Koala Plan of Management:

Project:

South Lindfield KPoM Stage 3:
Koala Plan of Management

Client:

Port Macquarie-Hastings Council

November 2018

Document Status

Version	Purpose	Author	Reviewed By	Approved By	Date
Rev 0	Preliminary Draft	Will Steggall	Jason Berrigan		
Rev 1	Draft	Will Steggall/Jason Berrigan	Jason Berrigan	Erin Davies	08/12/14
Rev 2	Draft	Will Steggall/Jason Berrigan	Jason Berrigan	Erin Davies	12/12/14
Rev 3	Draft	Will Steggall/Jason Berrigan	Jason Berrigan	Erin Davies	09/02/15
Rev 4	Draft	Will Steggall	Will Steggall	Christopher Doig	05/04/17
Rev 5	Final Draft	Will Steggall	Will Steggall	Christopher Doig	15/05/17
Rev 6	Final Draft edits	Will Steggall	Karl Robertson	Will Steggall	02/05/2018
Rev 7	Final Draft edits	Will Steggall	Karl Robertson	Will Steggall	25/05/2018
Rev 8	Final Draft edits	Will Steggall	Karl Robertson	Will Steggall	03/09/2018
Rev 9	Final Draft edits	Will Steggall	Karl Robertson	Will Steggall	11/09/2018
Rev 10	Final	Will Steggall	Karl Robertson	Will Steggall	05/11/2018

Document Control

Copy No.	Date	Type/Via	Issued to	Name	Purpose
1	8/12/14	Electronic/ Email	PMHC	Stephen Nicholson	Client Review
2	8/12/14	Electronic/ Email	Naturecall	Chantal Sergeant	File Copy
3	12/12/14	Electronic/ Email	PMHC	Stephen Nicholson	Client Review
4	12/12/14	Electronic/ Email	Naturecall	Chantal Sergeant	File Copy
5	09/02/15	Electronic/ Email	PMHC	Stephen Nicholson	Client Review
6	09/02/15	Electronic/ Email	Naturecall	Chantal Sergeant	File Copy
7	05/04/17	Electronic/ Email	PMHC	Stephen Nicholson	Client Review
8	05/04/17	Electronic/ Email	Naturecall	Chantal Sergeant	File Copy

9	15/05/17	Electronic/ Email	PMHC	Stephen Nicholson	Client Copy
10	15/05/17	Electronic/ Email	Naturecall	Chantal Sergeant	File Copy
11	02/05/2018	Electronic/ Email	PMHC	Stephen Nicholson	Client Copy
12	02/05/2018	Electronic/ Email	Biodiversity Australia	Chantal Sergeant	File Copy
13	25/05/2018	Electronic/ Email	PMHC	Stephen Nicholson	Client Copy
14	25/05/2018	Electronic/ Email	Biodiversity Australia	Chantal Sergeant	File Copy
15	03/09/2018	Electronic/ Email	PMHC	Stephen Nicholson	Client Copy
16	03/09/2018	Electronic/ Email	Biodiversity Australia	Chantal Sergeant	File Copy
17	03/09/2018	Electronic/ Email	PMHC	Peter Cameron	Client Copy
18	03/09/2018	Electronic/ Email	Biodiversity Australia	Chantal Sergeant	File Copy
19	05/11/2018	Electronic/ Email	PMHC	Peter Cameron	Client Copy
20	05/11/2018	Electronic/ Email	Biodiversity Australia	Chantal Sergeant	File Copy

Project Number: EC795/EC1502/EC2911

Our Document Reference: EC2911-BEC-REP-SouthLindfield_Stage2_KPoM-rev10.0

Contents

Document Status 2
Document Control 2

Contents 4

List of Tables 5

1.0 Introduction 1

2.0 Background Information 2

2.1. Key Definitions 2
2.2. Site Description 2
2.3. Proposed Development 2

3.0 KPoM Objectives and Performance Criteria 6

3.1. Objectives 6
3.2. Performance Criteria 6
3.3. Guidelines for Individual Koala Plans of Management 6

4.0 State and Federal Koala Policies 8

4.1. SEPP No. 44 - Koala Habitat Protection 8
4.2. National Koala Conservation Strategy 1998 8
4.3. National Koala Conservation and Management Strategy 2009-2014 9
4.4. NSW Koala Recovery Plan 2008 9
4.5. *Biodiversity Conservation Act 2016* 9
4.6. *Environmental Protection and Biodiversity Conservation Act 1999* 10

5.0 Koala Habitat and Population Characteristics 11

5.1. Site Vegetation Communities 11
5.2. SEPP 44 Koala Habitat Assessment 13
5.3. Characteristics of the Core Koala Habitat 14

6.0 Threat Assessment 22

6.1. Current Threats 22

7.0 Ameliorative Measures 27

7.1. Habitat Retention, Consolidation and Linkage Enhancement 27
7.2. Clearing Management 28
7.3. Future Dwelling on Western Lot 29
7.4. Road Design and Speed Controls 30

7.5. Barriers and Fencing 30
7.6. Bushfire 30
7.7. Disease 31

8.0 Implementation, Monitoring and Compliance 32
8.1. Monitoring and Review 32
8.2. Implementation Schedule 34

9.0 Conclusion 37

10.0 References 38

Appendix 1: Offset Planting Specifications 47
A1.1: Offset Requirements 47
A1.2 Objectives and Performance Criteria 47
A1.3 Planting Specifications 48
A1.4 Authority for Implementation 48
A1.5 Milestones 49
A1.6 Monitoring and Compliance 49

Appendix 2: Compliance Checklist 50

List of Figures

Figure 1: Site location and extent 4
Figure 2: Proposed future land zoning and road location 5
Figure 3: Vegetation within the KPoM area 12
Figure 4: OEH Corridors 20
Figure 5: Local context of site habitat 21
Figure 6: Location of Koala Food Trees 23

List of Tables

Table 1: SEPP 44 KPoM guidelines 7
Table 2: PMHC LGA primary preferred Koala food trees per soil landscape 14
Table 3: Implementation schedule for ameliorative measures 34
Table 4: KPoM compliance checklist 51

1.0 Introduction

Biodiversity Australia Pty Ltd was engaged by Port Macquarie-Hastings Council to prepare a Koala Plan of Management for the area nominated as South Lindfield located on the western fringe of Port Macquarie. The KPoM is to accompany a rezoning proposal for future residential subdivision over parts of the 20ha site.

This report forms Stage 2 and 3 of the Project which is preparation of a Koala Plan of Management. This follows on from Stage 1 of the project which involved mapping of Koala food trees over the site, background literature review, SEPP 44 assessment, review of preliminary development concept layouts, and formulation of preliminary recommendations to guide refinement of a masterplan for the area.

The SEPP 44 Assessment undertaken in Stage 1 found that the site contained areas of Core Koala Habitat and was regularly used by a small local aggregate of Koalas, which form part of a local population that extends to the south, southeast and southwest over a larger landscape of occupied Koala habitat.

Consequently, as per SEPP 44, the rezoning for the area must take into account the presence of Core Koala Habitat. This will be informed by this Koala Plan of Management.

2.0 Background Information

2.1. Key Definitions

The **study site** is defined as the approximately 20ha piece of land subject to an assessment for rezoning under the *Port Macquarie Local Environmental Plan 2011*, referred to as 'South Lindfield'. This is shown in Figure 1.

The **study area** is land within 100m of the site and the locality is land within a 10km radius of the site.

2.2. Site Description

The site is located in the northern Lake Innes/Thrumster area on the southwest urban fringe of Port Macquarie, between the Oxley Highway and Innes Gardens Memorial Park (the Port Macquarie crematorium and cemetery). A site locality map is provided in Figure 1.

John Oxley Drive passes through the north of the site, with the Oxley Highway Deviation forming the northern and western boundary.

Rural-residential properties form the dominant landuse on site, with seven current residences occurring on the site, along with the Major Innes Motel in the west. One vacant Lot occurs north of John Oxley Drive, being the site of the former BMD Constructions Pty Ltd compound for construction of the Oxley Highway. West of Philip Charley Drive, the western-most lot is vacant.

The Port Macquarie crematorium and cemetery adjoin the southern and southwest boundaries of the site.

2.3. Proposed Development

At present, there is no agreed master development plan for the entire site.

Lot 2 north of John Oxley Drive is anticipated to become a bus depot. The adjacent Lot 1 which was originally surveyed in Stage 1 but is now excluded due to the landowner withdrawing from the process, is not proposed to be developed at this stage, however it is expected to be rezoned as light industrial or commercial in the future.

West of Philip Charley Drive, the only development proposed is a dwelling on the vacant western-most lot. The lots will be zoned E3 and E4, to otherwise maintain their current character.

East of Philip Charley Drive, the remaining Lots will largely be zoned Residential to allow for traditional residential developments. An area of vegetation has been identified for conservation and koala habitat, and will be zoned E2.

Figure 2 identifies the general layout of the development and proposed future land zoning boundaries. This zoning is in line with the objectives of this KPoM and protects key habitat areas.

Figure 1: Site location and extent

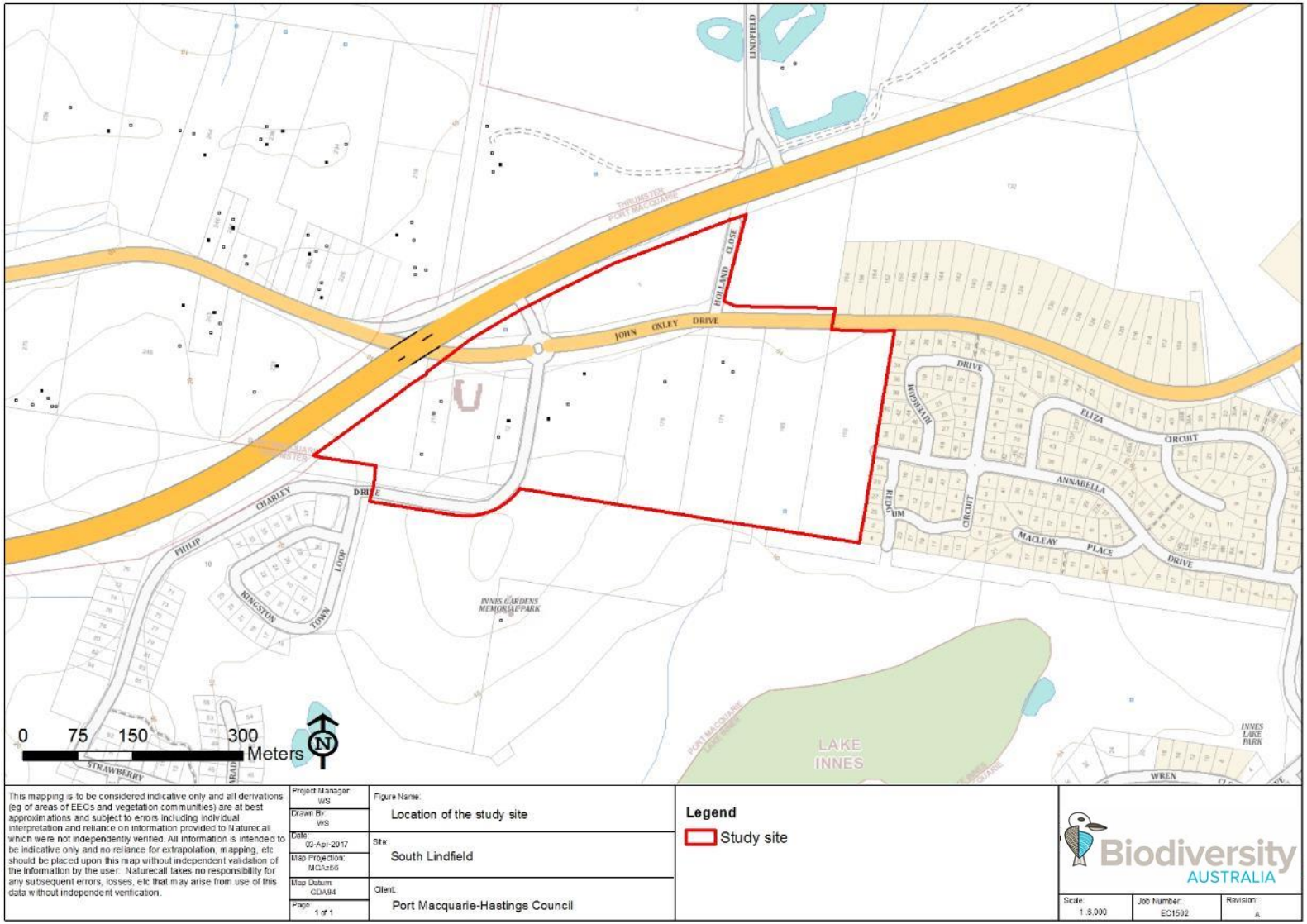
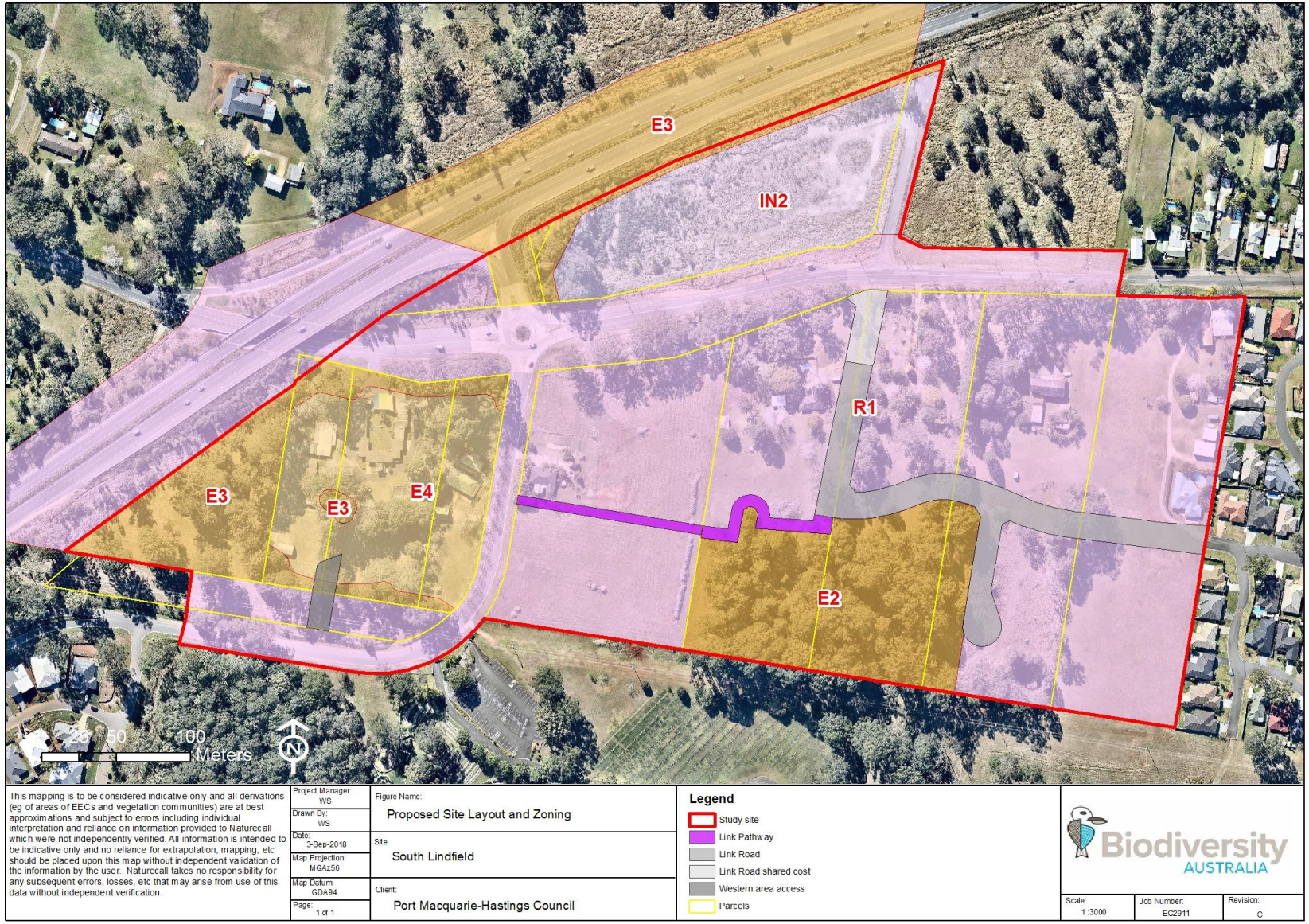


