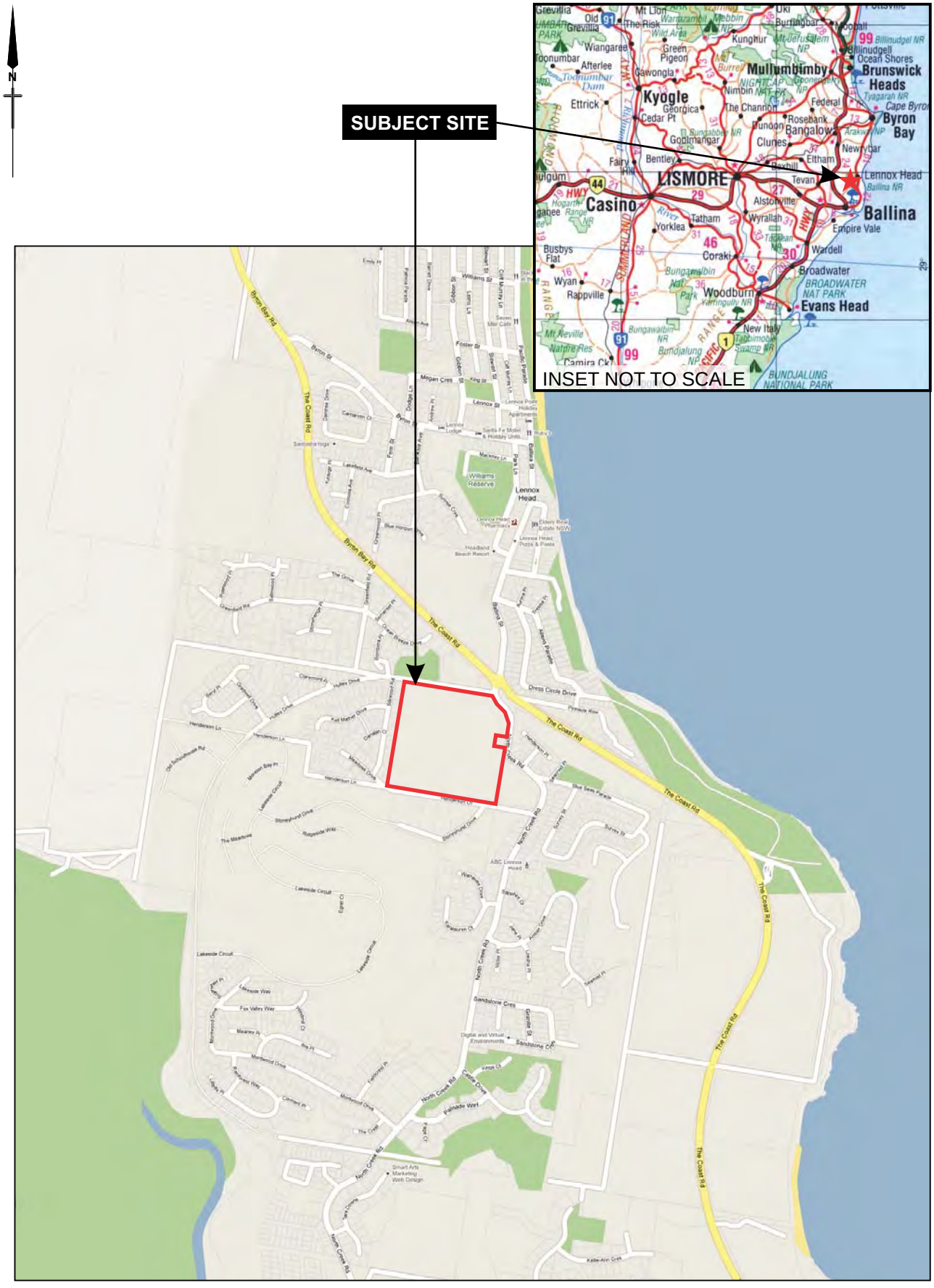
SEPP 14 State Wetlands numbers 87 – 94, 98 and 99 occur within 10km of the locality, and are shown in **FIGURE 2**. These wetlands are protected by State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14).

SEPP 26 Littoral Rainforests numbers 32 – 34B, and 36 – 39 occur within the locality and are shown in **FIGURE 3**. These rainforests are protected by State Environmental Planning Policy No. 26 – Littoral Rainforest (SEPP 26).

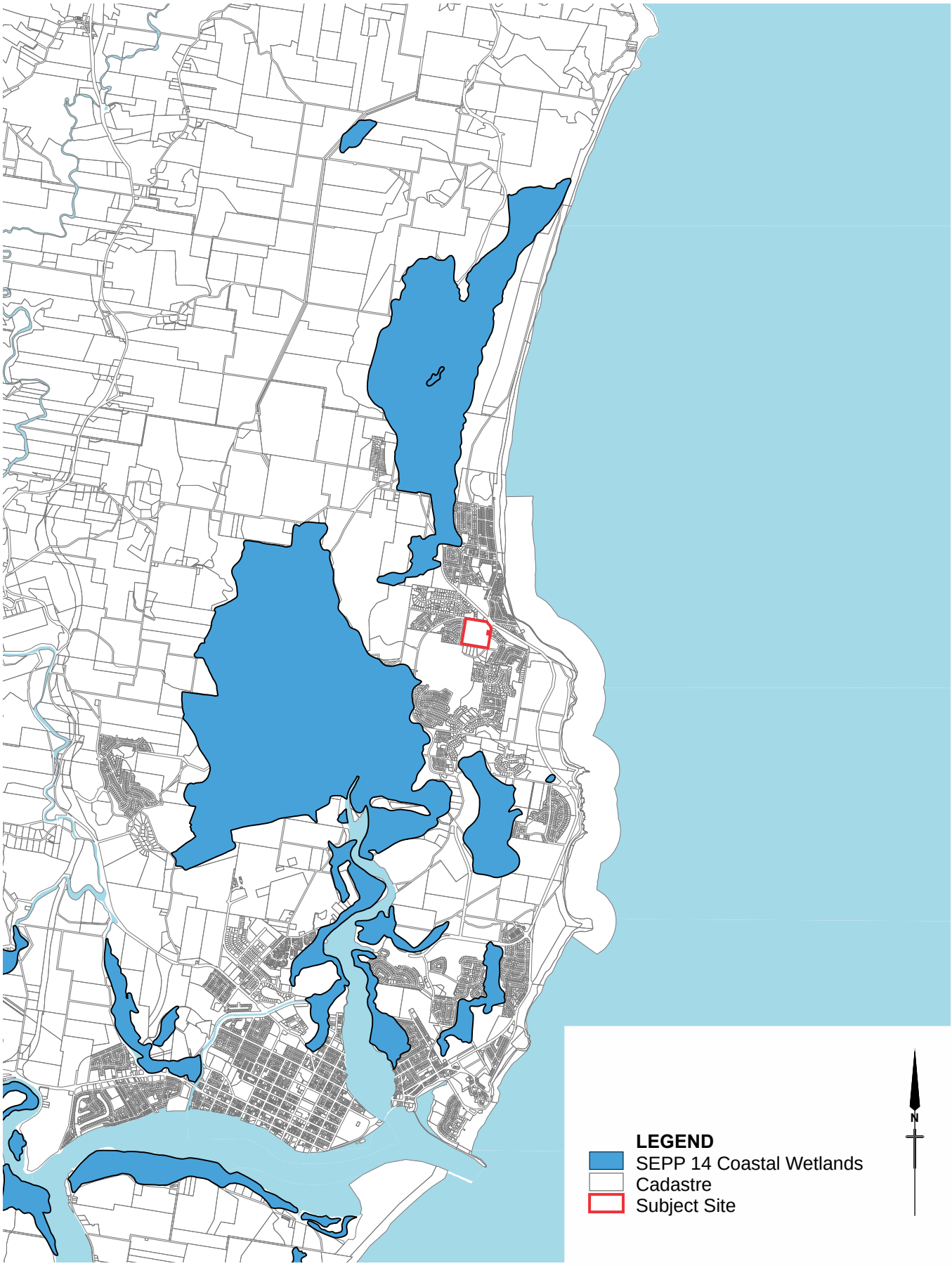
There is a new Coastal Management SEPP (2018) that updates and consolidates into one integrated policy the SEPP 14, SEPP 26 and SEPP 71 (Coastal Protection). However, the Coastal Management SEPP (2018) was not in force at the time of the development application, therefore is not applicable to the proposed development.

1.3 The Subject Site

The Subject site comprises Lot 1 DP 517111 which covers an area of approximately 15 hectares and consists of agricultural land. Historically the subject site has been grazed by cattle, however the cattle have since been removed from the site. Little native



SOURCE: Google Maps SCALE: 1 : 20 000 @ A4 JWA PTY LTD Ecological Consultants	CLIENT Ballina Island Developments Pty Ltd PROJECT Ecological Assessment Lot 1 on DP517111 20 North Creek Road, Lennox Head, NSW Ballina Shire Council LGA	**FIGURE 1** PREPARED: BW DATE: 08 January 2018 FILE: N20068_EA_Locality.cdr	TITLE **LOCALITY PLAN**



SOURCE: NSW Department of Planning
SEPP 14 Coastal Wetlands GIS dataset

SCALE: 1 : 80 000 @ A4

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FIGURE 2

PREPARED: BW
DATE: 08 January 2018
FILE: N20068_EA_SEPP14.cdr

TITLE

SEPP No 14 COASTAL WETLANDS

SOURCE: NSW Department of Planning
SEPP 26 Littoral Rainforests GIS dataset

SCALE: 1 : 80 000 @ A4

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FIGURE 3

PREPARED: BW
DATE: 08 January 2018
FILE: N20068_EA_SEPP26.cdr

TITLE

SEPP No 26 LITTORAL RAINFORESTS

vegetation occurs within the site. An aerial photograph of the subject site is shown in **FIGURE 4**.

The site is bounded by North Creek Road to the east, Henderson Lane to the south, Hutley Drive to the north and residential housing to the west.

1.4 Landuse Zones

The subject site is zoned as the following under the Ballina Local Environmental Plan (LEP) 2012 (**FIGURE 5**):

- RU1 – Primary Production;
- R2 – Low density residential; and
- R3 – Medium density residential.

1.5 Proposed Development

The proposed development is for a subdivision comprising of one hundred and eighteen (118) residential lots, five (5) super lots subject to future development, and one (1) lot for the purpose of public open space (**FIGURE 6)**.

1.6 Council Pre-lodgement Meeting Requirements

As previously discussed, a pre-lodgement meeting was held between the proponent and representatives of BSC on the 24th April 2018. **TABLE 1** below provides a summary of the relevant ecological issues raised by BSC, a response to each relevant issue and identifies where in this report further details can be found.

N

LEGEND
Subject Site

0 50m
1 : 2000

SOURCE: Near Map 06 Dec 2017 Aerial

SCALE: 1 : 2000 @ A3

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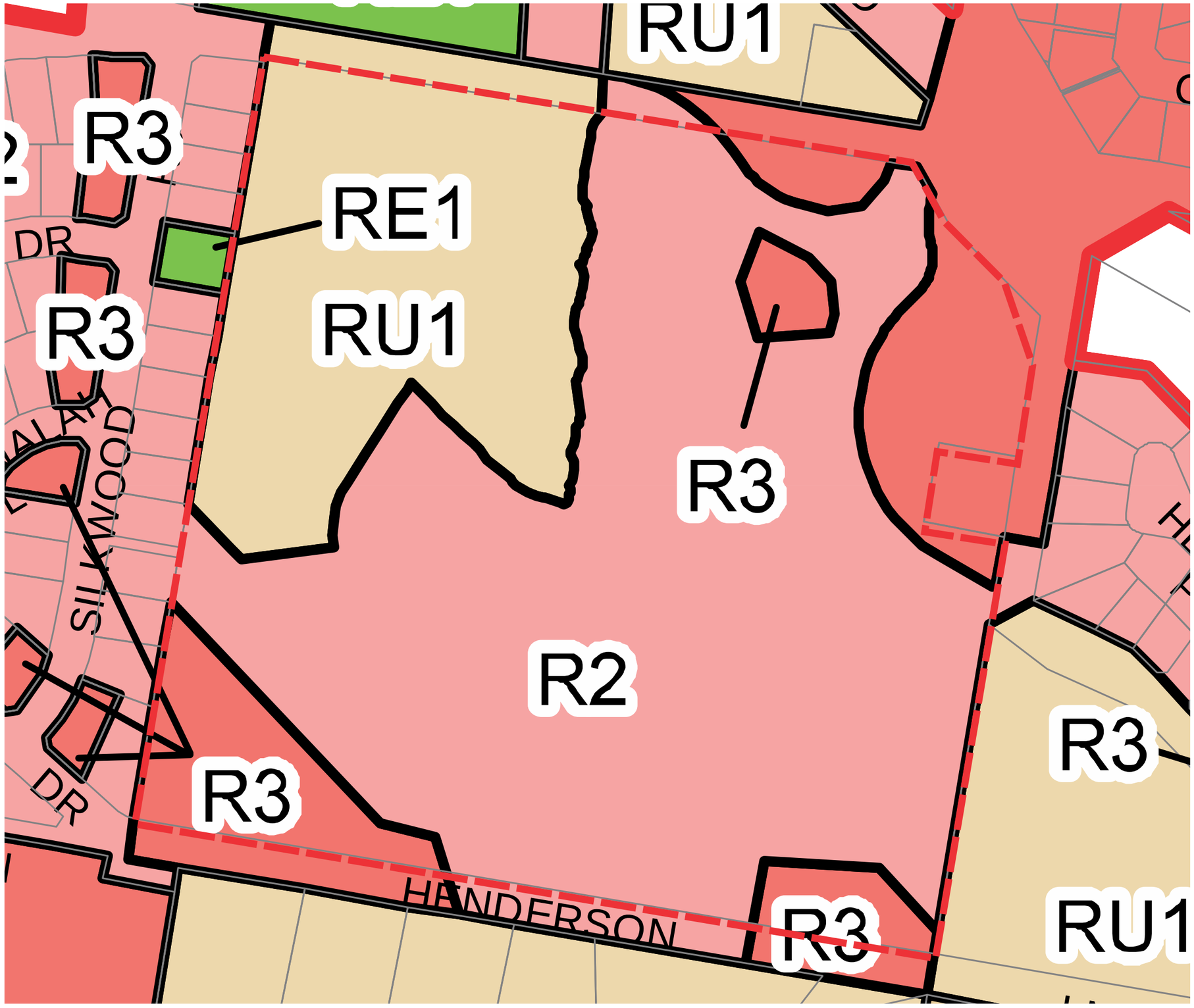
FIGURE 4

PREPARED: BW
DATE: 08 June 2018
FILE: N20068_EA_Aerial.cdr

TITLE

AERIAL PHOTOGRAPH



LEGEND
- R2 - Low Density Residential
- R3 - Medium Density Residential
- RE1 - Public Recreation
- RU1 - Primary Production
- DM - Deferred Matter
- Cadastre Boundary
- Subject Site

0 50m
1 : 2000

SOURCE: Ballina LEP 2012 Land Zoning Map - Sheet LZN_005D (17 Mar 2017)

SCALE: 1 : 2000 @ A3

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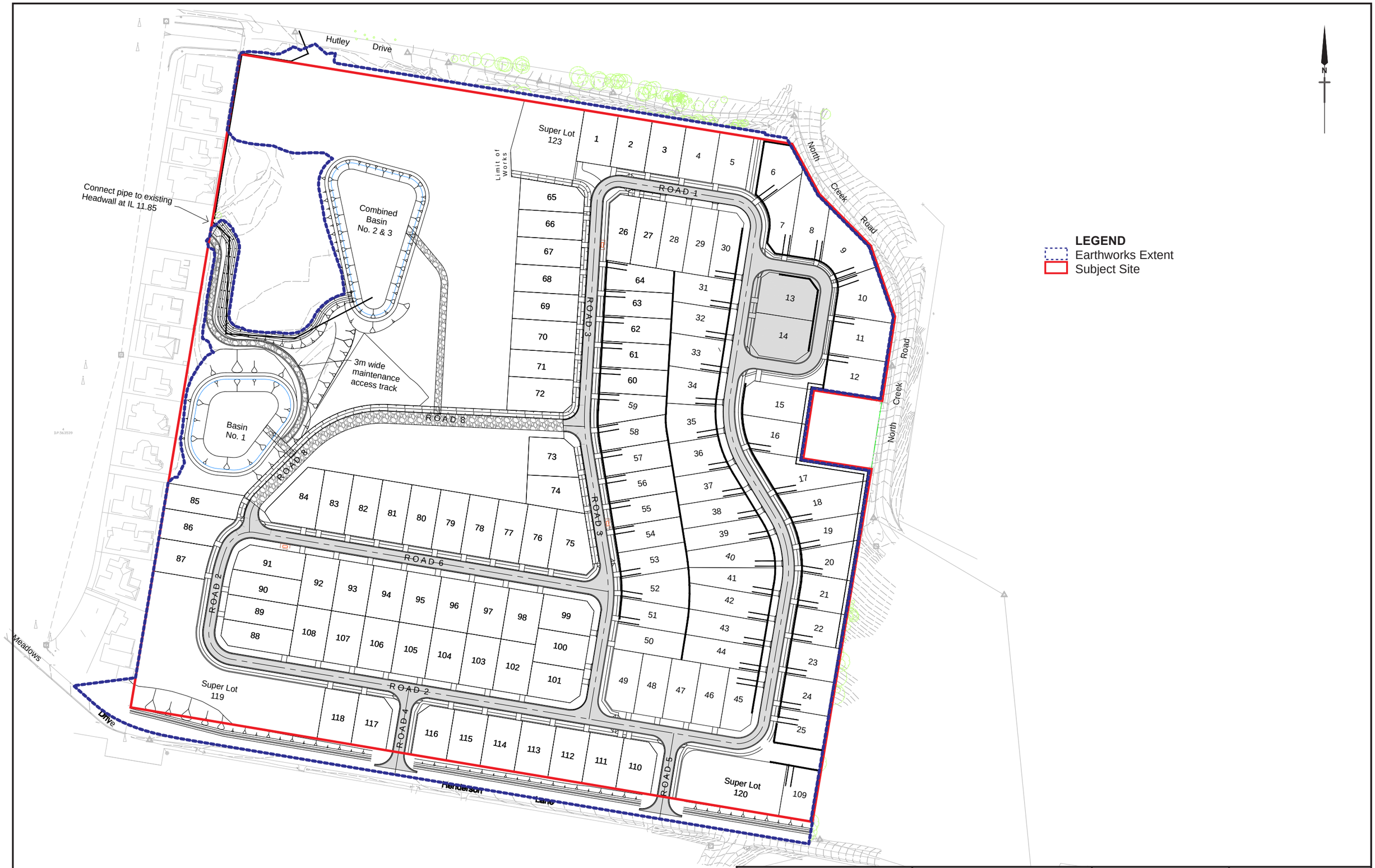
FIGURE 5

PREPARED: BW
DATE: 08 January 2018
FILE: N20068_EA_Aerial.cdr

TITLE

ZONING PLAN



SOURCE: Mott MacDonald (Ref: 389705-MMD-00-XX-SK-C-0043.dwg & Lennox - Bdy for tin design.dwg)
SCALE: 1 : 2000 @ A3

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FIGURE 6

PREPARED: BW
DATE: 28 February 2019
FILE: N20068_EA_Layout.cdr

TITLE
PROPOSED DEVELOPMENT LAYOUT

TABLE 1
RESPONSES TO RELEVANT PRE-LODGEMENT MEETING ISSUES (DA 2018/51: 24/04/2018)

Council Requirements	Response	Relevant Section of Report
It would appear the current development application proposes to clear approximately 3 hectares of native vegetation. Based on the minimum lot size clearing native vegetation at development site being above 0.25 hectares, it requires the development application to be supported by a BDAR report under the Biodiversity Conservation Act (2016). The current development application is considered deficient as it is not supported by a BDAR. Also, the new legislation, requires a developer (on a sliding scale) to avoid, minimise and offset impacts to biodiversity, with the first principle being avoidance. Given the current application proposes removes the majority of the native vegetation on-site it appears the avoidance principle has not been applied.	The DA was initially lodged on 2nd February 2018 and it is understood that the assessment is currently under "Stop the Clock" as a result of the removal of council's proposed road through the site, leading to a redesign. The revised application is to be lodged under the same DA number (DA2018/51). In accordance with the transitional arrangements set out in the *Biodiversity Conservation (Savings and Transitional) Regulation 2017*, development applications (including for modifications) which were made before 25th February 2018 will be assessed under the old legislation. A BAR is therefore not required for the development application which was lodged before the end of the transitional period.	n/a
Council also notes the submitted Ecological Assessment (EA) and the associated Tests of Significance have incorrectly identified the areas of native vegetation to be retained versus removed, e.g. Table 9 confirms 0.73 ha (5%) of the existing vegetation communities are to be retained. However, appendix 3 refers to a compensatory area of 2.69 ha. It is unknown where this offset area is given the retention rates detailed in Table 9 of the EA.	The area of retention of existing native vegetation and the size of the compensatory habitat area have no direct relationship to each other. The compensatory habitat area currently contains some native vegetation (i.e. 0.66 ha of wetland vegetation to be retained) and the remainder is comprised of non-native vegetation which is proposed to be rehabilitated in accordance with the Hairy Joint Grass (HJG) Compensatory Habitat Plan (JWA 2018a).	**Section 5**
The current development proposes to dedicate to Council the remaining freshwater wetland and HJG restoration areas (identified in the EA as approx. 2.86Ha). Council does not have the resources to manage this area. Consequently,	It is now proposed that the compensatory habitat area be managed and protected in perpetuity in accordance with the HJG Compensatory Habitat Plan (JWA 2018a). Ballina Island Developments to decide on ownership of the land and	**Section 5.3**

Council Requirements	Response	Relevant Section of Report
alternative arrangements will be required to manage these areas in perpetuity.	how it will be adequately funded for management in perpetuity. The ongoing management of the land in accordance with the CHP will likely be enforced via a positive covenant on the land title and deed. Further Ballina Island Developments should consider that retaining ownership of this lot is required to facilitate ongoing subdivision of the land, subject to future rezoning.	
It appears the mosquito report has had little regard for the restoration works proposed by the EA. Consequently, a revised mosquito report will need to address this issue.	Mosquito Consulting Services has been engaged to prepare a Mosquito Impact Assessment (MIA)) for the proposed development. The MMP should have regard for the requirements of this Ecological Assessment and the HJG Compensatory Habitat Plan (JWA 2018a).	**Section 5.3**
The development application needs to address the matter of vegetation growing on the boundary of development site and Lot 1 DP 878933. In addressing this matter compliance with Australian Standards AS 4373-2007 (Pruning of amenity trees) and AS 4970-2009 (Protection of trees on development sites) will be required.	A desktop study and site visit has identified that there are several trees located on the boundary of the site. The applicant has made contact with the adjoining land owner to discuss the relevant trees and access has been granted to undertake a tree survey. A desktop study of the trees close to the boundary is included in **Section 3.2.4** identifying the tree species, estimated size and position. Further investigation is being undertaken to determine relevant Tree Protection Zones (TPZ's) for trees in proximity to the site boundary (in accordance with the relevant Australian Standard) and will be provided to Council ASAP. It is acknowledged that there will also be a requirement during construction for an arborist to be engaged to complete/ supervise any pruning works.	**Sections 2.2.4, 3.2.4 and 5.3**

