Swift Parrots and Regent Honeyeaters in the Lower Hunter Region of New South Wales

An Assessment of Status, Identification of High Priority Habitats and Recommendations for Conservation

Prepared by Birdlife Australia

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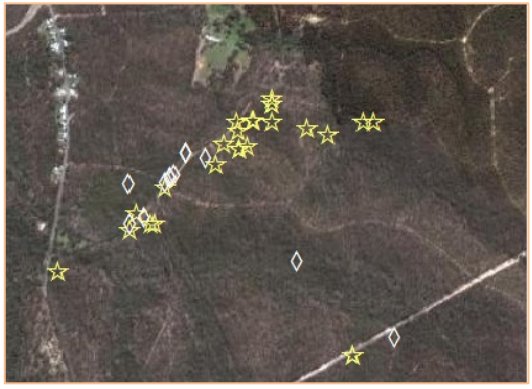

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Front cover photographs – **top left**: Lower Hunter Spotted Gum-Ironbark Forest (Mick Roderick), **top right:** Swift Parrot (Chris Tzaros), **bottom left:** Regent Honeyeater (Dean Ingwersen), **bottom right**: locations of Regent Honeyeater and Swift Parrot records near Pelton, Cessnock.

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LIST OF ABBREVIATIONS

BBAM – BioBanking Assessment Methodology

BCAM – Biodiversity Certification Assessment Methodology

DEWHA – Department of Environment, Water, Heritage and The Arts

DPI – Department of Planning and Infrastructure

DSEWPaC – Department of Sustainability, Environment, Water, Population and Communities

EPBC Act - *Environment Protection and Biodiversity Conservation Act 1999*

EEC – Endangered Ecological Community HBOC – Hunter Bird Observers Club

HC-R CMA – Hunter Central Rivers Catchment Management Authority

HEZ – Hunter Economic Zone

LALC – Local Aboriginal Land Council

LEP – Local Environmental Plan

LGA – Local Government Area

MNES – Matters of National Environmental Significance

NCT – Nature Conservation Trust of NSW

NP – National Park

NPWS – National Parks and Wildlife Service

NRM – Natural Resource Management

NSW – New South Wales

OEH – Office of Environment and Heritage SCA – State Conservation Area

SRD – Sustainable Regional Development

TSC Act - *Threatened Species Conservation Act 1995*

EXECUTIVE SUMMARY

The Lower Hunter Region of New South Wales has been shown to be a critically important area for Swift Parrots and Regent Honeyeaters, both listed as Endangered nationally under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. The importance of the Lower Hunter is underpinned by the availability of preferred habitat types in the form of winter foraging areas for Swift Parrots, and foraging and breeding sites for Regent Honeyeaters in winter and spring. The continuing use of these areas by both species is evidence that these habitats are of great importance to these species. The impacts of projected changes in climate and rainfall could also result in greater emphasis on such an important region situated within a coastal catchment.

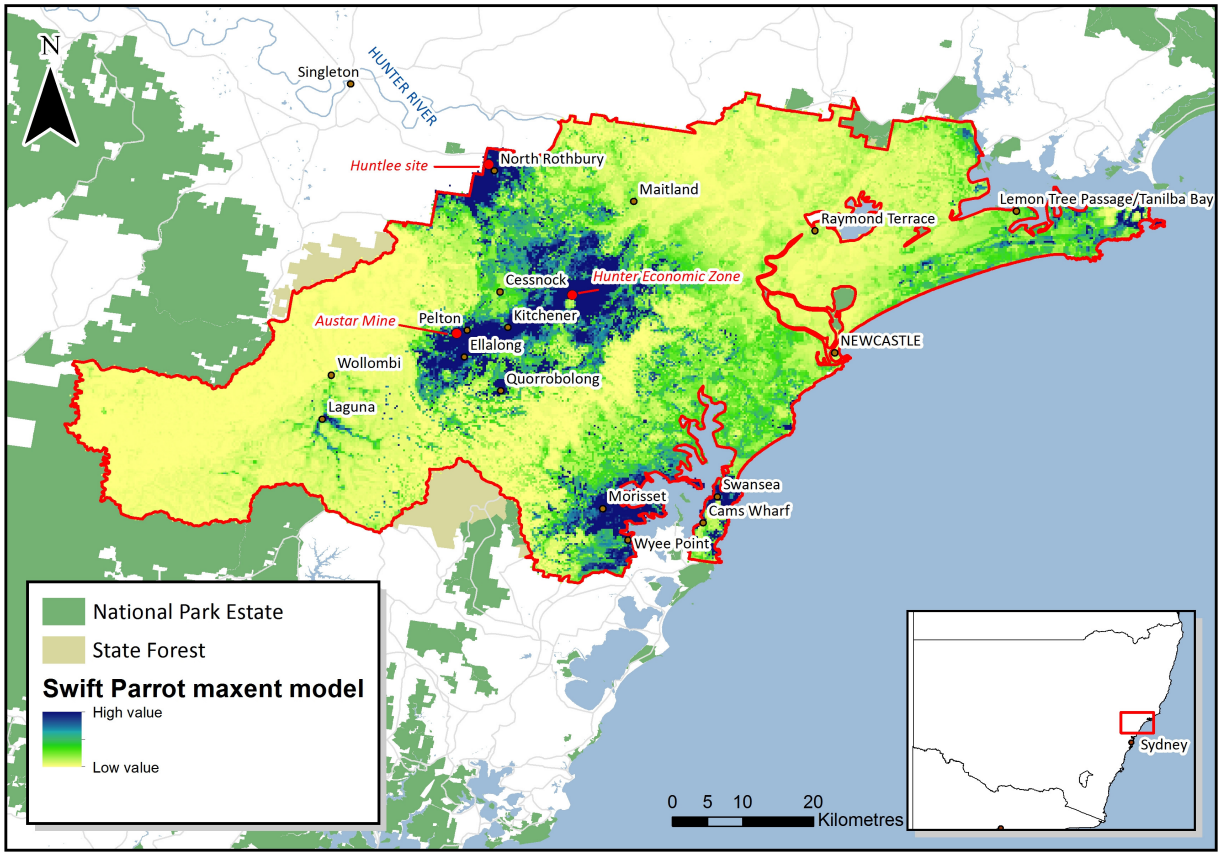
A detailed literature review and desktop assessment was undertaken and this process resulted in a considerable refinement of extant data for the subject species within the Lower Hunter. This review process also laid the foundation for highlighting the significance of the Lower Hunter for both species.