Figure 2: Proposed future land zoning and road location



3.0 KPoM Objectives and Performance Criteria

3.1. Objectives

The principle objective of this Koala Plan of Management is to ensure the study area retains its ability to support a Koala population, and also to enhance this by increasing potential carrying capacity and linkages within the broader Core Koala Habitat.

The objectives of this Koala Plan of Management (KPoM) are:

1. To maintain the viability of the current Koala population which occurs in the local area via:
    - Retaining the majority of existing mature Koala food trees, and current activity areas.
    - Increasing the net extent of primary browse species in the study area to increase its carrying capacity and potentially allow population expansion;
    - Maintaining and enhancing linkages with other habitat known to be required by the local Koala population; and,
    - Effectively mitigate threats to the viability of Koalas induced by the proposal.
2. To effectively minimise the proposal's contributions to other threats facing the Koala.

3.2. Performance Criteria

The criteria against which achievement of the objectives are to be measured are:

1. A net increase of food trees within the study area.
2. Enhancement of local linkages to reinforce landscape linkages.
3. Nil Koala losses or injury due to road strike, drowning in pools or attack by dogs - determined by monitoring.
4. No increase in disease incidence.
5. No unmitigated increase in threats to Koalas within the study area.

3.3. Guidelines for Individual Koala Plans of Management

The SEPP 44 B35 Circular (Department of Urban Affairs and Planning 1995) provides guidelines for the preparation of individual Koala plans of management. These are shown in Table 1 below along with the section in which they are addressed in the KPoM.

Table 1: SEPP 44 KPoM guidelines

Number	Criteria	Section Addressed
i)	An estimate of population size	Section 5.3.1
ii)	Identification of preferred tree species for the locality and extent of resource available	Section 5.2.1
iii)	An assessment of the regional distribution of Koalas and the extent of alternative habitat available to compensate for that to be affected by the actions	Section 5.3.3
iv)	Identification of linkages of Core Koala Habitat to other adjacent areas of habitat and movement of Kolas between areas of habitat. Provision of strategies to enhance and manage these corridors	Section 5.3.3 Section 7.1
v)	Identification of major threatening processes such as disease, clearance of habitat, road kill and dog attack which impact on the population. Provision of methods for reducing these impacts	Section 6 & 7
vi)	Provision of detailed proposals for amelioration of impacts on Koala populations from any anticipated development within zones of Core Koala Habitat	Section 7
vii)	Identification of any opportunities to increase size or improve condition of existing core habitat, this should include lands adjacent to areas of identified Core Koala Habitat	Section 7
viii)	The plan should state clearly what it aims to achieve (for example, maintaining or expanding the current population size or habitat area)	Section 3
ix)	The plan should state criteria against which achievement of these objectives is to be measured (for example, a specified population size or specific time frame or the abatement of threats to the population)	Section 3
x)	The plan should also have provisions for continuing monitoring, review and reporting. This should include an identification or who will undertake further work and how it will be funded.	Section 8 and appendices

4.0 State and Federal Koala Policies

4.1. SEPP No. 44 - Koala Habitat Protection

State Environmental Planning Policy no. 44 – Koala Habitat Protection (SEPP 44) is a planning policy that "*aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline*".

SEPP 44 requires the identification of Potential and Core Koala Habitat on development sites and planning areas, and the preparation of a Koala Plan of Management (KPOM) if Core Koala Habitat is found.

SEPP 44 also allows local governments to prepare LGA wide Koala management plans referred to as Comprehensive Koala Plans of Management (CKPoM). Coastal LGA's that have implemented CKPoMs include Kempsey, Coffs Harbour, Port Stephens and Lismore. No approved CKPoM has been prepared for the Port Macquarie-Hastings LGA to date, however a large Koala population study has recently been undertaken by Biolink (2013).

4.2. National Koala Conservation Strategy 1998

This report was prepared in 1998 by the Australian and New Zealand Environment and Conservation Council (ANZECC) and subsequently signed by the Commonwealth, States and Territories. The primary aim of the strategy was "*to conserve Koalas by retaining viable populations in the wild throughout their natural range*".

The report sets out the following six objectives to achieve this:

- To conserve Koalas in their existing habitat
- To rehabilitate and restore Koala habitat and populations
- To develop a better understanding of the conservation biology of Koalas
- To ensure that the community has access to factual information about the distribution, conservation and management of Koalas at a national, state and local scale
- To manage captive, sick or injured Koalas and orphaned wild Koalas to ensure consistent and high standards of care
- To manage over-browsing to effectively prevent both Koala starvation and ecosystem damage in discrete patches of habitat

A 10 year review of the strategy was undertaken by Parsons Brinckerhoff in 2008 (Predavec 2008). This found that the strategy had been poorly implemented and coordinated overall and had achieved few positive outcomes. The review also stated that significant declines in Koala populations and

habitat in Queensland, New South Wales and Victoria had occurred since the strategy was implemented and the main threatening processes continued to operate.

4.3. National Koala Conservation and Management Strategy 2009-2014

This was report was prepared by the Natural Resource Management Ministerial Council to supersede the 1998 National Koala Strategy, and was effective from December 2009 with a review scheduled in 2014. It identified shortcomings of the 1998 strategy by including a detailed implementation plan and setting up an implementation team to coordinate the identified actions which were linked to outputs, prioritised, and given a time-frame

The plan also aimed to strengthen partnerships between government, stakeholders and the community and effectively engage the community in Koala conservation.

4.4. NSW Koala Recovery Plan 2008

A NSW Recovery Plan for the Koala was prepared by the then Department of Environment and Climate Change (DECC) in 2008. The overall objective of the plan is "*to reverse the decline of the Koala in New South Wales, to ensure adequate protection, management and restoration of Koala habitat, and to maintain healthy breeding populations of Koalas throughout their current range.*"

The plan adopted the specific objectives of the National Koala Conservation Strategy (ANZECC 1998) to achieve broader conservation outcomes. A number of specific recovery actions and performance criteria were formulated to implement the objectives.

4.5. *Biodiversity Conservation Act 2016*

The *Biodiversity Conservation Act 2016* (BC Act) is a newly implemented piece of NSW legislation with an overall objective of maintaining "*a healthy, productive and resilient environmental for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development*". The act incorporates a Biodiversity Offset Scheme which outlines rules and regulations on the application of biodiversity offsets, in order to achieve conservation outcomes.

Any future residential subdivisions in the planning area may be subject to assessment under the Biodiversity Assessment Method (BAM) and Biodiversity Offset Scheme. In this event, any offsets under this act are applicable in isolation of this KPoM and hence will form additional offset requirements.

The Koala is listed as Vulnerable under the BC Act.

4.6. *Environmental Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's primary environmental legislative instrument. This act necessitates approval for any action that will have a Significant Impact on Matters of National Environmental Significance (MNES). MNES recognised under the EPBC Act, that act as a trigger for the Commonwealth assessment and approval process include;

- World Heritage properties;
- National Heritage Places;
- RAMSAR wetlands of international significance;
- Threatened species and ecological communities;
- Migratory species;
- Nuclear actions, including uranium mining;
- The Commonwealth marine environment;
- A water resource, in relation to coal seam gas development and large coal mining development

The Koala was listed as Vulnerable under the EPBC Act in April 2012. This listing covered the most at-risk Koala populations in Queensland, NSW and the ACT. As a result, any actions that are likely to have a significant impact on the Koala in these states must be referred to the Minister who will decide whether an assessment is required under the EPBC Act (DoE 2013).

5.0 Koala Habitat and Population Characteristics

5.1. Site Vegetation Communities

Four vegetation communities were described in the study area (Naturecall 2014), as shown in Figure 3.

These comprised:

- **Very Tall Open/Dry Sclerophyll Forest**: Occurs in the central elevated parts of the site, and is the dominant forest community covering approximately 4.7ha. Blackbutt (*Eucalyptus pilularis*) and Tallowwood (*E. microcorys*) were generally co-dominant overall, with a few Pink Bloodwood (*Corymbia intermedia*) occurring throughout. Forest Red Gum (*E. tereticornis*) and Flooded Gum (*E. grandis*) also occur in this community along John Oxley Drive and around Major Innes Motel. Most canopy trees are even-aged and trunk DBH is generally around 20-60cm.

  The mid storey is comprised of regenerating canopy species, Black Oak (*Allocasuarina littoralis*), Forest Oak (*Allocasuarina torulosa*), Cheese Tree (*Glochidion ferdinandi*), Coffee Bush (*Breynia oblongifolia*) and Wavy Pittosporum (*Pittosporum undulatum*).

  The groundcover strata comprises an open cover of grasses, sedges and herbs including Kangaroo Grass (*Themeda triandra*), Wiry Panic (*Entolasia stricta*), Spiny Matrush (*Lomandra longifolia*), Bladey Grass (*Imperata cylindrica*), Bracken (*Pteridium esculentum)* and Blue Flax Lily *(Dianella caerulea).*