Council Requirements	Response	Relevant Section of Report
It is noted the current EA does not consider the Freshwater wetland community as an EEC. This outcome is inconsistent with the ecological reports prepared as part of the rezoning application. The primary reason provided in the EA is the wetland is located above the 1:1000 flood event. However, the Scientific Determination (SD) for Freshwater wetlands states: "Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). Freshwater Wetlands on Coastal Floodplains generally occur below 20m elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions."	It is acknowledged that the ecological reports prepared as part of the rezoning application considered the Freshwater wetland community as an EEC. This area is no longer considered to represent an EEC as follows: • The full name of the freshwater wetland EEC is "Freshwater Wetlands on Coastal Floodplains". By its very naming and definition (as reproduced by Council in their minutes) the community must occur on the "floodplain". The vegetation in question on the subject site does not occur on a floodplain. • Freshwater Wetlands on Coastal Floodplains "generally occur below 20m elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions" as the "floodplain" generally occurs below 20m elevation. This statement does not mean that all wetlands below 20m elevation automatically qualify as representatives of the EEC. • It is now apparent, from discussions with OEH that the EEC can be "associated" with the floodplain, despite this requirement not specifically occurring in the Scientific Community's determination. However, it is not considered that the vegetation community on the subject site is directly linked or in any way associated with the floodplain. Regardless, Council's ecologist is of the opinion that the area previously mapped (JWA 2013) is representative of the EEC, and this area will therefore be treated as such for the purposes of this assessment. The area of EEC (i.e. better-	**Section 3.2.2**

Council Requirements	Response	Relevant Section of Report
	quality wetland vegetation comprising >50% native species, as opposed to areas dominated by exotic grasses) was ground-truthed during this assessment.	
Location of stormwater infrastructure and Creek filling - the current development application proposes to fill in the watercourse and locate stormwater infrastructure within known threatened species habitats. These outcomes are not supported by Council's Environmental Scientist. In addition, these matters were investigated in detail during the rezoning process where it was concluded (see the attached plan from Greg Alderson and Associates) that the watercourse was to be retained and all stormwater infrastructure was to be located outside of threatened species habitat. Consequently, the development application should be revised to comply with the attached plan; however Council will also be guided by NSW Water in relation to this matter.	An assessment of the riparian corridor on the subject site was referred to the Office of Water. The Office of Water has confirmed that the drainage line on the subject site is a first order watercourse and have advised that there is no riparian corridor downstream of the site. They have also advised that any 'significant vegetation', including intact/good quality/mature stands of riparian vegetation should be retained. From an ecological perspective, 'significant vegetation' would particularly include any vegetation listed within schedules of the relevant commonwealth (i.e. EPBC Act 1999), state (i.e. TSC Act 1995) or local government legislation. From the Office of Water's perspective, 'significant vegetation' includes the above and any intact/good quality/mature stands of riparian vegetation. None of these vegetation types are considered to occur within the watercourse on the Subject site.	**Section 5.2.7**

Council Requirements	Response	Relevant Section of Report
While is it understood the development site has been subject to previous Hairy Joint Grass surveys (HJG), it remains unknown where on the development site the surveys were conducted. Surveys associated with the lodgement of the development application will need to be undertaken at the appropriate time of the year (mid March-April). All surveys are to be tracked by GPS. In regards to survey design please refer to the following link: http://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/about-threatened-species/surveys-andassessments A cursory review of the submitted Ecological Assessment Report confirms no further survey works have been undertaken for HJG. Given the survey season for the species has now passed Council will not be in a position to verify the survey results until mid March-April 2019.	Original correspondence from Council requested surveys in April/May. It is assumed that the reason being that the species is thought to be a perennial plant that tends to die down in winter, and that this makes it hard to detect. The relevant literature suggests that flowers appear in March to July (Harden, 1993) and summer to autumn (Jacobs & Wall, 2007) before the plant dies off in Winter. It should be noted that there are no published survey guidelines for this species that suggest certain times of the year that surveys must be completed. It can only be assumed that Council would prefer the surveys be completed prior to the annual die-off of HJG over winter. It could be argued that this die-off mechanism actually makes the species easier to detect, especially amongst other grasses that do not die off. Regardless, the HJG observed on site during the May 2018 surveys were found to be growing well and were lush and green, suggesting that the annual winter die-off had not yet commenced. The survey timing is therefore considered to be adequate. The May 2018 surveys were tracked by GPS.	**Sections 2.2.3 and 3.2.3**
Proposed stormwater basins should be located within designated drainage reserves which will be dedicated to Council, these should allow for access as per the Northern Rivers Local Government Guidelines and be clear of areas of environmental value (hairy joint grass etc).	The size and location of stormwater basins are governed by relevant engineering and hydrological requirements. These basins have avoided areas of HJG as far as practicable.	**Section 5.2.3**

2 METHODOLOGY

2.1 Desktop Review

2.1.1 Introduction

A desktop review of relevant ecological databases, mapping overlays, legislation and associated plans and policies was undertaken to identify mapped ecosystems and significant species and communities, as well as other ecological features that may occur on or within the vicinity of the site.

2.1.2 Literature Review

A number of previous documents have been prepared, which included assessments of the subject site, and were reviewed for the purposes of this assessment are as follows:

- Flora and Fauna Assessment for Lot 1 DP 517111 Lennox Head (JWA 2013a);
- Hairy-joint Grass Compensatory Habitat Plan for Lot 1 DP 517111 Lennox Head (JWA 2013b); and
- Ecological Assessment for Lot 1 DP 517111 Lennox Head (JWA 2017).

2.1.3 Database Searches

2.1.3.1 Background

The following databases were reviewed as part of the desktop assessment:

- the Commonwealth *Environment Protection Biodiversity and Conservation (EPBC) Act* (*1999*) Protected Matters Search Tool (PMST) (Dept. Environment 2017); and
- the NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife database (OEH 2017).

2.1.3.2 EPBC Act PMST

The Commonwealth PMST generates a list of protected matters under the Commonwealth *EPBC Act* that may occur in or near the subject area including:

- world heritage and national heritage areas;
- wetlands of international significance (Ramsar Wetlands);
- Commonwealth marine areas;
- threatened ecological communities;
- threatened species; and
- migratory species.

The database incorporates information from a range of sources including government, research and community organisations. It should be noted that there are limitations on the accuracy of some matters reported by the PMST. In particular, database records of threatened and migratory species are based on their current known distribution and do

not necessarily correlate to an actual observation. Database records are an indicator of potential presence only and do not take into account if suitable vegetation, geology, soil, climate or habitat types are actually present to support the occurrence of a significant species or community.

The Commonwealth PMST was used to determine the suite of threatened flora and fauna, migratory species and threatened ecological communities that were likely to be present within a 10km radius of the subject site.

2.1.3.3 OEH Atlas of NSW Wildlife

The NSW OEH maintains a database of flora and fauna records. It contains over 6 million records authorised for distribution by OEH.

Searches of the Atlas of NSW Wildlife (OEH 2017) database were completed to find records of State and Commonwealth threatened species within 10km of the subject site.

2.2 Site Investigations

2.2.1 Introduction

Following the desktop review, site investigations including an assessment of flora, fauna and general ecological values were undertaken by JWA ecologists on 21st August 2017, 10th January 2018, and 16th May 2018. The following flora and fauna survey techniques were utilised.

2.2.2 Vegetation Surveys

The site has been comprehensively surveyed between 2004 and 2013 utilising random meander searches (Cropper 1993) and a comprehensive plant species list has been compiled.

A further site inspection was completed in 2017 to assess whether any significant changes had occurred in the distribution and/or condition of previously mapped vegetation communities, and whether the native vegetation communities recorded on the site were still intact.

An additional site survey was completed in January 2018 which included a plot-based survey over an area of vegetation suggested by Ballina Shire Council as potentially representing a patch of littoral rainforest. The plot-based survey was completed in accordance with the BioBanking Assessment Methodology (BBAM) (OEH 2014).

Vegetation surveys included a description of each vegetation community identified on the site and each structural layer of the community. Mapping of vegetation communities was achieved using 1:1000 (2005) aerial photography, GPS and cadastral bases with relevant survey points.

2.2.3 Targeted Flora Surveys

During all vegetation surveys completed over the site targeted searches for significant plant species were also completed utilising the following methodology:

- Significant species likely to occur on or in the vicinity of the study site were identified;
- Habitats in which those species are likely to occur were identified from published reference material; and
- Habitats present on the Subject site that were most likely to contain significant species were intensively searched.

Landmark Ecological Services Pty Ltd was commissioned by Ballina Shire Council in 2008 to investigate all occurrences of Hairy joint grass (*Arthraxon hispidus*) in the Lennox Head district. As part of that study, the locations of Hairy joint grass (HJG) on the Subject site were mapped. During targeted flora surveys completed on 12th November 2009 two (2) scientists from JWA ground-truthed the locations of HJG on the subject site, as mapped by Landmark Ecological in 2008. Further searches for HJG were also completed in November 2010 and April 2013.

In August 2017 an additional site inspection was completed to assess whether the HJG distribution had altered significantly from 2013.

To allow for the greatest chance of finding and translocating HJG prior to development of the site, suitable habitat areas (i.e. previously known occurrence areas to be cleared and weed infested areas within the compensatory habitat) were slashed and raked in Spring 2017 to allow the species to germinate from the seed-bank. This was particularly important in areas previously known to be occupied by HJG (i.e. 2013 locations) as soil in these areas may have contained a viable seed bank. Slashed areas were then monitored for the presence of HJG seedlings every two (2) weeks for eight (8) weeks.

A further targeted site survey was completed in May 2018 to assess the current status of the Hairy joint grass distribution.

A summary of flora surveys completed on the site are as follows:

- 20th April 2004 – one (1) scientist for four (4) hours;
- 19th October 2004 – one (1) scientist for three (3) hours;
- 11th November 2004 – one (1) scientist for three (3) hours;
- 24th May 2005 – one (1) scientist for three (3) hours;
- 21st November 2005 – one (1) scientist for two (2) hours;
- 28th November 2007 – one (1) scientist for four and a half (4.5) hours;
- 30th May 2008 – one (1) scientist for three (3) hours;
- 9th July 2008 – one (1) scientist for two (2) hours;
- 12th November 2009 – two (2) scientists for three (3) hours;

- 1st April 2010 – one (1) scientist for one (1) hour;
- 11th November 2010 – one (1) scientist for two and a half (2.5) hours;
- 17th April 2013 - two (2) scientists for two and a half (2.5) hours;
- 24th April 2013 – one (1) scientist for one and a half (1.5) hours;
- 21st August 2017 – one (1) scientist for four (4) hours;
- 24th October 2017 – one (1) scientist for two (2) hours;
- 2nd November 2017 – one (1) scientist for two (2) hours;
- 16th November 2017 – one (1) scientist for two (2) hours;
- 30th November 2017 - one (1) scientist for two (2) hours;
- 10th January 2018 – two (2) scientists for five (5) hours; and
- 16th May 2018 – three (3) ecologists for six (6) hours.

2.2.4 Trees on Adjoining Land

At the pre-lodgement meeting (24/04/2018) council requested that the development application addressed the matter of vegetation growing on the boundary of development site and Lot 1 DP 878933. In addressing this matter compliance with Australian Standards AS 4373-2007 (Pruning of amenity trees) and AS 4970-2009 (Protection of trees on development sites) will be required.

A desktop study and site visit has identified that there are several trees located on the boundary of the site. The applicant has made contact with the adjoining land owner to discuss the relevant trees and access has been granted to undertake a tree survey. A desktop study of the trees close to the boundary is included in **Section 3.2.4** identifying the tree species, estimated size and position. Further investigation is being undertaken to determine relevant Tree Protection Zones (TPZ's) for trees in proximity to the site boundary, in accordance with AS 4970-2009 (Protection of trees on development sites) and will be provided to Council ASAP.

2.2.5 Watercourse assessment

At the pre-lodgement meeting (24/04/2018) council have noted that the current development application proposes to fill in the watercourse in the western portion of the site and that this outcome is not supported by Council's Environmental Scientist. However, the pre-lodgement minutes go on to state that Council will also be guided by NSW Water in relation to this matter.

An assessment of the current values of this watercourse were completed as part of this assessment (refer **Section 3.2.5**). It is noted that the NSW Office of Water have advised advised that any 'significant vegetation', including intact/good quality/mature stands of riparian vegetation should be retained.

2.2.6 Fauna Survey

2.2.6.1 Introduction

The fauna survey mainly relied upon an assessment of available habitats and their suitability for conservation significant fauna species considered a possible occurrence in the vicinity of the site. Targeted searches for specific species were also completed opportunistically whilst moving through the site when likely habitat was encountered.

2.2.6.2 Habitat Assessment

Site habitats were assessed to determine their value for native fauna species. This assessment was completed in conjunction with the flora survey. The assessment focused on identifying habitat features associated with Threatened species as well as other native fauna groups. Particular attention was paid to habitat features such as:

- The presence of mature trees with hollows, fissures and/or other suitable roosting/nesting places;
- The presence of Koala food trees;
- The presence of preferred Glossy black cockatoo feed trees (Forest oak and/or Black she-oak);
- The presence of characteristic signs of foraging (e.g. glider feeding scars);
- Condition, flow and water quality of drainage lines and bodies of water;
- Areas of dense vegetation;
- Presence of hollow logs/debris and areas of dense leaf litter;
- Presence of fruiting flora species;
- Presence of blossoming flora species, particularly winter-flowering species;
- Vegetation connectivity and proximity to neighbouring areas of intact vegetation; and
- Presence of caves and man-made structures suitable as microchiropteran bat roost sites.

Each Threatened species known from the locality was regarded as *Likely, Possible* or *Unlikely* to occur on the Subject site based on the occurrence of suitable habitat characteristics. A rating of *Likely* was given for those species where breeding or high-quality habitat is present on the site; a rating of *Possible* was given for those species where suitable foraging or roosting habitat is present on the site; and a rating of *Unlikely* was given for species where no suitable habitat occurs on the site.

2.2.6.3 Incidental and Targeted Fauna Surveys

The site has been comprehensively surveyed between 2004 and 2018 utilising random meander searches (Cropper 1993). During all site inspections, the 'random meander' technique (Cropper 1993) was used to traverse the site. Furthermore, logs, sheets of tin, cardboard, bark and leaves were overturned in search of reptiles and amphibians while

incidentally traversing the site. The site was actively searched for scats and bones, diggings and signs of droppings. Active observation of bird activity was undertaken during the site visit. All incidental records of fauna utilising the study area were recorded.

Incidental fauna surveys completed in conjunction with the flora surveys listed in **Section 2.2.3** above.

Furthermore, a targeted survey for the Threatened species Grass owl (*Tyto capensis*) and Wallum froglet (*Crinia tinnula*) was completed over two (2) nights on the 19th October, and the 11th of November 2004. While the site represents sub-optimal habitat for both of these species, it was decided to complete call playback over two (2) nights, as both species have been reputedly recorded on a nearby site (Pacific Pines).

The survey on 19th October 2004 was preceded by considerable rainfall in the previous 4-5 days. Weather conditions consisted of drizzling rain, with windy conditions at the initial visit, with the ground quite soggy, and pools of water common in low lying areas. Ponds on the site were full, and drainage lines flowing. The second visit was completed several days after rainy periods, on a clear evening with some mild wind. Conditions on the site were as previously.

Call playback was completed for five (5) minutes following an initial listening time of ten (10) minutes. A further listening time of five (5) minutes was allowed following call playback. Calls were broadcast at four (4) sites throughout the site for the Wallum froglet, and two (2) sites for the Grass owl.

3 FLORA ASSESSMENT

3.1 Database Searches

The Commonwealth PMST indicated that thirty (30) threatened flora species are known from within 10km of the subject site. A search of the OEH Atlas of NSW Wildlife database revealed twelve (12) threatened flora species are known from within 10km of the subject site.

Threatened flora species detected in the database searches are listed in **TABLE 2**. The conservation status of each species listed in **TABLE 2** is shown in accordance with the Commonwealth *EPBC Act* (*1999*) and NSW *TSC Act (1995)*.

TABLE 2
DATABASE RECORDS OF LISTED THREATENED FLORA SPECIES WITHIN 10KM OF THE SITE

Scientific Name	Common Name	TSC Act*	EPBC Act#
Acronychia littoralis	Scented acronychia	E1	E
Allocasuarina defungens	Dwarf heath casuarina	(E)	E
Allocasuarina thalassoscopica		(-)	E
Archidendron hendersonii	White lace flower	V	(-)
Arthraxon hispidus	Hairy-joint grass	V	V
Baloghia marmorata	Marbled Balogia	(V)	V
Bulbophyllum globuliforme	Miniature moss-orchid	(V)	V
Cryptocarya foetida	Stinking cryptocarya	V	V
Cryptostylis hunteriana	Leafless tongue-orchid	(V)	V
Cynanchum elegans	White-flowered wax plant	(E)	E
Davidsonia jerseyana	Davidson's plum	E1	E
Davidsonia johnsonii	Smooth davidsonia	(E1)	E
Desmodium acanthocladum	Thorny pea	(V)	V
Diploglottis campbellii	Small-leaved tamarind	(E1)	E
Elaeocarpus williamsianus	Hairy quandong	(E)	E
Endiandra hayesii	Rusty rose walnut	(V)	V
Endiandra floydii	Floyd's walnut	(E1)	E
Endiandra muelleri subsp. bracteate	Green-leaved rose walnut	E1	(-)
Fontainea oraria	Coastal fontainea	E4A	E
Floydia praealta	Ball nut	(V)	V
Gossia fragrantissima	Sweet myrtle	E1	E
Hicksbeachia pinnatifolia	Red boppel nut	(V)	V
Isoglossa eranthemoides	Isoglossa	(E)	E
Macadamia integrifolia	Macadamia nut	(-)	V
Macadamia tetraphylla	Rough-shelled bush nut	V	V
Ochrosia moorei	Southern ochrosia	(E1)	E
Owenia cepiodora	Onionwood	(V)	V

Scientific Name	Common Name	TSC Act*	EPBC Act#
Phaius australis	Southern swamp orchid	E1	E
Pterostylis nigricans	Dark greenhood	V	(-)
Randia moorei	Spiny gardenia	(E1)	E
Syzygium hodgkinsoniae	Red lilly pilly	(V)	V
Syzygium moorei	Durobby	(V)	V
Thesium australe	Austral toadflax	(V)	V
Tinospora tinosporoides	Arrow-head vine	V	(-)

* E1 – Endangered, E2 – Endangered Population, E4 – Critically Endangered, PE – Presumed Extinct as listed within schedules of the NSW *TSC Act* (1995).
# CE - Critically Endangered, E – Endangered and V - Vulnerable as listed within schedules of the Commonwealth *EPBC Act* (1999).

Database searches using the Commonwealth PMST also revealed that three (3) threatened Ecological Communities have the potential to occur within 10km of the subject site. These communities have been described in **TABLE 3** below.

TABLE 3
THREATENED ECOLOGICAL COMMUNITY DESCRIPTIONS

Ecological Community	Status[1]	Description
Coastal Swamp Oak (*Casuarina glauca*) Forest of NSW and SE Qld Ecological Community	E	The ecological community is characterised by the dominance of *Casuarina glauca* in the canopy, with an understorey of rushes, sedges, forbs and grasses. Coastal Swamp Oak Forest is typically found on loose or alluvial soil on coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated. Sometimes the ecological community can intergrade with mangroves or saltmarsh communities (on the seaward side), or with Melaleuca species and eucalypts (more landward)
Littoral rainforest and coastal vine thickets of Eastern Australia	CE	Complex of rainforest and coastal vine thickets on the east coast of Australia influenced by its proximity to the sea. The canopy, which protects less tolerant species and propagules in the understorey from salt laden winds, can range from patchy to closed and may include emergents as well as dead trees due to ongoing natural disturbance. The vegetation height depends on the degree of exposure and can range from dwarf to medium
Lowland rainforest of subtropical Australia	CE	The ecological community is generally a moderately tall (≥20 m) to tall (≥30 m) closed forest (canopy cover ≥70%). Tree species with compound leaves are common and leaves are relatively large (notophyll to mesophyll). Typically there is a relatively low abundance of species

Ecological Community	Status[1]	Description
		from the genera Eucalyptus, Melaleuca and Casuarina. Buttresses are common as is an abundance and diversity of vines. Lowland Rainforest has the most diverse tree flora of any vegetation type in NSW (Floyd, 1990a) and the species composition of the canopy varies between local stands and between regions (Keith, 2004). The ecological community typically has high species richness (≥ 30 woody species from Appendix A). The canopy comprises a range of tree species but in some areas a particular species may dominate e.g. palm forest, usually dominated by *Archontophoenix cunninghamiana* (bangalow palm) or *Livistona australis* (cabbage palm); and riparian areas dominated by *Syzygium floribundum* (syn. Waterhousea floribunda) (weeping satinash/weeping lilly pilly). The canopy is often multilayered consisting of an upper, discontinuous layer of emergents, over the main canopy and subcanopy. Below the canopy is an understorey of sparse shrubs and seedlings.
[1] Conservation status as listed within schedules of the EPBC Act (1999), where CE: Critically Endangered, E: Endangered, V: Vulnerable.		

3.2 Results of Site Investigations

3.2.1 Introduction

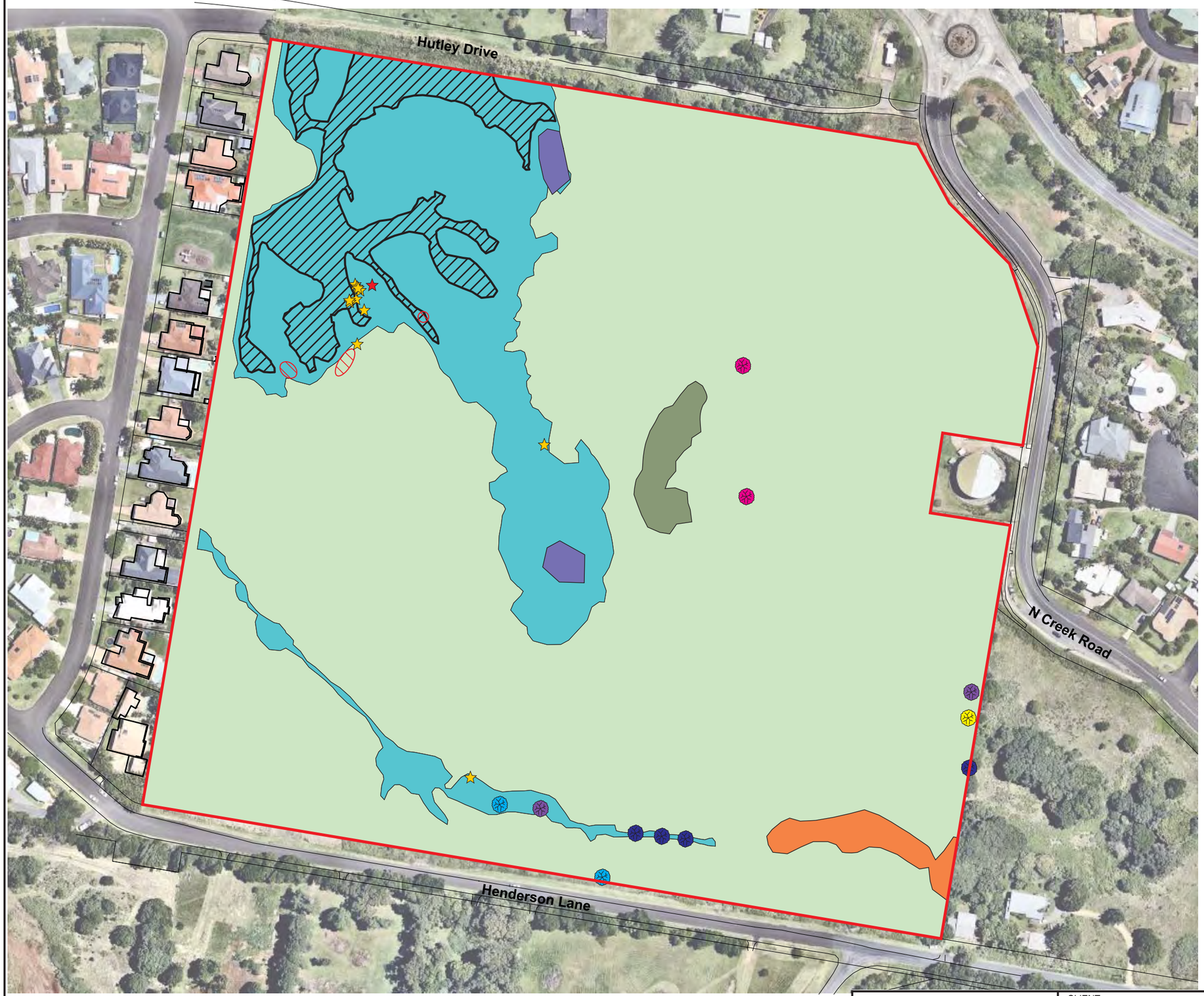
Four (4) vegetation communities have been identified on the subject site. The 2017 and 2018 site assessments confirmed the previous vegetation mapping (JWA 2013a)**.** However, the removal of the cattle grazing pressure from the subject site has resulted in the growth of the pasture species to over 1m tall. Therefore, the community descriptions for Community 3 and Community 4 have been amended to reflect this growth (**SECTION 3.2.2**). These communities are described in **SECTION 3.2.2** and are shown in **FIGURE 7**.