Habitat surveys and modelling were undertaken and key areas containing high priority habitat have been identified (refer to diagrams overleaf). These areas generally equate to the dry open forests of the Cessnock Local Government Area and forest types in poorly drained areas in the southern half of the Lake Macquarie Local Government Area. In particular, the drier forests of the Cessnock area are considered to be of utmost importance given the ongoing records of significant numbers of both species (including during 2012) and the fact that Regent Honeyeaters have bred successfully in the area on more than one occasion. In fact, it is evident that few areas across the entire range of the Regent Honeyeater appear to have been frequented (including for nesting attempts) to the extent that the Cessnock-Kurri woodlands have in recent years, outside of the recognised core breeding areas. It is relevant to point out this area also exhibits a high diversity of avifauna species, including a number of threatened and declining woodland bird species; a testament to the quality and nature of the habitat in that area that provides preferred resources for the subject species.

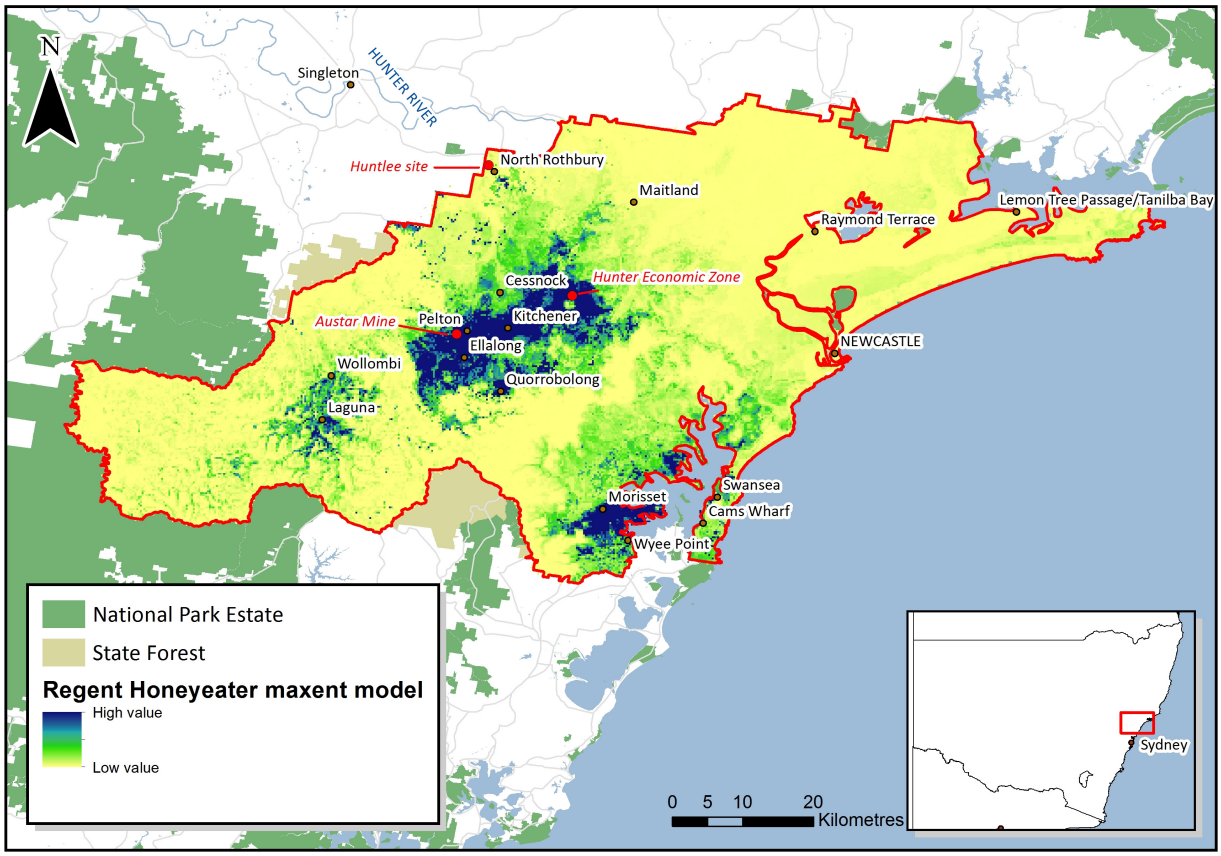
This report has found that along with the recognised importance of the Lower Hunter, conservation of identified key habitats and specific sites is currently inadequate and ongoing loss / fragmentation of habitat is further contributing to the factors that could place these species at the risk of extinction. This loss / fragmentation of habitat is also giving rise to other threats, such as increased potential for invasive / aggressive bird species to flourish, degradation of critical habitat resources, higher fire frequency and erosion of movement corridors.

These threats have been exacerbated by planning decisions that have resulted in poor outcomes for the conservation of habitat for Swift Parrots and Regent Honeyeaters and are likely to continue should development proceed in areas of important habitat that have been identified as future development sites. Whilst some important habitat does occur within existing conservation reserves there remains a significant proportion outside of formally protected areas. The area known as the Hunter Economic Zone (HEZ), which has been shown to be one of the most important sites in the region for both species and in particular for the Regent Honeyeater, requires the most immediate and substantial action for resolution of conservation and development outcomes.

Discussion and subsequent recommendations have been made with regards to relevant biodiversity strategies, planning instruments and environmental impact assessment processes. Options for the recovery and protection of habitat, as well as possible mechanisms for private land conservation have been tabled, as has the potential for further research to better our understanding of how these species utilise the important habitats within the Lower Hunter.