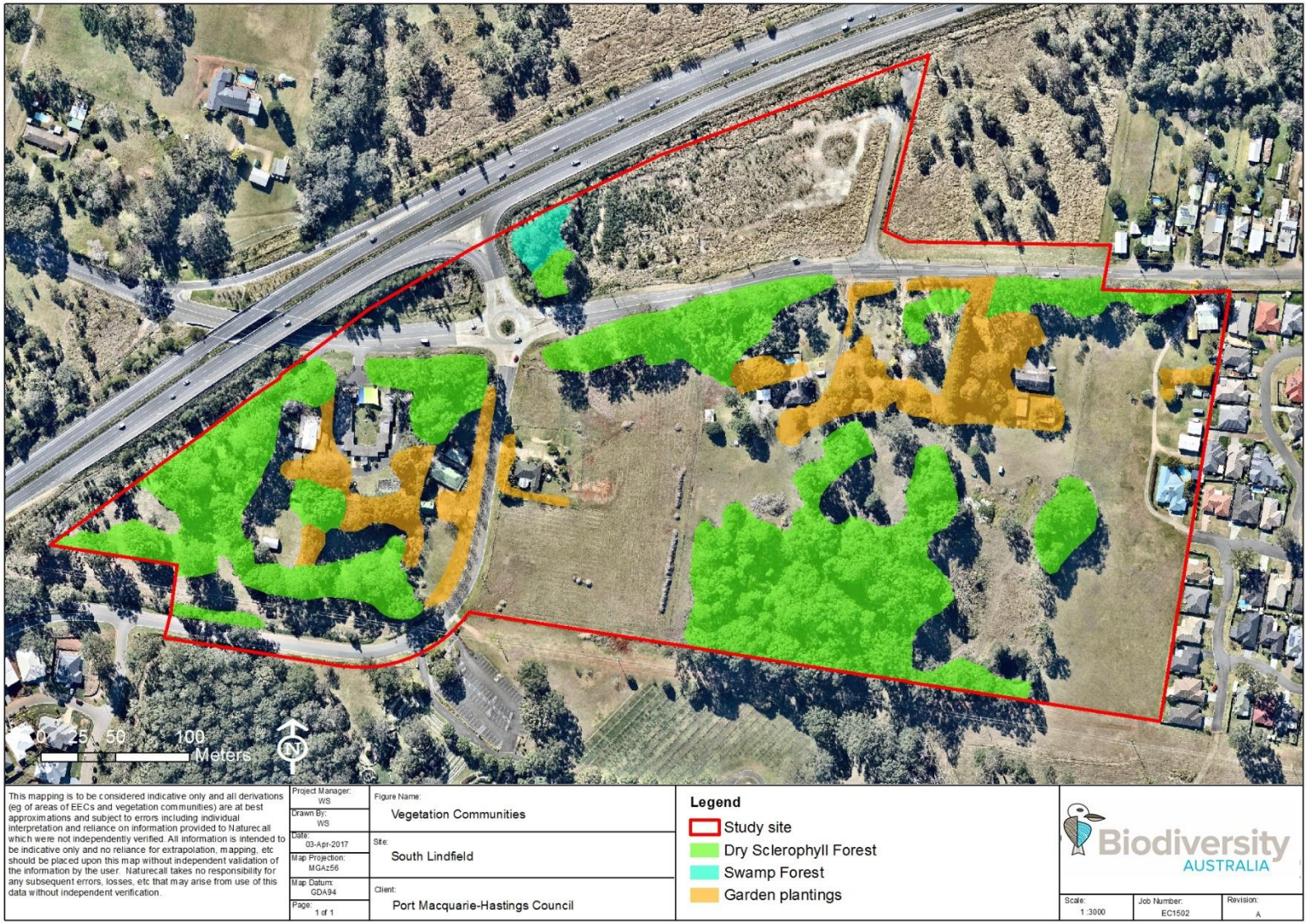
- **Tall Open/Swamp Forest**: Occurs as a small patch in the north covering an area of 0.1ha. Dominated by a tall open canopy cover of Broad-leaved Paperbark (*Melaleuca quinquenervia*) around 18-20m high, with a few Swamp Mahogany *(E. robusta*), Swamp Oak (*Casuarina glauca*) and Forest Red Gum. Crown separation is mid-dense to sparse.

  The mid storey strata comprised a mix of Paperbarks, Lilly Pilly (*Acmena smithii*), Cheese Tree, Willow Bottlebrush (*Callistemon salignus*) and White Sally (*Acacia floribunda*).

  Groundcover comprised sedges and grasses including *Baumea sp*., *Lepidosperma laterale*, Wiry Panic and Blue Fan Flower (*Dampiera stricta*).

- **Garden and Roadside Plantings**: Occurs around the dwellings and motel on the site and along sections of John Oxley Drive and Phillip Charley Drive. Comprises a mix of planted or self-sown exotic species varying in height and density. Commonly occurring species include Radiata Pine, Cocos Palms, Jacarandas, Coral Trees Junipers and Liquidamber.

Figure 3: Vegetation within the KPoM area



5.2. SEPP 44 Koala Habitat Assessment

Refer to Naturecall (2014) for the full assessment. The following is a summary.

5.2.1. Potential Koala Habitat Assessment

Three Schedule 2 browse species are present on the site: Tallowwood, Forest Red Gum and Swamp Mahogany. There are also a few specimens of the naturally occurring hybrid *E. patentinervis*. A total of 140 Koala food trees were marked, ranging in trunk diameter from 10-150cm.

A formal Potential Koala Habitat Assessment was undertaken in the dry sclerophyll forest in the centre of the site (this area being approximately 2.5ha). This resulted in schedule 2 species comprising 24.8% of the upper tree layer and 25% of the lower tree layer. This surpasses the 15% threshold required by SEPP 44.

Biolink (2013) also classified the site in terms of Koala habitat, with all but a small patch with a cluster of Forest Red Gums (mapped as Primary) classed as Secondary A.

5.2.2. Field Survey Results

Field surveys resulted in the detection of three Koalas on the site. Two females were directly observed on several occasions during both day searches and spotlighting: one clearly had a Chlamydia infection. A male was also heard calling from the crematorium during call playback surveys. These sightings confirmed with previous records on site (Bionet 2014, Biolink 2009, Darkheart 2013).

A total of seven SAT surveys were undertaken across the site, as well as searches under all trees for scats. Activity levels ranged from 0-16% and fell within the low use threshold based on the soil landscape ranges recommended by Biolink (2013). This was in contrast to SAT scores taken by Biolink (2009) prior to the Oxley Highway Deviation, which recorded very high activity levels and indicated Core Koala Habitat.

5.2.3. Conclusion

Due to evident generational persistence of Koalas in the study area; the presence of female Koalas on site and a breeding male in the study area; and ongoing records of Koalas within associated habitats, as well as previous activity levels: the site was considered to form part of a larger area of Core Koala Habitat.

5.3. Characteristics of the Core Koala Habitat

5.3.1. Estimate of Population Size

Naturecall (2014) and previous studies confirm that the site is part of a wider area of Core Koala Habitat used by a population of Koalas. This population appears to range well beyond the site, possibly over the wider Ruins Way area, south to Lake Innes Nature, and possibly west to Ascot Park. This wider population appears to be small, as suggested by on-going survey for and by Vilro; and sightings by this and previous survey on and adjacent to the site.

Due to this wider landscape of Core Koala Habitat (e.g. Mahers Headland, Lake Innes Nature Reserve, etc), there is also likely to be a periodic influx of recruits to maintain genetic diversity in the study area. Hence at certain times of the year, it is possible that temporary resident Koalas may be present in the study area e.g. sub-dominant males.

In line with Koala ecology, the local aggregate using the site and directly adjacent habitat is thus considered likely to be at most about 5 Koalas, constituting a dominant male, at least 1-2 breeding females and their young.

5.3.2. Preferred Tree Species

From a collation of previous landscape-based Koala food tree research and data collected the coastal LGA study, Biolink (2013) determined that the following are the primary preferred Koala browse species in the PMHC LGA, depending on soil landscape:

Table 2: PMHC LGA primary preferred Koala food trees per soil landscape

Transferral, Alluvial, Swamp and Thrumster Residual (TASTr) Soil Landscapes: Medium to High Fertility	Erosional, other Residuals, Colluvial, Beach and Aeolian (ERCBA) Soil Landscapes: Low to Medium Fertility
Tallowwood (*E. microcorys*)	*Tallowwood (*E. microcorys*)
Swamp Mahogany (*E. robusta*)	Swamp Mahogany (*E. robusta*)
Grey Gum (*E. propinqua*)	
Forest Red Gum (*Eucalyptus tereticornis*)	

* Tallowwood use appears to be size dependent on low to medium soil landscapes (Biolink 2013).

Tallowwood, Forest Red Gum, *E. patentinervis* and Swamp Mahogany (in decreasing order of abundance) are the only preferred Koala browse species on site. In line with other research and SEPP 44, these trees were preferentially used on site, with no use recorded of Blackbutt or Pink Bloodwood.

Darkheart (2013) recorded use of Tallowwood, Swamp Mahogany and Forest Red Gum on the surveyed part of Lot 171 to the south. Biolink (2005a) and Darkheart (2005g, 2006e) recorded use of Tallowwood in Ascot Park to the southwest.

5.3.3. Distribution of Koala Populations, Site Context and Linkages

Regional and Local Government Area Distribution of Koalas

(i) *Regional Distribution of Koalas*

Koala numbers have declined throughout most of their previous range in NSW, with the main occurrences being in the northeast of the state (DECC 2008). Most coastal populations now persist in fragmented and isolated areas of habitat (predominantly secondary class A with some localised primary areas supporting high density populations), with extensive areas of potential habitat appearing to be devoid of Koalas (DECC 2008). In contrast, some well-known western populations appear to be increasing. The difference is considered to primarily be due to increasing development pressure e.g. from agriculture and urban expansion in the coastal region (DECC 2008, AKF 2014, 2007).

In the north coast and mid-north coast regions, areas with large numbers of records are restricted to localities such as Ballina, Port Stephens, Port Macquarie, Coffs Harbour, Tweed and Lismore (Connell Wagner 2000b, Lunney *et al* 1999, Port Stephens Council 2001, DECC 2008, AKF 2008, 2007). The Koala Recovery Plan (DECC 2008) notes that in addition to these major population centres are numerous small populations many of which are disjunct to urban and rural development, as well as natural barriers (DECC 2008).

(ii) *Distribution and Abundance of Koalas in the PMHC LGA*:

The coastal sector of the Port Macquarie-Hastings Local Government Area (LGA) is well known to contain a viable Koala population in varying densities, generally within the following major areas (Biolink 2013, Connell Wagner 2000a, 2000b, Starr 1990, Biolink 2003, 2005a, 2005a, 2005c, 2008, 2013, AMBS 2003, Biosis 2004, Darkheart 2013, 2008a, 2008b, 2006e, 2005a-i, 2005a-h, Berrigan 2003a-d, 2002a-c, 2001a-e, 2000a-f, 1999a-c, 1998, 1997, Kendall 1993, 1991, Mt King Ecological Surveys 1993, OEH 2014a):

- Port Macquarie urban area
- Lake Cathie Plains to Lakes Innes/Thrumster area (approaching Sancrox)
- Lake Innes Nature Reserve/Kooloonbung Creek Nature Reserve and adjoining private lands
- Lake Cathie area

- Dunbogan Peninsula
- Point Plomer area

A number of other well-known smaller population centres also occur in scattered occurrences e.g. Broken Bago State Forest, Telegraph Point, North Brother, Bonny Hills, North Shore and Huntington area (OEH 2014a, Biolink 2005c, 2013, Darkheart 2005a, 2005b, 2004a, Kel Mackay pers. comm., Mrs Penny Marshall BHCC pers. comm.).

Biolink (2013) in their major study estimated a population of approximately 2000 Koalas in the coastal LGA, occupying an Area of Occupancy of only 24% of available habitat.

Studies of the nearby Lake Innes Nature Reserve (Starr 1990, Mt King Ecological Surveys 1991, Connell Wagner 2000b), Thrumster (Biolink 2008, 2005a, 2005b, 2005d, 2003, Darkheart 2005g, 2006e) and Port Macquarie (Starr 1990, Mt King Ecological Surveys 1991, Connell Wagner 2000b, Wilkes and Snowden 1998, Martin 1996) have estimated that a sizeable Koala population exists in the locality of the site. Estimates range from 400-500 in Port Macquarie (Martin 1996) with a similar number in the northern reaches of Lake Innes Nature Reserve (NPWS 1999, Phillips unpub. data cited in Biolink 2008, 2005a, 2005b), to >200 in the Thrumster area (Biolink 2008, 2005a, 2005c). An estimated 300 Koalas in the Lake Cathie area has been proposed though given limitations on survey methodology (i.e. public records which may be many sightings of the same Koala), this figure is recommended by Biolink to be treated with caution (Biolink 2005a, 2005c).

The Lake Innes-Thrumster population is considered by Biolink (2013) to be of national and state significance (Biolink 2008, 2005a, 2005b, 2013).

(iii) *Local Populations*:

Studies of the adjacent Lake Innes Nature Reserve (Biolink 2013, Starr 1990, Mt King Ecological Surveys 1991, Connell Wagner 2000b), the majority of Vilro Pty Ltd land holding (Biolink 2005a, 2005b, Darkheart 2006e), Thrumster (Biolink 2008, 2003) and Port Macquarie (Starr 1990, Mt King Ecological Surveys 1991, Connell Wagner 2000b, Wilkes and Snowden 1998, Martin 1996) have determined that a sizeable Koala population exists in the locality.

As noted above, estimates have been proposed in the range of 400-500 in Port Macquarie (Martin 1996) with a smaller number in the northern reaches of Lake Innes Nature Reserve (NPWS 1999, Phillips unpub. data cited in Biolink 2005a, 2005c), and the Thrumster area (Biolink 2008). These numbers are only provisional estimates however, with no comprehensive survey or verified statistical census undertaken to date (DECC 2008). Biolink (2005a, 2008) has offered estimates from their work in the northern Lake Innes Peninsular and Thrumster area, but these have not been independently verified and are subject to review (Dr Jim Charley, pers. comm.).

Any lack of firm knowledge about the extent and health status of the local Koala population is a significant concern for planning. Over-estimation of the Koala population size and poor

understanding of health status (e.g. low fertility due to Chlamydia) can mask declines, hence in the absence of adequate data, the Precautionary Principle must be applied.

Linkages

(i) *Regional*:

The Office of Environment and Heritage (OEH) has mapped corridors at a regional scale throughout northern NSW. This map is shown in Figure 4.

The subject site does not fall within a regional or sub-regional corridor. As evident in Figure 4, a sub-regional corridor is mapped to the west of the site connecting to Lake Innes Nature Reserve.

The focal species of this corridor are the Koala, Brushtailed Phascogale and the Eastern Chestnut Mouse (Scotts 2002). Due to the lack of fragmentation of this portion of the corridor, it is considered likely to support Koala movement as this species may use as little as 1 tree/ha - Wilkes and Snowden 1998).