3.2.2 Community Descriptions

3.2.2.1 Background

Four (4) vegetation communities were recorded on the subject site and are listed in **TABLE 4**. The status of these communities is discussed below with reference to Plant Community Types (PCTs) as described in the NSW BioNet Vegetation Information System (VIS) and also Endangered Ecological Community (EEC) descriptions where relevant. Identification of PCTs and potential EECs on the subject site was completed by comparing data collected from site to:

1. Detailed descriptions of PCTs and relevant geographic distributions within the BioNet Vegetation Classification;
2. Detailed descriptions of EECs on the OEH website;



N

LEGEND

- Community 1 - Mid-high woodland (*Banksia integrifolia*)
- Community 2 - Disturbed regrowth (*Lantana camara*, *Senna pendula*, *Cinnamomum camphora*)
- Community 3 - Low closed grassland (*Stenotaphrum secundatum*, *Paspalum dilatatum*, *Cynodon dactylon*, *Axonopus affinis*)
- Community 4 - Wet grassland/sedgeland (*Paspalum dilatatum*, *Cynodon dactylon*, *Juncus* sp., *Persicaria* sp., *Cyperus* sp.)
- Dams
- Freshwater Wetland EEC
- *Arthraxon hispidus* - May 2018 (Vulnerable - ROTAP)
- *Arthraxon hispidus* seedling - November 2017 (Vulnerable - ROTAP)
- *Arthraxon hispidus* (Vulnerable - ROTAP) (Locations confirmed by JWA September 2017
- Tuckeroo (*Cupaniopsis anacardioides*)
- Guioa (*Guioa semiglauca*)
- Guioa (*Guioa semiglauca*) & Tuckeroo (*Cupaniopsis anacardioides*)
- Guioa (*Guioa semiglauca*) & Sweet pittosporum (*Pittosporum undulatum*)
- Coast banksia (*Banksia integrifolia*)
- Subject Site

0 50m

1 : 2000

SOURCE: JWA Site Investigations 2004, 2008, 2013, 2017 & 2018; Urbis (Ref: PLN-Concept 5c.pdf)

SCALE: 1 : 2000 @ A3

JWA PTY LTD
Ecological Consultants

CLIENT
Ballina Island Developments Pty Ltd

PROJECT
Ecological Assessment
Lot 1 on DP517111
20 North Creek Road, Lennox Head, NSW
Ballina Shire Council LGA

FIGURE 7

PREPARED: BW
DATE: 27 February 2019
FILE: N20068_EA_Vegetation.cdr

TITLE

VEGETATION COMMUNITIES

3. Survey data and/or individual species records held in BioNet; and
4. Existing maps of native vegetation in the area.

TABLE 4
VEGETATION COMMUNITIES PRESENT ON THE SUBJECT SITE

	Vegetation Community
1	Mid-high woodland (*Banksia integrifolia*)
2	Disturbed regrowth (*Lantana camara*, *Senna pendula, Cinnamomum camphora*)
3	Low closed grassland (*Paspalum dilatatum*, *Cynodon dactylon*)
4	Wet grassland/sedgeland (*Paspalum dilatatum, Cynodon dactylon*, *Juncus* sp., *Persicaria* sp., *Cyperus* sp.)

3.2.2.2 Community 1 - Mid-high woodland (*Banksia integrifolia*)

Location and Area

This community occurs in the central portion of the subject site and covers a total area of approximately 0.14 ha (**FIGURE 7**).

Description

This community is small in area and is relatively disturbed. Coast banksia (*Banksia integrifolia)* and Camphor laurel* (*Cinnamomum camphora)* are the dominant canopy species. Other species present include Guioa (*Guioa semiglauca)*, Tuckeroo (*Cupaniopsis anacardioides)*, Cockspur thorn (*Maclura cochinchinensis*), Barbwire vine (*Smilax australis*) and Sweet pittosporum (*Pittosporum undulatum*). Other weed tree/shrub species present include Winter senna* (*Senna coluteoides)*, Guava* (*Psidium guajava)*, Brazilian cherry* (*Eugenia uniflora)*, Murraya* (*Murraya paniculata),* Corky passion vine (*Passiflora suberosa*), Polka dot plant (*Hypoestes phyllostachya*) and Ochna* (*Ochna serrulata*). An understorey of Lantana* (*Lantana camara*) occurs throughout this community.

Applicable PCT and EEC

The plant community identification function within the BioNet Vegetation Classification database was utilised to assist with PCT identification. Details of the vegetation formation (Keith 2004) and dominant species observed within the upper stratum, mid stratum and ground stratum were entered into the system. Data collected from the site was then compared to the resulting PCT descriptions.

The vegetation community described above is considered to best fit with PCT 1536 - Tuckeroo – Lilly Pilly – Coast Banksia littoral rainforest. This community has been disturbed by grazing and weed infestations. The mid-high woodland community on the subject site contains some species that are representative of the EEC – Littoral rainforest in the NSW North Coast, Sydney Basin and South-East Corner bioregions, as listed within

schedules of the NSW *TSC Act (1995).* This community could possibly be considered to be a degraded representative of this EEC.

The small size and degraded nature of this vegetation excludes it from meeting relevant criteria for representing the Commonwealth listed TEC Littoral rainforest and coastal vine thickets of Eastern Australia.

The conservation value of this community is reduced by its small size, disturbance by cattle, and high level of degradation by weed species and other edge effects.

3.2.2.3 Community 2 - Disturbed regrowth (*Lantana camara**, *Senna pendula**, *Cinnamomum camphora**)

Location and Area

This community occurs in association with a gully in the south-western portion of the subject site and covers a total area of 0.14 ha (**FIGURE 7**).

Description

This community is almost exclusively dominated by Lantana*. Other weed species present include Winter senna* (*Senna pendula*), Wild tobacco* (*Solanum mauritianum)* and Stinking roger* (*Tagetes minuta)*. Several large Camphor laurels* also occur within the gully, along with one mature Yellow kamala (*Mallotus discolor*) at the eastern end of the drainage line. Regenerating native species include Brown kurrajong (*Commersonia bartramia)*, Banana bush (*Tabernaemontana pandacaqui)*, Cockspur (*Maclura cochinchinensis)*, Midgen berry (*Austromyrtus dulcis)* and Twining Guinea flower (*Hibbertia dentata)*.

Applicable PCT and EEC

There is no appropriate PCT or EEC classification for this non-native community. The conservation value of this community is considered to be relatively low due to the mixture of exotic and weed species, and general lack of native vegetation.

3.2.2.4 Community 3 - Low closed grassland (*Paspalum dilatatum*, Cynodon dactylon*)

Location and Area

This community occupies the majority of the site and covers a total area of 11.27 ha (**FIGURE 7**).

Description

This community is dominated by pasture grasses (predominantly Paspalum and Couch grass) along with other pasture grasses and herbaceous weed species such as Rhodes grass* (*Chloris gayana*), Buffalo grass* (*Stenotaphrum secundatum*), Farmers's friends* *(Bidens pilosa),* Ragweed* *(Ambrosia artemisiifolia),* Crofton weed* *(Ageratina adenophora),* Fleabane* *(Conyza albida),* Scotch thistle* *(Onopordium acanthum)* and

Narrow-leaf cottonbush* *(Gomphocarpus fruticosus).* Other weed species present include Lantana*, Winter senna*, Wild tobacco* and Paddy's Lucerne* (*Sida rhombifolia)*.

Applicable PCT and EEC

There is no appropriate PCT or EEC classification for this non-native community. The conservation value of this community is considered to be relatively low.

3.2.2.5 Community 4 – Wet grassland/sedgeland (*Paspalum dilatatum**, *Cynodon dactylon*, *Juncus* sp., *Persicaria* sp., *Cyperus* sp.)

Location and Area

This community occurs in the low-lying areas of the site, most notably in the north-western corner, and covers a total area of 3.44 ha (**FIGURE 7**).

Description

The north-western portion of the site and a drainage line in the south of the site are low lying and generally comprise of a mixture of exotic grasses including Paspalum*, Couch grass*, Pigeon grass* (*Setaria* sp.), Rhodes grass*, Buffalo grass* along with native wetland species. Native wetland species present include Swamp rice-grass (*Leersia hexandra*), Bunchy sedge (*Cyperus polystachyos*), *Cyperus odoratus,* Common rush (*Juncus usitatus*), Tall spikerush (*Eleocharis sphacelata*), Bullrush (*Typha orientalis*), Frogsmouth (*Philydrum lanuginosum*), Pale Knotweed (*Persicaria attenuata*), Smartweed (*Persicaria lapathifolia*) and Swamp water fern (*Blechnum indicum*).

The Threatened species Hairy-joint grass also occurs sporadically throughout this community amounting to 148 m^2 (**FIGURE 7**).

Applicable PCT and EEC

The plant community identification function within the BioNet Vegetation Classification database was utilised to assist with PCT identification. Details of the vegetation formation (Keith 2004) and dominant species observed within the upper stratum, mid stratum and ground stratum were entered into the system. Data collected from the site was then compared to the resulting PCT descriptions.

The vegetation community described above is considered to best fit with PCT 1736 - Water couch – Tall spike rush freshwater wetland of the Central Coast and lower Hunter. This community has been disturbed by grazing and weed infestations.

It is noted that previous ecological assessments of the subject site (JWA 2013) indicated that portions of this vegetation community may be representative of the EEC - Freshwater Wetlands on Coastal floodplain, as listed under the NSW *TSC Act (1995).* It is now understood that this area of Freshwater wetland does not occur on the floodplain (defined as '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' within the EEC listing) and has no direct linkage or association with

the floodplain, and therefore is not likely to be representative of this EEC. Despite this, Council's ecologist is of the opinion that the area previously mapped (JWA 2003) is representative of the EEC, and this area will therefore be treated as such for the purposes of this assessment. The area of EEC (i.e. better-quality wetland vegetation comprising >50% native species, as opposed to areas dominated by exotic grasses) was ground-truthed during this assessment and it's extent is shown in **FIGURE 7**).

It is interesting to note that the degraded wetlands on the site were not recommended to be zoned for Environmental Protection during a review conducted in 2000 into the adequacy and suitability of the zoning provided in the BLEP (refer Lennox Head Structure Plan 2004).

This community is considered to have a moderate conservation value due to its degraded nature.

3.2.3 Targeted Flora Surveys

One hundred and five (105) flora species have been recorded at the Subject site (all surveys combined). A full list of species recorded at the site is included as **APPENDIX 1**. Weed species are indicated by the use of an asterisk*.

One (1) species listed as Vulnerable within schedules of the NSW *TSC Act (1995)* and the *EPBC Act* 1999 - Hairy joint grass (*Arthraxon hispidus*) – has historically been recorded from the site and has been found persisting in highly degraded areas of habitat.

Clumps of HJG have been located at several areas within the subject site. These populations have been monitored over a number of years i.e. JWA 2007, 2008, 2009, 2010, 2013, 2017, 2018 and Landmark ecological consulting 2008. Surveys completed in August 2017 found that the distribution of the HJG populations had contracted to just three (3) small patches (**FIGURE 7**). It appears while likely that historical cattle grazing on the site has impacted these plants, the subsequent removal of grazing cattle from the property has resulted in significant growth of pasture grasses which may have resulted in HJG being outcompeted.

In Spring 2017 areas of the site known to be suitable habitat for HJG were slashed and raked to allow for the greatest chance of finding HJG as it germinated and allow for translocation into the proposed compensatory habitat area.

An additional targeted survey for HJG was completed in May 2018 and the current distribution of HJG is shown in **FIGURE 7**. A detailed description of the methodology and results of the HJG surveys are provided in the Hairy-joint grass Survey Report (JWA 2018b).

3.2.4 Trees on Adjoining Land

A desktop study and site visit has identified that there are several trees located on the boundary of the site (**TABLE 5**). The applicant has made contact with the adjoining land owner to discuss the relevant trees and access has been granted to undertake a tree

survey. Further investigation is being undertaken to determine relevant Tree Protection Zones (TPZ's) for trees in proximity to the site boundary, in accordance with AS 4970-2009 (Protection of trees on development sites) and will be provided to Council ASAP.

Trees in **TABLE 5** were identified to species level by a JWA ecologist, and details collected on the estimated dbh[1], which allowed preliminary tree protection zones to be determined in accordance with AS 4970-2009 (Protection of trees on development sites). Approximate locations of the trees are provided in **FIGURE 8.** A tree survey is yet to be completed to allow the accurate mapping of the trees and relevant TPZ's. The estimated details will be confirmed (once site access is available), in addition to height and canopy spread, and will be included in a Vegetation Management Plan and provided to Council ASAP.

TABLE 5
TREES ON ADJOINING PROPERTY REQUIRING FURTHER ASSESSMENT

Tree No.	Species	Common Name	Estimated DBH	Estimated TPZ
1	*Guioa semiglauca*	Guioa	10 cm	1.2 m
2	*Guioa semiglauca*	Guioa	10 cm	1.2 m
3	*Cupaniopsis anacardioides*	Tuckeroo	10 cm	1.2 m
4	*Guioa semiglauca*	Guioa	30 cm	3.6 m
5	*Guioa semiglauca*	Guioa	10 cm	1.2 m
6	*Guioa semiglauca*	Guoia	10 cm	1.2 m
7	*Ficus macrophylla*	Moreton Bay fig	175 cm	15 m
8	*Ficus macrophylla*	Moreton Bay fig	125 cm	15 m

3.2.5 Watercourses

A low-lying drainage line occurs in the south of the site. This watercourse is poorly developed, is degraded by erosion and provides little leaf litter or rocky areas for fauna shelter, although dense weed growth towards the east does provide some cover.

An assessment of the watercourse on the subject site was referred to the Office of Water. The Office of Water has confirmed that the drainage line on the subject site is a first order watercourse and have advised that there is no riparian corridor downstream of the site (**APPENDIX 2**). They have also advised that any 'significant vegetation', including intact/good quality/mature stands of riparian vegetation should be retained.

From an ecological perspective, 'significant vegetation' would particularly include any vegetation listed within schedules of the relevant commonwealth (i.e. EPBC Act 1999), state (i.e. TSC Act 1995) or local government legislation. From the Office of Water's perspective, 'significant vegetation' includes the above and any intact/good quality/mature stands of riparian vegetation.

[1] Diameter at breast height

N

LEGEND
Surveyed Tree
Surveyed Palm
Subject Site

0 10m 20m
1 : 800

SOURCE: RCS Group (Ref: 18047-8.dwg); Near Map 06 Dec 2017 Aerial

SCALE: 1 : 800 @ A3

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Ecological Assessment
Lot 1 on DP517111
20 North Creek Road, Lennox Head, NSW
Ballina Shire Council LGA

FIGURE 8

PREPARED: BW
DATE: 18 July 2018
FILE: N20068_EA_Tree Survey.cdr

TITLE

TREE SURVEY

None of these vegetation types are considered to occur within the watercourse on the Subject site.

4 FAUNA ASSESSMENT

4.1 Database Searches

Database searches using the Commonwealth PMST identified twenty-one (21) threatened fauna species that may occur within 10km of the subject site based on the availability of suitable habitat. The OEH Atlas of NSW Wildlife database indicated that forty (40) threatened fauna species have been recorded from within 10km of the subject site.

Threatened fauna species detected in the database searches are listed in **TABLE 6**. The conservation status of each species listed in **TABLE 6** is shown in accordance with the Commonwealth *EPBC Act* (1999) and NSW *TSC Act* (1995). Species that will clearly not occur on the site i.e. whales, sharks, turtles, shore birds and marine birds have been omitted.

TABLE 6
DATABASE RECORDS OF LISTED THREATENED FAUNA SPECIES WITHIN 10KM OF THE SITE

Scientific Name	Common Name	TSC Act*	EPBC Act#
Amaurornis moluccana	Pale-vented bush-hen	V	-
Anseranas semipalmata	Magpie goose	V	-
Anthochaera phrygia	Regent honeyeater	(CE)	CE
Argynnis hyperbius inconstans	Australian fritillary	(E)	CE
Artamus cyanopterus cyanopterus	Dusky woodswallow	V	-
Botaurus poiciloptilus	Australasian bittern	E1	E
Burhinus grallarius	Bush stone-curlew	E1	-
Calidris alba	Sanderling	V	-
Calidris ferruginea	Curlew sandpiper	E1	CE
Calyptorhynchus lathami	Glossy black-cockatoo	V	-
Chalinolobus dwyeri	Large-eared pied bat	(V)	V
Circus assimilis	Spotted harrier	V	-
Crinia tinnula	Wallum froglet	V	-
Cyclopsitta diophthalma coxeni	Coxen's fig-parrot	(CE)	E
Daphoenositta chrysoptera	Varied sittella	V	-
Dasyurus maculatus	Spotted-tailed quoll	V	E
Ephippiorhynchus asiaticus	Black-necked stork	E1	-
Erythrotriorchis radiatus	Red goshawk	(CE)	V
Gavicalis fasciogularis	Mangrove honeyeater	V	-
Grus rubicunda	Brolga	V	-
Haliaeetus leucogaster	White-bellied sea-eagle	V	-
Hieraaetus morphnoides	Little eagle	V	-
Irediparra gallinacean	Comb-crested jacana	V	-
Ixobrychus flavicollis	Black bittern	V	-
Lathamus discolor	Swift parrot	(E)	CE
Litoria aurea	Green and golden bell frog	E1	(V)

Scientific Name	Common Name	TSC Act*	EPBC Act#
Litoria olongburensis	Wallum sedge frog	V	V
Miniopterus australis	Little bentwing-bat	V	-
Miniopterus schreibersii oceanensis	Eastern bentwing-bat	V	-
Mormopterus norfolkensis	Eastern free-tailed bat	V	-
Myotis macropus	Southern myotis	V	-
Numenius madagascariensis	Eastern curlew	-	CE
Nyctophilus bifax	Eastern long-eared bat	V	-
Pandion cristatus	Eastern osprey	V	-
Petauroides volans	Greater glider	(-)	V
Pezoporus wallicus wallicus	Eastern ground parrot	V	-
Phascolarctos cinereus	Koala	V	V
Phyllodes imperialis smithersi	Pink underwing moth	(E)	E
Planigale maculata	Common planigale	V	-
Podargus ocellatus	Marbled frogmouth	V	-
Pomatostomus temporalis termporalis	Grey-crowned babbler (eastern subspecies)	V	-
Potorous tridactylus tridactylus	Long-nosed potoroo (SE mainland)	(V)	V
Pseudomys novaehollandiae	New Holland mouse	(V)	V
Pteropus poliocephalus	Grey-headed flying-fox	V	V
Ptilinopus regina	Rose-crowned fruit-dove	V	-
Rostratula australis	Australian painted snipe	(E)	E
Scoteanax rueppellii	Greater broad-nosed bat	V	-
Stictonetta naevosa	Freckled duck	V	-
Syconycteris australis	Common blossom-bat	V	-
Thersites mitchellae	Mitchell's rainforest snail	E1	CE
Turnix melanogaster	Black-breasted button-quail	(E4A)	V
Tyto longimembris	Eastern grass owl	V	-
Tyto novaehollandiae	Masked owl	V	-
Xeromys myoides	Water mouse	(-)	V

* E1 – Endangered, E2 – Endangered Population, E4A – Critically Endangered, E4 – Presumed Extinct, V - Vulnerable as listed within schedules of the NSW *TSC Act* (1995).
# CE - Critically Endangered, E – Endangered, and V – Vulnerable as listed within schedules of the Commonwealth *EPBC Act* (1999).

Database searches using the Commonwealth PMST also revealed that thirty-five (35) migratory and/or marine species may occur within 10km of the site based on the availability of suitable habitat. Migratory and Marine species identified in database searches are listed in **TABLE 7**. Species that will clearly not occur on the site i.e. whales, sharks, turtles, shore birds and marine birds have been omitted.

TABLE 7
DATABASE RECORDS OF COMMONWEALTH LISTED MIGRATORY AND/OR MARINE SPECIES WITHIN 10KM OF THE SITE

Scientific Name	Common Name	EPBC Act#
Actitis hypoleucos	Common sandpiper	M, Ma
Apus pacificus	Fork-tailed swift	M, Ma
Ardea alba	Great egret	M, Ma
Ardea ibis	Cattle egret	M, Ma
Calidris acuminata	Sharp-tailed sandpiper	M, Ma
Calidris ferruginea	Curlew sandpiper	M, Ma
Calidris ruficollis	Red-necked stint	M
Calidris subminuta	Long-toed stint	M
Charadrius bicinctus	Double-banded plover	M, Ma
Charadrius veredus	Oriental plover	M
Cuculus optatus	Oriental cuckoo	M, Ma
Cuculus saturates	Oriental cuckoo	Ma
Gallinago hardwickii	Latham's snipe	M, Ma
Gallinago megala	Swinhoe's snipe	M, Ma
Gallinago stenura	Pin-tailed snipe	M, Ma
Haliaeetus leucogaster	White-bellied sea-eagle	Ma
Himantopus himantopus	Black-winged stint	Ma
Hirundapus caudacutus	White-Throated Needletail	M, Ma
Lathamus discolour	Swift parrot	Ma, CE
Merops ornatus	Rainbow bee-eater	Ma
Monarcha melanopsis	Black-Faced Monarch	M, Ma
Monarcha trivirgatus	Spectacled Monarch	M, Ma
Motacilla flava	Yellow wagtail	M, Ma
Myiagra cyanoleuca	Satin Flycatcher	M, Ma
Numenius madagascariensis	Eastern curlew	M, Ma, CE
Rhipidura rufifrons	Rufous Fantail	M, Ma
Pandion haliaetus	Osprey	M, Ma
Philomachus pugnax	Ruff	M, Ma
Pluvialis fulva	Pacific golden plover	M
Pluvialis squatarola	Grey plover	M
Rhipidura ruffirons	Rufous fantail	Ma
Rostratula benghalensis	Painted snipe	E, Ma
Tringa glareola	Wood sandpiper	M, Ma
Tringa nebularia	Common greenshank	M, Ma
Tringa stagnatilis	Marsh sandpiper	M

M – Migratory and Ma - Marine as listed within schedules of the Commonwealth *EPBC Act (1999).*

4.2 Habitat Assessment

4.2.1 Amphibians

Amphibians occurring in the region are poikilothermic, predominantly insectivorous and generally require free water for reproduction, with the exception of two highland genera (*Assa darlingtoni* and *Philoria* spp.) The habitat requirements of most species are unlikely to be determined by forest cover or floristics but are more strongly influenced by factors such as climate, distance to water bodies, riparian vegetation, hydrological and morphological characteristics of water bodies and the availability of suitable micro-habitat for aestivation and shelter.

The majority of species that occur within the region lay eggs in or near temporary or permanent water bodies and rely on free water for larval development and metamorphosis. Of these species, only a few are dependent on forested habitats beyond the riparian zone or beyond areas of temporary inundation. These species include the Red-eyed tree frog (*Litoria chloris*), Leseuer's frog (*Litoria leseueri*), Fletchers frog (*Lechriodus fletcheri*) and the Barred frogs of the *Mixophyes* genus.