Above: Summary map showing results of habitat modelling for Swift Parrots



Above: Summary map showing results of habitat modelling for Regent Honeyeaters

1. INTRODUCTION

1.1 Background to the Study

The Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) commissioned BirdLife Australia (BA) to undertake a study to identify the extent and quality of foraging habitat, breeding sites, movement corridors and potentially recoverable habitat in the Lower Hunter region of New South Wales (NSW) for the Swift Parrot *Lathamus discolor* and Regent Honeyeater *Anthochaera phrygia.* Both species are listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) and as Critically Endangered / Endangered respectively under the NSW *Threatened Species Conservation Act 1995* (TSC Act 1995).

Specifically, as part of the Australian Government's Sustainable Population Strategy, the Strategic Approaches Branch within DSEWPaC is administering the Sustainable Regional Development program (SRD program) which is undertaking regional sustainability planning activities in selected high-growth areas with significant biodiversity values, such as the Lower Hunter. Identification of high priority areas of habitat within the study area will assist with informing the location of protected area networks and potential vegetation / habitat corridors within the area. It is envisaged that the project will address a key knowledge gap identified by Local, State and Australian governments in relation to the Lower Hunter region and will support the preparation of the revised Lower Hunter Regional Strategy and Lower Hunter Regional Conservation Plan and other local planning instruments.

The program is intended to address major themes within the Lower Hunter region and the wider SRD program, namely Matters of National Environmental Significance (MNES) protection and management, enhancing environmental values and resolving land use conflicts. The Lower Hunter study area showing Local Government Area (LGA) boundaries is depicted in Figure 1.

1.2 Scope of the Study

The aims of this study were to:

- Undertake literature and data reviews on recovery planning work undertaken to date for Swift Parrots and Regent Honeyeaters in the Lower Hunter (including a review of existing available data for both species);
- Conduct targeted field surveys to determine extent and quality of foraging and breeding areas for both species;
- Prepare a report (including map production and habitat modelling) that identifies high priority habitat and conservation areas and potential areas for additional protection or management; and
- Provide strategic planning recommendations for incorporating outcomes into local and regional land use planning.

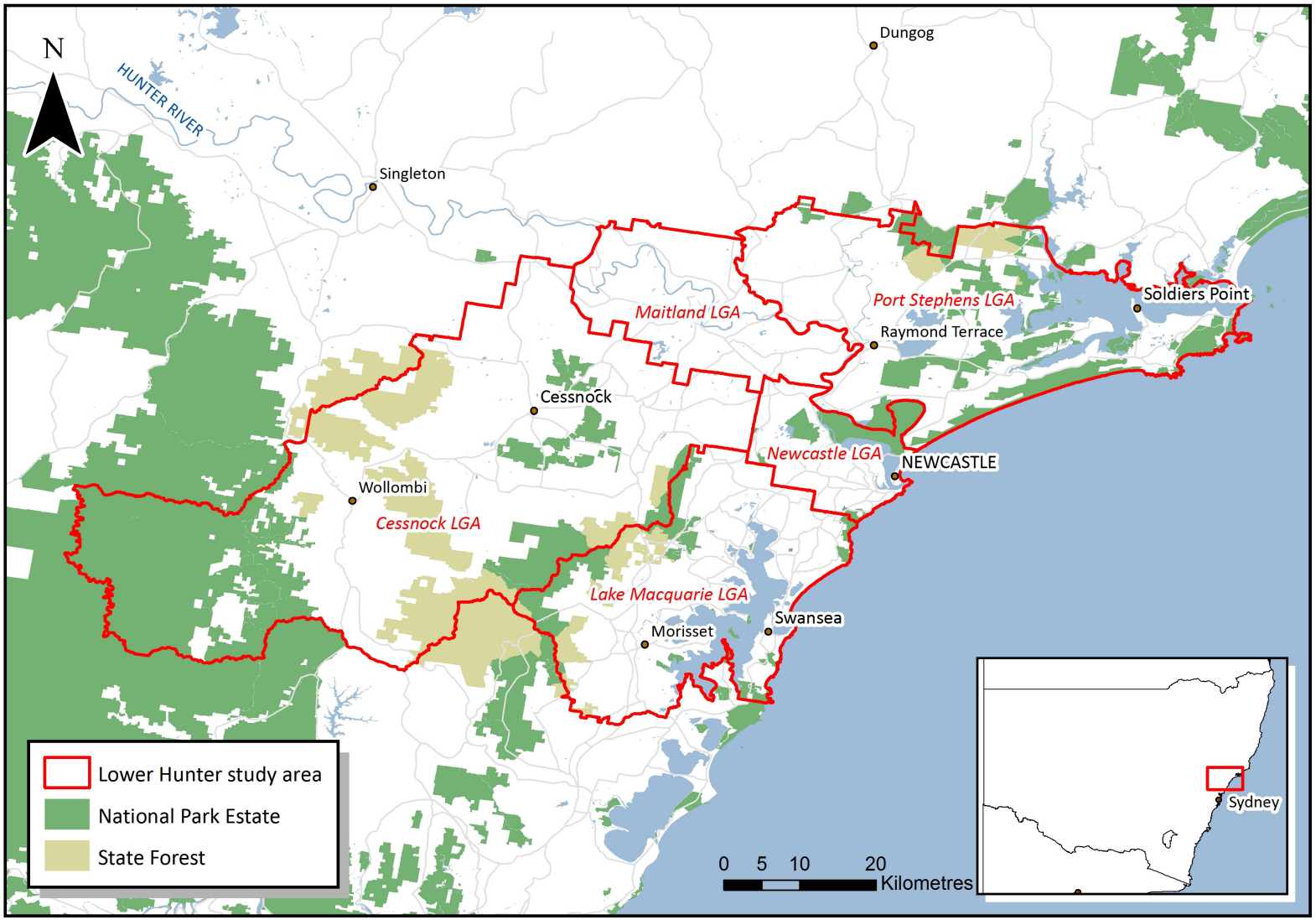


Figure 1: Lower Hunter region showing Local Government Area boundaries.

1.3 Stakeholder Contact

In the first instance, contact was made with various organisations / individuals identified as key stakeholders within the scope of the project. These stakeholders included (but were not limited to) the organisations listed below.

- Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC)
- NSW Office of Environment and Heritage (OEH)
- NSW Department of Planning and Infrastructure (DPI)
- NSW Department of Primary Industries (Crown Lands Division)
- Commonwealth Department of Defence
- Cessnock / Maitland / Port Stephens / Newcastle and Lake Macquarie City Councils
- Hunter Central Rivers Catchment Management Authority (H-CR CMA)
- Mindaribba / Koompahtoo / Bahtabah / Worimi / Awabakal / Karuah Local Aboriginal Land Councils (LALCs)
- Hunter Bird Observers Club (HBOC)
- Birding NSW
- Birdlife Australia Southern NSW Group
- Great Eastern Ranges Initiative (OzGreen)
- Friends of Tumblebee
- Friends of Werakata
- Tom Farrell Institute (University of Newcastle)
- Port Waratah Coal Services
- Austar Coal Mine
- RPS Australia East Pty Ltd (Ecological Consultants)
- Eastcoast Flora Survey (Ecological Consultant)
- Other key private landholders (e.g. at Quorrobolong)

2. LITERATURE AND DATA REVIEW

Available literature and data sources were reviewed to enable a thorough analysis of existing information for both species in the Lower Hunter and to inform ground-truthing of identified priority habitats. Key literature reviewed is listed below. All documentation available (aside from some consultant's reports for developments) was for either Swift Parrot or Regent Honeyeater separately (i.e. not for both species), further highlighting the need for a combined analysis of both species such as that presented herein.

2.1 Summary of Key Documents

Swift Parrot

- National Swift Parrot Recovery Plan (endorsed by the Commonwealth in 2011)
- A winter survey of the Swift Parrot in coastal New South Wales (Kennedy 2000)
- Winter habitat use by the endangered, migratory Swift Parrot in New South Wales (Saunders and Heinsohn 2008)
- Assessment of Swift Parrot Sites near Cessnock, Lower Hunter Valley Region, NSW – including the Hunter Employment Zone (D. Saunders, National Swift Parrot Recovery Team 2002)
- Swift Parrot Surveys – Huntlee lands at North Rothbury (RPS-HSO 2007)

Regent Honeyeater

- National Regent Honeyeater Recovery Plan (advanced draft, February 2013).
- Regent Honeyeater – Capertee Valley Regional Works Plan, which incorporates the Lower Hunter (Geering and Mason 2009).
- Regent Honeyeater surveys conducted by the NSW Department of Environment, Climate Change and Water (Roderick 2010)
- Targeted surveys for Regent Honeyeater within the Hunter Economic Zone (HEZ) (Biosis Research 2008)
- Review of Species for the NSW Scientific Committee: Regent Honeyeater *Anthochaera phrygia*. Debus (2008).

Other relevant documents consulted

- Ecological Constraints Master Plan for the Hunter Economic Zone (HSO 2004).
- Flora and Fauna Inventory for Ellalong Lagoon (HSO 2005).
- Plan of Management for 'Iomar Conservation Area', Quorrobolong, NSW: Protection and restoration of habitat for threatened and declining woodland birds (Nature Conservation Trust of NSW 2011)
- Department of Defence Singleton Training Area Fauna Surveys (SKM 2006).
- Various available fauna surveys in national parks and reserves (e.g. University of Newcastle 2002; DECC 2008a).
- Important Bird Area profiles.

2.2 Contextual Definition of the Hunter Economic Zone

The Hunter Economic Zone (HEZ) is referred to on many occasions within this report. Under the Cessnock LEP 2011 the area referred to as HEZ is depicted in the Cessnock Local Environmental Plan (LEP) map, which can be seen in Figure A1 in Appendix A. The HEZ generally contains the IN1 General Industrial and E2 Environmental Conservation zones, with smaller areas of RU2 Rural Landscape and SP2 Infrastructure. For the purposes of assessments and recommendations made within this report, this is the area that has been treated as the HEZ.

However, historically the area generally referred to as "the HEZ Study Area" also included parts of State Forests that were subsequently gazetted as Werakata National Park (NP) and this included many early assessments and documentation pertaining to HEZ. These areas can be seen as the E1-zoned land immediately adjacent to the HEZ in the Cessnock Council's land zoning sheet in Figure A2 in Appendix A.

The amalgam of the LEP-defined HEZ and those sections of Werakata NP form a broader vegetated remnant that has in the past been referred to generically as HEZ. Notwithstanding, the vast majority of Swift Parrot and Regent Honeyeater records have been noted from areas within the LEP-defined area of HEZ. Where discussion has been made in this report for records outside this area (i.e. within Werakata NP), this has been clarified in the text.

2.3 Swift Parrot Literature Review

2.3.1 Swift Parrot Recovery Plan

The Swift Parrot Recovery Plan was endorsed by the Australian Government in 2011, following a detailed review of earlier versions. The plan outlines the suite of conservation issues facing Swift Parrots and outlines the threats and recommended actions to be taken to address the decline of the species. Apart from threats at breeding sites, those dealt with in the plan are considered to be relevant to the Lower Hunter region and have not been discussed in this review. The plan is underpinned by key background studies on the ecology and status of Swift Parrots and these are detailed below.

The plan also lists four broad objectives for the recovery of the species, as listed below.

> ***Objective 1****: To identify and prioritise habitats and sites used by the species across its range, on all land tenures.*
>
> ***Objective 2****: To implement management strategies to protect and improve habitats and sites on all land tenures*
>
> ***Objective 3****: To monitor and manage the incidence of collisions, competition and Beak and Feather Disease (BFD).*
>
> ***Objective 4****: To monitor population trends and distribution throughout the range.*

Again, each of these objectives applies directly to the Lower Hunter region and it is beyond the scope of this review to make specific comment in this regard. For the purposes of this project, Objective 1 applies foremost and with this information, Objectives 2 and 4 will be able to be better addressed (Objective 3 may require more specialised input).