(ii) *Local*:

As shown in Figures 4 and 5, the study area and immediate locality has a high level of fragmentation by urban development and historical rural land uses. Koalas occurring in this local matrix are also increasingly threatened by further fragmentation and gradual attrition of habitat via residential development, increased exposure to predators (wild and domestic dogs), and the introduction of barriers/mortality threats posed by local roads which may all contribute to the decline of the local population (DECC 2008, AKF 2006, 2006, 2011, Curtin *et al* 2002, Port Stephens Council 2001, Hindell and Lee 1990, Connell Wagner 2000b, Dique *et al* 2004, Hume 1995, Jurskis and Potter 1997, Phillips 2000, Phillips *et al* 2000, Biolink 2005a, 2005b, 2008).

Movement north from the site was previously constrained by the former Oxley Highway and fragmented habitat which posed physical and behavioural barriers, and a known mortality threat (Connell Wagner 2000b). Establishment of the Deviation has evidently resulted in a greater barrier due to fencing and habitat loss and fragmentation despite provision of underpasses; with John Oxley Drive also retaining most its barrier effects and at least a proportion of its mortality risk. Koala movement west and north from the site is thus considered to be effectively limited to an adventurous dispersing Koala crossing under the John Oxley Drive overpass. In effect thus, the site is now likely to form part of the northern limit of Core Koala Habitat to the south and southwest, as described by Biolink (2009).

Linkage south from the site is only limited by the deer-exclusion fence around the crematorium but this is overcome by trees close to either side of the fence, and Koalas entering via the open gates during the day (Koalas have been observed entering Westport High School via the daily open gates). A deer fence also runs along the rear boundaries of the eastern Lots in the central part of South Lindfield, but again, Koalas can circumvent this fence from other directions.

Movement further south and southeast is comparatively well supported by Lake Innes Nature Reserve and strips of vegetation along the proposed golf course. Retained habitat in Ascot Park is also an important corridor to the west, linking the golf course vegetation strips to an underpass under the Oxley Highway Deviation which is designed to facilitate Koalas.

The peninsular of intact swamp forest within Lake Innes Nature Reserve to the southeast of the site has very few preferred Koala food trees (hence very limited forage potential and minimal carrying capacity), but it does provide a permanent intact arboreal and terrestrial link directly to the remainder of the Reserve. This body of forest (and the corridor crossing Brierley Hill to the south and interlinking to Kooloonbung Creek Nature Park) may also be used by Koalas when the northern parts of Lake Innes is burnt out by major bushfire. They could also seek refuge habitat within the Lake Innes residential precinct; or using these linkages for dispersing between the urbanised population in Port Macquarie and the Lake Innes Peninsular population (Connell Wagner 2000b, Wilkes and Snowden 1998).

Movement east to east-northeast is constrained by relatively recently developed residential land with very few food or refuge trees. Movement northeast is relatively unconstrained (but requires some traversing of open paddock) to access potential Koala habitat on low-lying land adjacent to the Oxley Highway, but appears to show little use (Darkheart 2004i, 2008d).

Overall, these links collectively provide connectivity for movement between the local remnants, and assist genetic exchange between the urban and Nature Reserve populations to maintain viability of the local Koala population (Connell Wagner 2000b, Biolink 2008, 2005a, 2005b).

Site Context:

In the local context, appraisal of Figure 5 shows that the site's and adjacent land's limited remnant habitat combined with the wooded road reserves form part of a larger matrix of remnants amongst mostly developed land in the John Oxley Drive/Ruins Way/Major Innes Drive area. Historical photos also show that this area has been subject to a cumulative loss of Koala habitat, particularly in the last 5 years.

As detailed previously, there are a plethora of Koala records in the locality. This includes several records on and close to the site, and numerous records within approximately 1km of the site (e.g. OEH 2014a, Biolink 2008, 2005a, 2005b, Berrigan 2003c, 2003g, 2003h, 2001b, 2001c, 2001d, 2000b, 2000c, 1999a, 1999b, Darkheart 2007e,2006e, 2005d, 2005f, 205l, 2004g, 2004l, 2004g, 2004l, 2004n, 2004p, 2004q, etc, Connell Wagner 2000b, Wilkes and Snowden 1998, Biosis 2005, 2004, AMBS 2003).

As noted in Naturecall (2014), previous studies have determined that Lot 171 and the Ruins Way/Lake Innes residential area to Ascot Park areas contains Core Koala Habitat spread over both the northern reaches of Lake Innes Nature Reserve and adjacent forested rural land (Biolink 2005a, 2005b, 2008, 2003), supported by a matrix of remnants, roadside trees and an urban woodland

(Berrigan 1999c, 2001i, 2003m, 2003n, Darkheart 2007c, 2013, EcoPro 1999b, Connell Wagner 2000b, Hastings Council 2003, Wilkes and Snowden 1998, Biolink 2005a, 2005b, 2008).

Most relevant to the current study site, Biolink (2009) considered the South Lindfield area as forming part of the larger area of Core Koala habitat in the Lake Innes Peninsular locality. Koalas occurring on site thus form part of the local sub-population within the larger population which use the site as part of their range. This range is likely to extend over adjacent land to the southeast, the crematorium, northern extent of Lake Innes Nature Reserve, and possibly west to Ascot Park and east to the Ruins Way area.

Figure 4: OEH Corridors

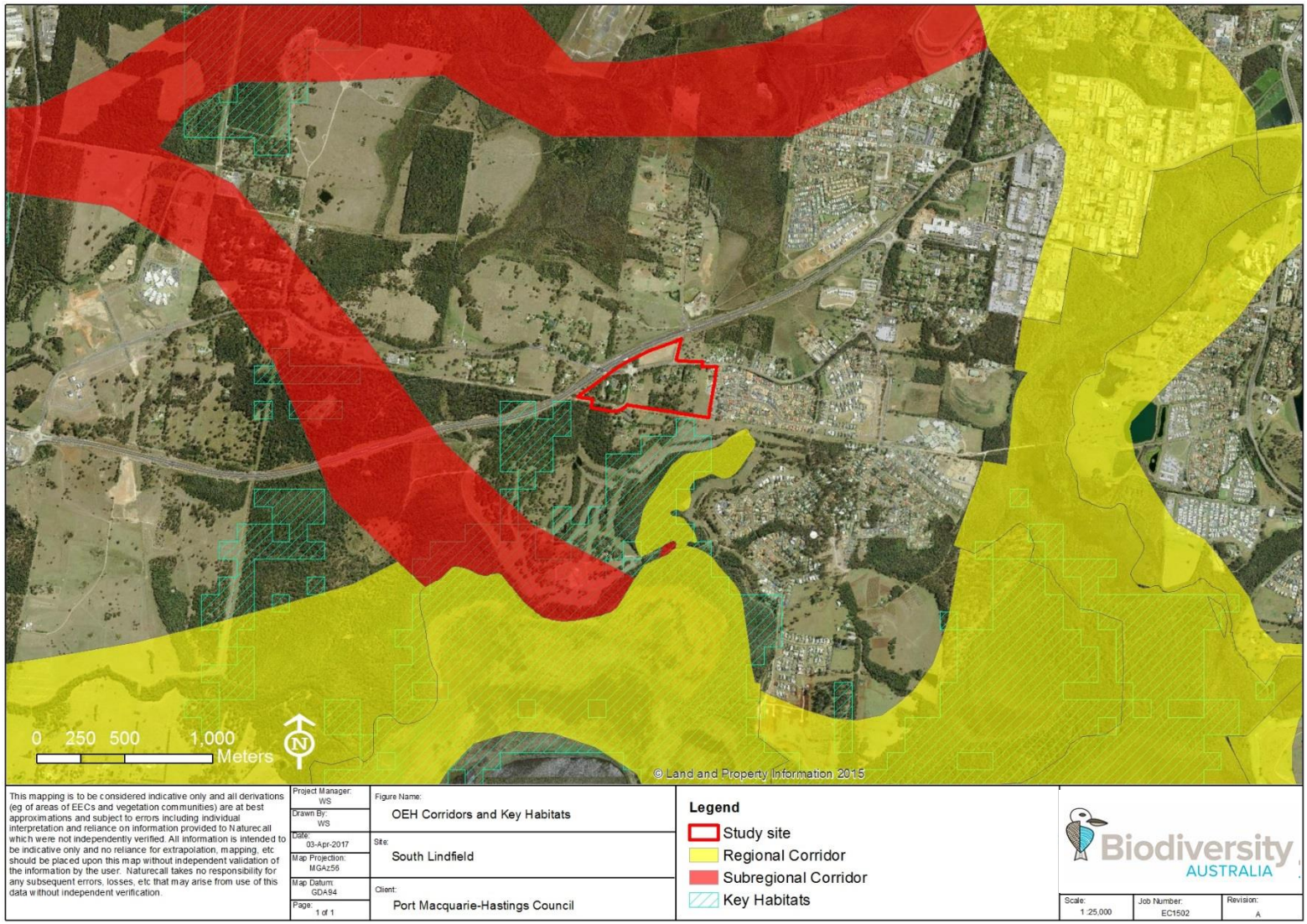
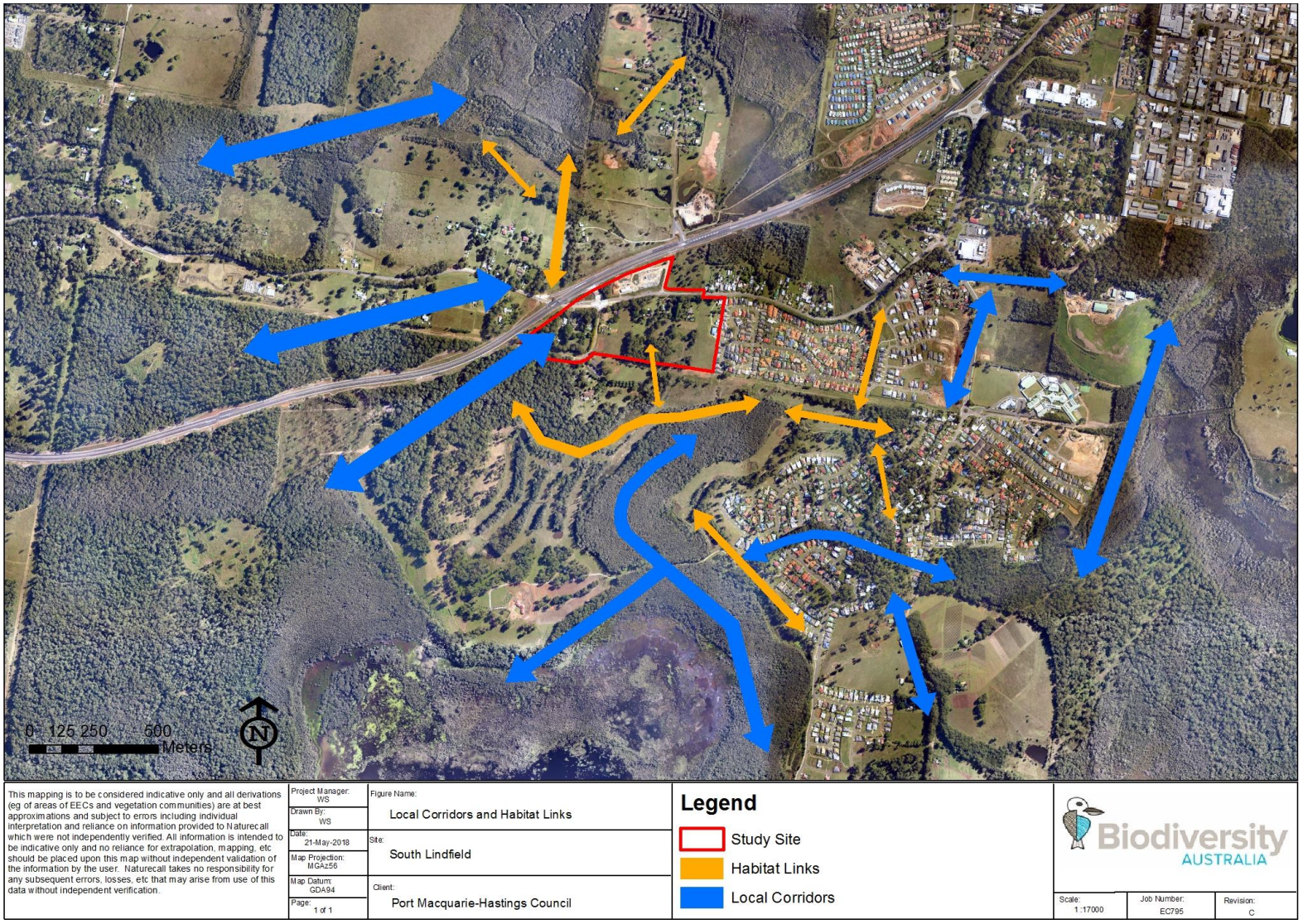


Figure 5: Local context of site habitat



6.0 Threat Assessment

6.1. Current Threats

Development of Koala habitat is generally associated with the following impacts/threats (Connell Wagner 2000a, 2000b, Wilkes and Snowden 1998, Biolink 2003, 2005a, 2005b, 2005c, 2008, Dr Stephen Phillips pers. comm., Lunney *et al* 1999, Port Stephens Council 2001, AKF 2007, 2000, State Forests 2000, DECC 2008). In context of the anticipated rezoning, these are first identified, and then the ameliorative measures/recommendations to address this threat/impact are described in this section.

Identified threatening processes are:

- Loss of forage trees/habitat
- Injury during clearing
- Road kill
- Dog attack
- Drowning in pools
- Physical barriers
- Bushfire
- Disease

These are described in detail below.