The Subject site is likely to provide moderate quality habitat for a range of frogs. The main sedgeland/wetland area in the north-west corner of the site is well vegetated and large in size and is suitable for a range of commonly occurring tree frog species. The ponds on the site similarly provide such habitat. The drainage lines in the south of the site are poorly developed and are degraded by erosion and provide little leaf litter or rocky areas for shelter, although dense weed growth towards the east does provide some cover.

Grasslands provide suitable habitat for a range of Amphibian species, particularly along drainage depressions and soaks. Species commonly encountered in grassland communities include the Common eastern froglet, Eastern sign bearing froglet, Striped marsh frog, Spotted grass frog, Eastern dwarf tree frog, Rocket frog, Whistling tree frog and Cane toad.

Species typically encountered in or adjacent to Closed Forests include the Eastern dwarf tree frog, Red-eyed tree frog, Striped marsh frog, Cane toad and Dainty green tree frog. Relatively few species occur in conjunction with Closed Forest types when permanent water is absent. Species which typically occur in low elevation Rainforest and permanent streams such as the Giant barred frog (*Mixophyes iteratus*) are unlikely to occur at the study site.

4.2.2 Reptiles

As reptiles are poikilothermic, and predominantly insectivorous or carnivorous, their habitat requirements are less directly determined by vegetation species composition than other taxa which feed directly on plants. Reptile distributions are strongly influenced by structural characteristics of the vegetation, climate and other factors affecting thermoregulation such as shade and availability of shelter and basking sites (Smith *et al* 1994).

In a survey of the moist forest herpetofauna of North-eastern NSW, Smith *et al* (1989) found that few species discriminated between rainforest and wet sclerophyll forest, however, most species exhibited a response to differences in elevation and the availability of microhabitat components and other substrates.

The availability of microhabitats, of varying thermal properties is particularly important for most reptile species, as behavioural thermoregulation (regulation of body heat) is important in controlling critical body functions such as digestion, foraging activity and reproduction.

Reptile diversity and abundance is often (but not always) significantly higher in drier habitat types, particularly those with a wide variety of ground substrate microhabitats. This contrasts markedly with the distribution patterns of birds, and most mammals.

The single limiting factor in terms of species diversity in coastal vegetation is the lack of shelter sites (e.g. logs, tree hollows and decorticating bark). Such habitat components characterise eucalypt forests and woodlands, where species diversity may be much higher, depending on disturbance factors.

The Subject site is considered to provide moderate quality habitat for reptiles due to the presence of: the combination of shelter and basking sites; some forested areas with good canopy and limited leaf litter development; availability of water in drainage lines; and reliable sources of prey. There are few rocky areas and fallen logs for shelter, with leaf litter generally sparse in vegetation communities.

4.2.3 Birds

The significance of near coastal environments of the N.S.W. Far North Coast and South-East Queensland as overwintering habitat for migratory birds has been established by many observers and bird banders including Keast (1968), Robertson (1973), Gravatt (1974), Porter (1982) and Robertson and Woodall (1983). These patterns may be attributable to the relatively high winter temperatures and long growing season of this region compared with the rest of south-eastern Australia (Fitzpatrick and Nix 1973; Edwards 1979; Nix 1982; Specht 1981).

Many insectivorous birds from higher latitudes and elevation overwinter in the locality. These include species such as the Fantail cuckoo, Sacred kingfisher, Rainbow bee-eater, Noisy pitta, Tree martin, Black-faced cuckoo-shrike, Cicada bird, Golden whistler, Rufous whistler, Rose robin, Grey fantail, White-throated gerygone, Silvereye, Olive-backed oriole and Spangled drongo.

Birds such as honeyeaters and lorikeets are Blossom nomads (*ibid.*). These birds move locally in response to variation in the availability of nectar and or pollen, important components in their diet. Porter (1982) highlights the importance of Forest red gum, Broad-leaved paperbark and Coast banksia for Scaly-breasted and Rainbow lorikeets as these species flower during the lorikeet's winter breeding period. A sequence of important nectar bearing plants in the genera Eucalyptus, Banksia, Melaleuca and Callistemon provide a continuity of food for nectarivorous birds.

Studies of bird usage in rainforest remnants by Holmes (1987), Connelly and Specht (1988) and Lott & Duigan (1993) indicate that the diversity and abundance of birds is related to the size of the Rainforest patches and their degree of isolation from major areas of native forest. Lott & Duigan (1993) and Howe *et al* (1981) also note that sites with a higher diversity of vegetation and those which are closer to water generally support a greater diversity of birds. Locally nomadic and migratory rainforest species such as the Wompoo, Rose-crowned and Superb fruit-doves, Common koel and Black-faced cuckoo-shrike are known to use scattered areas of habitat as "stepping-stones" between more intact areas of forest (Date et al 1992; Lott & Duigan 1993).

The variety of habitats present in the Study area is likely to result in a high diversity of resident and nomadic birds occurring on the site over the duration of a year. The site provides a low diversity and abundance of fruiting species. The Subject site and adjacent areas of vegetation represent moderate quality habitat for frugivorous birds, particularly from remnant rainforest occurring in the study area.

The Study area provides some suitable foraging and breeding habitat for a range of rainforest birds. The Subject site provides some foraging resources for nectarivorous birds, chiefly from the occurrence of stands of Coast banksia. The level of disturbance to the drainage line and intermittent flow is likely to preclude the occurrence of birds associated with permanent watercourses.

There is a lack of trees with hollows necessary for hollow-nesting birds, however, the subject area may represent some limited forage habitat for hollow-dependent avifauna breeding in forests in the locality.

4.2.4 Mammals

Small terrestrial mammals generally occur in highest densities in association with a complex vegetation structure. A dense understorey layer, which provides shelter from predators and provides nesting opportunities, is particularly important.

In general medium-large terrestrial mammals such as macropods select habitats which provide a dense cover for shelter and refuge and open areas for feeding. The larger species tend to occupy drier more open habitats: the smaller species, moister and more densely vegetated habitats.

All Arboreal mammals that occur in the region (with the exception of the Koala) utilise tree hollows for nesting and shelter (although the Common ringtail possum is not dependent on hollows). Smith & Lindenmeyer (1988) consider that shortage of nest hollows is likely to limit arboreal mammal populations where density of hollow bearing trees is less than 2 to 8 trees per hectare.

Arboreal folivores (*e.g.* Common ringtail possum, Greater glider) are widespread and abundant in NSW, but exhibit local variation in response to such factors as tree species composition, foliage protein and fibre levels, leaf toughness, toxins, forest structure and the availability of shelter sites. Arboreal folivores are expected to be most abundant in

areas of high productivity, high soil fertility and moderate climate, in conjunction with adequate shelter and suitable foraging substrate.

Arboreal nectarivore/insectivores feed on a wide variety of plant and insect exudates including the nectar of flowering eucalypts, and shrubs such as Banksia and Acacia sp. These species also feed extensively on insects, particularly under the shedding bark of eucalypts. The distribution of nectarivore/insectivores is considered to be related to the abundance of nectar and pollen producing plants, the abundance of bark shedding eucalypts which harbour insect prey, and the occurrence of sap and gum exudate producing trees (Sap feed trees) and shrubs (*e.g.* Acacia sp.). Arboreal nectarivores and insectivores are generally hollow dependent species.

There is a lack of trees with hollows necessary for hollow-dependent mammals, however, as with the birds, the Study area may represent limited forage habitat for hollow-dependent mammals resident in forests in the locality. No primary Koala feed trees were recorded on the Subject site.

The poor structural complexity and habitat diversity of the site is likely to support a relatively low diversity and abundance of ground dwelling mammals. Expected species are likely to be disturbance tolerant exotic species such as the Black rat and House mouse. Native species present may include the Bush rat and Northern brown bandicoot.
Insectivorous bats like insectivorous birds overlap considerably in diet and broad vegetation preferences (Hall 1981), but specialise in foraging in specific layers or substrates within the forest (Crome and Richards 1988). The Study area is likely to provide limited forage habitat for a relatively low diversity and abundance of insectivorous bats, due to the lack of large areas of native vegetation. The large fig on the central site, and mature mango trees adjacent to the site represent relatively low-quality foraging habitat for frugivorous bats. The nectarivorous Common blossom bat may forage on Coast banksias throughout the site.

There is a lack of old-growth trees for hollow-dependant bats, and roosting habitat on the site is considered very poor. There is no suitable roost habitat for the Threatened Black flying-fox, Grey-headed flying fox and Common blossom bat.

4.3 Results of Site Investigations

4.3.1 Amphibians

Six (6) amphibian species were recorded during the site surveys (**TABLE 8**). No Threatened species were recorded. The targeted survey for the Threatened Wallum froglet utilising call playback did not result in any records of this species in 2013.

Large numbers of mature Cane toads were observed congregating around ponds and drainage lines on the site.

TABLE 8
AMPHIBIAN SPECIES RECORDED ON SITE

Common name	Scientific name	Year recorded
Cane toad*	*Bufo marinus*	2013, 2017
Bleating tree frog	*Litoria dentata*	2013
Striped marsh frog	*Limnodynastes peroni*	2013, 2017, 2018
Common eastern froglet	*Crinia signifera*	2013, 2017, 2018
Dwarf tree frog	*Litoria fallax*	2013, 2017, 2018
Green tree frog	*Litoria caerulea*	2013

4.3.2 Reptiles

Two (2) reptile species were recorded during the site surveys (**TABLE 9**). No Threatened reptiles were recorded.

TABLE 9
REPTILE SPECIES RECORDED ON SITE

Common name	Scientific name	Year recorded
Common garden skink	*Lampropholis delicata*	2013, 2017, 2018
Eastern blue-tongue lizard	*Tiliqua scincoides*	2013

4.3.3 Birds

Twenty-five (25) bird species have been recorded from the Study area and are listed in **TABLE 10**. No Threatened species were recorded. A targeted survey for the Threatened Grass owl utilising call playback did not result in any record of this species in 2013.

TABLE 10
BIRD SPECIES RECORDED DURING THE SURVEY

Common name	Scientific name	Year recorded
Pheasant coucal	*Centropus phasianinus*	2017, 2018
Golden-headed cisticola	*Cisticola exilis*	2017, 2018
Australian raven	*Corvus coronoides*	2013
Torresian crow	*Corvus orru*	2017, 2018
Brown quail	*Coturnix ypsilophora*	2013, 2018
Pied butcherbird	*Cracticus nigrogularis*	2013, 2017, 2018
White-faced heron	*Egretta novaehollandiae*	2013, 2018
Galah	*Eolophus roseicapilla*	2013, 2017
Magpie lark	*Grallina cyanoleuca*	2013, 2017, 2018
Magpie	*Gymnorhina tibicen*	2013, 2017, 2018
Superb blue wren	*Malurus cyaneus*	2013
Noisy miner	*Manorina melanocephala*	2013, 2017, 2018
Tawny grassbird	*Megalurus timoriensis*	2017, 2018
Lewin's honeyeater	*Meliphaga lewinii*	2013, 2017, 2018
Red-browed firetail	*Neochimia temporalis*	2013, 2018
Crested pigeon	*Ocyphaps lophotes*	2013, 2017, 2018
Little friarbird	*Philemon citreogularis*	2013, 2017

Common name	Scientific name	Year recorded
Purple swamp-hen	*Porphyrio porphyrio*	2017, 2018
Willie wagtail	*Rhipidura leucophyrys*	2013, 2017, 2018
Spotted turtle-dove	*Streptopelia chinensis**	2017, 2018
Pied currawong	*Strepera graculina*	2013, 2017
Australian white ibis	*Threskiornis molucca*	2017
Straw-necked ibis	*Threskiornis spinicollis*	2017
Rainbow lorikeet	*Trichoglossus haematodus*	2013, 2017, 2018
Masked lapwing	*Vanellus miles*	2013, 2018

4.3.4 Mammals

Only one (1) mammal species was recorded in 2013, which were cows grazing the site (since been removed).

4.4 Habitat Suitability Assessment for Threatened Fauna Species

Habitat suitability assessments of the threatened fauna and migratory fauna species that are known to occur or considered possible occurrences in the locality (**TABLE 6** and **TABLE 7**) determined that five (5) threatened and eight (8) migratory species had reasonable potential to be present within the subject site (**APPENDIX 3**):

Threatened species

- Black-necked stork (*Ephippiorhynchus asiaticus*);
- Grey-headed flying fox (*Pteropus poliocephalus*);
- Australian painted snipe (*Rostratula australis*);
- Common blossom bat (*Syconycteris australis*); and
- Eastern grass owl (*Tyto longimembris*).

Migratory species

- Fork-tailed swift (*Apus pacificus*);
- Great egret (*Ardea alba*);
- Cattle egret (*Ardea ibis*);
- Double-banded plover (*Charadrius bicinctus*);
- Long-toed stint (*Calidris subminuta*);
- Painted snipe (*Rostratula benghalensis*);
- Red-necked stint (*Calidris ruficollis*); and
- Yellow wagtail (*Motacilla flava*).

APPENDIX 3 lists the threatened fauna, migratory and marine species that are known or considered to possibly occur in the locality and discusses the likelihood of occurrence of each species within the subject area.

5 POTENTIAL IMPACTS AND AMELIORATION

5.1 Introduction

The following sections examine the potential direct and indirect impacts of the proposed development and recommends amelioration measures if necessary, to minimise and mitigate impacts on the biodiversity and habitat values of the site.

5.2 Potential Impacts

5.2.1 Potential Impacts on Vegetation

The proposed development will result in vegetation and habitat loss associated with the associated earthworks. The impact of the proposed development on vegetation communities on the site is shown in **FIGURE 9**. The proposal will result in the removal of approximately 14.33 ha of vegetation of which 0.14 ha (1.0%) is considered to represent a degraded Littoral rainforest EEC (i.e. Community 1) and 2.25 ha (15.7%) is considered to represent a highly disturbed wetland community (i.e. Community 4). The remaining 12.16 ha (83.3%) is generally comprised of non-native vegetation.

The impacts of clearing on vegetation communities are provided in **TABLE 11**.

TABLE 11
IMPACTS OF CLEARING ON VEGETATION COMMUNITIES

Vegetation Community	Total Area	Area to be Removed	Area to be Retained
1. Mid-high woodland (*Banksia integrifolia*)	0.14 ha	0.14 ha (100%)	0 ha (0%)
2. Disturbed regrowth (*Lantana camara, Senna pendula, Cinnamomum camphora*)	0.14 ha	0.14 ha (100%)	0 ha (0%)
3. Tall closed grassland (*Paspalum dilatatum, Cynodon dactylon*)	11.95 ha	11.73 ha (98%)	0.22 ha (2%)
4. Tall wet grassland/ sedgeland (*Paspalum dilatatum, Cynodon dactylon, Juncus sp., Persicaria sp., Cyperus sp.)*	2.76 ha	2.25 ha (81%)	0.51 ha (19%)
5. Dams	0.07	0.07 (100%)	0 ha (0%)
TOTAL	**15.06 ha**	**14.33 ha (95%)**	**0.74 ha (5%)**

LEGEND

- Proposed Impact Area
- Earthworks Extent
- Community 1 - Mid-high woodland (*Banksia integrifolia*)
- Community 2 - Disturbed regrowth (*Lantana camara*, *Senna pendula*, *Cinnamomum camphora*)
- Community 3 - Low closed grassland (*Stenotaphrum secundatum*, *Paspalum dilatatum*, *Cynodon dactylon*, *Axonopus affinis*)
- Community 4 - Wet grassland/sedgeland (*Paspalum dilatatum*, *Cynodon dactylon*, *Juncus* sp., *Persicaria* sp., *Cyperus* sp.)
- Dams
- Freshwater Wetland EEC
- *Arthraxon hispidus* - May 2018 (Vulnerable - ROTAP)
- *Arthraxon hispidus* seedling - November 2017 (Vulnerable - ROTAP)
- *Arthraxon hispidus* (Vulnerable - ROTAP) (Locations confirmed by JWA September 2017
- Tuckeroo (*Cupaniopsis anacardioides*)
- Guioa (*Guioa semiglauca*)
- Guioa (*Guioa semiglauca*) & Tuckeroo (*Cupaniopsis anacardioides*)
- Guioa (*Guioa semiglauca*) & Sweet pittosporum (*Pittosporum undulatum*)
- Coast banksia (*Banksia integrifolia*)
- Subject Site

0 50m

1 : 2000

SOURCE: JWA 2004, 2008, 2013, 2017 & 2018; Mott MacDonald (Ref: 389705-MMD-00-XX-SK-C-0043.dwg & Lennox - Bdy for tin design.dwg)

SCALE: 1 : 2000 @ A3

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Ballina Shire Council LGA

FIGURE 9

PREPARED: BW
DATE: 28 February 2019
FILE: N20068_EA_Impacts.cdr

TITLE

IMPACT OF PROPOSED DEVELOPMENT

Additional impacts that may occur as a result of the removal of vegetation communities on the subject site are summarised as follows:

- Clearance of vegetation on the subject site will reduce the size and area of habitats available for the dispersal and recruitment of native flora species and may reduce dispersal and visits by pollinators which may negatively impact on the reproductive success of remaining flora in the area;
- Disturbance to the subject site will create opportunities for weeds to colonise both the site and adjacent vegetation. Weeds are likely to be introduced to the subject site and adjacent vegetation in construction materials or by vehicles. Weed numbers on site are also likely to increase due to dumping of garden waste, changes in the nutrient status of the soil and increased light penetration;
- Occupation of the subject site by future residents may create opportunities for ornamental and landscape garden plant species to disperse into adjacent areas of retained vegetation;
- The removal of vegetation from the subject site will result in a decrease in organic material and biomass on the site;
- Edge effects may be experienced in areas of conserved vegetation adjacent to development zones. In these circumstances, there is likely to be a change in the composition of flora communities and subsequent impacts on fauna species;
- Occupation of the site may increase the risk of fire release into areas of native vegetation on the subject site leading to a disturbance in the natural fire regime of the locality and impacts on fire-sensitive flora species and/or those that require specific fire regimes;
- The removal of vegetation will disturb the soil structure and integrity which can reduce the health and longevity of remaining vegetation and result in increased soil erosion which may cause sedimentation of watercourses;
- Clearing may result in injury, displacement and death to fauna;
- Clearing physically removes food sources, shelter and other habitat attributes that fauna use;
- Domestic dogs and cats prey on native fauna and may have significant impacts on the populations of native species. The proposed development may increase the rate by which non-native predators such as dogs and cats are introduced into habitats retained on the site or adjoining the site;
- Vegetation clearing may result in fragmentation of remaining habitat areas which leads to reduced habitat connectivity and reduces dispersal opportunities for fauna and flora species;
- The proposed development will result in an increase in traffic on and to the subject site. This increases the likelihood of animals being killed or injured by vehicles. The establishment of infrastructure with people, noise and lighting can have important implications for the behaviour of fauna within retained vegetation (particularly nocturnal fauna) and may cause reclusive species to move away from

habitat edges and will act as a deterrent on the movement of animals through the site;

- Impermeable surfaces resulting from the proposed development may alter the hydrology of the site, potentially impacting on the freshwater wetland and Hairy-joint grass*;* and
- Stormwater entering the freshwater wetland and compensatory habitat area may contribute pollutants in the form of increased nutrients and/or chemicals. This could result in the direct loss of vegetation or change in community structure.

5.2.2 Potential Impacts on EECs

The mid-high woodland community (i.e. Community 1) on the subject site contains some species that are representative of the EEC – Littoral rainforest in the NSW North Coast, Sydney Basin and South-East Corner bioregions, as listed within schedules of the NSW *TSC Act (1995).* This community is considered to be a degraded representative of this EEC. The proposed development will result in the loss of 0.14 ha (100%) of this degraded EEC. An Assessment of Significance (7-part test) has therefore been completed in accordance with the requirements of the TSC Act (refer **Section 6.3**).

As previously discussed, Council's ecologist is of the opinion that a portion of the highly-degraded wet grassland/sedgeland community (i.e. a portion of Community 4) is covering 0.72 ha is representative of the EEC Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. The proposed development will result in the loss of 0.44 ha (61%) of this degraded EEC. An Assessment of Significance (7-part test) has therefore been completed in accordance with the requirements of the TSC Act (refer **Section 6.3**).

A summary of the impacts of the proposed development on EECs is provided in **TABLE 12**.

TABLE 12
IMPACTS OF CLEARING ON EECS

Endangered Ecological Community	Total Area	Area to be Removed	Area to be Retained
Littoral rainforest in the NSW North Coast, Sydney Basin and South-East Corner bioregions	0.14 ha	0.14 ha (100%)	0 ha (0%)
Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	0.72 ha	0.44 ha (61%)	0.28 ha (39%)

5.2.3 Potential Impacts on Threatened Plants

Based on the results of the latest targeted surveys on site (May 2018), one small clump of HJG (approx. 1m^2) and one (1) additional isolated individual occur within the proposed development footprint and will require translocation to the compensatory habitat area.

As previously discussed, impermeable surfaces resulting from the proposed development may alter the hydrology of the site, potentially impacting on the freshwater wetland and Hairy-joint grass, and stormwater entering the freshwater wetland and compensatory habitat area may contribute pollutants in the form of increased nutrients and/or chemicals. This could result in the direct loss of vegetation or change in community structure.

An Assessment of Significance (7-part test) has been completed in accordance with the requirements of the TSC Act (refer **Section 6.3**).