The identification of priority habitats used by the species on the mainland is outlined in Table 2 of the Recovery Plan, which lists 10 key winter foraging tree species for the Swift Parrot. Of these, four are listed as occurring in the H-CR CMA area. These are:

- Swamp Mahogany *Eucalyptus robusta;*
- Forest Red Gum *E. tereticornis;*
- Blackbutt *E. pilularis;* and
- Spotted Gum *Corymbia maculata*

Whilst a further three species included in Table 2 of the Recovery Plan do also occur in the H-CR CMA area (White Box *E. albens,* Yellow Box *E. melliodora* and Mugga Ironbark *E. sideroxylon*), it is probable that none of these occur naturally within the Lower Hunter study area, although *E. albens* has been recorded within 5km of the north-western boundary of the Cessnock LGA (S. Bell pers. comm.). Other species that Swift Parrots have been noted feeding on the blossom of in the Lower Hunter study area include Coastal Grey Box *E. mollucana,* Brown Stringybark *E. capitellata* and an undescribed stringybark *E.* sp. aff. *agglomerata* (M. Roderick; S. Roderick pers. obs.). Note that several tree species are known to be used for foraging on foliage insects, whilst others have been used in un-natural settings for blossom (such as street-planted and landscape trees).

The species is known to utilise a number of vegetation communities, however the Recovery Plan specifies only those that are of special conservation significance, being the following Endangered Ecological Communities (EECs) listed under the TSC Act 1995:

- Hunter Lowland Red Gum forest
- Lower Hunter Spotted Gum – Ironbark forest
- River-Flat Eucalypt Forest on Coastal Floodplains
- Swamp Sclerophyll Forest on Coastal Floodplains

A further EEC within the Lower Hunter study area has been found to be used regularly by Swift Parrots, with the Central Hunter Ironbark-Spotted Gum-Grey Box Forest utilised in the North Rothbury area, as well as in the western part of the Cessnock LGA in the vicinity of Broke and Hermitage Roads (M. Roderick; S. Roderick pers. obs.).

Identifying key habitats is considered to be the first step in the process of achieving Objective 1. The second step is to determine the distribution of those key habitats, often determined by the vegetation communities within which they occur. The following statement from the Swift Parrot Recovery Plan is of relevance in this instance:

> *"In New South Wales, habitat mapping has been limited by the availability of suitable vegetation mapping with some areas of the species' range not currently mapped. Due to the highly fragmented nature of some Swift Parrot sites in New South Wales, some important habitats, such as those within coastal urban environments, are not evident from vegetation mapping alone. Therefore Swift Parrot records need to be combined with vegetation mapping to get a clearer indication of habitat use in New South Wales. Prioritisation of New South Wales sites is currently being undertaken; however this is primarily on public land. Therefore further work is needed to survey and identify sites on private properties."* (p.7)

This is clearly a deficiency that needs to be addressed with priority to enable Objective 1 of the Recovery Plan to be achieved and very much applies to the Lower Hunter study area (see Discussion).

The Swift Parrot Recovery Plan notes that the species is distributed across 30 Natural Resource Management (NRM) regions, and of these the H-CR CMA area is one of the 15 considered to be highest priority for implementation of recovery actions. It is considered that the Lower Hunter portion of the H-CR CMA contains some of the most important areas of habitat for wintering Swift Parrots. This is evidenced by the majority of occurrences in that CMA area having been recorded from coastal and sub-coastal habitats (generally equating with the Lower Hunter study area).

2.3.2 A winter survey of the Swift Parrot in coastal New South Wales (Kennedy 2000)

Kennedy (2000) undertook surveys in the winter of 2000 in coastal areas, including many parts of the Lower Hunter study area. Below is an excerpt from the report.

> *"This survey highlighted the importance of Spotted Gum as well as Swamp Mahogany habitats to the Swift Parrot in coastal New South Wales. The results presented here suggest that Spotted Gum habitat in the Hunter Valley supported a significant percentage of the state's Swift Parrot population in the winter of 2000. Since the survey's completion more Swift Parrots have been sighted in Spotted Gum-dominated habitat in the Ellalong area, the Aberdare State Forest and at Singleton.*
>
> *The Hunter Valley concentration coincided with a poor year in other primary foraging habitats in NSW. Annual winter surveys in 2000 located only small numbers of Swift Parrots in the box-ironbark region, and none in Swamp Mahogany habitat. Box-ironbark and Swamp Mahogany habitats were generally considered to be the two major forest types for the Swift Parrot in New South Wales. However, it now appears that there are three forest types that may support a significant percentage of the state's population in a given year."* (p.10).

The findings of Kennedy (2000) with regards to the importance of Spotted Gum and Swamp Mahogany dominated forests in the Lower Hunter (and elsewhere) have since been confirmed by continuing records, with significant proportions of the population recorded feeding and roosting in these vegetation types. Some of the largest remnants of Spotted Gum-dominated forests occur within the Lower Hunter and the species continues to be found utilising these habitats.

*2.3.3 Winter habitat use by the endangered, migratory Swift Parrot (*Lathamus discolor*) in New South Wales.* (Saunders and Heinsohn 2008)

Saunders and Heinsohn (2008) later undertook a review of the usage of mainland (winter) habitats used by Swift Parrots. The abstract of the review states:

> *"Migratory birds are dependent on a combination of suitable wintering, migration and breeding habitats. Identification and protection of these habitats is essential for their conservation. The endangered Swift Parrot (*Lathamus discolor*, Psittacidae) migrates north from Tasmania in search of suitable winter food resources across south-eastern mainland Australia. This five year study examines the use of known winter foraging habitats by Swift Parrots on a state-wide scale not previously attempted. Swift Parrots used a diversity of winter foraging habitats in coastal and/or western slopes regions of New South Wales each year, including several habitats that occur in endangered ecological communities. Swift*

Parrot abundance fluctuated significantly between years and regions, with coastal areas providing important drought refuge habitats for a large proportion of the population. Over half of all foraging sites were used repeatedly, highlighting their likely importance for conservation. Landscapes containing winter foraging habitat included scattered trees, remnant vegetation and continuous forests, and Swift Parrots foraged extensively on lerp and nectar from a diversity of tree species within these. The occurrence of Swift Parrots at foraging sites was primarily associated with the abundance of lerp, nectar, and non-aggressive competitors."