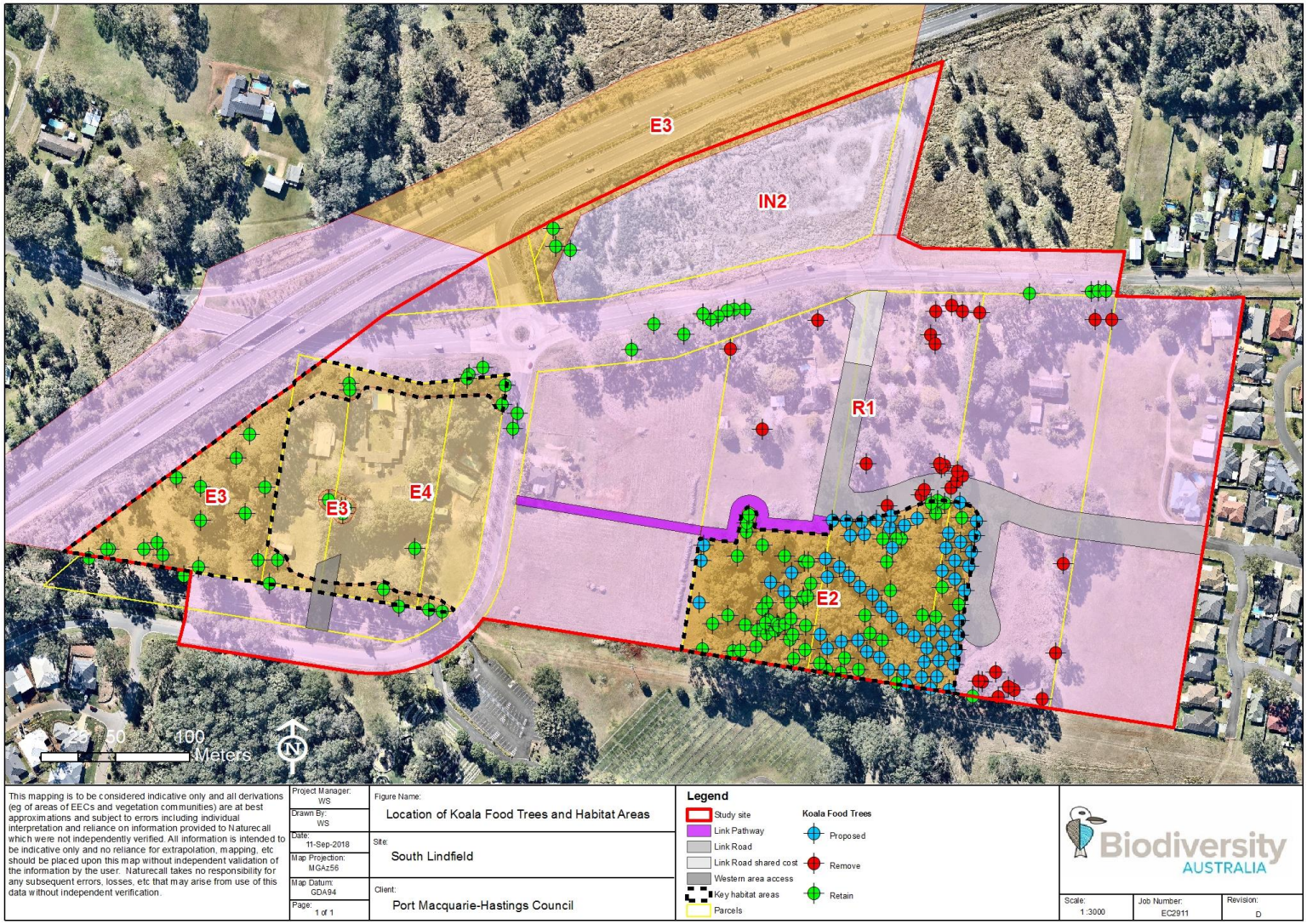
6.1.1. Loss of Forage Trees/Habitat

Habitat loss and/or fragmentation is the most serious threat to Koalas both historically and at present (DECC 2008, AKF 2014, 2007, 2000, Connell Wagner 2000b, Port Stephens Council 2001, Lunney *et al* 1999, Wilkes and Snowden 1998, etc.).

Figure 6 shows key habitat areas containing Koala food trees within the site which are to be retained. Koala food trees outside these areas may be permitted to be removed with offsets if they cannot be retained via effective long term measures.

Koala food trees in the residential zoned areas (as shown in Figure 6) are to be removed subject to compensation measures. It is anticipated that approximately 31 Koala food trees may be removed with an additional 14 Koala food trees adjacent to John Oxley Drive retained but isolated from safe koala access and usage. A total of 114 Koala food trees are anticipated to be retained. The overwhelming majority will thus be retained. PMHC have advised that planning provisions will be in place to ensure retained trees and habitat are not able to be removed under other provisions e.g. NSW Rural Fire Service (2013) *10/50 Vegetation Clearing Code of Practice for NSW.*

Figure 6: Location of Koala Food Trees



6.1.2. Potential Injury During Clearing

Tree-felling and clearing will pose an associated risk of injury or mortality to any Koalas present on site at the time (AKF 2007).

At least 3 Koalas are known to have an association with the site, hence pre-clearing surveys and supervision by an ecologist will be required during any clearing undertaken on the site to reduce the risk of injury or mortality.

6.1.3. Traffic Collision (Road Kills)

Wilkes and Snowden (1998) and Connell Wagner (2000b) note that traffic collision (usually resulting in death) is a major threatening process to the Port Macquarie Koala population, particularly to males, who account for most of the injured animals (most likely due to more frequent and longer movements during their life cycle e.g. during breeding seasons).

John Oxley Drive, Phillip Charley Drive and Annabella Drive are roads that currently bisect Koala habitat on the site, hence this is an existing threat to the local Koala population.

The current preliminary concept plans and PMHC propose new roads on the site in order to service the new residential area and reduce the potential for future traffic congestion. The proposed extension of Annabella Drive will bisect the central Lots and most of the road footprint will be in currently cleared areas. This road has been realigned to reduce Koala food tree losses, however some will require removal. These will be offset with plantings.

Thus the threat of road strike will be incrementally increased in the study area as a result of the proposal, and measures will be required to mitigate threats.

6.1.4. Pets and Feral Predators

Domestic Dogs

Dog attack is a major cause of Koala mortality. Domestic dogs are probably the main source of dog attack mortality near residential areas (Wilkes and Snowden 1998, Lunney *et al* 1999, Port Stephens Council 2001, Connell Wagner 2000, State Forests 2000).

To meet the performance criteria of nil injuries or mortality due to domestic animal attack, dogs will be required to be excluded from retained and created habitat on the site. This will be most important south of John Oxley Drive where Koalas periodically occur.

Cats

Cats are not considered a serious predator to the Koala (NWSC 2000a, Dickman 1996, Wilkes and Snowden 1998, DECC 2008, Lunney *et al* 1999, Connell Wagner 2000b, etc). Hence no specific prescription is provided in this KPoM.

6.1.5. Drowning In Pools

Koalas can swim, but have been recorded drowning in pools where they could not climb out. Koalas may enter the pool via falling from overhanging branches, or walking in by mistake (DECC 2008). Wilkes and Snowden (1998) state that since the implementation of child-proof fencing around pools, accidental drowning has ceased to be a significant threatening process in Port Macquarie.

As pools may be installed by new landowners, there may be a risk of Koalas drowning if there are trees overhanging the pools. The development aims to separate Koalas from the residential land uses, hence this is unlikely to be a threat if Koalas can be effectively excluded from residential areas.

6.1.6. Barriers

Developments may result in physical and behavioural barriers that impair Koala usage of the site or access to adjacent areas.

Fences offer the main physical barrier. Koalas can climb sturdy chain mesh, wooden paling or solid-type fences with wooden fences on both sides (Port Stephens Council 2001, Wilkes and Snowden 1998). Busy roads, barking or aggressive dogs, and adverse human contact may pose behavioural barriers (DECC 2008).

The site is currently partially fenced along boundaries, however the majority of fencing is post and wire or post and rail which does not pose a barrier to Koalas. The Oxley Highway is fenced with floppy top fauna fencing west of John Oxley Drive and mesh fencing east of here, preventing Koalas attempting to cross the Highway. This will remain post development.

The crematorium is also fenced with deer proof fencing, however the presence of Koala activity either side of this fence indicates that that Koalas are able to cross it (e.g. via leaping between proximate trees). Koala ladders are also proposed to facilitate koala movement (see Section 7.5).

The proposed development will eventually establish new fences around each residential Lot. Some are likely to be sheet metal (colorbond) fences that are a barrier for Koalas (Wilkes and Snowden 1998). This is unlikely to exclude any habitat from the Koala, as no preferred food trees or forest areas will be retained in residential areas and it is envisaged that Koalas would be excluded from residential areas to reduce the risk of road strike and dog attack.

6.1.7. Bushfire

Bushfires, particularly intense, crown-burning fires, are a major threat to wildlife and threatened fauna such as Koalas (DECC 2008). Extensive fires that burn out a large extent of habitat – particularly habitat that is isolated or fragmented, and thus limited in escape, refuge or re-

colonisation potential, are particularly damaging if not catastrophic via direct mortality or indirectly (e.g. insufficient resources left to support the population).

Less intense fires may also cause secondary problems such as smoke-inhalation/breathing disorders, loss of food supply, stress and displacement (e.g. via complete burning of an individual's home range).

Altered fire frequency can also ultimately simplify or alter the character of vegetation communities by removing fire sensitive species (e.g. convert wet sclerophyll to dry), and even develop fire-prone communities e.g. promote development of a grassy groundcover (NSWSC 2000).

The site is bound by residential areas to the east and the Oxley Highway to the north and west and there is very little risk of fire approaching the site from these areas.

The main fire threat overall is from the south. For the main part of the site (south of John Oxley Drive), there is a gap in the canopy separating the vegetation on site created by boundary clearing and the overhead powerline easement; and land to the immediate south of most of the site is predominantly managed or underscrubbed. Consequently, there is only a low risk of bushfire impacting the site north of the main powerline easement.

6.1.8. Disease

Most Koalas are naturally infected with Chlamydia pathogens (Sharp and Phillips 1999, Phillips 1997). Chlamydia and other diseases may develop when Koalas are under stress, of which one cause is habitat loss/disturbance (DECC 2008, Catling 1991, McFarland 1999, AKF 2007, Port Stephens Council 2001). Chlamydia infections may lead to urinary tract and reproductive tract infections which can cause female infertility.

This disease occurs throughout the Port Macquarie Koala population (Connell Wagner 2000b), and a female observed on the site during the survey showed signs of Chlamydia infection. This is a concern given the risk of transmission of this disease through the population via breeding activity, and potential sterilisation of dominant adults limiting recruitment and fecundity.

The proposal may increase stresses on the local aggregate that are commonly associated with development such as loss and modification of habitat, barriers and increased human presence. This has the potential to increase vulnerability to Chlamydia (AKF 2007), and monitoring and public awareness will be required to determine if any new infections are occurring and undertake remedial action.

7.0 Ameliorative Measures

7.1. Habitat Retention, Consolidation and Linkage Enhancement

7.1.1. Habitat Retention and Protection

North of John Oxley Drive, habitat retention is not considered essential given lack of usage. However, the three Koala food trees located in this area are not proposed to be removed.

West of Philip Charley Drive, Zones E3 and E4 will be applied and will limit tree loss. It is anticipated that a new house (refer to Section 7.3) will be built on the western-most lot, where there is opportunity for onsite offset planting for any loss of KFTs.

East of Philip Charley Drive the key vegetated area will be conserved with an E2 zone, and be enhanced with offset planting from KFT loss elsewhere on those lots, designed to separate koala habitat from residential development. There are several KFTs along the southern side of John Oxley Drive, and Council does not propose to remove them until necessary with any road upgrades. When this occurs Council will provide offset planting on suitable conservation land nearby.

In relation to the area to be zoned E2, once in Council ownership Council intends to declare this land “community land containing significant natural features” in accordance with the Local Government Act 1993. This declaration will ensure that the continued management of this conservation area will be in accordance with site-specific Plan of Management objectives and targets.

7.1.2. Habitat Replacement and Linkage Enhancement

Offset and Tree Planting Locations

If the key habitat areas are to be dedicated as public land, removal of Koala food trees outside these areas are to be offset via replacement plantings at a rate of 1:2 within the retained key habitat areas to consolidate the Koala habitat within secure areas. Additional plantings in these areas will enhance habitat linkages, especially to existing habitat within the crematorium lands to the south. To enhance the connectivity to the Crematorium three koala bridges will be installed on the boundary fence to the future public E2 reserve.

Where offset planting cannot be accommodated within the defined E2 land, then:

a) the first option is to locate the offset planting immediately adjacent to the E2 land, in order to maintain continuity,

b) if option a) is also not possible, the offset planting may be located within the vicinity with suitable management arrangements, subject to Council's agreement.

Removal of non-native tree species is permissible to achieve a higher density of Koala food trees in the protected areas. Ongoing management of these protected areas will need to be guaranteed. Management will include bush regeneration to ensure weeds are controlled and all offset plantings are effectively established at target levels.

If these offset planting areas remain in private ownership, Koala food trees removed outside these protected areas will be subject to an offset ratio of 1:4. This ratio is required to due to lack of long term secure tenure and ensured retention of Koala habitat in the key habitat area.

Any additional offsets outside of defined E2 land defined in this plan would be preferenced to public land that lies within the home range of the local Koala population impacted. This land is to be secured and managed in perpetuity as a fully structured forest to the satisfaction of Council.

Planting Specifications

The offset plantings are to comprise Tallowwoods, Forest Red Gum and Swamp Mahogany, with species selection targeting suitable edaphics at the planting location.

All Koala offset plantings are to be located in available canopy spacings within existing forest or planted out at 10m spacings with accompanied mid and ground storey plantings to create a fully structured forest.