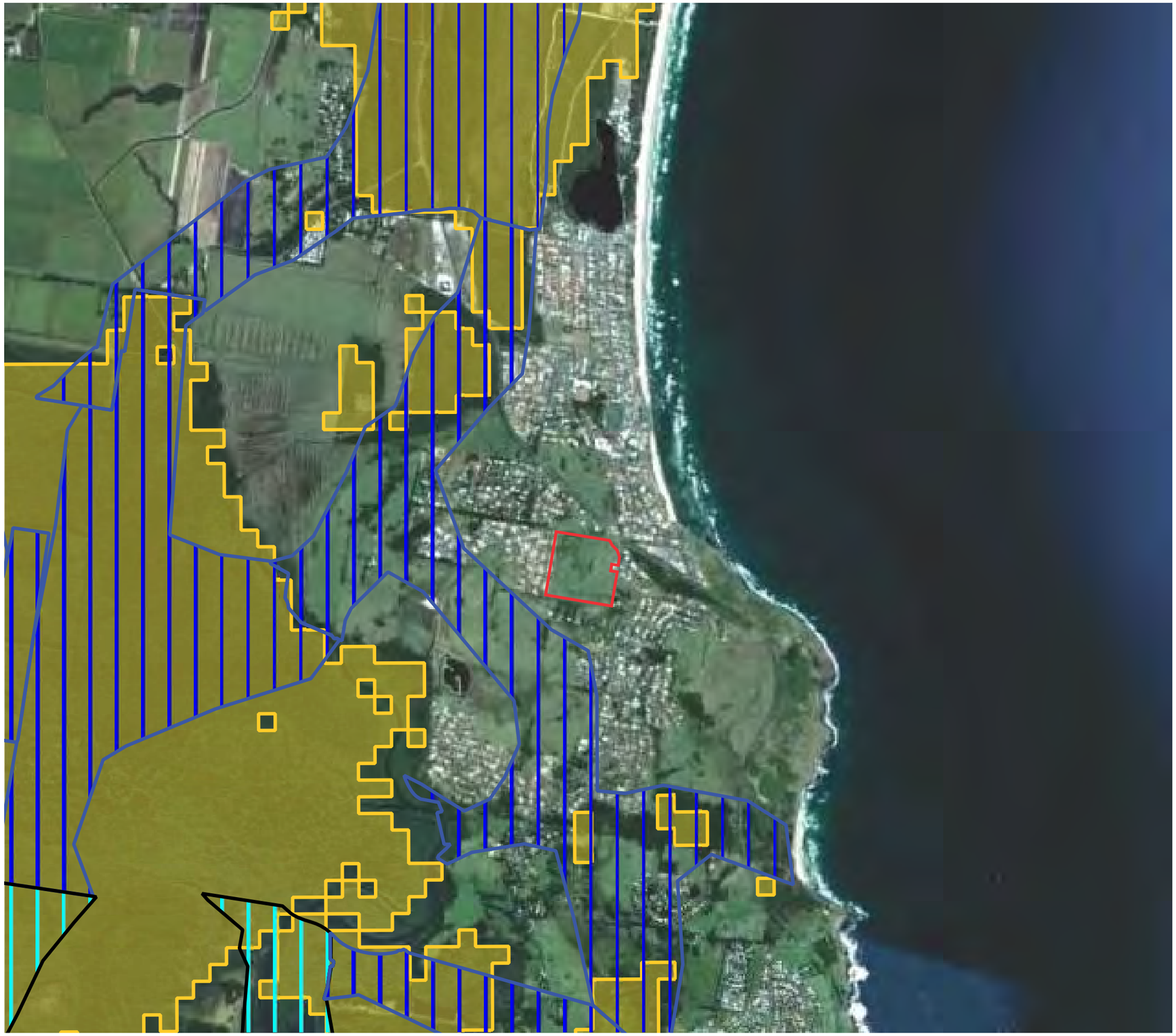
5.2.4 Potential Impacts on Fauna

The Subject site is not considered to comprise significant fauna habitat. No Threatened species were recorded on site. Species recorded from the site are generally considered to be commonly occurring and disturbance adapted species. The proposed development will result in the minor loss of foraging, sheltering and breeding habitat for native fauna occurring in the locality. This loss may have a range of impacts including:

- Minor loss of forage habitat for nectarivorous and insectivorous fauna species, including the loss of autumn/ winter flowering plants;
- Minor decrease in the size of the prey base for carnivorous species;
- Reduction in opportunities for movement through the site;
- Animals may be killed or injured during works occurring on the site;
- Domestic dogs and cats prey on native fauna and may have significant impacts on the populations of native species; and
- Development of the subject site may favour native and introduced disturbance adapted competitors. For example, Cane toads may out-compete other amphibians and reptiles, aggressive open country bird species (e.g. Noisy miner, Crow, Pied currawong) may out-compete other birds, and non-native mammals (Black rat and House mouse) may out-compete native small mammals;
- Increased light, noise and activity may cause reclusive species to move away;
- The proposed development will result in an increase in traffic on and to the Subject site. This increases the likelihood of animals being killed or injured by vehicles; and
- Alterations to the site hydrology and land use may alter the water quality or hydrological regimes in EEC Freshwater wetland communities.

5.2.5 Potential Corridor Impacts

The subject site does not occur within any corridors mapped by the NPWS Key Habitats and Corridors database. However, Lennox Regional corridor lies west of the site, and links Ballina Nature Reserve (approximately 2 km west of the site) with Lennox Head (as shown in **FIGURE 10**).



LEGEND
- Regional Corridor
- Subregional Corridor
- Key Habitat
- Subject Site

N

0 1000m

1 : 25 000

SOURCE: NSW NPWS Key Habitats & Corridors in Northern NSW GIS dataset; Indigo Properties(Ref: 5021ALL-image.dwg)

SCALE: 1 : 25 000 @ A3

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FIGURE 10

PREPARED: BW
DATE: 08 January 2018
FILE: N20068_EA_Corridor.cdr

TITLE

NPWS KEY HABITATS & CORRIDORS

Fauna utilising the Lennox Regional Corridor are unlikely to use the Subject site due to the lack of vegetation present, and its lack of connectivity with any significant areas of native vegetation. The site is considered to have poor connectivity, given that it is isolated within an urban matrix, which limits fauna dispersal and movement. The site is most likely to function as 'stepping stone' habitat for disturbance adapted birds, which is reflected in the common bird species recorded.

The proposed development is considered unlikely to significantly affect the (limited) corridor values of the site in the local context.

5.2.6 Potential Impacts on Offsite Trees

BSC have requested an assessment of potential impacts on trees on the adjoining Lot 1 DP 878933. A desktop study and site visit has identified that there are several trees located on the boundary of the site. The applicant has made contact with the adjoining land owner to discuss the relevant trees and access has been granted to undertake a tree survey. Further investigation is being undertaken to determine relevant Tree Protection Zones (TPZ's) for trees in proximity to the site boundary, in accordance with AS 4970-2009 (Protection of trees on development sites) and will be provided to Council ASAP.

Potential impacts on surveyed trees are summarised in **TABLE 13** below. These trees were identified to species level by a JWA ecologist, and details collected on the estimated dbh, which allowed preliminary tree protection zones to be determined in accordance with AS 4970-2009 (Protection of trees on development sites). A tree survey is yet to be completed to allow the accurate mapping of the trees and relevant TPZ's. The estimated details will be confirmed (once site access is available), in addition to height and canopy spread, and will be included in a Vegetation Management Plan and provided to Council ASAP.

TABLE 13
POTENTIAL IMPACTS ON SURVEYED TREES

Tree No.	Species	Common Name	Estimated DBH	Estimated TPZ	Potential Impacts
1	*Guioa semiglauca*	Guioa	10 cm	1.2 m	It is estimated that this tree occurs approx. 3 m from the site boundary. TPZ will not likely be impacted.
2	*Guioa semiglauca*	Guioa	10 cm	1.2 m	It is estimated that this tree occurs approx. 3 m from the site boundary. TPZ will not likely be impacted.
3	*Cupaniopsis anacardioides*	Tuckeroo	10 cm	1.2 m	It is estimated that this tree occurs approx. 2.5 m from the site boundary. TPZ will not likely be impacted.

Tree No.	Species	Common Name	Estimated DBH	Estimated TPZ	Potential Impacts
4	*Guioa semiglauca*	Guioa	30 cm	3.6 m	It is estimated that this tree occurs approx. 3.5 m from the site boundary. The proposed development is therefore not likely to encroach significantly (if at all) into the TPZ.
5	*Guioa semiglauca*	Guioa	10 cm	1.2 m	It is estimated that this tree occurs approx. 3 m from the site boundary. TPZ will not likely be impacted.
6	*Guioa semiglauca*	Guoia	10 cm	1.2 m	It is estimated that this tree occurs approx. 3 m from the site boundary. TPZ will not likely be impacted.
7	*Ficus macrophylla*	Moreton Bay fig	175 cm	15 m	It is estimated that this tree occurs approx. 15 m from the site boundary. The proposed development is therefore not likely to encroach significantly (if at all) into the TPZ, however the crown of the tree extends into the site slightly and pruning works (in accordance with the relevant Australian Standard, and supervised by an Arborist) may be required.
8	*Ficus macrophylla*	Moreton Bay fig	125 cm	15 m	It is estimated that this tree occurs approx. 7-8 m from the site boundary. The exact location of this tree is to be determined as are likely impacts on the TPZ. Details will be included in a Vegetation Management Plan and provided to Council ASAP.

5.2.7 Potential Impacts on Waterways

A poorly developed and degraded drainage line occurs in the south of the site. The Office of Water has confirmed that this drainage line is a first order watercourse. However, as there is no riparian corridor downstream of the site and no significant vegetation considered to occur within the watercourse on site, it is proposed that the flows on the Subject site be piped as part of the development. The proposed piping of the watercourse will result in the alteration to the site hydrology and land use which has the potential to alter the water quality or hydrological regimes in the low-lying areas of the site.

5.3 Amelioration

5.3.1 Amelioration Measures for Vegetation Communities

An area covering 2.38 ha in the north-western portion of the Subject site is proposed to be retained as a compensatory habitat area (**FIGURE 11**). A HJG Compensatory Habitat Plan (JWA 2018a) has been prepared for the proposed development and should be read in conjunction with this Ecological Assessment. The compensatory habitat area will be cleared of weed species and revegetated with native freshwater wetland species and should be managed and protected in perpetuity in accordance with the HJG Compensatory Habitat Plan (JWA 2018a). The proponent will maintain ownership of the compensatory habitat area and the area will be protected in perpetuity under an Environmental Covenant pursuant to Section 88B of the Conveyancing Act 1919, or similar arrangement.

A Hydrologic Regime Assessment (Gilbert & Sutherland 2019) has been completed and demonstrates that, with the incorporation of mitigation measures (which include targeted recharge of the soil store via swales, a bio-basin, bio-swales and a detention basin), the proposed development will not adversely alter the hydrologic regime of the retained wetland/Groundwater Dependent Ecosystem (GDE). The hydrologic management measures incorporated into the development will help to ensure that the existing hydrologic regime within the identified wetland/GDE can be maintained. That is, the volume of water reporting to the wetland/GDE and the rate at which it is delivered to that location will be maintained in a similar state, pre- and post-development (Gilbert & Sutherland 2019).

Consideration of impacts to this wetland community that may arise from changes to hydrological flows and water quality as a result of the proposed development have also been considered in the Stormwater Management Plan (Mott MacDonald 2019) prepared for the site.

The following additional amelioration measures are recommended:

- Any landscape, buffer and compensatory habitat plantings should utilise locally endemic native plant species;
- Weeds should be controlled during construction through vehicle, tool and plant hygiene measures;
- Weeds should be controlled in retained areas and known environmental weeds should be avoided in landscape plantings;
- Mosquito Consulting Services has been engaged to prepare a Mosquito Impact Assessment (MIA) for the proposed development. The MMP should have regard for the requirements of this Ecological Assessment and the HJG Compensatory Habitat Plan (JWA 2018a);
- Existing native vegetation should be retained within compensatory habitat where feasible. This vegetation should be clearly identified on the ground (e.g. temporary fencing installed) prior to commencement of site clearing works/earthworks; and

Hutley Drive
Super Lot 123
Limit of Works
North Creek Road
ROAD 1
ROAD 3
ROAD 8
ROAD 6
ROAD 2
ROAD 4
ROAD 5
Connect pipe to existing Headwall at IL 11.85
Existing wetland
Combined Basin No. 2 & 3
Basin No. 1
3m wide maintenance access track
1
Super Lot 119
Meadows Drive
Henderson Lane
Super Lot 120

LEGEND

- *Arthraxon hispidus* Compensatory Habitat Area
- Proposed Translocation Site
- Proposed Fencing
- *Arthraxon hispidus* seedlings (11) - May 2018 (Vulnerable - ROTAP)
- *Arthraxon hispidus* seedling - November 2017 (Vulnerable - ROTAP)
- *Arthraxon hispidus* (Vulnerable - ROTAP) (Locations confirmed by JWA September 2017
- Subject Site

0 50m

1 : 2000

SOURCE: JWA 2004, 2008, 2013, 2017 & 2018; Mott MacDonald (Ref: 389705-MMD-00-XX-SK-C-0043.dwg & Lennox - Bdy for tin design.dwg)
SCALE: 1 : 2000 @ A3

JWA PTY LTD
Ecological Consultants

CLIENT
Ballina Island Developments Pty Ltd

PROJECT
Ecological Assessment
Lot 1 on DP517111
20 North Creek Road, Lennox Head, NSW
Ballina Shire Council LGA

FIGURE 11

PREPARED: BW
DATE: 28 February 2019
FILE: N20068_EA_HJG Compo.cdr

TITLE
***ARTHRAXON HISPIDUS* COMPENSATORY HABITAT AREA**

- Vegetation removed during construction should be mulched for use on the site (with the exception of hollow-bearing trees). This will prevent the introduction of weeds from seeds in mulch brought in from elsewhere and will retain biomass that would otherwise be removed from the system.
- Offsets may be required (and could be conditioned) for the removal of EEC vegetation from the subject site. Although not necessarily applicable to the development (due to the timing of the application) it may be appropriate to determine whether the NSW Biodiversity Offset Scheme would apply to the proposed development and, if it would apply, have an accredited assessor assess the impacts utilising the Biodiversity Assessment Method (BAM) to determine the number and type of credits required to offset residual impacts (i.e. 'credit obligation').

5.3.2 Amelioration Measures for Threatened Plants

The rehabilitation of the 2.38ha compensatory habitat area (**FIGURE 11**) in the north-western portion of the subject site (in accordance with the HJG Compensatory Habitat Plan – JWA 2018a) will result in a significant improvement in habitat values occurring on the site for HJG. Furthermore, the incorporation of proposed hydrologic management measures into the development (which include targeted recharge of the soil store via swales, a bio-basin, bio-swales and a detention basin) will help to ensure that the existing hydrologic regime within the HJG compensatory habitat area can be maintained (Gilbert and Sutherland 2019).

Based on the results of the latest targeted surveys on site (May 2018), one small clump of HJG (approx. $1m^2$) and one (1) additional isolated individual occur within the proposed development footprint and will require translocation to the compensatory habitat area. Furthermore, additional HJG plants will be propagated and planted into the rehabilitated habitat area to further bolster the local population.

5.3.3 Amelioration Measures for Offsite Trees

A desktop study and site visit has identified that there are several trees located on the boundary of the site. The applicant has made contact with the adjoining land owner to discuss the relevant trees and access has been granted to undertake a tree survey. A desktop study of the trees close to the boundary has been completed (**Section 3.2.4)** identifying the tree species, estimated size and position, and potential impacts on these trees discussed (**Section 5.2.6**). Further investigation is being undertaken to determine relevant Tree Protection Zones (TPZ's) for trees in proximity to the site boundary (in accordance with the relevant Australian Standard) and will be provided to Council ASAP.

Any encroachment $\geq$10% on the calculated Tree Protection Zone (TPZ) of trees on the adjoining Lot 1 DP 878933 should be completed under the guidance and/or supervision of a suitably qualified arborist.

Any required pruning of these trees should be completed in accordance with AS 4373-2007 (Pruning of amenity trees) and also under the guidance and/or supervision of a suitably qualified arborist.

5.3.4 Amelioration Measures for Fauna

The following amelioration measures are recommended to reduce potential impacts of the proposed development on native fauna species utilising the site:

- The use of appropriate fencing to allow fauna movement between vegetated areas and exclude fauna from hazardous areas should be incorporated into the detailed design;
- The effects of light on adjoining vegetation could be managed by the capping of night lights to reduce glare into the sky and the careful positioning of lighting and use of screening vegetation;
- Appropriate fauna management strategies including the use of a spotter-catcher should be implemented during site clearing operations to minimise potential adverse impacts on fauna;
- Consideration should be given to any opportunities to link areas of retained vegetation; and
- Landowners should control cats and dogs. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure.

6 STATUTORY CONSIDERATIONS

6.1 Introduction

This section includes assessments of the impacts of the Proposed development with regard to:

- the Commonwealth *Environment Protection and Biodiversity Conservation Act (1999);*
- the NSW *Threatened Species Conservation Act (1995)*; and
- the *State Environmental Planning Policy No. 44* (SEPP 44) – Koala Habitat Protection.

6.2 Commonwealth Environment Protection and Biodiversity Conservation Act (1999)

6.2.1 Introduction

The *Environment Protection & Biodiversity Conservation (EPBC)* Act (1999) was passed by Commonwealth Parliament in June 1999 and came into force on 16 July, 2000. A person must not, without an approval under the Act, take an action that has or will have, or is likely to have, a significant impact on a matter of National Environmental Significance (NES). These matters are listed as:

a) the world heritage values of a declared World Heritage property,

b) the ecological character of a declared Ramsar wetland,

c) a threatened species or endangered community listed under the Act,

d) a migratory species listed under the Act, or

e) the environment in a Commonwealth marine area or on Commonwealth land.

The Act also prohibits the taking, without an approval under the Act, of:

(a) a nuclear action, or

(b) an action in a Commonwealth marine area or on Commonwealth land, that has or will have, or is likely to have, a significant impact on the environment.

An action includes a project, development, undertaking or an activity or series of activities. An action does not require approval if it is a lawful continuation of a use of land, sea or seabed that was occurring before the commencement of the Act. An enlargement, expansion or intensification of a use is not a continuation of a use.

The *EPBC Act (1999)* does not require Commonwealth approval for the rezoning of land. It does, however, suggest that when rezoning land, planning authorities should consider whether to allow actions that could significantly affect NES matters or the environment of Commonwealth land.

Matters of NES in NSW are:

- Declared World Heritage Areas;
- Declared Ramsar Wetlands;
- Listed Threatened Species (Schedule 1 and 2 of Commonwealth Endangered Species Protection Act 1992);
- Listed Ecological Communities in NSW;
- Listed migratory species (JAMBA and CAMBA).

A Commonwealth Assessment will be required for proposed activities on the subject site if they affect a MNES. The Commonwealth Department of the Environment has prepared *EPBC Act* Policy Statements, including the *EPBC Act* – Principal Significant Impact Guidelines 1.1 (2009) which provides a self-assessment process to assist in determining whether an action should be referred to the Commonwealth for a decision on whether assessment and approval is required under the Act. The proposed development has been considered against the Principal Significant Impact Guidelines for each of the MNES identified on the subject site. This assessment is provided in the following sections.

6.2.2 Declared World Heritage Areas On or Near the Site

There are no declared World Heritage areas on, or within 10km, of the subject site.

6.2.3 Declared Ramsar Wetlands On or Near the Site

6.2.3.1 Significant Impact Criteria

An action is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will result in:

- areas of the wetland being destroyed or substantially modified;
- a substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland;
- the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected;
- a substantial and measurable change in the water quality of the wetland, for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health; or
- an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

6.2.3.2 Site Assessment

There are no declared Ramsar wetlands on, or within 5km of the subject site.

6.2.4 Commonwealth Listed Threatened Flora and Fauna Species

6.2.4.1 Significant Impact Criteria

An action is likely to have a significant impact on a Critically Endangered, Endangered or Vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline; or
- interfere with the recovery of the species.

A 'population of a species' is defined under the *EPBC Act* as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to a geographically distinct regional population, or collection of local populations, or a population, or collection of local populations that occur within a particular bioregion.

An 'invasive species' is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.

6.2.4.2 Site Assessment

No Commonwealth Threatened fauna species have previously been recorded within the subject site. Two (2) Commonwealth Threatened fauna species were considered possible occurrences within the Study Area based on the availability of suitable habitat:

- Grey-headed flying fox (*Pteropus poliocephalus*) – Vulnerable; and
- Australian painted snipe (*Rostratula australis*) - Endangered.

One (1) Commonwealth Threatened flora species was recorded on the site, Hairy joint grass (*Arthraxon hispidus)*. An additional EPBC listed species, Rough-shelled bush (*Macadamia tetraphylla)* has been recorded on a property adjacent to the Subject site. Both of these species are listed as Vulnerable under the EPBC Act.

Recent targeted surveys for HJG were completed in May 2018 and the current extent of this species on site is shown in **FIGURE 7**. Based on the results of the latest targeted surveys on site (May 2018), one small clump of HJG (approx. 1m^2) and one (1) additional isolated individual occur within the proposed development footprint and will require translocation to the compensatory habitat area. The incorporation of proposed hydrologic management measures into the development (which include targeted recharge of the soil store via swales, a bio-basin, bio-swales and a detention basin) will help to ensure that the existing hydrologic regime within the HJG compensatory habitat area can be maintained (Gilbert and Sutherland 2019).

With the mitigation measures described in this report, the HJG Compensatory Habitat Plan (JWA 2018a), and the Hydrologic Regime Assessment (Gilbert & Sutherland 2019) it is considered that the proposed development will not result in any significant impacts on any of the EPBC listed Threatened species recorded from or considered possible occurrences on the Subject site.

No significant impacts to threatened flora or fauna or their habitat is expected as a result of the proposed development.

6.2.5 Listed Ecological Communities

6.2.5.1 Significant Impact Criteria

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- reduce the extent of an ecological community;
- fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- adversely affect habitat critical to the survival of an ecological community;
- modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;
- cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting; or
- cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
    - assisting invasive species, that are harmful to the listed ecological community, to become established; or
    - causing regular mobilization of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or
    - interfere with the recovery of an ecological community.

6.2.5.2 Site Assessment

No ecological community currently listed in the EPBC Act (1999) is considered to occur in the study area.

6.2.6 Listed Migratory Species on or Near the Site

6.2.6.1 Significant Impact Criteria

The list of migratory species established under section 209 of the EPBC Act comprises:

- migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II);
- migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and
- native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Listed migratory species include Migratory Marine Birds, Migratory Marine Species (including mammals, reptiles and fish), Migratory Terrestrial Species and Migratory Wetland Species. Migratory Marine Species and the majority of Migratory Marine Birds do not occur within the study area. Migratory Terrestrial Species and Migratory Wetland Species include a range of bird species, many of which are known from the wider locality.

An action will require approval if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species. The significant impact criteria below are relevant to migratory species that are not threatened.

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles; or
- altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species; or
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

An area of 'important habitat' for a migratory species is:

- habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or

- habitat that is of critical importance to the species at particular life-cycle stages; and/or
- habitat utilized by a migratory species which is at the limit of the species range; and/or
- habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, the definition of what an 'ecologically significant proportion' of the population is varies with the species (each circumstance needs to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

The term 'population' in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one (1) or more national jurisdictional boundaries including Australia.

6.2.6.2 Site Assessment

No migratory species were observed on Subject Site. It is considered that although a number of listed migratory species are known or likely to occur occasionally in the Study area, no area of important habitat occurs in the Study area for listed migratory species. No significant impacts to listed migratory species are expected as a result of the proposed development.

6.2.7 Requirement for Commonwealth Referral

On the basis of the above assessment, it is considered that Commonwealth referral is not required for the Proposed development of the subject site.

6.3 Threatened Species Conservation Act (1995)

6.3.1 Background

An Assessment of Significance (7-part test equivalence) has been undertaken for all listed species/EECs recorded on the site, including threatened fauna predicted to occur over time **(Section 4.4**). Potential impacts on threatened species, populations or ecological communities, or their habitats were assessed using the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007).

The Assessment of Significance should not be considered a "pass or fail" test as such, but a system allowing proponents to undertake a qualitative analysis of the likely impacts and ultimately whether further assessment needs to be undertaken via a Species Impact Statement. All factors must be considered and an overall conclusion must be drawn from all factors in combination. Where there is any doubt regarding the likely impacts, or where detailed information is not available, a Species Impact Statement should be prepared.

Mitigating, ameliorative or compensatory measures proposed as part of the action, development or activity should not be considered in determining the degree of the effect on threatened species, populations or ecological communities, unless the measure has been proven successful for that species in a similar situation. In many cases where complex mitigating, ameliorative or compensatory measures are required, such as translocation, bush restoration, purchase of land, further assessment through the Species Impact Statement process is likely to be required.

In determining the nature and magnitude of an impact, it is important to consider matters such as:

- Pre-construction, construction and occupation/maintenance phases;
- All on-site and offsite impacts, including location, installation, operation and maintenance of auxiliary infrastructure and fire management zones;
- All direct and indirect impacts;
- The frequency and duration of each known or likely impact/action;
- The total impact which can be attributed to that action over the entire geographic area affected, and over time;
- The sensitivity of the receiving environment; and
- The degree of confidence with which the impacts of the action are known and understood.

Recovery and threat abatement plans, priorities action statements and threatened species profiles may provide further guidance on whether an action/activity is likely to be significant.

Application of the precautionary principle requires that a lack of scientific certainty about the potential impacts of an action does not itself justify a decision that the action is not likely to have a significant impact. If information is not available to conclusively determine that there will not be a significant impact on a threatened species, population or ecological community, or its habitat, then it should be assumed that a significant impact is likely.

6.3.2 Threatened Flora

6.3.2.1 Background

One (1) Threatened flora species has been recorded on the subject site - Hairy joint grass (*Arthraxon hispidus*). Recent targeted surveys for HJG were completed in May 2018 and the current extent of this species on site is shown in **FIGURE 7**. Based on the results of the latest targeted surveys on site (May 2018), one small clump of HJG (approx. 1m^2) and one (1) additional isolated individual occur within the proposed development footprint and will require translocation to the compensatory habitat area.