Repeated surveys and records have shown that several Lower Hunter forest types and other sites are favoured by significant numbers of Swift Parrots, thus distinguishing the Lower Hunter as likely one of the most important mainland areas for the species.

2.3.4 Assessment of Swift Parrot sites near Cessnock, Lower Hunter Valley Region, NSW, including the Hunter Employment Zone (Saunders 2002)

In 2002, an assessment of Swift Parrot habitat in the Cessnock LGA was undertaken by the then co-ordinator of the Swift Parrot Recovery Team, Debbie Saunders. This was prompted in part by the proposed rezoning of significant bushland parcels for the Hunter Employment Zone (HEZ; later renamed Hunter Economic Zone). The following are excerpts from that document.

"Since 1985, Swift Parrots have been recorded 40 times from 24 sites (21 foraging, 3 flying over) within the study area (Tables 1 and 2) in addition to at least four sites with anecdotal records from the Paxton/Ellalong area (R. Wade pers. comm.). Swift Parrots have been recorded every 2-3 years in the HEZ depending on flowering events that provide suitable foraging resources for this species (Tables 1 and 2). There were no suitable flowers or lerp infestations present in the study area during the current assessment and therefore no swift parrots were recorded. However, over 37% of the Swift Parrot sites in the study area occur within the proposed HEZ, including the largest record of this species in Spotted Gum habitats in the NSW (SPRT database and NPWS database). None of the sites (seven sites) supporting over 80 Swift Parrots were within conservation reserves. Five of these sites were within HEZ (Sites 4, 5, 9, 10 and 11, Figures 1 and 2) and two sites were on private property (Sites 3 and 12, Figures 1a and 2)." (p.3)

"In addition, Swift Parrots are known to prefer foraging in mature trees and have a high level of site fidelity whereby they return to the same sites on a seasonal basis (Kennedy and Tzaros in press, and Kennedy and Overs 2001). The Lower Hunter Valley region is of particular importance given that large numbers of Swift Parrots are known to use habitats within the region (including HEZ) on an ongoing basis.

The Swift Parrot population estimate is 2000 mature birds (Swift Parrot Recovery Team 2001) and therefore the HEZ has been recorded as supporting 10% of the total population. This is the largest number of Swift Parrots (200) ever recorded within Spotted Gum habitats of NSW and one of the largest records of Swift Parrots within the state." (p.8)

"Given the status of the Swift Parrot at the national level all known sites for this species within the Lower Hunter Valley region are of significance and the loss of habitat in areas such as the HEZ can only further endanger the species." (p.9)

Prior to the publication of this report and in information made available during the 2004 Public Enquiry into HEZ (NSW Legislative Council 2004), Saunders had provided advice to the NSW National Parks and Wildlife Service (NPWS) at the time in relation to Swift Parrots using

the HEZ site, including the text below in reference to the consistency of ongoing reports of Swift Parrots at HEZ.

> *"This is the longest and most consistent site fidelity ever recorded on mainland Australia for the Swift Parrot…and therefore the Tomalpin forest area [HEZ] is currently the most significant Swift Parrot site in NSW."*

Since this publication and subsequent enquiries, other areas dominated by Spotted Gum have also been found to contain large numbers of Swift Parrots than the Cessnock woodlands (i.e. on the South Coast of NSW in winter 2012). Notwithstanding, the Cessnock forests discussed in Saunders (2002) remain one of the most significant and oft-visited forested areas in NSW for Swift Parrots, including significant numbers (likely 200-300 birds) as recently as winter 2012 (Swift Parrot Recovery Team unpublished data).

2.3.5 Swift Parrot Surveys – Huntlee lands at North Rothbury (RPS 2010; RPS-HSO 2007; 2009; RPS Australia East 2011)

Following a number of Swift Parrot sightings made by consultants RPS-HSO in the winter of 2005 on the proposed "new township" of Huntlee (at North Rothbury, north of Cessnock), it was suggested that regular monitoring take place on the site once subsequent new owners took control of the land. This involved surveying those areas previously used by Swift Parrots during winter 2005. It also involved surveys of stands of *Eucalyptus crebra* (identified as an important species for lerping in 2005) and flowering *Corymbia maculata* or *E. tereticornis* as well as general searches performing intermittent spot surveys through areas where the above indicator species did not occur. Thirty-six hours of surveys were carried out over seven days between June and September 2007, followed by similar survey effort carried out in 2008, 2009 and 2011. It is understood that surveys were also undertaken in 2012.

Note that this area occurs on the boundary of Cessnock and Singleton LGAs, with the latter being outside of the study area for this report. Those records of Swift Parrots within Singleton LGA have not been included in the mapping component of the data review, though it should be noted that the habitat is contiguous with the habitat within Cessnock LGA where Swift Parrots have been recorded.

In 2005, the Ecological Assessment Report for Huntlee (RPS 2010) states that:

> *"Swift Parrots were observed at a number of locations on Huntlee during the winter of 2005 (flocks up 60-80 individuals). The birds were observed roosting at three locations (Grids H30, M22 and N19) on at least 7 nights through June 2005" (Author pers. obs.)* (Appendix 1 – Threatened Species Habitat Profiles, p.12)

Three birds were also recorded in North Rothbury (in contiguous habitat) on the 3rd May 2005 (S. Roderick pers. comm.).

Other documents and surveys show that 15 Swift Parrots were recorded at Huntlee in 2007 and 70 birds again in 2008. Although not recorded on the Huntlee site directly, two records (one of a single bird and one of three birds) were noted from North Rothbury township in August and September 2008 respectively (S. Roderick pers. comm.). No records have been noted during formal surveys at Huntlee since 2008.

Other occasional incidental observations of Swift Parrots have been made in the North Rothbury area over the past decade or so (A. Zoneff pers. comm.).

These survey results and additional observations show clearly that this area is used regularly by Swift Parrots and is likely to represent an important winter-foraging area for the species.

2.4 Regent Honeyeater Literature Review

2.4.1 Regent Honeyeater Recovery Plan

The Regent Honeyeater Recovery Plan is currently under review (latest draft version February 2013), with the previous version endorsed in 1999. As with the Swift Parrot, the Regent Honeyeater Recovery Plan addresses the severe decline of the species by considering background research and identifying the major threats to the species. It also outlines conservation actions recommended to occur to reverse this decline. Those threats and actions have not been subject to review within this project.