These plantings will be managed and monitored as per the specifications in Appendix 1. All plantings are to be maintained in perpetuity with any failures to be replaced in accordance with this KPoM.

Plantings must not conflict with current or future planning, engineering, infrastructure and bushfire requirements, including the 10/50 Vegetation Clearing Code of Practice.

Any offset planting that is required outside this KPoM area will require Council agreement, a Vegetation Management Plan and maintenance program.

7.2. Clearing Management

In order to minimise the risk of Koala's being killed or injured during any clearing works on the site; the following measures must be implemented:

- The area of work is to be inspected for Koalas by an ecologist immediately prior to commencement of any vegetation removal.
- The ecologist is to remain on-site during vegetation removal to maintain surveillance for Koalas and rescue other fauna as required.

- No such vegetation removal is to be carried out while any Koala is present in the area of operation unless a 50m buffer is established; or if Koala does not voluntarily move on, is removed by Port Macquarie Koala Hospital staff.
- A report by the ecologist is to be provided within 7 days of the clearing event detailing methods and results of the supervision.

7.3. Future Dwelling on Western Lot

Any future dwelling on Lot 2 DP 1186806 must be located to minimise removal of mature trees and Koala food trees.

7.4. Road Design and Speed Controls

As discussed previously, current concepts and planning indicates an extension of Annabella Drive in the east to Philip Charley Drive. There will be no retained habitat on Lot 1 and 2, hence no speed restriction measures or crossing points will be required. Other new internal roads will pass close to vegetation or form part of a linkage between retained habitat.

To reduce the risk of Koala road strike, the following measures will need to be implemented:

- If a formal road is directed through the southwest boundary of Lot 3 DP 533058, Koala crossing points will be required.
- Koala crossing and warning signage should be erected at crossing points. The Port Macquarie Koala Hospital number is to be displayed on the sign.
- Street lighting to be strategically positioned at the southwest corner of Lot 3 if required.
- Street lighting along roads where required to help motorists see any Koalas that have wandered onto roads

7.5. Barriers and Fencing

Development of the site will introduce new barriers for Koalas in the form of fences, hence the following measures should be implemented:

- To separate Koalas from the hazards of residential areas, fencing is to be erected around the E2 public reserve. Three one way bridges will be installed on the northern boundary of the E2 public land to allow for koala access into the reserve. Three two-way bridges will be provided on the southern boundary with the Crematorium.
- No fence design (either temporary or permanent) is to include a material or design feature that may potentially injure Koalas (or other fauna) e.g. barbs and loose wire.
- Retro-fitting the crematorium boundary fencing with Koala ladders is recommended to increase access to this habitat, and general linkages across the wider landscape.

7.6. Bushfire

The following measures are to be implemented in regards to bushfire:

- The designation/location and management of APZs is to minimise perceived risk of vulnerability to bushfire and hence demand for hazard reduction in adjacent habitat including retained habitat and offset areas.
- Offsets are to be located to avoid conflicts with APZs and negate risk for their potential to be removed by legislation changes, etc.

7.7. Disease

Disease is a current threat to the local Koala aggregate and habitat loss associated with development of the site has the potential to increase the current disease risk. To help reduce this, the following measures are to be implemented:

- Contact details for Koala Hospital at site office during construction.
- Koala warning signage is to detail contact details for the Koala Hospital to facilitate prompt reporting of sick or injured Koalas.

8.0 Implementation, Monitoring and Compliance

8.1. Monitoring and Review

Given that ownership is spread over multiple parties, and that full development of the area will be realised in the long term, the monitoring regime has been devised to consider short and long term achievement of the KPoM objectives and measures (see 8.1.2).

By undertaking monitoring, compliance and review, conditions of consent of future DAs (such as the effective implementation of this KPoM) will be allowed to be legally enforced. This should ensure that the KPoM is effectively implemented.

The check list appended to this document summarises the specific actions required to be undertaken by responsible authorities to implement the recommendations of the KPoM (Appendix 2). This can assist to ensure the provisions of the KPoM are implemented.

The provision of a KPoM Compliance Check with each DA will also assist in ensuring both the relevant provisions of the KPoM and conditions of consent of future are implemented and provide a means of feedback for compliance assessment.

The KPoM will be deemed successful if monitoring determines that the objectives stated in section 3.0 are achieved as per the listed specified performance criteria.

8.1.1. Pre DA KPoM Compliance Checks

To ensure key measures of this KPoM are implemented, each proponent's DA must demonstrate compliance with the provisions of the KPoM at various stages from the DA to post-construction e.g. prior to issuing the subdivision certificate, it must be demonstrated that clearing was monitored and offset plantings have been established. Table 3 shows a provisional timeline for implementation of the KPoM measures which indicates what will need to be reported at given stages.

This is to ensure KPoM measures such as clearing monitoring and establishment of offset plantings are undertaken as required on an ongoing basis until the full development of the area is realised.

8.1.2. Strategic Reviews

As part of a wider strategic review funded by VPA contributions, the following is to be undertaken by an approved ecologist, and reported to PMHC:

1. **Koala Presence and Usage Survey**: A Koala survey is to be undertaken to census Koala usage of retained habitat and check for the incidence of disease. Methods are to:
    - Include a combination of survey techniques to be used e.g. spotlighting, call playback, day searches, scat searches and SAT assessments. Objective is to detect Koalas present, indicate current population size, and assess health (e.g. signs of Chlamydia) and fecundity (e.g. presence of young, breeding activity of male).
    - Be undertaken during the Koala breeding season to increase detection; and include several non-consecutive day and night surveys.
2. Annual reviews of the KPoM actions are to be undertaken by Council to ensure works are on track and recommendations/remediation measures implemented, and allow compliance enforcement.

A major review (including the above Koala survey) is recommended to be undertaken every 5 years until the development is completed to ensure the KPoM is addressing its objectives. Recommendations are to be implemented before the next review period.

8.2. Implementation Schedule

The following table provides a summary of the timeline for implementation of the ameliorative measures for assisting with compliance assessment.

Table 3: Implementation schedule for ameliorative measures

Issue	Pre-DA Stage	DA Approval	Construction Phase	Operation Phase
Retention and Protection of Key Habitat	• Habitat to be removed or retained identified. • Planning mechanisms to protect retained habitat implemented. • DA to demonstrate compliance with KPoM • Key Koala Habitat is zoned E2 • Area west of Phillip Charley Drive outside key habitat area zoned E4.	• Approval of plan detailing trees/habitat to be removed.	• Clear identification and fencing off of trees/vegetation to be removed/retained. • Construction undertaken in accordance with KPoM and consent conditions. • Compliance enforcement by Council.	• All planted trees managed and protected permanently. • Implementation of any recommendations for improvements. • Compliance enforcement by Council.
Habitat replacement	• Identify Koala food trees to be removed. • Identify and map proposed location of all planting areas in	• Plans for offset plantings regeneration approved and become binding on proponent to execute as detailed. • Commence and complete	• 100% Koala food tree replacement within 3 months of failure. • 75% survival of all other mid and ground storey plantings	• Maintenance of weeds and plantings until established. • Ongoing maintenance until all plantings self-sufficient. • Compliance enforcement by Council.

Issue	Pre-DA Stage	DA Approval	Construction Phase	Operation Phase
	relation to development, and estimate number of replacements.	planting works.	within the first 3 years. • 90% reduction of invasive weeds per annum in E2 and E4 zoned land.	Implementation of any recommendations for improvements until plantings are self-sufficient.
Predator Control	NA	• Council to erect signs and enforce no dogs within the E2 public reserve upon dedication.	Koala proof fencing to be installed around E2 land to prevent interactions with dogs	• Rangers enforce no dogs provision.
Mortality/injury during clearing of habitat	• Survey and mapping of all habitat to be retained/removed.	• Consent condition specifying ecologist to supervise clearing and manage Koala welfare.	• Clearing as per protocol. • Report to PMHC confirming compliance.	N/A
Vehicle Collision	• Identify where engineering designs required to control speed, signage required; and strategic lighting.	• DA approval of appropriate engineering mechanisms, lighting and signage installation.	• Measures implemented. • Road design as per KPoM.	• Measures effective. • Records kept of Koala incidents involving fences and vehicles included in monitoring reports.

Issue	Pre-DA Stage	DA Approval	Construction Phase	Operation Phase
Physical and Behavioural Barriers (fences and roads)	• DA plans to show permanent fencing is required • Measures to ensure temporary construction fences Koala friendly where required.	• Consent approval subject to Koala friendly fencing where applicable. • Compliance enforcement by Council.	• Fencing constructed as per development consent conditions • Compliance enforcement by Council.	• Reporting of any injured Koalas to Koala Hospital. • Remedial taken following reporting of injuries. • Compliance enforcement by Council.
Disease	Provisions for signage to include Koala Hospital number.	• Signage required as condition of consent.	• Construction undertaken in accordance with plans. • Contact details for Koala Hospital provided on site during construction	• Records kept and included in monitoring reports. • Permanent public Koala signage at crossing points with Koala Hospital phone number. • Implementation of any recommendations for improvements. • Compliance enforcement by Council.

9.0 Conclusion

This report forms Stage 2 and 3 of the South Lindfield project which is a Koala Plan of Management for the site.

The site has been determined to contain Core Koala Habitat which is considered to support at most 5 Koalas as part of a broader home range which includes high quality habitat on adjacent land to the south and southwest.

The principle objective of this Koala Plan of Management is to ensure the study site retains its ability to support a Koala population in the long term, and also to enhance this by increasing potential carrying capacity and linkages within the broader landscape of identified Core Koala Habitat.

To achieve this, the KPoM aims to achieve the following:

- Retention of the overwhelming majority of Koala habitat within secure tenures in the long term.
- Compensatory plantings of removed Schedule 2 Primary Browse Species result in a net increase of Potential Koala Habitat and provide a higher carrying capacity to allow expansion of the local aggregate.
- Enhancement of local linkages via strategic location of offset plantings.
- Mitigation of potential and existing threats via effective measures with compliance mechanisms to ensure mortality rates are not elevated to the point of resulting in population collapse or creation of a sink.

It is submitted that while the proposed development involves some loss and modification of part of the local extent of Core Koala Habitat, if this KPoM is effectively implemented, the ameliorative measures reported herein should not only quantitatively compensate for this loss but in net effect will improve connectivity, habitability and carrying capacity for the Koala in the surrounding habitat.

Therefore, in the long term, the proposal is considered unlikely to have a significant effect on, and should ultimately improve the viability of the local Koala population.

10.0 References

Australian Koala Foundation (2006). Website: www.savetheKoala.com.au Accessed 31/11/06.

Berrigan J, A. (2003a). Threatened Species, EPBC Act and SEPP 44 Assessments for Proposed School Playing Field On Lot 581 DP 754434, Major Innes Drive, Port Macquarie. Unpublished Report to Hopkins Consultants. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan J, A. (2003b). Threatened Species, EPBC Act and SEPP 44 Assessments for Proposed School Playing Field On Lot 581 DP 754434, Major Innes Drive, Port Macquarie. Unpublished Report to Hopkins Consultants. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J.A. (2003c). Threatened Species, EPBC Act and SEPP 44 Assessment for Proposed Manufactured Housing Estate (The Retreat) on Lot 2 DP 748837, off Lincoln Rd, Port Macquarie. Unpublished report to Luke and Co. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan J, A. (2003d). Threatened Species, EPBC Act and SEPP 44 Assessments for Residential Subdivision On Lot 9 DP 255991, The Ruins Way, Port Macquarie. Unpublished Report to King and Campbell Pty Ltd. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J.A. (2002a). Threatened Species, EPBC Act and SEPP 44 Assessments for Proposed Port Oxley Residential Estate, Oxley Highway, Port Macquarie. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J.A. (2002b) Threatened Species, EPBC Act and SEPP 44 - Koala Habitat Assessment For Proposed Multi-Storey Tourist Resort on Lot 331 DP 828346 and Lot 24 DP 22883 (Taskers Beachside Palms), Flynn St, Port Macquarie. Unpublished report to King and Campbell Pty Ltd. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J.A. (2002c). Northgate Koala Monitoring Report – 2002. Darkheart Eco-Consultancy, Port Macquarie

Berrigan, J.A. (2001a). Northgate Koala Monitoring Report – 2001. Darkheart Eco-Consultancy, Port Macquarie

Berrigan, J.A. (2001b). Threatened Species and SEPP 44 - Koala Habitat Assessment For Proposed Combined School on Lot 591 DP 754434, Major Innes Drive, Port Macquarie. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J.A. (2001c). Threatened Species and SEPP 44 – Koala Habitat Assessment for Proposed Residential Subdivision, Lot 4, DP 788598, The Oxley Highway, Port Macquarie. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J.A. (2001d). Threatened Species and SEPP 44 – Koala Habitat Assessment for Proposed Residential Subdivision, Lot 581 DP 754434, Major Innes Drive, Port Macquarie. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J.A. (2001e). SEPP 44 Assessment for Lot 1 DP 536256, The Ruins Way. Darkheart

Eco-Consultancy, Port Macquarie

Berrigan, J.A. (2000a). Threatened Species and SEPP 44 Assessment for Lot 1, DP 748977; Lot 21, DP 866801; and Lot 221, DP 868193, Port Macquarie. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J.A. (2000b). Updated Threatened Species Assessment for Proposed Rezoning, Lot 1, DP 829920, Greenmeadows Drive. Darkheart Eco-Consultancy, Port Macquarie

Berrigan, J.A. (2000c). Threatened Species and SEPP 44 Assessment for Proposed Subdivision, “The Lowe Property”, Lake Rd Darkheart Eco-Consultancy, Port Macquarie

Berrigan, J.A. (2000d). Threatened Species and SEPP 44 Koala Habitat Assessment for Lot 8 in Plan of Subdivision of Lots 8 and 9 DP 263651, Kingfisher Rd, Port Macquarie. Darkheart Eco-Consultancy, Port Macquarie

Berrigan, J.A. (2000e). Threatened Species and SEPP 44 Assessment for Lot 1, DP 748977; Lot 21, DP 866801; and Lot 221, DP 868193, Yaluma Drive, Port Macquarie. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J.A. (2000f). Threatened Species and SEPP 44 Assessment for Proposed Subdivision, “The Lowe Property”, Lake Rd Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J. A. (1999a). Threatened Species and SEPP 44 - Koala Habitat Assessment for Proposed Subdivision, Lot 2, DP 589082, The Ruins Way, Port Macquarie. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J. A. (1999b). Threatened Species and SEPP 44 - Koala Habitat Assessment for Proposed Residential Subdivision, Lots 3 and 5, The Ruins Way, Port Macquarie. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J.A. (1999c). Threatened Species and SEPP 44 Assessment for Hastings District Hospital - Residual Land. Darkheart Eco-Consultancy, Port Macquarie

Berrigan, J. A. (1998). Threatened Species Assessment for Proposed Development, Lot 496, Pacific Drive, Port Macquarie. Darkheart Eco-Consultancy, Port Macquarie.