The threatened species Rough-shelled bush nut (*Macadamia tetraphylla*) has been recorded from previous studies by JWA as occurring on a site adjacent to the subject site.

In accordance with Section 5a of the TSC Act, a test for determining whether the proposed development is likely to significantly affect these species has been completed (**APPENDIX 4**)**.**

6.3.2.2 Result of Significance Test

On the basis of the assessments provided in **APPENDIX 4** it is considered that the proposed development is unlikely to result in any significant impacts on Threatened flora species recorded on or adjacent to the subject site. Therefore, a Species Impact Statement (SIS) is not required for threatened flora occurring in the study area.

6.3.3 Endangered Ecological Communities (EECs)

6.3.3.1 Background

The mid-high woodland community (i.e. Community 1) contains species that are representative of the Endangered Ecological Community (EEC) - Littoral rainforest in the NSW North Coast, Sydney Basin and South-East Corner bioregions. This community on the subject site is considered to be a highly degraded, regenerating representative of this EEC. The proposed development will result in the removal of approximately 0.14 ha of this vegetation community (**FIGURE 9**).

As previously discussed, Council's ecologist is of the opinion that a portion of the highly-degraded wet grassland/sedgeland community (i.e. a portion of Community 4) covering 0.72 ha is representative of the EEC Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. The proposed development will result in the loss of 0.44 ha (61%) of this degraded EEC (**FIGURE 9**).

In accordance with the *TSC Act (1995),* a test for determining whether the proposed development is likely to significantly affect these vegetation communities has been completed (**APPENDIX 4).**

6.3.3.2 Result of Significance Test

On the basis of the assessments provided in **APPENDIX 4** there will be no significant impacts on any Endangered Ecological Communities as a result of the proposed development. It is considered that a Species Impact Statement (SIS) is not required for degraded EEC vegetation occurring in the study area.

6.3.4 Fauna

6.3.4.1 Background

No threatened fauna species have been recorded within the study area. Based on an assessment of available habitat, five (5) threatened fauna species are considered to possibly occur within the study area over time:

- Black-necked stork (*Ephippiorhynchus asiaticus*);
- Grey-headed flying fox (*Pteropus poliocephalus*);
- Australian painted snipe (*Rostratula australis*);

- Common blossom bat (*Syconycteris australis*); and
- Eastern grass owl (*Tyto longimembris*).

In accordance with the *TSC Act (1995),* a test for determining whether the proposed development is likely to significantly affect these species has been completed (**APPENDIX 4**).

6.3.4.2 Result of Assessment of Significance

On the basis of the assessments provided in **APPENDIX 4** there will be no significant impacts on any Threatened fauna species as a result of the proposed development. It is considered that a Species Impact Statement (SIS) is not required for threatened fauna species considered a possible occurrence on the subject site.

6.4 SEPP 44 Koala Habitat Assessment

6.4.1 Background

In response to the statewide decline of Koala populations the Department of Planning has enacted SEPP - 44 Koala Habitat Protection. The Policy aims to "encourage the proper conservation and management of area of natural vegetation that provide habitat for Koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline."

A number of criteria in the SEPP are to be addressed. These are addressed in the following section.

6.4.2 Site Assessment

1. Does the policy apply?

Does the subject land occur in an LGA identified in Schedule 1?

The Subject site occurs in the Ballina LGA, which is listed under Schedule 1.

Is the landholding to which the DA applies greater than 1 hectare in area?

Yes.

2. Is the land potential Koala habitat?

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

No. The site does not contain any Koala food trees.

3. Is there core Koala habitat on the subject land?

The site does not support core Koala habitat.

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

No.

7 SUMMARY AND CONCLUSIONS

JWA Pty Ltd has been engaged by Ballina Island Developments to complete a revised Ecological Assessment for 20 North Creek Road, Lennox Head. The site is formally referred to as Lot 1 DP 517111. The current report has been updated to assess any further ecological impacts that may result from the expanded development layout. The assessment has involved the following:

- Mapping and ground truthing vegetation units and determining their conservation status.
- Searching for and recording Threatened and regionally significant plant species.
- Determining the suite of Threatened fauna that occurs in the locality.
- Assessing habitat provided by the site in relation to adjacent habitat and making an assessment of the corridor value of the site.
- Addressing statutory requirements including State Environmental Planning Policy No. 44 (SEPP 44 – Koala Habitat Protection), Section 5a of the TSC Act and the EPBC Act.

It is noted that whilst the *Biodiversity Conservation Act 2016* (BC Act) commenced on the 25th August 2017, the development application was lodged prior to the 25th February 2018 (i.e. the end of the transitional period), and therefore the previous legislation – the *TSC Act (1995*) - applies.

It is also noted that the State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP) came into effect on the 3rd April 2018 and updates and consolidates into one integrated policy SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5. of the Standard Instrument – Principal Local Environmental Plan. These policies are now repealed. However, as the development application was lodged prior to the 3rd April 2018, the previous legislation will apply.

The Subject site comprises Lot 1 DP 517111 which covers an area of 15.06 hectares, and consists of agricultural land, with cattle recently removed from the site. Little native vegetation occurs within the site.

Four (4) vegetation communities were identified on the Subject site. One hundred and five (105) flora species were recorded at the subject site including one (1) Threatened species - Hairy joint grass (*Arthraxon hispidus)*.

The fauna surveys recorded six (6) amphibian, two (2) reptile, twenty-five (25) bird, and one (1) mammal species. No Threatened fauna species were recorded. Five (5) Threatened fauna species listed under the *Threatened Species Conservation Act (1995)* are considered possible occurrences on the subject site over time:

- Common blossom bat (*Syconycteris australis*);
- Grey-headed flying fox (*Pteropus poliocephalus*);

- Eastern grass owl (*Tyto longimembris*);
- Black-necked stork (*Ephippiorhynchus asiaticus*); and
- Australian painted snipe (*Rostratula australis*).

Two (2) *EPBC Act (1999)* Threatened fauna species were considered possible occurrences on the Subject site over time:

- Grey-headed flying-fox (*Pteropus poliocephalus);* and
- Australian painted snipe (*Rostratula australis*).

Overall the subject site is considered to provide relatively poor habitat for native fauna in the locality.

The proposed development will result in vegetation and habitat loss associated with the associated earthworks. The proposal will result in the removal of approximately 14.33 ha of vegetation of which 0.14 ha (1.0%) is considered to represent a degraded Littoral rainforest EEC (i.e. Community 1) and 2.25 ha (15.7%) is considered to represent a highly disturbed wetland community (i.e. Community 4). The remaining 12.16 ha (83.3%) is generally comprised of non-native vegetation.

The key amelioration measures for the Subject site include:

1) Retention of HJG within a designated compensatory habitat area on the site;
2) Translocation of a small clump (approx. 1m^2) and a single isolated stem of HJG, and any other stems that may regenerate in areas within the developmental footprint;
3) Propagation of additional HJG for planting into the compensatory habitat area to bolster the local population;
4) Rehabilitation of degraded freshwater wetland (i.e. Tall wet grassland/sedgeland) vegetation;
5) The compensatory habitat area should be managed and protected in perpetuity in accordance with the HJG Compensatory Habitat Plan (JWA 2018a);
6) The proponent will maintain ownership of the compensatory habitat area and the area will be protected in perpetuity under an Environmental Covenant pursuant to Section 88B of the Conveyancing Act 1919, or similar arrangement; and
7) Maintenance of current hydrological flows and water quality.

A Hydrologic Regime Assessment (Gilbert & Sutherland 2019) has been completed and demonstrates that, with the incorporation of mitigation measures (which include targeted recharge of the soil store via swales, a bio-basin, bio-swales and a detention basin), the proposed development will not adversely alter the hydrologic regime of the retained wetland/Groundwater Dependent Ecosystem (GDE). The hydrologic management measures incorporated into the development will help to ensure that the existing hydrologic regime within the identified wetland/GDE can be maintained. That is, the

volume of water reporting to the wetland/GDE and the rate at which it is delivered to that location will be maintained in a similar state, pre- and post-development (Gilbert & Sutherland 2019).

Consideration of impacts to the wetland that may arise from changes to hydrological flows and water quality as a result of the proposed development have also been considered in the Stormwater Management Plan (Mott MacDonald 2019) prepared for the site.

An Assessment of Significance (7 Part Test of the *TSC Act 1995*) was undertaken for the degraded Littoral rainforest EEC (i.e. Community 1), the highly degraded Freshwater wetland (i.e. Community 4) which in Council's ecologists opinion is an EEC, the two (2) Threatened flora species recorded on and adjacent to the site, as well as five (5) Threatened fauna species considered a possible occurrence at the subject site over time. The assessment concluded that, provided the recommended amelioration measures are completed, the impacts of the Proposed development would be unlikely to result in the local extinction of any of these species. A Species Impact Statement is not required.

Regardless, offsets may be required (and could be conditioned) for the removal of EEC vegetation from the subject site. Although not necessarily applicable to the development (due to the timing of the application) it may be appropriate to determine whether the NSW Biodiversity Offset Scheme would apply to the proposed development and, if it would apply, have an accredited assessor assess the impacts utilising the Biodiversity Assessment Method (BAM) to determine the number and type of credits required to offset residual impacts (i.e. 'credit obligation').

A Koala Habitat assessment of the site under SEPP 44 (Koala Habitat Protection) concluded that the Subject site does not comprise core Koala habitat, and a Koala Plan of Management is therefore not required.

An assessment under the Commonwealth *EPBC Act (1999)* concluded that, provided the recommended amelioration measures are completed, the proposed development will not have a significant impact on any matters of National Environmental Significance (MNES). Commonwealth assessment of the proposal is therefore not required.

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APPENDIX 1 – PLANT SPECIES LIST

Grouping	**Family**	**Botanical Name**	**Common Name**
Ferns and Fern Allies	Blechnaceae	*Blechnum cartilagineum*	Gristle fern
Ferns and Fern Allies	Blechnaceae	*Blechnum indicum*	Swamp water fern
Ferns and Fern Allies	Blechnaceae	*Doodia media*	Common rasp fern
Ferns and Fern Allies	Dennstaedtiaceae	*Pteridium esculentum*	Bracken fern
Gymnosperms	Pinaceae	*Pinus elliotii**	Slash pine
Monocotyledons	Commelinaceae	*Commelina cyanea*	Native wandering jew
Monocotyledons	Cyperaceae	*Cyperus sp.*	
Monocotyledons	Cyperaceae	*Cyperus polystachyos*	Bunchy sedge
Monocotyledons	Cyperaceae	*Eleocharis sphacelata*	Tall spikerush
Monocotyledons	Dioscoraceae	*Dioscorea transversa*	Native yam
Monocotyledons	Juncaceae	*Juncus usitatus*	Common rush
Monocotyledons	Juncaceae	*Juncus* sp.	
Monocotyledons	Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling lilly
Monocotyledons	Philydraceae	*Philydrum lanuginosum*	Frogsmouth
Monocotyledons	**Poaceae**	*Arthraxon hispidus*	**Hairy joint grass**
Monocotyledons	Poaceae	*Chloris gayana**	Rhodes grass
Monocotyledons	Poaceae	*Cynodon dactylon**	Couch grass
Monocotyledons	Poaceae	*Entolasia sp.*	Entolasia
Monocotyledons	Poaceae	*Leersia hexandra*	Swamp ricegrass
Monocotyledons	Poaceae	*Melinis repens**	Red natal grass
Monocotyledons	Poaceae	*Paspalum dilatatum**	Paspalum
Monocotyledons	Poaceae	*Pennisetum purpureum**	Elephant grass
Monocotyledons	Poaceae	*Setaria palmifolia*	Palm grass
Monocotyledons	Poaceae	*Setaria sp.**	Pigeon grass
Monocotyledons	Poaceae	*Stenotaphrum secundatum**	Buffalo grass
Monocotyledons	Smilacaceae	*Smilax australis*	Austral sarsparilla
Monocotyledons	Typhaceae	*Typha orientalis*	Cumbungi
Monocotyledons	Zingiberaceae	*Etlingera elator*	Native ginger
Dicotyledons	Acanthaceae	*Hypoestes phyllostachya*	Polka dot plant
Dicotyledons	Acanthaceae	*Pseuderanthemum variabile*	Pastel flower
Dicotyledons	Apiaceae	*Centella asiatica*	Pennywort (Gotu kola)

Grouping	**Family**	**Botanical Name**	**Common Name**
Dicotyledons	Apocynaceae	*Tabernaemontana pandacaqui*	Banana bush
Dicotyledons	Araliaceae	*Schefflera actinophylla**	Umbrella tree
Dicotyledons	Arecaceae	*Chrysanthemoides monilifera**	Bitou bush
Dicotyledons	Asclepiadaceae	*Gomphocarpus fruticosus**	Narrow- leafed cotton bush
Dicotyledons	Asclepiadaceae	*Gomphocarpus physocarpus**	Balloon cotton bush
Dicotyledons	Asteraceae	*Ageratina adenophora**	Crofton weed
Dicotyledons	Asteraceae	*Ageratina riparia**	Mistflower
Dicotyledons	Asteraceae	*Ageratum houstonianum**	Billygoat weed
Dicotyledons	Asteraceae	*Ambrosia artemisiifolia**	Annual ragweed
Dicotyledons	Asteraceae	*Baccharis halimifolia**	Groundsel
Dicotyledons	Asteraceae	*Bidens pilosa**	Cobblers pegs
Dicotyledons	Asteraceae	*Conyza albida**	Fleabane
Dicotyledons	Asteraceae	*Taraxacum officinale**	Dandelion
Dicotyledons	Asteraceae	*Onopordum acanthium**	Scotch thistle
Dicotyledons	Asteraceae	*Senecio madagascariensis**	Fireweed
Dicotyledons	Asteraceae	*Tagetes minuta**	Stinking roger
Dicotyledons	Caesalpinioideae	*Senna coluteoides**	Winter senna
Dicotyledons	Capparaceae	*Capparis arborea*	Brush caper berry
Dicotyledons	Caryophyllaceae	*Stellaria media*	Chick weed
Dicotyledons	Dilleniaceae	*Hibbertia scandens*	Climbing guinea flower
Dicotyledons	Elaeocarpaceae	*Elaeocarpus obovatus*	Hard quandong
Dicotyledons	Euphorbiaceae	*Breynia oblongifolia*	Coffee bush
Dicotyledons	Euphorbiaceae	*Glochidion sumatranum*	Umbrella cheese tree
Dicotyledons	Euphorbiaceae	*Glochidion ferdinandi*	Cheese tree
Dicotyledons	Euphorbiaceae	*Mallotus discolor*	White/yellow kamala
Dicotyledons	Euphorbiaceae	*Mallotus philippensis*	Red kamala
Dicotyledons	Fabaceae	*Austrosteenisia blackii*	Blood vine
Dicotyledons	Fabaceae	*Trifolium repens**	White clover
Dicotyledons	Lauraceae	*Cinnamomum camphora**	Camphor laurel
Dicotyledons	Lauraceae	*Cryptocarya triplinervis* var. *triplinervis*	Three-veined Cryptocarya
Dicotyledons	Lauraceae	*Neolitsea dealbata*	White bolly gum
Dicotyledons	Malvaceae	*Sida rhombifolia**	Paddy's lucerne

Grouping	**Family**	**Botanical Name**	**Common Name**
Dicotyledons	Meliaceae	*Dysoxylum fraserianum*	Rosewood
Dicotyledons	Meliaceae	*Synoum glandulosum* subsp. *Glandulosum*	Scentless rosewood
Dicotyledons	Menispermaceae	*Stephania japonica*	Snake vine
Dicotyledons	Mimosaceae	*Acacia melanoxylon*	Blackwood wattle
Dicotyledons	Moraceae	*Ficus coronata*	Creek sandpaper fig
Dicotyledons	Moraceae	*Ficus obliqua*	Small leaf fig
Dicotyledons	Moraceae	*Maclura cochinchinensis*	Cockspur
Dicotyledons	Moraceae	*Malaisia scandens*	Burny vine
Dicotyledons	Moraceae	*Morus alba**	Mulberry
Dicotyledons	Myrtaceae	*Austromyrtus dulcis*	Midgenberry
Dicotyledons	Myrtaceae	*Eugenia uniflora**	Brazilian cherry
Dicotyledons	Myrtaceae	*Pilidiostigma glabrum*	Plum myrtle
Dicotyledons	Myrtaceae	*Psidium guajava**	Yellow guava
Dicotyledons	Myrtaceae	*Syzygium oleosum*	Blue lilly pilly
Dicotyledons	Nymphaeceae	*Nymphaea* sp.	Waterlily
Dicotyledons	Ochnaceae	*Ochna serrulata**	Mickey mouse plant
Dicotyledons	Oleaceae	*Ligustrum sinense**	Small-leaved privet
Dicotyledons	Onagraceae	*Ludwigia peploides*	Water primrose
Dicotyledons	Passifloraceae	*Passiflora suberosa**	Corky passion vine
Dicotyledons	Passifloraceae	*Passiflora subpeltata**	White passionflower
Dicotyledons	Phytolacaceae	*Phytolacca octandra**	Inkweed
Dicotyledons	Pittosporaceae	*Pittosporum undulatum*	Sweet pittosporum
Dicotyledons	Polygonaceae	*Persicaria attenuata*	Smartweed
Dicotyledons	Polygonaceae	*Persicaria lapathifolia*	Pale Knotweed
Dicotyledons	Proteaceae	*Banksia integrifolia*	Coast banksia
Dicotyledons	Rosaceae	*Rubus parvifolius*	Native raspberry
Dicotyledons	Rutaceae	*Flindersia bennettiana*	Bennett's ash
Dicotyledons	Rutaceae	*Murraya paniculata**	Mock orange
Dicotyledons	Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo
Dicotyledons	Sapindaceae	*Guioa semiglauca*	Guioa
Dicotyledons	Sapindaceae	*Jagera pseudorhus*	Foambark
Dicotyledons	Santalaceae	*Exocarpos latifolius*	Broad-leaved ballart
Dicotyledons	Solanaceae	*Solanum capsicoides**	Devil's apple
Dicotyledons	Solanaceae	*Solanum mauritianum**	Wild tobacco tree

Grouping	**Family**	**Botanical Name**	**Common Name**
Dicotyledons	Solanaceae	*Solanum nigrum**	Black-berry nightshade
Dicotyledons	Sterculiaceae	*Commersonia bartramia*	Brown kurrajong
Dicotyledons	Thymelaeaceae	*Wikstroemia indica*	Wikstromeia
Dicotyledons	Ulmaceae	*Aphananthe philippinensis*	Rough–leaved elm
Dicotyledons	Verbenaceae	*Lantana camara**	Lantana
Dicotyledons	Verbenaceae	*Verbena bonariensis**	Purple top
Dicotyledons	Violaceae	*Viola hederacea* subsp. *Hederaceae*	Native violet
Dicotyledons	Vitaceae	*Cissus antarctica*	Water vine

* Introduced species

Threatened species shown in bold

APPENDIX 2 – CORRESPONDENCE FROM NSW OFFICE OF WATER

APPENDIX 3 – THREATENED FAUNA AND MIGRATORY SPECIES CONSIDERED AS POSSIBLE OR LIKELY OCCURRENCES WITHIN THE STUDY AREA

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
Botaurus poiciloptilus	Australasian bittern	Unlikely	The Australasian Bittern occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. It favours wetlands with tall, dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. The species favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus*) or cutting grass (*Gahnia*) growing over muddy or peaty substrate (DoE 2016).
Argynnis hyperbius inconstans	Australian fritillary	Unlikely	They are restricted to open, swampy, coastal areas where the larval food plant, *Viola betonicifolia*, grows as a small, insignificant ground herb in association with *Lomandra longifolia* (long leaved matrush) and grasses, especially the grass *Imperata cylindrica* (blady grass).
Rostratula australis	Australian painted snipe	**Possible**	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (Melaleuca). The Australian Painted Snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber (DoE 2016).
Ixobrychus flavicollis	Black bittern	Unlikely	Coastal and sub-coastal areas of south-western, northern and eastern

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
			Australia. Dense vegetation fringing and in streams, swamps, tidal creeks and mudflats. Particularly found amongst swamp she-oaks and mangroves
Turnix melanogaster	Black-breasted button quail	Unlikely	The Black-breasted Button-quail is restricted to rainforests and forests, mostly in areas with 770-1200 mm rainfall per annum. They prefer drier low closed forests, particularly semi-evergreen vine thicket, low microphyll vine forest, *araucarian* microphyll vine forest and *araucarian* notophyll vine forest. They may also be found in low, dense acacia thickets and, in littoral area, in vegetation behind sand dunes (DoE 2016).
Monarcha melanopsis	Black-Faced Monarch	Unlikely	The Black-faced Monarch mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest (DoE 2016). This species also occurs in selectively logged and 20—30 years old regrowth rainforest. It is also sometimes found in nearby open eucalypt forests (mainly wet sclerophyll forests), especially in gullies with a dense, shrubby understorey as well as in dry sclerophyll forests and woodlands, often with a patchy understorey. The species especially occurs in 'marginal' habitats during winter or during passage (migration) (DoE 2016).
Ephippiorhynchus asiaticus	Black-necked Stork	**Possible**	This species is widespread in northern Australia and sparse in coastal eastern Australia from Qld to southern NSW. It inhabits swamps, mangroves, mudflats, dry floodplains and irrigated land. It occasionally forages in open grassy woodland.
Himantopus himantopus	Black-winged stilt	Unlikely	Black-winged Stilts prefer freshwater and saltwater marshes, mudflats, and the shallow edges of lakes and rivers.

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
Grus rubicunda	Brolga	Unlikely	Although this species occurs in northern and eastern Australia, it is uncommon and localised in the east. It inhabits shallow swamps and swamp margins, floodplains, grasslands and pastoral lands, usually in pairs or parties.
Burhinus grallarius	Bush Stone-curlew	Unlikely	Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. Suitable habitat for this species is not considered to occur within the study site although may occur in the broader Kings Forest study area.
Ardea ibis	Cattle Egret	**Possible**	The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation (DoE 2016).
Irediparra gallinacean	Comb-crested jacana	Unlikely	Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation. Forage on floating vegetation, walking with a characteristic bob and flick. They feed primarily on insects and other invertebrates, as well as some seeds and other vegetation. Suitable habitat for this species is not considered to occur within the study area.
Syconycteris australis	Common blossom-bat	**Possible**	Common Blossom Bats in NSW, the Southern part of their range, feed mostly on nectar. There are several blossom producing trees on the

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
			Subject site.
Tringa nebularia	Common greenshank	Unlikely	This species is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. The edges of the wetlands used are generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees (Dept. Environment 2017).
Planigale maculate	Common planigale	Unlikely	This species occurs in coastal north-east NSW. It occupies a wide range of habitats from rainforest, sclerophyll forest, grasslands, marshlands, rocky areas and even some suburban areas, and usually occurs close to water. Suitable habitat occurs on the Subject site.
Actitis hypoleucos	Common sandpiper	Unlikely	The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags. The site is unlikely to provide any nesting habitat
Cyclopsitta diophthalma coxeni	Coxen’s fig-parrot	Unlikely	Coxen's Fig-Parrot occurs in rainforest habitats including subtropical rainforest, dry rainforest, littoral and developing littoral rainforest, and vine forest. Remaining populations are now concentrated into fragmented remnants of dry rainforest and cool subtropical rainforest that are drier and hillier than the habitats that were occupied in the past. Within these

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
			rainforest habitats, the fig-parrot is likely to favour alluvial areas that support figs and other trees with fleshy fruits, in particular, habitats that have a high diversity of fig species, and that have a fruiting season that is staggered across moisture and altitudinal gradients (DoE 2016). Most recent records of the fig-parrot have been from small stands of remnant native vegetation, at forest edges, and in thin tracts of gallery forest (at edges of rivers or streams). Coxen's Fig-Parrot has also been recorded in other habitat types including sub-littoral mixed scrub; corridors of riparian vegetation in woodland, open woodland or other types of cleared or partially-cleared habitat; and isolated stands of fig or other trees on urban, agricultural or cleared land (DoE 2016).
Calidris ferruginea	Curlew sandpiper	Unlikely	Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012).
Charadrius bicinctus	Double-banded plover	**Possible**	The double-banded plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture.
Artamus cyanopterus cyanopterus	Dusky woodswallow	Unlikely	The Dusky Woodswallow is found in open forests and woodlands, and may be seen along roadsides and on golf courses. Occurs in small flocks, hawking insects through clearings and above the canopy.
Miniopterus schreibersii oceanensis	Eastern bent-wing bat	Unlikely	This species occurs throughout eastern Australia. It generally occupies caves and tunnels during the day, but may occasionally roost singularly or in small collectives under the bark of mature paperbark trees.
Numenius madagascariensis	Eastern curlew	Unlikely	This wading species is usually associated with estuaries, bays and lagoons where intertidal mud and sandflats occur. Occasionally also found on beaches, reefs and rocky islets.