The plan lists six broad objectives in the recovery of the Regent Honeyeater, as listed below.

> ***Objective 1:*** *Restore, protect and enhance the value of Regent Honeyeater habitat in 'regularly used areas' and at other sites throughout the former range.*
>
> ***Objective 2:*** *Monitor trends in population distribution and abundance across the range of the Regent Honeyeater.*
>
> ***Objective 3:*** *Facilitate research on strategic questions which will enhance capacity to achieve the long-term objectives of the recovery program.*
>
> ***Objective 4:*** *Manage the captive population of Regent Honeyeaters to provide insurance against the demise of the wild population and to meet the needs of the recovery program.*
>
> ***Objective 5:*** *Maintain and increase community awareness, understanding and involvement in the Regent Honeyeater recovery program.*
>
> ***Objective 6:*** *Effectively administer the recovery effort to ensure that recovery plan objectives are met.*

Each of these objectives will affect the population and usage of the Lower Hunter region by Regent Honeyeaters, though Objectives 4 and 6 are met externally. Objectives 1, 3 and 5 are being implemented within the Lower Hunter study area and current projects continue to carry out these, though it is Objective 2 that applies most directly to this project.

Fourteen key foraging species for Regent Honeyeaters (with regards to blossom) are outlined in the plan, with eleven of these being eucalypts and three being mistletoe. Of these, eight occur in the Lower Hunter study area. These are:

- Swamp Mahogany *Eucalyptus robusta;*
- Grey Gum *E. punctata;*
- Thin-leaved Stringybark *E. eugenioides;*
- Stringybark sp. (undescribed) *E.* sp. aff. *agglomerata;*
- Broad-leaved Ironbark *E. fibrosa;*
- Spotted Gum *Corymbia maculata;*
- Box Mistletoe *Amyema miquelii;* and

- Long-flower Mistletoe *Dendropthoe vitellina.*

Further to these species listed in the plan, other naturally occurring species that Regent Honeyeaters have been recorded foraging in within the Lower Hunter study area include Brown Stringybark *E. capitellata,* Narrow-leaved Ironbark *E. crebra* and Ferguson's Ironbark *E. fergusonii*.

The area comprising the Lower Hunter study area within the endorsed plan is referred to as the "Central-Lower Hunter Valley" and is considered to be a 'subsidiary area' to the Capertee Valley. It is considered within the Recovery Plan that the Lower Hunter (and Central Coast) forests serve perhaps largely as drought refuges, defined as wet lowland coastal forests dominated by Swamp Mahogany and/or Spotted Gum and Spotted Gum-Ironbark associations.

Away from the generalised core breeding areas (traditionally recognised as being Chiltern [Vic], Capertee Valley and Bundarra-Barraba), significant breeding events have occurred recently in the Lower Hunter study area and an increase in the number of sightings in the Lower Hunter has been noted.

In recent years a pattern of breeding activity by Regent Honeyeaters in the Cessnock LGA has been identified, particularly at Quorrobolong and Ellalong. In November 2007 Regent Honeyeaters were also located breeding in Lower Hunter Spotted Gum/Ironbark Forest at nearby Kurri Kurri. With approximately 40 birds being present, this particular breeding event (which carried into January 2008) constituted the largest recorded anywhere that season (D. Geering pers. comm.) and was the largest known breeding event anywhere between 2007-2012 (Regent Honeyeater recovery team unpublished data). A similar number of birds were also present in the region during 2009 and 2012, suggesting the Hunter Valley may be becoming increasingly important, as not only a drought refuge but as important habitat in its own right.

2.4.2 Capertee Valley Regional Regent Honeyeater Works Plan. (Geering and Mason 2009)

The Capertee Valley Regional Regent Honeyeater Works Plan was produced to serve as a guiding document for on-ground recovery efforts in the Capertee Valley and surrounding / associated areas, which included the Upper and Lower Hunter Valleys. The following are excerpt from the Works Plan.

> *"The Hunter Valley, generally from east of the Wollemi National Park across to the lakes system between Newcastle and Broken Bay, is an important refuge site for Regent Honeyeaters. This area undoubtedly provides nectar resources in years when flowering fails further west and as a thoroughfare to the coastal Swamp Mahogany E. robusta forests.*
>
> *During the last decade or so, there are records of Regent Honeyeaters almost annually in the Hunter Valley e.g. Cessnock area (1995, 1997, 1998, 2000, 2003, 2004, 2005, 2007, 2008), Howes Valley (1994, 1995, 1996, 1999, 2000) and the Widden Valley (1995, 1997, 1998, 1999, 2000, 2006, 2008). It is not certain whether this annual pattern of movements into the Hunter is an artefact of drought, and an associated suppression of flowering, west of the ranges or a regular migration.*
>
> *Most records in this area are associated with flowering Spotted Gum C. maculata. However, in 1994 a particularly large flock of 150 Regent Honeyeaters were at Howes Valley where the primary food resource was lerp in eucalypts regenerating after fire. Regent Honeyeaters have also been recorded utilising areas of flowering Yellow Bloodwood Corymbia eximia at*

Broke and an unidentified Stringybark at Quorrobolong. In the Widden Valley the River She-oak riparian zone is an important habitat, the birds foraging on Needle-leaved Mistletoe Amyema cambagei.

Although generally regarded as a wintering area breeding attempts were recorded at Quorrobolong in 2000, 2003, 2007 and, previously, in 1979. Breeding attempts have also been reported from Ellalong, Broke and Howes Valley although few of these appear to have resulted in fledged young. A relatively major breeding event near Kurri Kurri in 2007/08 did however produce significant numbers of fledged young.

The Spotted Gum forests of the Singleton - Cessnock area are important to the integrity of the movement patterns of the Regent Honeyeater. The long-term viability of the Capertee Valley breeding population may well be underpinned by the ability of Regent Honeyeaters to move to coastal, and near coastal, forests during periods of resource deficiencies west of the ranges." (p.7-8)"

Significant numbers of Regent Honeyeaters have been noted in the broader Cessnock area since this report was written again in 2009, 2010 and 2012.