Berrigan, J. (1997). Threatened Species Assessment for Proposed Rezoning at Willandra Park Estate, Port Macquarie. Darkheart Eco-Consultancy, Port Macquarie.

Biolink (2013). Port Macquarie-Hastings Koala Habitat & Population Assessment. Final Report to Port Macquarie-Hastings Council. Biolink, Uki.

Biolink (2008). Area 13 UIA Koala Plan of Management. Unpublished report to Port Macquarie-Hastings Council, Port Macquarie.

Biolink (2005a). An Ecological Overview of Koalas and their Habitats on the Lake Innes Peninsula, Port Macquarie, NSW. Unpublished report to Vilro Pty Ltd and Luke and Company Pty Ltd, Port Macquarie.

Biolink (2005b). Koala Plan of Management for Part Lot 32 DP 809231 – Mahers Headland, Port Macquarie, NSW. Unpublished report to Vilro Pty Ltd and Luke and Company Pty Ltd, Port Macquarie.

Biolink (2005c). Area 14 Master Planning Area - Koala Plan of Management. Unpublished report to Port Macquarie-Hastings Council, Port Macquarie.

Biolink (2003). An Ecological Overview of the Area 14 Master Planning Area. Unpublished report to Hastings Council. Biolink – Natural History and Environmental Consultants, Uki.

Briggs, B. (1996). Tracks, Scats and Other Traces. Oxford University Press, Melbourne.

Connell Wagner Pty Ltd (2000a). Koala Plan of Management – Coastal Area. Part A: The KPOM – Hastings Council. Connell Wagner Pty Ltd, Neutral Bay.

Connell Wagner Pty Ltd (2000b). Koala Plan of Management – Coastal Area. Part B: Resource Study – Hastings Council. Connell Wagner Pty Ltd, Neutral Bay.

Darkheart Eco-Consultancy (2013a). Ecological Survey and Constraints Assessment: Part Lot 289 DP 1184284 and Lot 6 DP110560, The Ruins Way, Port Macquarie. Unpublished report to Charley Bros Pty Ltd. Darkheart Eco-Consultancy, Kew.

Darkheart Eco-Consultancy (2008a). Threatened Species, EPBCA and SEPP 44 Assessments for Proposed for Residential Subdivision of Lot 2 DP 1091253, Beach Street, Bonny Hills. Unpublished report to Beach Street Projects Pty Ltd. Darkheart Eco-Consultancy, Laurieton.

Darkheart Eco-Consultancy (2008b). SEPP 44 Koala Plan of Management for Residential Subdivision of Lot 1 and 2 DP 1091253, Beach Street, Bonny Hills. Unpublished report to Beach Street Projects Pty Ltd. Darkheart Eco-Consultancy, Laurieton.

Darkheart Eco-Consultancy (2008c). Threatened Species, EPBCA and SEPP 44 Assessments for Proposed for Residential Subdivision of Lot 5 DP 998125, The Ruins Way, Port Macquarie. Unpublished report to Luke and Co. Pty Ltd. Darkheart Eco-Consultancy, Laurieton.

Darkheart Eco-Consultancy (2007a). Carnegie Cove SIS: Summer Fauna Survey on Lot 106 DP 754444 McGilvray Rd, Bonny Hills. Unpublished report to Hopkins Consultants. Darkheart Eco-Consultancy, Laurieton.

Darkheart Eco-Consultancy (2007b). Threatened Species, EPBCA and SEPP 44 Assessments

for Proposed Re-Development of Taskers Residential Village, Ocean St, Port Macquarie. Unpublished report to King and Campbell. Darkheart Eco-Consultancy, Laurieton.

Darkheart Eco-Consultancy (2007c). Threatened Species, EPBCA and SEPP 44 Assessments for Proposed Rural Subdivision on Lots 108, 109 and 113 DP754444 & Lot 112 DP661717, Waterloo Creek Road, Bonny Hills. Unpublished report to Hopkins Consultants Pty Ltd. Darkheart Eco-Consultancy, Laurieton.

Darkheart Eco-Consultancy (2007d). Threatened Species, EPBCA and SEPP 44 Assessments for Proposed Residential Subdivision of 168 Pacific Drive, Port Macquarie. Unpublished report to

All About Planning Pty Ltd. Darkheart Eco-Consultancy, Laurieton.

Darkheart Eco-Consultancy (2006a). Ecological Impact Assessment Volume 1: Flora and Fauna Survey and SEPP 44- Koala Habitat Assessment of Future Effluent Irrigation Area/ Sports Fields on Portion of Lot 5 DP 558822, The Boulevard, Dunbogan. Unpublished report to Port-Macquarie Hastings Council. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2006b). Flora and Fauna Survey and SEPP 44 Assessment of Proposed Rezoning and Residential Subdivision of Lot 1 DP 827937 Ocean Drive, West Haven. Unpublished report to King and Campbell. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2006c). Flora and Fauna Survey and SEPP 44 Assessment of Proposed Residential Subdivision of Lot 1 DP 506306 Lighthouse Road, Port Macquarie. Unpublished report to Frank O'Rourke and Associates Pty Ltd. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2006d). Flora and Fauna Survey and SEPP 44 Assessment of Artificial Wetland and Filling on Part Lot 92 DP 1078055, Ocean Drive, Lake Cathie. Unpublished report to Luke and Company Pty Ltd. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2006e). Commonwealth EPBCA 1999, NSW Threatened Species Conservation Act 1995: Fauna Assessments of Proposed Residential Subdivision of Part of Lot 32 DP 809231, Phillip Charley Drive, Port Macquarie. Unpublished report to Luke and Company Pty. Ltd. Darkheart Eco-Consultancy, Laurieton.

Darkheart Eco-Consultancy (2006f). Statutory Ecological Assessments of Proposed Residential Subdivision of Lot 5 DP 998125, The Ruins Way, Port Macquarie. Unpublished report to Luke and Company Pty. Ltd. Darkheart Eco-Consultancy, Laurieton.

Darkheart Eco-Consultancy (2005a) Flora and Fauna Survey and SEPP 44 Assessment of Rainbow Beach Holliday Village, Beach St, Bonny Hills. Unpublished report to Hopkins Consultants. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2005b) Flora and Fauna Survey and SEPP 44 Assessment of Lot 192 DP 106102, Beach St, Bonny Hills. Unpublished report to King and Campbell. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2005c). Flora and Fauna Survey and SEPP 44 Assessment of Lot 192 DP 106102, Beach St, Bonny Hills. Unpublished report to King and Campbell. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2005d). Flora and Fauna Survey and SEPP 44 Assessment of Proposed Rural-Residential Subdivision on Lot 1 DP 574308, and Lots 4 & 5 DP 785611, Sancrox Rd, Sancrox. Unpublished report to King and Campbell. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2005e) Koala Threatened Species, EPBC Act and SEPP 44 Assessments for Rural Residential Subdivision on Portions 246 and 247 and Lot 2 DP 553191

and Lot 2 in DP 555095 Bushland Drive. Unpublished report to Luke and Company. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2005f). SEPP 44 Assessment of Lot 22, Wrights Rd, Port Macquarie. Unpublished report to Budden Nandle Michael Hudson Architects. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2005g) Koala monitoring study of Mahers Headland. Unpublished report to Luke and Company. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2005h). Flora and Fauna Survey and SEPP 44 Assessment of Proposed Filling and Future Industrial Development on Lot 2, DP 442098 Boundary Street, Port Macquarie. Unpublished report to Luke and Company Pty Ltd. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2005i). Flora and Fauna Survey and SEPP 44 Assessment of Proposed Shopping Extension of Coastside Church on Lot 2 DP 601094, Mumford Street, Port Macquarie. Unpublished report to Hopkins Consultants. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart (2004a). Carnegie Cove Ecological Assessment Volume 1: Flora and Fauna Assessment. Unpublished report to Hopkins Consultants. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart (2004b). Carnegie Cove Ecological Assessment Volume 2: Statutory Considerations. Unpublished report to Hopkins Consultants. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2004c) Threatened Species, EPBC Act and SEPP 44 Assessments for Proposed Community Facilities Building, Lot 5 DP 790668, Tulloch Rd, Port Macquarie. Unpublished report to Hastings Council. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2004d) Threatened Species, EPBC Act and SEPP 44 Assessments for Proposed Tourist Accommodation, Taskers Caravan Park, Port Macquarie. Unpublished report to King and Campbell Pty Ltd. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2004e) Threatened Species, EPBC Act and SEPP 44 Assessments for Proposed Emergency Services Centre, Lots 1 and 2 DP 804235, Central Rd, Port Macquarie. Unpublished report to Hastings Council. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy. (2004f). Threatened Species, EPBC Act and SEPP 44 Assessments for Residential Estate – “Innes Downs”, Major Innes Drive. Unpublished report to O’Rourke and Associates. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy. (2004g). Threatened Species and State Environmental Planning Policy 44 - Koala Habitat Assessment for Proposed High School on Lot 12, DP 819462 & Pt Lots3 DP 813358 & Lot 2 DP 547484 and Lot 1 DP 242345 (Closed Road), Corner of Boundary Street and Tuffins Lane, Port Macquarie. Unpublished report to Hopkins Consultants. Darkheart Eco-Consultancy, Port Macquarie.

Darkheart Eco-Consultancy (2004h). Ecological Assessment for Proposed Subdivision of Lot 124 DP 1034771, Seafront Circuit, Bonny Hills. Unpublished report to King and Campbell Pty Ltd. Darkheart Eco-Consultancy, Port Macquarie.

Davey, S.M. (1984). Habitat preferences of arboreal marsupials within a coastal forest in southern NSW. pp 509-16. In: Smith, A. and Hume, I.D. (Eds) (1984). Possums and Gliders. Australian Mammal Society.

Department of the Environment (2014). *Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat.

Department of the Environment (2013). Draft EPBC Act referral guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory). Department of the Environment, Canberra.

DECC (2008). NSW Koala Recovery Plan. NSW Department of Environment and Climate Change, Hurstville.

Department of Environment, Water, Heritage and the Arts (2009).

Department of Urban Affairs and Planning (1995). Circular B35 – State Environmental Planning Policy 44 – Koala Habitat Protection.

Dickman, C. (1996). Overview of the Impacts of Feral Cats on Australian Native Fauna. Report prepared for the Australian Nature Conservation Agency, Canberra.

EcoPro (1999). Koala Management Plan Mill Hill, Port Macquarie. Ecopro, Lansdowne.

EcoPro (1999). Eight Point Test Assessment: Mill Hill Residential Development, Port Macquarie. Ecopro, Lansdowne.

Ellis, W.A., Hale, P.T. and Garrick, F.N. (2002). Breeding dynamics of Koalas in open woodlands. Wildl. Res. 29: pp 19-25.

Ellis, W.A., Sullivan, B.J., Lisle, A.T., and Garrick, F.N. (1998). The spatial and temporal distribution of Koala faecal pellets Wildl. Res. 25: pp 663-668.

Gilmore, A. and Parnaby, H. (1994). Vertebrate fauna of conservation concern in northeast NSW forests. Northeast Forests Biodiversity Study Report No. 3e. Unpublished report, NSW NPWS.

Hastings Council (2003). Development Control Plan 45: Innes Peninsula.

Hindell, M.A. and Lee, A.K. (1990). Tree preferences of the Koala. pp117-21 In: Biology of the Koala. Ed. by A.K. Lee, K.A. Handayde and G.D. Sanson. Surrey Beatty and Sons, Sydney.

Hume, I.D. (1995). The mystery of Koala food choice. In: Proceedings on a Conference on the Status of the Koala in 1995. pp 55-64. Australian Koala Foundation, Brisbane.

Imrie, M (2001). Correspondence to Hastings Council. Department of Urban Affairs and Planning.

Jurskis, V. and Potter, M. (1997). Koala Surveys, Ecology and Conservation at Eden. Research Paper No. 34. State Forests, Sydney.

Jurskis, V., Rowell, D. and Ridley, D. (1994). Survey Techniques and Aspects of the Ecology of the Koala Near Eden. Research Paper No. 22. State Forests, Sydney.

King and Campbell Pty Ltd (2002). Koala Plan of Management for Residential Subdivision Lot 1 DP 387920 Part Lot 2 DP 369206, Oxley Highway, Port Macquarie. Unpublished report by King and Campbell Pty Ltd, Port Macquarie.