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
Mormopterus norfolkensis	Eastern freetail-bat	Unlikely	This species is sparsely distributed in coastal eastern Australia, from approximately Sydney to Fraser Island. This is a poorly known species for which specific habitat requirements are not known. Inferences from wing morphology and echo-location call design suggest that it forages in more open environments. This species has been recorded from forest types ranging from rainforest to dry sclerophyll forest and woodland, but most records are from dry sclerophyll forest and woodland.
Tyto longimembris	Eastern grass owl	**Possible**	Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. They rest by day in a 'form' - a trampled platform in a large tussock or other heavy vegetative growth. Suitable habitat for this species occurs within the study area.
Pezoporus wallicus wallicus	Eastern ground parrot	Unlikely	In NSW this species is rare and confined to near coastal habitats, from south of the Clarence River to just north of the Richmond River. They inhabit Wet heathland and Sedgeland within or adjacent to swamps. Suitable habitat does not occur within the study area.
Nyctophilus bifax	Eastern long-eared bat	Unlikely	This species occurs from Cape York through eastern Qld to the far north-east corner of NSW. It inhabits lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest. This species may occasionally forage within the study area.
Apus pacificus	Fork-Tailed Swift	**Possible**	The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
			scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. They sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines (DoE 2016).
Stictonetta naevosa	Freckled duck	Unlikely	This species inhabits permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. The freckled duck breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. Nests are usually located in dense vegetation at or near water level. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. This species generally rest in dense cover during the day, usually in deep water. It feeds at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates (NSW OEH 2014).
Calyptorhynchus lathami	Glossy black-cockatoo	Unlikely	The species is uncommon although widespread from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, SA. This species inhabits open forest and woodlands off the coast and the Great Dividing Range where it feeds almost exclusively on the seeds of several species of she-oak. Black sheoak (*Allocasuarina littoralis*) and forest sheoak (*A. torulosa*) are important foods. This species is dependent on large hollow-bearing eucalypts for nest sites (NSW OEH 2014).
Ardea alba	Great Egret	**Possible**	The Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial).

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
			These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs. The species usually frequents shallow waters (DoE 2016).
Scoteanax rueppellii	Greater broad-nosed bat	Unlikely	Utilises a variety of habitats from woodland through to dry eucalypt forest and rainforest, though is commonly found in tall wet forest.
Petauroides volans	Greater glider	Unlikely	The greater glider is an arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. Suitable habitat for this species is not considered to occur within the study area.
Litoria aurea	Green and golden bell frog	Unlikely	This species occurs in isolated populations along the coast of NSW. It is found amongst vegetation in and around permanent swamps, lagoons and farm dams, and on flood-prone river flats. The Green and golden bell frog favours areas of Bulrush and Spikerush.
Pomatostomus temporalis	Grey-crowned babbler	Unlikely	The Grey-crowned babbler is patchily distributed throughout northern and eastern Australia but is considered rare in NSW. This species inhabits Open woodlands and along streams where vegetation is cleared. The Grey-crowned babbler may forage for invertebrates on the trunks and branches of trees in the woodland areas of the study area, or on the ground in the grassland communities.
Pteropus poliocephalus	Grey-headed flying fox	**Possible**	This species occurs from central eastern Qld south to Vic. In NSW they mainly occur in coastal areas and along river valleys. They typically roost in conspicuous camps in lowland rainforest and swamp forest, often in

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
			isolated remnants or on islands in rivers. They forage on fruit, nectar and pollen in rainforests and eucalypt forests. Suitable forage habitat (i.e. fruit, nectar and pollen producing vegetation) occurs within the study area.
Pluvialis squatarola	Grey plover	Unlikely	This species occurs almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes. The species is also very occasionally recorded further inland, where they occur around wetlands or salt-lakes (Dept. Environment 2012).
Phascolarctos cinereus	Koala	Unlikely	The Koala occurs in eucalypt woodlands and forests throughout eastern Australia. They inhabit areas where there are appropriate food trees. Preferred Koala food tree species were not recorded within the study area.
Chalinolobus dwyeri	Large-eared pied bat	Unlikely	Sandstone cliffs and fertile woodland valley habitat within close proximity of each other is habitat of importance to the Large-eared Pied Bat. Records from south-east Queensland suggest that rainforest and moist eucalypt forest habitats on other geological substrates (rhyolite, trachyte and basalt) at high elevation are of similar importance to the species (DoE 2016). Available roosts are not evenly distributed throughout the landscape. The species requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging. Almost all records have been found within several kilometres of cliff lines or rocky. Roosting has also been observed in disused mine shafts, caves, overhangs and disused Fairy Martin (*Hirundo ariel*) nests. It also possibly

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
			roosts in the hollows of trees (DoE 2016).
Gallinago hardwickii	Latham's snipe	Unlikely	This species prefers freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). No suitable habitat is present on this site.
Miniopterus australis	Little bentwing-bat	Unlikely	This species occurs in coastal north-east NSW and eastern Qld. It inhabits moist eucalypt forest, rainforest and dense coastal scrub. It generally occupies caves and tunnels during the day, and may occasionally roost singularly or in small collectives under the bark of mature paperbark trees. This species may occasionally forage within the study area.
Hieraaetus morphnoides	Little eagle	Unlikely	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Suitable habitat for this species is not considered to occur within the study area.
Potorous tridactylus tridactylus	Long-nosed potoroo	Unlikely	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. Suitable habitat for this species is not considered to occur within the study area.
Calidris subminuta	Long-toed stint	**Possible**	This species prefers shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds (Dept. Environment 2017)
Anseranas semipalmata	Magpie goose	Unlikely	Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
			monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW. Suitable habitat for this species may occur within the study area.
Gavicalis fasciogularis	Mangrove honeyeater	Unlikely	The primary habitat of the species is mangrove woodlands and shrublands but Mangrove Honeyeaters also range into adjacent forests, woodlands and shrublands, including casuarina and paperbark swamp forests and associations dominated by eucalypts or banksias.
Podargus ocellatus	Marbled frogmouth	Unlikely	This species is restricted to tropical coastal vine forests on Cape York Peninsula and lower altitude sub-tropical rainforests on the East Coast of NSW. Suitable habitat does not exist within the study area.
Tringa stagnatilis	Marsh sandpiper	Unlikely	This species occurs in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes (Dept. Environment 2016).
Tyto novaehollandiae	Masked owl	Unlikely	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats.
Thersites mitchellae	Mitchell's rainforest snail	Unlikely	Remnant areas of lowland subtropical rainforest and swamp forest on alluvial soils. Slightly higher ground around the edges of wetlands with palms and fig trees are particularly favoured habitat. Typically found amongst leaf litter on the forest floor, and occasionally under bark in trees. Suitable habitat for this species is not considered to occur within the study area.
Pseudomys	New Holland mouse	Unlikely	Across the species' range, the New Holland Mouse is known to inhabit the

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novaehollandiae			following types of habitat (DoE 2016): • open heathland; • open woodland with a heathland understorey; and • vegetated sand dunes. Due to the largely granivorous diet of the species, sites where the New Holland Mouse is found are often high in floristic diversity, especially leguminous perennials (DoE 2016).
Cuculus optatus	Oriental Cuckoo	Unlikely	*Cuculus optatus* (also known as *C. saturatus optatus*) uses a range of vegetated habitats such as monsoon rainforest, wet sclerophyll forest, open woodlands and appears quite often along edges of forests, or ecotones between forest types (DoE 2016).
Charadrius veredus	Oriental plover	Unlikely	Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012).
Pandion haliaetus	Osprey	Unlikely	Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range, but may also occur on low sandy, muddy or rocky shores and over coral cays. They may occur over atypical habitats such as heath, woodland or forest when travelling to and from foraging sites (DoE 2016).

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Pluvialis fulva	Pacific golden plover	Unlikely	This species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands. Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as *Sarcocornia,* or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks. The species is also sometimes recorded on islands, sand and coral cays and exposed reefs and rocks. They are less often recorded in terrestrial habitats, usually wetlands such as fresh, brackish or saline lakes, billabongs, pools, swamps and wet claypans, especially those with muddy margins and often with submerged vegetation or short emergent grass. Other terrestrial habitats inhabited include short (or, occasionally, long) grass in paddocks, crops or airstrips, or ploughed or recently burnt areas, and they are very occasionally recorded well away from water (Dept. Environment 2012).
Rostratula benghalensis	Painted snipe	**Possible**	This species inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (*Melaleuca*). The species sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber. Breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. Nest records are all, or nearly all, from or near small islands in freshwater wetlands, provided that these islands are a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover (Dept. Environment 2016).

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
Amaurornis moluccana	Pale-vented bush-hen	Unlikely	The Bush-hen occurs in coastal northern Australia and through eastern Qld to the NSW north coast. It inhabits a variety of coastal wetlands from mangroves, lagoons and swamps, to river margins and creeks running through rainforest. Suitable habitat for this species is not considered to occur within the study area.
Phyllodes imperialis smithersi	Pink underwing moth	Unlikely	The Pink Underwing Moth is found below the altitude of 600 m in undisturbed, subtropical rainforest. It occurs in association with the vine *Carronia multisepalea*, a collapsed shrub that provides the food and habitat the moth requires in order to breed (DoE 2016).
Gallinago stenura	Pin-tailed snipe	Unlikely	Occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation.
Merops ornatus	Rainbow Bee-Eater	Unlikely	The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including mallee, and in open forests that are usually dominated by eucalypts, and farmland and areas of human habitation. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches (DoE 2016).
Erythrotriorchis radiatus	Red goshawk	Unlikely	The Red Goshawk occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia. Riverine forests are also used frequently. Such habitats typically support high bird numbers and biodiversity, especially medium to large species which the goshawk requires for prey. The Red Goshawk nests in large trees, frequently the tallest and most massive in a tall stand, and nest trees are

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
			invariably within one km of permanent water (DoE 2016). The Red Goshawk occurs over wooded and forested lands of tropical and warm-temperate Australia, coastal and sub-coastal. This species prefers forest and woodland with a mosaic of vegetation types, large prey populations (birds), and permanent water. The vegetation types include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins (DoE 2016).
Calidris ruficollis	Red-necked stint	**Possible**	Suitable habitat for this species includes tidal mudflats, saltmarshes, sandy or shelly beaches, saline and freshwater wetlands, coastal and inland, salt fields, and sewage ponds (Dept. Environment 2012).
Anthochaera phrygia	Regent honeyeater	Unlikely	Regent Honeyeaters mostly occur in dry Box-Ironbark eucalypt woodland and dry sclerophyll forest associations in areas of low to moderate relief, wherein they prefer moister, more fertile sites available, for example along creek flats, or in broad river valleys and foothills. At times of food shortage (e.g. when flowering fails in preferred habitats), Regent Honeyeaters also use other woodland types and wet lowland coastal forest dominated by Swamp Mahogany (*Eucalyptus robusta*) or Spotted Gum (*Corymbia maculata*) (DoE 2016). Regent Honeyeaters usually nest in the canopy of forests or woodlands, and in the crowns of tall trees, mostly eucalypts. Studies in the Bundarra-Barraba region indicate that birds actively select the tallest trees available to nest in. Nests in riparian sites are mostly built in rough-barked trees. Nests in woodland sites vary according to the availability of rough-barked trees: in woodlands dominated by rough-barked species (e.g. ironbarks), nests are placed in rough-barked trees; in woodlands where rough-barked trees are scarce (e.g. those dominated by White Box), nests are placed mostly in smooth-barked species (DoE 2016).

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Ptilinopus regina	Rose-crowned fruit-dove	Unlikely	The Rose-crowned fruit-dove occurs along the coast and the ranges of Qld and eastern NSW. It occurs mainly in subtropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. Suitable forage habitat (i.e. fruiting trees) occurs within the study area.
Philomachus pugnax	Ruff	Unlikely	This species is found on generally fresh, brackish of saline wetlands with exposed mudflats at the edges. It is found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands. They are occasionally seen on sheltered coasts, in harbours, estuaries, seashores and are known to visit sewage farms and saltworks. They are sometimes found on wetlands surrounded by dense vegetation including grass, sedges, saltmarsh and reeds. They have been observed on sand spits and other sandy habitats including shingles. The Ruff forages on exposed mudflats, in shallow water and occasionally on dry mud (Dept. Environment 2017).
Rhipidura rufifrons	Rufous Fantail	Unlikely	The Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (*Eucalyptus microcorys*), Mountain Grey Gum (*E.cypellocarpa*), Narrow-leaved Peppermint (*E. radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); usually with a dense shrubby understorey often including ferns. They also occur in subtropical and temperate rainforests, where they have been recorded in temperate Lilly Pilly (*Acmena smithi*) rainforest, with Grey Myrtle (*Backhousia myrtifolia*), Sassafras (*Doryphora sassafras*) and Sweet Pittosporum (*Pittosporum undulatum*) subdominants. They occasionally occur in secondary regrowth, following logging or disturbance in forests or rainforests. When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands, including Spotted Gum (*Eucalyptus*

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			maculata), Yellow Box (*E. melliodora*), ironbarks or stringybarks, often with a shrubby or heath understorey (DoE 2016).
Calidris alba	Sanderling	Unlikely	Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). Suitable habitat for this species is not considered to occur within the study area.
Myiagra cyanoleuca	Satin Flycatcher	Unlikely	Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. They generally occur in moister, taller forests than the Leaden Flycatcher, *Myiagra rebecula*, often occurring in gullies. They also occur in eucalypt woodlands with open understorey and grass ground cover, and are generally absent from rainforest. In south-eastern Australia, they occur at elevations of up to 1400 m above sea level, and in the ACT, they occur mainly between 800 m above sea level and the treeline (DoE 2016).
Calidris acuminate	Sharp-tailed sandpiper	Unlikely	These birds forage on grasslands and mudflats. This species prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves (Dept. Environment 2017).
Myotis macropus	Southern myotis	Unlikely	This species is distributed throughout eastern Australia. It forages over bodies of water ranging from rainforest streams to large lakes and reservoirs. It roosts during the day in caves, mines, tunnels, tree hollows and under bridges. Suitable habitat for this species is not considered to

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			occur within the study area.
Monarcha trivirgatus	Spectacled Monarch	Unlikely	The Spectacled Monarch prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves. Also inhabits Rainforests, eucalypt woodlands, coastal scrubs, damp gullies in rainforest, eucalypt forest, when migrating, more open woodlands (Birdlife Australia 2016; Pizzey and Knight 2002).
Circus assimilis	Spotted harrier	Unlikely	The Spotted harrier occurs in grassy open woodland including *Acacia* and mallee remnants, inland riparian woodlands, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Suitable habitat for this species may occur within the study area.
Dasyurus maculatus	Spotted-tailed quoll	Unlikely	The range of the Spotted-tailed Quoll has contracted to the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Mostly nocturnal consuming a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects; also eats carrion and takes domestic fowl. Suitable habitat for this species is not considered to occur within the study site.
Lathamus discolor	Swift parrot	Unlikely	This species migrates to the Australian south-east mainland between March and October and occurs in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*,

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			Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Suitable habitat for this species is not considered to occur within the study area.
Gallinago megala	Swinhoe's snipe	Unlikely	This species inhabits shallow freshwater wetlands of various kinds including paddy fields, swamps and sewage farms, with bare mud or shallow water for feeding, with nearby vegetation cover. This species is also known to occur in grasslands, drier cultivated areas and market gardens (Higgins and Davies 1996). Most species records are from the Northern Territory.
Daphoenositta chrysoptera	Varied sittella	Unlikely	Varied Sitellas are found in eucalypt woodlands and forests throughout their range. They prefer rough-barked trees like stringybarks and ironbarks or mature trees with hollows or dead branches. Suitable habitat for this species is not considered to occur within the study area.
Crinia tinnula	Wallum Froglet	Unlikely	The Wallum froglet is found in coastal areas from South-East Qld to the central coast of NSW. It is found only in acid Paperbark swamps and sedge swamps of the coastal 'wallum' country.
Litoria olongburensis	Wallum sedge frog	Unlikely	This species inhabits and breeds in acidic, permanent to ephemeral, freshwater wetlands with emergent reeds, ferns and/or sedges in undisturbed coastal wallum. This species may also be found around creeks and freshwater lakes in coastal wallum. This species is typically found below 20m ASL, and always above tidal influence. Water is typically nutrient poor, acidic (pH between 3.5 and 6.0), clear, still and tannin stained. In general, vegetation types where the species may occur include wet and dry heathlands, sedgelands, woodlands and forests. Under wet conditions (i.e. resulting from significant rainfall events), this species is also known to utilize heathlands, grasslands, woodlands and forests adjoining breeding habitats in wallum environments and on near-coastal

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
			alluvial (clay) plains (Dept. Environment 2012).
Xeromys myoides	Water mouse	Unlikely	This species inhabits mangrove communities and associated saltmarsh, sedgelands, clay pans, and heathlands as well as adjacent freshwater wetlands (NSW OEH 2014). No suitable habitat for this species occurs on the site.
Haliaeetus leucogaster	White-bellied sea eagle	Unlikely	The White-bellied Sea-Eagle is found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). Birds have been recorded in (or flying over) a variety of terrestrial habitats (DoE 2016). Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest (including rainforest) and even urban areas. Breeding has been recorded on the coast, at inland sites, and on offshore islands. Breeding territories are located close to water, and mainly in tall open forest or woodland, although nests are sometimes located in other habitats such as dense forest (including rainforest), closed scrub or in remnant trees on cleared land (DoE 2016).
Hirundapus caudacutus	White-Throated Needletail	Unlikely	The White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps (DoE 2016).

Scientific Name	Common Name	Likelihood of occurrence in the Study area	Notes
Tringa glareola	Wood sandpiper	Unlikely	The wood sandpiper prefers well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially Melaleuca and River Red Gums *Eucalyptus camaldulensis*
Motacilla flava	Yellow wagtail	**Possible**	Habitat requirements for the Yellow Wagtail are highly variable, but typically include open grassy flats near water. Habitats include open areas with low vegetation such as grasslands, airstrips, pastures, sports fields; damp open areas such as muddy or grassy edges of wetlands, rivers, irrigated farmland, dams, waterholes; sewage farms, sometimes utilise tidal mudflats and edges of mangroves (DoE 2016).

APPENDIX 4 – ASSESSMENT OF SIGNIFICANCE (7 PART TEST)

Flora

(a) In the case of a Threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Hairy-joint grass (*Arthraxon hispidus*)

Extent of the local population

A search of the NPWS database contained five thousand, seven hundred and seventy-four (5,774) records of this species within 10 kilometres of the subject site and eight thousand, four hundred and sixty-one (8,461) records within the Ballina LGA. The local population, for this species, is considered to be the individuals recorded on the subject site, as well as any individuals within adjoining areas (contiguous or otherwise) that may be potentially cross-pollinating.

This species has been recorded in several locations within the boundaries of the subject site**.** These locations were recently ground-truthed by JWA (August 2017 and May 2018). Results of the recent site surveys suggest that the distribution of Hairy-joint grass (HJG) within the site has contracted since the 2013 surveys (**FIGURE 1**).

Life-cycle attributes

HJG is found over a wide area in south-east Queensland, and on the northern tablelands and north coast of NSW, but is never common. Hairy joint grass is a creeping grass with branching, erect to semi-erect purplish stems. Leaf-blades are 2–6 cm long, broad at the base and tapering abruptly to a sharp point. Long white hairs project around the edge of the leaf. The seed-heads are held above the plant on a long fine stalk. This grass is considered to be a perennial but it tends to die down in winter.

It is a moisture and shade-loving grass, found in or on the edges of Rainforest and in Wet eucalypt forest, often near creeks, swamps or groundwater seeps.

Potential direct and indirect Impacts

The NSW National Parks and Wildlife Service consider the following, direct and indirect impacts, as threats to the survival of this species (DEC 2005):

- Clearing of habitat for agriculture and development;
- Inappropriate fire regimes;
- Over-grazing by domestic stock;
- Competition from introduced grasses such as Paspalum and Kikuyu;
- Changes to hydrological flows and water quality; and
- Slashing or mowing of habitat.

N

LEGEND

- *Arthraxon hispidus* - May 2018 (Vulnerable - ROTAP)
- *Arthraxon hispidus* seedling - November 2017 (Vulnerable - ROTAP)
- *Arthraxon hispidus* (Vulnerable - ROTAP) (Locations confirmed by JWA September 2017
- *Arthraxon hispidus* (Vulnerable - ROTAP) (Landmark Ecological Consulting 2008 - Locations confirmed JWA November 2009, November 2010 & April 2013)
- Subject Site

0 50m

1 : 2000

SOURCE: JWA Site Investigations 2004, 2008, 2013, 2017 & 2018; Landmark (Ref: arthraxon final report.pdf); Urbis (Ref: PLN-Concept 5c.pdf)
SCALE: 1 : 2000 @ A3

JWA PTY LTD
Ecological Consultants

CLIENT
Ballina Island Developments Pty Ltd

PROJECT
Ecological Assessment
Lot 1 on DP517111
20 North Creek Road, Lennox Head, NSW
Ballina Shire Council LGA

APPENDIX 4
FIGURE 1

PREPARED: BW
DATE: 08 June 2018
FILE: N20068_EA_Arthraxon.cdr

TITLE

***ARTHRAXON HISPIDUS* LOCATIONS**

The following management practises are relevant for the protection of this species:

- Protect habitat from frequent fire;
- Avoid slashing or mowing around wetland edges;
- Fence habitat remnants to protect from stock;
- Control introduced grasses in areas with known populations;
- Protect areas of rainforest, wet eucalypt forest and swamp from clearing and development;
- Maintenance of the existing hydrological regime to ensure the viability of the Hairy Joint Grass population on site i.e. maintaining the wet and boggy conditions at the base of the slope;
- Maintenance and control of stormwater run-off water quality.

HJG generally occurs outside the proposed development footprint. One small clump of HJG (approx. 1m^2) and one (1) additional isolated individual occur within the proposed development footprint and will require translocation to the compensatory habitat area in the north-western portion of the subject site. The Compensatory habitat area will be cleared of weeds and rehabilitated in accordance with the HJG Compensatory Habitat Plan (JWA 2018a). The proponent will maintain ownership of the compensatory habitat area and the area will be protected in perpetuity under an Environmental Covenant pursuant to Section 88B of the Conveyancing Act 1919, or similar arrangement. All efforts will be made to protect plants during both construction and operational phases (i.e. protective fencing and signage).

The incorporation of proposed hydrologic management measures into the development (which include targeted recharge of the soil store via swales, a bio-basin, bio-swales and a detention basin) will help to ensure that the existing hydrologic regime within the HJG compensatory habitat area can be maintained (Gilbert and Sutherland 2019). Consideration of impacts to this species that may arise from changes to hydrological flows and water quality as a result of the proposed development have also been considered in the Stormwater Management Plan (Mott MacDonald 2019) prepared for the site.