Kendall, K. and Kendall, P. (1993). Koala Survey on Land Owned by Jimneva Pty Ltd at Dunbogan. Kendall and Kendall Environmental and Ecological Consultants, Yessabah.

Kendall, K. and Kendall, P. (1991). Fauna Survey – Environmental Impact Statement – Camden Shores Residential Canal Development – Planning Workshop. Kendall and Kendall Environmental and Ecological Consultants, Yessabah.

Lee, A.K., Martin, R.W. and Handasyde, K.A. (1988). Experimental translocation of Koalas to new habitat. In: Biology of the Koala. Ed. by A.K. Lee, K.A. Handasyde and G.D. Sanson. pp 299-312. Surrey Beatty and Sons, Sydney.

Lee, A.K. and Martin, R.W. (1988). The Koala – A Natural History. NSW University Press, Kensington.

Lunney, D, Moon, C, Matthews, A., and Turbill, J. (1999). Coffs Harbour City Koala Plan of Management: Part B Coffs Harbour Koala Study. NSW NPWS, Hurstville.

Mackay, K. (1996). Fauna Impact Statement for Portion 118, Padmans Rd, Elands, parish of Bulga for Boral Timber Division.

Martin, R.W. and Lee, A. (1984). The Koala, Phascolarctos cinereus, The Largest Marsupial Folivore. In: Possums and Gliders. Smith, A.P. and Hume, I.D. (Eds). Australian Mammal Society, Sydney.

Mt. King Ecological Surveys (1993a). Proposed residential canal development at Dunbogan - Fauna Impact Statement.

Mt. King Ecological Surveys (1993b). Fauna Survey of the Kempsey and Wauchope Forest Management Areas. Prepared for the Forestry Commission of NSW.

NSW National Parks and Wildlife Service (1999). Threatened Species Management – Species Information.

NSW National Parks and Wildlife Service (1996). Threatened Species Assessment under the EP&A Act: The '8 Part Test' of Significance. Threatened Species Management - Information Circular No. 2

NSW National Parks and Wildlife Service (1995). Integrated faunal information for public lands in northeastern NSW. NSW NPWS.

NSW National Parks and Wildlife Service (1994a). Lake Cathie/Lake Innes Management Study: Appendix D - Terrestrial Biological System.

NSW National Parks and Wildlife Service (1994b). Kempsey and Wauchope Management areas - Endangered Fauna License Application Draft Decision Report.

NSWSC (2000a). Predation by feral cats - Key Threatening Process declaration. www.npws.nsw.gov.au.

NSWSC (2000b). Predation by the European red fox - Key Threatening Process declaration. www.npws.nsw.gov.au.

Osawa, R. (1993). Dietary preferences of the Koala, Phascolarctos cinereus, for Eucalyptus spp. with a specific reference to their simple sugar contents. Aust. Mammalogy, 16:87-89.

Pahl, L.I. and Hume, I.D. (1990). Preferences for Eucalyptus species of the New England Tablelands and initial development of an artificial diet for Koalas. In: Biology of the Koala (Eds: Lee, A.K, Handasyde, K.A. and Sanson, G.D.). pp 123-128. Surrey Beatty and Sons, Sydney.

Phillips, S., Callaghan, J. and Thompson, V. (2000). The tree preferences of Koalas (Phascolarctos cinereus) inhabiting forest and woodland communities on Quaternary deposits in the Port Stephens area, NSW. Wildl. Res. 27: pp 1-10.

Phillips, S. (1997). Some issues associated with the translocation of Koalas (Phascolarctos cinereus). Paper presented to the Australian Veterinary Association Symposium.

Port Stephens Council (2001). Port Stephens Council Comprehensive Koala Plan of Management (CKPoM) – June 2001). Prepared by Port Stephens Council with the Australian Koala Foundation.

Predavec, M. (2008). Review of progress inimplementing the 1998 National Koala Conservation Strategy. Report prepared by Parsons Brinckerhoff for the Commonwealth Department of the Environment, Water, heritage and the Arts, Canberra.

Reed, P.C, Lunney, D. and Walker, P. (1990). A 1986-87 survey of the Koala, Phascolarctos cinereus, in NSW, and an ecological interpretation of its distribution. In: Biology of the Koala. Lee, A.K. Handasyde, K.A. and Sanson, G.D. (Eds). Surrey Beatty and Sons, Sydney.

Sarre, A. (1999). Caught in the Crossfire – The Koala. Ecos 99, April-June: 9- 14.

Sharp, A. and Phillips, S. (1999). Koalas, Science and Conservation. In: Saving Our Natural Heritage - The role of science in managing Australia's ecosystems.

Standing, V. (1990). A Study Of Koalas in the Macleay Valley District - Past, Present and Future. Koala Preservation Society of NSW, Port Macquarie.

State Forests of NSW (2000). Koala Management Plan – Pine Creek State Forest. State Forest of NSW, North East Region.

State Forests of NSW (1994). Walcha/Nundle and Styx River MA Fauna Survey. State Forest of

NSW, Sydney.

Strahan, D. (Editor) (1991 and 2000). Complete Book of Australian Mammals. Cornstalk Publishing, Sydney.

Ullrey, D.E., Robinson, P.T. and Whetter, P.A. (1981). Composition of preferred and rejected Eucalyptus browse offered to captive Koalas, Phascolarctos cinereus. Aust. J. Zool, 29: 839-846.

Wildthing (2001a). Statement of Effect on Threatened Flora and Fauna at Lot 5 DP 998125 The Ruins Way Port Macquarie NSW. Unpublished report to Luke and Co.

Wildthing (2001b) Statement of Effect on Threatened Flora and Fauna at Lot 1 DP 782186 The Ruins Way Port Macquarie NSW. Unpublished report to Luke and Co.

Appendix 1: Offset Planting Specifications

A1.1: Offset Requirements

Future development within the KPoM area will require the removal of an estimated 31 primary Koala food trees listed in the PMHC DCP 2013 and SEPP 44. These are located in the future residential zoned areas as shown in Figure 6.

These are to be offset with planting Koala food trees at a ratio of 1:2 where on land to be managed by Council and otherwise at a ratio of 1:4.

Plantings are to be located in the E2 zoned area within canopy gaps in the forest of a minimum of 10m spacings.

If any plantings cannot be accommodated within the KPoM area, Council agreement is to be sought to find a suitable planting location. These offsite plantings would be managed under a Vegetation Management Plan (VMP) and maintenance program.

A1.2 Objectives and Performance Criteria

A1.2.1 Objective

The primary objective is to ensure the required offset plantings for the proposed development are effectively implemented to achieve positive environmental outcomes for the site and the broader area, and address statutory compliance.

A1.2.2 Performance Criteria

The performance criteria against which achievement of this primary objective is to be measured are:

- Establishment of offset plantings prior to release of the first Part 6 certificate relating to the land in which the trees are being removed.
- 100% Koala food tree replacement within 3 months of failure.
- 75% survival of all other mid and ground storey plantings within the first 3 years.
- 90% reduction of invasive weeds per annum in E2 zoned land.
- Achieve fully structured forest in offset areas and restore linkages to adjacent habitat.

A1.3 Planting Specifications

- Replacement trees to comprise Tallowwood, Forest Red Gum and Swamp Mahogany and are to be sourced from local supplier
- Trees to be used for planting must be advanced size trees that meet NATSPEC Specifying Trees (i.e. 600mm/75-100L pots), which are to be protected against browsing with three 2m high star pickets covered with shade cloth.
- Trees to be planted out at 10m spacings or within existing canopy gaps of a minimum of 10m spacings in forested areas.
- Mid storey and groundcover species should comprise native species listed in the vegetation descriptions in Section 5.1 of this Plan.
- Remove any and all invasive weed species including exotic grasses using environmentally acceptable methods (i.e. hand pulling and selective herbicide spraying) from nominated planting areas
- Slashing is to cease in the E2 area once trees are planted
- Each tree is to be provided with a mulch bed of native materials with a minimum 3m radius and 200m depth. This mulch material is recommended to be sourced from chipping of trees removed for the proposal.
- Water at planting and regularly (at least once per month or if insufficient rain every 2 weeks) for first 3 months
- The plantings are required to have a 100% survival rate, with replacements of any failures made within 3 months using the same size or larger tree.
- The plantings and offset areas are to be maintained in perpetuity.

A1.4 Authority for Implementation

A1.4.1 Council

a) Implement KPoM provisions as appropriate per development stage.

b) Preparation of necessary contracts with effective compliance conditions e.g. provision of clauses regarding penalties for non-compliance with KPoM measures.

c) Monitoring of contractor compliance to KPoM measures.

d) Implement any follow-up actions arising from monitoring reports.

A1.4.2 Landowner/Proponent

a) Implement KPoM provisions as appropriate per development stage.

b) Provide funding for tree plantings

c) Project management to ensure all surveying, map preparation, arrangements and instructions for contractors to carry out planting works, clearing according to plans, etc. undertaken.

d) Implement any follow-up actions arising from monitoring reports or PMHC instructions.

e) Engage ecologist to prepare VMP if offset plantings required outside KPoM area

A1.4.2 Bush Regenerator

a) Identification and marking of area for offset plantings, etc.

b) Correlation of all maps with signed statement of acceptance of their accuracy.

c) Undertaking planting and weeding works

d) Maintenance of plantings

A1.5 Milestones

1. KPoM approved.
2. Contractors/consultants appointed.
3. Offset works commenced pre-construction commencement, and on-going.
4. Areas for planting identified and marked.
5. Plantings completed.
6. Plantings successful and self-sufficient.

A1.6 Monitoring and Compliance

1. Contractual conditions with consultant/contractor provided to allow enforcement for non-compliance.
2. Council to assess individual developments for compliance to KPoM.
3. Monitoring of KPoM and rehabilitation works every 5 years to ensure compliance with KPoM measures.

Appendix 2: Compliance Checklist

The following checklist details the specific actions to be taken to achieve the objectives the KPoM and the responsible authorities for implementation. This Plan will help compliance assessment of the KPoM in regards to its performance criteria.

Table 4: KPoM compliance checklist

Number	Action	Responsible Organisation	Timeframe	Action completed	Comments
1. In-situ Habitat Retention					
1a	Key habitat areas retained and protected.	PMHC Proponents	During rezoning and future development	☐	
2. Offset Plantings					
2a	Suitable offsets provided; and trees planted 10m apart or in canopy gaps if planted in existing forest.	Proponents	Offset plantings to occur prior to release of the first Part 6 certificate relating to the land in which the trees are being removed.	☐	All trees to be advanced stock of at least 600mm in height.
2b	Offsets located in secure area where cannot be removed under other planning processes and mechanisms.	Proponents PMHC	Pre-DA DA	☐	
2c	Offset plantings enhance linkages	Proponents PMHC	Pre-DA DA	☐	
2d	Implement offset planting provisions within KPoM to manage plantings/offset areas on site. VMP prepared for offset plantings outside the KPoM area.	Proponents PMHC	Pre-DA DA Post-DA	☐	

Number	Action	Responsible Organisation	Timeframe	Action completed	Comments
2e	Planning mechanism to ensure continuous replacement of Koala food trees where removed under a planning mechanism	PMHC	On-going	☐	
3. Clearing and Construction Management					
3a	All trees to be removed mapped on plan for DA approval to demonstrate KPoM Compliance	Surveyor PMHC	Pre-DA DA	☐	
3b	Pre-clearing survey by ecologist prior to clearing	Ecologist	Clearing Phase	☐	
3c	Clearing monitoring by ecologist	Ecologist		☐	
3d	Any Koalas found to be monitored during clearing and inspected for signs of disease. Any welfare concerns to be referred to the Koala Hospital	Ecologist		☐	
3e	Report to PMHC on clearing monitoring	Ecologist	Post-clearing.	☐	
4. Traffic Collision					
4a	Additional street lighting where new roads pass through or next to Koala habitat.	PMHC, Proponent	Pre-DA DA	☐	

Number	Action	Responsible Organisation	Timeframe	Action completed	Comments
		5. Barriers			
5a	Residential development is to exclude Koalas by way of Koala proof fencing around E2 areas where they adjoin residential areas or roads.	PMHC Proponents Construction Contractors	DA Construction	☐	
5b	No fence design (either temporary or permanent) is to include a material or design feature that may potentially injure Koalas (or other fauna) e.g. barbs and loose wire.	PMHC Proponents Construction Contractors	DA Construction	☐	
5c	No fence to form a barrier to access of retained or offset habitat in E2/E3 zones.	PMHC Proponent	DA	☐	
5d	Retro-fitting the crematorium boundary fencing with Koala ladders to increase access to this habitat, and general linkages	PMHC	Within 12 months of approval of KPoM.	☐	
		6. Bushfire			
6a	Designation and management of APZs to minimise perceived risk of vulnerability to bushfire and hence demand for hazard reduction	PMHC Planners/propone	Pre-DA DA	☐	

Number	Action	Responsible Organisation	Timeframe	Action completed	Comments
	in adjacent habitat.	nts			
6b	Offsets to be located to avoid conflicts with APZs and negate risk for their potential to be removed by legislation changes, etc	PMHC Planners/proponents	Pre-DA DA	☐	
7. Disease					
7a	Public signage detailing contact details for the Koala Hospital to facilitate prompt reporting of sick or injured Koalas.	PMHC Proponent	DA	☐	
7b	Monitoring to census Koala health and records of disease in Koalas in vicinity of site from Koala Hospital.	PMHC Ecologist	Operational phase	☐	
7c	Contact details for Koala hospital at construction site during construction to report any sick or injured Koalas	PMHC Construction Contractor	DA Construction Phase	☐	