Provided that the above management practises are implemented for this species, the proposed development is unlikely to result in any significant impacts to this species.

Rough-shelled bush nut (Macadamia tetraphylla)

Extent of the local population

A search of the NPWS database contained nineteen (19) records of this species within 10 kilometres of the Study area and two hundred and sixty-three (263) within the Ballina LGA. The local population of this species would be comprised of individuals within the study area (should they occur) as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those in the study area.

This species was recorded in several locations adjacent to the subject site by previous studies.

Life-cycle attributes

The main habitat for *Macadamia tetraphylla* is subtropical rainforest near the coast (Floyd 1989). It is also found in notophyll vine forest (Quinn *et al*. 1995). Neither Floyd (1989), Barry & Thomas (1994) nor Quinn *et al* (1995) discuss the pollination or dispersal vectors for this species. Bees have been observed on the flowers of this species on a number of occasions and may be responsible for pollination. Rodents are known to take fruits of the similarly sized *M. integrifolia* from plantations. It is likely that rodents are also involved in the dispersal of *Macadamia tetraphylla* in natural situations. Gravity and water may also play a role in dispersal.

Potential direct and indirect Impacts

The NSW National Parks and Wildlife Service consider the following, direct and indirect impacts, as threats to the survival of this species (DEC 2005):

- Clearing and fragmentation of habitat for coastal development, agriculture and roadworks;
- Risk of local extinction due to low numbers;
- Grazing and trampling by domestic stock;
- Inappropriate fire regimes;
- Invasion of habitat by weeds; and
- Loss of local genetic strains through hybridisation with commercial varieties.

The proposed development is not expected to result in any impacts to this species as this tree occurs outside the development footprint, on an adjoining private land parcel.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable for threatened flora.

(c) In the case of an endangered ecological community or critically endangered ecological community whether the action proposed:

- *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable for threatened flora species.

(d) In relation to the habitat of a threatened species, population or ecological community:

- *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*

A summary of impacts on habitat for each of the two (2) Threatened flora species recorded on or adjacent to the subject site is provided in **TABLE 1.** Habitat has been considered as the area occupied by Threatened flora species as well as the area potentially providing opportunities for establishment of additional individuals.

TABLE 1
POTENTIAL LOSS OF THREATENED FLORA HABITAT FROM THE SITE

Common Name	Botanical Name	Area of existing habitat	Area of habitat to be removed/ modified
Hairy-joint grass	*Arthraxon hispidus*	2.76 ha (i.e. Wet grassland/sedgeland)	2.25 ha
Rough-shelled Bush Nut	*Macadamia tetraphylla*	Nil	Nil

It is considered that the proposed rehabilitation of 2.38 ha of Compensatory Habitat will result in a gain of good quality habitat for this species. Whilst clumps of *A. hispidus* already occur within the Compensatory habitat area, this area is dominated by weed species and the species will benefit greatly from the proposed rehabilitation works.

- *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*

Habitat for Threatened flora species is already fragmented and has a history of disturbance from land clearing, grazing and other activities on the subject site. The proposed development includes a number of vegetated areas which will undergo weed removal and revegetation activities. The proposed development is unlikely to contribute significantly to an increase in the fragmentation of native vegetation communities.

Specific management actions for HJG have been identified through the preparation of an HJG Compensatory Habitat Plan (JWA 2018a). This plan aims to protect HJG at the Subject site, such that the species continue to persist and reproduce. The relevant objectives of the Plan include:

- Translocation of any HJG clumps which will be impacted by the development;
- Retain and restore areas of suitable habitat;

- Implement weed control measures and vegetation restoration where appropriate; and
- To provide practical strategies for the protection of threatened species and the management and enhancement of their habitats including management of the existing hydrological regime and water quality.

- *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

Most of the vegetation to be removed is highly disturbed. The assessment of the importance of the habitat to be removed has taken into consideration the stages of the Threatened floras' life cycles and how reproductive success may be affected. It is considered that, with the adoption of recommended amelioration and management measures, the proposed development will not affect the life cycle or reproductive success of any identified Threatened flora species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

There will be no adverse effects on any of the critical habitats listed under the *Threatened Species Conservation Act (1995)* from the action proposed.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No Approved Recovery Plans or Threat Abatement Plans have any relevance to Threatened flora on the subject site.

A range of protective measures have been proposed with the objective of improving and protecting areas of habitat on the site for Threatened flora species and reducing impacts on Threatened flora wherever possible. With the implementation of these measures it is considered that Threatened flora species will continue to persist on the site following development.

In 2004, amendments were made to the TSC Act (1995) that removes the mandatory requirement to prepare recovery plans and threat abatement plans, and instead requires the preparation of Threatened species Priority Action Statements (PAS). The ten (10) priority actions outlined for HJG are:

- Maintain populations *ex situ* at suitable botanic gardens, regional gardens or nurseries;
- Provide information to the public on HJG, particularly landowners adjacent to areas of known occurrence;

- Develop and implement site management plans for some of the known populations;
- Control Feral animals in known habitat for this species;
- Reserve Fire management Strategy include operational guidelines to protect this species from fire;
- Prepare Environmental Impact Assessment Guidelines;
- Assess weed threats to populations, manage as necessary. Implement Bitou bush control as described in the approved TAP;
- Establish monitoring sites to determine trends in habitat condition and population size;
- Observations suggest HJG is an annual but literature suggest it is a perennial species; this needs to be resolved through biological research; and
- Map extent of known populations and survey areas of potential habitat near known occurrences for additional populations.

The HJG Compensatory Habitat Plan (JWA 2018a) includes consideration of these Priority actions.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A "threatening process" means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes have been listed in Schedule 3 of the *TSC Act (1995).*

An assessment of key threatening processes is provided in **APPENIDX 7.** This assessment concluded that with the adoption of the recommended management actions, the proposed development will not increase the impact of a key threatening process.

Endangered Ecological Communities

(a) In the case of a Threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable to EEC's.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable to EEC's.

(c) In the case of an endangered ecological community or critically endangered ecological community whether the action proposed:

- *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Littoral rainforest EEC

The mid-high woodland community (Community 1) on the subject site contains species that are representative of the Endangered Ecological Community (EEC) – Littoral rainforest in the NSW North Coast, Sydney Basin and South-East Corner bioregions, as listed within schedules of the NSW *Threatened Species Conservation Act (1995).* This community on the subject site is considered to be a highly degraded, regenerating representative of this EEC.

The removal of 0.14 ha of this community will not place the occurrence of this EEC in the Lennox Head locality at risk of extinction due to the following reasons:

1. Areas identified as representing this EEC within the site are in a highly degraded state and exotic species were found to be prevalent within this community.
2. The site's degraded woodland communities have very low connectivity values.
3. Visual inspection of aerial photography indicates that similar communities, namely degraded woodlands are widespread throughout the Lennox Head locality.
4. Significant areas of good quality Littoral rainforest EEC are known from the locality including areas protected in nature reserves/national parks.

Given the above, it is determined that the proposed development will not adversely affect the extent of the ecological community nor adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Freshwater wetland EEC

Council's ecologist is of the opinion that a portion of the highly-degraded wet grassland/sedgeland community (i.e. Community 4) is representative of the EEC Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, as listed within schedules of the NSW *Threatened Species Conservation Act (1995).* This community on the subject site is considered to be a highly degraded representative of this EEC at best.

The removal of 0.44 ha of this community will not place the occurrence of this EEC in the Lennox Head locality at risk of extinction due to the following reasons:

1. Areas identified as representing this EEC within the site are in a highly degraded state and exotic species were found to be prevalent within this community.

2. The site's degraded wet grassland/sedgeland communities have very low connectivity values.
3. Visual inspection of aerial photography indicates that similar communities, namely degraded wetlands are widespread throughout the Lennox Head locality.
4. Significant areas of good quality Freshwater wetland EEC are known from the locality including areas protected in nature reserves/national parks.
5. A Hydrologic Regime Assessment (Gilbert & Sutherland 2019) has been completed and demonstrates that, with the incorporation of mitigation measures (which include targeted recharge of the soil store via swales, a bio-basin, bio-swales and a detention basin), the proposed development will not adversely alter the hydrologic regime of the retained wetland/Groundwater Dependent Ecosystem (GDE). The hydrologic management measures incorporated into the development will help to ensure that the existing hydrologic regime within the identified wetland/GDE can be maintained. That is, the volume of water reporting to the wetland/GDE and the rate at which it is delivered to that location will be maintained in a similar state, pre- and post-development (Gilbert & Sutherland 2019).
6. Consideration of impacts to this species that may arise from changes to hydrological flows and water quality as a result of the proposed development have also been considered in the Stormwater Management Plan (Mott MacDonald 2019) prepared for the site.

Given the above, it is determined that the proposed development will not adversely affect the extent of the ecological community nor adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

(d) In relation to the habitat of a threatened species, population or ecological community:

- *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*

The proposed development will necessitate the removal of approximately 0.14 ha (or 100%) of highly degraded Littoral rainforest EEC, and 0.44 ha (or 61%) of highly degraded Freshwater wetland EEC within the site.

- *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*

The EECs located on the site are highly degraded and currently surrounded by expanses of cleared grassland and existing urban development. The proposed development has been designed to utilise disturbed areas of the site as far as practicable and is unlikely to contribute significantly to an increase in the fragmentation of native vegetation communities.

- *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

As described in points (i) and (ii) above, areas within the site identified as supporting EECs are currently in a highly degraded state and have relatively low connectivity value.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

There will be no adverse effects on any of the critical habitats listed under the *Threatened Species Conservation Act (1995)* from the action proposed.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No Approved Recovery Plans or Threat Abatement Plans have any relevance to the EECs present on the Subject site.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of a key threatening process.

A "threatening process" means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes have been listed in Schedule 3 of the *TSC Act (1995).*

An assessment of key threatening processes is provided in **APPENDIX 5**. This assessment concluded that with the adoption of the recommended management actions, the proposed development will not increase the impact of a key threatening process.

Fauna

(a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

Australian painted snipe (Rostratula australis)

Extent of the local population

The OEH database contained no record of this species within 10 kilometres of the subject site and one (1) record within the Ballina LGA.

The Australian Painted Snipe is considered to occur as a single, contiguous breeding population (Garnett & Crowley 2000). The local population of this species comprises those individuals known or likely to occur in the study area, as well as any individuals

occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.

Stages of the life-cycle affected by the proposed development

The Painted snipe inhabits fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. It nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.

The OEH Threatened Species Unit discusses the following threats for the Painted snipe:

- Drainage of breeding sites in wetlands.
- Reduced water quality from siltation and pollution.
- Predation by foxes and feral cats.
- Use of herbicides, insecticides and other chemicals near wetlands.
- Grazing and associated frequent burning of wetlands.

Likelihood of local extinction

The majority of suitable habitat for this species occurs in the flood-prone portions of the site and will be retained. In addition, the proposed development will:

- Remove grazing and trampling impacts by domestic stock; and
- Retain and rehabilitate large areas of suitable habitat.

It is considered unlikely that the proposed development would lead to the extinction of any local population of this species.

Black-necked stork (Ephippiorhynchus asiaticus)

Extent of the local population

The OEH database contained forty-nine (49) records of this species within 10 kilometres of the subject site and one hundred and four (104) records in the Ballina LGA.

The local population of this species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area. This species is highly mobile with large variable territories estimated to average about 9,000ha, ranging from 3,000-6,000ha in high quality habitat and 10,000-15,000ha in areas where habitat is poor or dispersed (OEH 2014). The local population of this species could therefore extend to areas well outside of the study area.

Stages of the life-cycle affected by the proposed development

The OEH Threatened Species Unit records the following information on the habitat and ecology of the Black-necked Stork.

The Black-necked Stork inhabits swamps, mangroves, mudflats, dry floodplains, and irrigated land. It occasionally forages in open grassy woodland. An abundant supply of frogs and fish is required, together with suitable roost and nest trees, usually overhanging rivers and swamps (SFNSW 1995). It strides through the water probing for prey with its bill and may chase fish. The nest is a large flat pile of sticks, grass and rushes in a tree, usually near water.

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the north-east region. The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Black-necked stork, with the following results:

1st order disturbances	Drainage of wetlands Dams
2nd order disturbances	Power lines Intensive horticulture (tea trees)
3rd order disturbances	Pesticide contamination of wetlands Urban development Loss of nest trees
4th order disturbances	Shooting

The proposed development is unlikely to have any significant impacts on the potential habitat for this species.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

Common blossom bat

Extent of the local population

The NPWS database contained one (1) record of this species within 10 kilometres of the Study area and ten (10) recorded sightings within the Ballina LGA. The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, which could reasonably be expected to be mating with individuals on the Subject site.

Habitat and life-cycle

The Common blossom-bat shows preference with regards to feeding sites, often repeatedly visiting the same sites on consecutive nights within a flowering season and returning to the aforementioned site over several years. They require a year-round supply of nectar and pollen, which is gathered from a mosaic of coastal complex vegetation types. When these vegetation types are in short supply of nectar and pollen (Nov/Dec in northern NSW) Common Blossom-bats have been known to utilise riverine areas containing Black Bean, Silky Oak and Weeping Bottlebrush. Common Blossom-bats often roost in littoral rainforest and feed on nectar and pollen from flowers in adjacent

heathland and paperbark swamps. They have also been recorded in a range of subtropical forest types, rainforest, wet sclerophyll forest and coastal Eucalypt forest. Individuals of the species generally roost individually in dense foliage and vine thickets of the sub-canopy, staying in the same general area for a season. They change roost sites daily, but each roost site is generally only 50m or so away from other recent roosts (DEC 2005, Churchill 1998).

Potential impacts of the proposed development

The NSW National Parks and Wildlife Service consider the following direct and indirect impacts as threats to the survival of the Common blossom-bat (DEC 2005):

- Predation by foxes and feral cats, which may occur whilst the bat is feeding on low hanging flowers and fruit;
- Inappropriate fire regimes applied in heathland habitats leading to reduced flowering of Banksia, Callistemon and Melaleuca species;
- Clearing of coastal habitat for urban development or sandmining; and
- Weeds, such as Bitou Bush, that suppress the regeneration of key food trees, such as Coastal Banksia (DEC 2005).

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Common blossom bat, with the following results:

1st order disturbances	Clearing – habitat loss Management burns, including illegal
2nd order disturbances	Clearing resulting in fragmentation, increasing predation and decreasing food availability Wildfire Apiary Weed invasion Drainage of swamps Sand mining
3rd order disturbances	Logging of coastal sclerophyll forests with Banksia understorey Aerial spraying of bitou bush
4th order disturbances	Sand dune disturbance from recreational 4WDs
5th order disturbances	Barbed wire fences Introduced predators

The Common blossom bat may occasionally utilise the site to forage on flowering Coast banksia, which also occurs patchily throughout the study area. Loss of Banksia from the site, while slightly reducing the local forage resource, is unlikely to have a significant impact on this species. Rehabilitation works on the site will utilise Coast Banksia's where appropriate.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

Eastern Grass owl (Tyto longimembris)

Extent of local population

The NPWS database contains twelve (12) records of this species within 10 km of the Kings Forest site and a total of fifty-six (56) records within the Tweed LGA.

The local population for this species is considered to be comprised of all individuals likely to occur on the site as well as any individuals within adjoining areas (contiguous or otherwise) that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

The NPWS Threatened Species Unit records the following information on the distribution and ecology of the Grass owl.

Grass owls are found in areas of tall grass, including grass tussocks in swampy areas, grassy plains, swampy heath, and cane grass, or sedges on flood plains. They rest by day in a 'form' – a trampled down platform in a large tussock or other heavy growth. If disturbed, they burst out of cover flying rather slowly, before dropping straight down again into cover. They also nest in trodden down grass.

The NPWS Threatened Species Unit discusses the following threats for the Grass owl:

- Loss of suitable habitat from grazing, agriculture and development;
- Disturbance and habitat degradation by stock;
- Use of pesticides in agriculture to control rodent populations thereby reducing food sources for owls, and potentially poisoning owls; and
- Frequent burning, which reduces ground cover.

Potential threats to the species from development of the site include:

- Fragmentation and loss of habitat;
- Injury/death from vehicle strike;
- Human disturbance;
- Injury/death from domestic animals;
- Increased risk of fire;
- Disturbance from light spill from houses and roads; and
- Use of second-generation (single-dose) rodenticides based on brodifacoum (e.g. Talon).

The proposed development will not result in the removal or modification suitable roost/nesting habitat for this species.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

Grey-headed flying-fox

Extent of the local population

The NPWS database contained twenty-two (22) records of this species within 10 kilometres of the Study area and eighty-six (86) recorded sightings within the Ballina LGA.

The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, which could reasonably be expected to be mating with individuals on the Subject site.

Habitat and life-cycle

The Grey-headed flying fox is found mainly in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Their roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, birth and the rearing of young. Annual mating commences in January and a single young is born each October or November.

Potential impacts of the proposed development

The NSW National Parks and Wildlife Service consider the following direct and indirect impacts as threats to the survival of the Grey-headed flying fox (DEC 2005):

- Loss of foraging habitat;
- Disturbance of roosting sites;
- Unregulated shooting; and
- Death by electrocution on powerlines.

This species forages widely and may occasionally visit the site to forage on fruiting figs (and mangoes on the adjacent lot to the east). The proposed development site will result in the loss of the single mature Small-leaved fig on the site. This constitutes a minor loss of foraging resources within the locality and is unlikely to have a significant impact on this species.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

(b) In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

Fifty-two (52) endangered populations have been identified under the TSC Act (1995). The following four (4) endangered populations occur in north-east NSW:

- Long-nosed potoroo population, Cobaki Lakes and Tweed Heads West;
- Emu population in the NSW North Coast Bioregion and Port Stephens LGA;
- Low growing form of *Zieria smithii*, Diggers Head; and
- Narrow-leaved red gum in the Greater Taree LGA;
- *Glycine clandestina* (Broad-leaf form) in the Nambucca LGA.

None of these endangered populations are known to occur on or near the study area. The proposed action will not have an adverse effect on any of these endangered populations.

(c) In the case of an endangered ecological community or critically endangered ecological community whether the action proposed:

- *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not relevant to Threatened fauna species.

(d) In relation to the habitat of a threatened species, population or ecological community:

- *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

Vegetation on the Subject site is not considered to represent primary habitat for any of the species considered possible occurrences within the study area due to the disturbed nature and small area of suitable habitat. The proposed revegetation and regeneration practices are planned to offset any habitat loss as a result of the proposed development.

It is considered highly unlikely that the minor vegetation removal associated with the proposed development would result in the local extinction of any of the above species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitat areas listed under the *Threatened Species Conservation Act (1995)* currently consist of habitat for; Mitchell's rainforest snail in Stott's Island Nature Reserve, Little penguin population in Sydney's North Harbour, Gould's Petrel and the Wollemi Pine.

There will be no adverse effects on any of the critical habitats listed under the *Threatened Species Conservation Act (1995)* from the action proposed.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Grey-headed flying fox

The relevant objectives of the Draft National Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus)* (DECC 2009) are as follows:

- To reduce the impact of threatening processes on Grey-headed Flying-foxes and arrest decline throughout the species' range;
- To conserve the functional roles of Grey-headed Flying-foxes in seed dispersal and pollination;
- To improve the standard of information available to guide recovery of the Grey-headed Flying-fox, in order to increase community knowledge of the species and reduce the impact of negative public attitudes on the species; and
- To protect and increase the extent of key winter and spring foraging habitat of Grey-headed Flying-foxes.

Provided that Coastal Banksia and mature fruiting rainforest trees are replaced on the subject site where they are removed, it is considered that the Proposed development is consistent with the objectives and actions of this Recovery Plan.

Other species

An Approved recovery plan has not been completed for the other threatened species considered a possible occurrence at this site.

There are no relevant threat abatement plans for any of the Threatened species considered a possible occurrence on the subject site.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of or increase the impact of a key threatening process.

A "threatening process" means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes have been listed in Schedule 3 of the *TSC Act (1995).*

An assessment of key threatening processes is provided in **APPENDIX 5.** This assessment concluded that with the adoption of the recommended management actions, the proposed development will not increase the impact of a key threatening process.

On the basis of this assessment, it is considered that a Species Impact Statement (SIS) is not required.

APPENDIX 5 – ASSESSMENT OF KEY THREATENING PROCESSES

Key Threatening Processes (Schedule 3 TSC Act 1995):

- Invasion and establishment of exotic vines and scramblers;
- Invasion of native plant communities by Bitou bush & Boneseed;
- Invasion of native plant communities by exotic perennial grasses
- Invasion, establishment and spread of Lantana camara;
- Competition and grazing by the feral European rabbit;
- Competition and habitat degradation by feral goats;
- Competition from feral honeybees;
- Herbivory and environmental degradation caused by feral deer;
- Importation of red imported fire ants into NSW;
- Introduction of the large earth bumblebee (*Bombus terrestris*);
- Invasion and establishment of the Cane Toad;
- Invasion of the yellow crazy ant (*Anoplolepis gracilipes*);
- Predation by feral cats;
- Predation by the European Red Fox;
- Predation by the Plague Minnow (*Gambusia holbrooki*);
- Predation by the ship rat (*Rattus rattus*) on Lord Howe Island;
- Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*);
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands
- Bushrock Removal;
- Clearing of native vegetation;
- Alteration of habitat following subsidence due to longwall mining;
- Ecological consequences of high frequency fires;
- Human-caused Climate Change;
- Loss and/or degradation of sites used for hill-topping by butterflies;
- Loss of Hollow-bearing Trees;
- Removal of dead wood and dead trees;
- Infection by Psittacine circoviral (beak & feather) disease affecting endangered psittacine species;
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis;

- Infection of native plants by *Phytophthora cinnamomi;*
- Death or injury to marine species following capture in shark control programs on ocean beaches; and
- Entanglement in, or ingestion of, anthropogenic debris in marine and estuarine environments.

The proposed development has the potential to result in an increase in the **'Invasion and establishment of exotic vines and scramblers**', '**Invasion of native plant communities by exotic perennial grasses**' and '**Invasion, establishment and spread of** *Lantana camara***'**. Weed Control measures are discussed in detail in the *Arthraxon hispidus* Compensatory Habitat Plan (JWA 2018a).

The proposed development has the potential to result in an increase in the '**Invasion and establishment of the Cane Toad'**, '**Predation by feral cats'** and '**Predation by the European Red Fox'**. A Feral Animal Management Plan should be prepared at the Construction Certificate stage to ensure that these key threatening processes are not exacerbated.

The proposed development has the potential to result in an increase in the **'Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands'.** A Hydrologic Regime Assessment (Gilbert & Sutherland 2019) has been completed and demonstrates that, with the incorporation of mitigation measures (which include targeted recharge of the soil store via swales, a bio-basin, bio-swales and a detention basin), the proposed development will not adversely alter the hydrologic regime of the retained wetland/Groundwater Dependent Ecosystem (GDE). The hydrologic management measures incorporated into the development will help to ensure that the existing hydrologic regime within the identified wetland/GDE can be maintained. That is, the volume of water reporting to the wetland/GDE and the rate at which it is delivered to that location will be maintained in a similar state, pre- and post-development (Gilbert & Sutherland 2019).

The proposed development will contribute towards the **'Clearing of native vegetation'**. The final determination of the NSW Scientific Committee notes that clearing of native vegetation is recognised as a major factor contributing to loss of biological diversity, with impacts such as: destruction of habitat; fragmentation of habitat; riparian zone degradation; increased greenhouse gas emissions; increased habitat for invasive species; loss of leaf litter layer; loss or disruption of ecological function (*e.g.* loss of populations of pollinators or seed dispersers) and changes to soil biota.

Habitat loss is the main threatening process affecting all subject species. The Proposed development will make a minor contribution towards the loss of habitat in the region. However, as previously discussed, the majority of vegetation to be lost has been highly disturbed by past landuse activities.