"Re-sightings of banded birds indicate that there is regular movement of birds between Capertee, Mudgee, the Central Coast and the Hunter Valley

These movements are almost certainly driven by flowering, or more correctly available nectar flows, of eucalypts. In years with extensive nectar flows of the winter flowering Eucalypts (notably White Box and Mugga Ironbark) it appears that Regent Honeyeaters may not disperse as great a distance as during years when these species do not flower. For example, in the excellent White Box flowering episode of 1999 Regent Honeyeaters were located in many locations in the Mudgee – Wollar area as well as further to the north-west. However, during the drought years immediately following Regent Honeyeaters were located in the Hunter Valley and Central Coast in either Spotted Gum (2000) or Swamp Mahogany (2002)." (p.9)

"In the Hunter Valley, Spotted Gum is an important foraging tree when this species is flowering. Regent Honeyeaters are often located foraging in Spotted Gum in the Singleton – Broke area and the Ellalong – Kitchener – Quorrobolong area. Within these broader Spotted Gum forests Regent Honeyeaters have also been observed to forage on an unidentified Stringybark in the Quorrobolong area and, in 2007/08, on Broad-leaved Ironbark in the Tomalpin area at times when Spotted Gum is not flowering. It is quite likely that the Long-flower Mistletoe Dendropthoe vitellina, which flowers prolifically in this region during spring and attracts large numbers of other honeyeater species, may also be utilised.

On the Central Coast, Regent Honeyeaters have primarily been located at sites with flowering Swamp Mahogany although there are occasional records of the species in Red Bloodwood. These latter records, generally of only a few days duration, may indicate birds in transit." (p.14)

"In the Hunter Valley, breeding has been recorded in association with flowering Spotted Gum, Stringybark and, in 2007/08, Broad-leaved Ironbark." (p.15)

From these excerpts it is very clear that the Lower Hunter represents an extremely important area of winter-foraging, drought-refuge and potential breeding habitat for Regent Honeyeaters. It is hoped recent banding work (carried out by BA in 2012) will contribute to a better understanding of the use of the Lower Hunter forests by Regent Honeyeaters.

2.4.3 Surveys for the endangered Regent Honeyeater Anthochaera phrygia, January to June 2010. (Roderick 2010)

Surveys were conducted by the Biodiversity Conservation Unit of the NSW Department of Environment, Climate Change and Water (DECCW; now OEH) in the summer-winter of 2010. Below is a summary excerpt from the report.

"Surveys were conducted over 20 separate days at 35 distinct locations where searches for Regent Honeyeaters were undertaken. A total of 53 BA Atlas surveys were carried out over the course of the surveys, comprising a total of approximately 27 hours of formal surveys.

Regent Honeyeaters were recorded at 2 sites during these surveys. The first sighting was initially made along the Kearsley South Fire Trail in Werakata NP near Kitchener on the 12th March; the second being at 2838 Putty Road, Milbrodale on the 23rd April.

Following a significant autumn / winter season in the Lower Hunter Valley in 2009, which saw up to 40 Regent Honeyeaters recorded in particular locations, BA requested that the Department of Environment, Climate Change and Water (DECCW) assist with monitoring known sites and conducting surveys in additional areas where the species could potentially occur. One major difficulty faced by BA officers responsible for Regent Honeyeaters is that they are based in Victoria. In January 2010 formal surveys were funded by DECCW to assist BA and the Recovery Team with such surveys. These surveys were undertaken by Mick Roderick, Senior Threatened Species Officer with the Biodiversity Conservation Unit, North East Branch.

It appears that at present the Lower Hunter Valley represents one of the most important areas of habitat for the species throughout its entire range. This is evidenced by the fact that all records of Regent Honeyeaters in large numbers (>12 individuals) since 2008 have all been within the Lower Hunter Valley. This includes records of at least 40 birds at Pelton (Werakata State Conservation Area) in June 2009, approximately 20 birds at Kitchener (Werakata National Park) in July 2009 and 19 birds at Milbrodale during these recent surveys.

In late 2007 one of the most successful breeding efforts for the species in recent times occurred near Kurri Kurri, in bushland approximately 5km north-east of the Kitchener site. Therefore, not only does the Lower Hunter provide seasonal foraging habitat but is also important as a supplementary breeding area for the species when conditions at more traditional breeding areas may not be suitable.

The recent records of Regent Honeyeaters in the Lower Hunter are of the significance such that there have been implications noted within the draft revised versions of the national Recovery Plan (D. Ingwersen pers. comm.). Also of note, approvals granted by the NSW Department of Planning for the Hunter Economic Zone (HEZ; where Regent Honeyeaters bred in 2007) have included the requirement for monetary contributions to offset the potential impacts upon Regent Honeyeaters."

Again, the significance of the Lower Hunter Valley to Regent Honeyeaters is emphasised and it should be noted that significant numbers were once again recorded in the area during 2012.

2.4.4 Assessments of Significance for Regent Honeyeater within the Hunter Employment Zone (HEZ). (Biosis Research 2008)

A significant breeding event of Regent Honeyeaters took place in bushland south of the townships of Abermain and Neath (east of Cessnock) on land included within the Cessnock LEP-defined HEZ (with a single nest being located in Werakata NP). The consultancy 'Biosis Research' was engaged to perform research into the breeding event and provide an assessment of the potential impacts of the proposed Precinct 1 of the greater HEZ project.

"During targeted searches for nesting and individual Regent Honeyeaters, the vegetation was assessed for its value as both potential foraging and nesting habitat (Biosis Research 2008). Previous assessments conducted by Harper Somers O'Sullivan involved assessment and mapping of the potential foraging habitat for the Regent Honeyeater within the HEZ site. These surveys found that the majority of the HEZ Local Environmental Plan study area contained good quality Regent Honeyeater habitat (breeding and foraging). These findings were confirmed by the 2007 survey, as two of the dominant vegetation types, Lower Hunter Spotted Gum / Ironbark Forest and Hunter Lowland Redgum Forest, contained abundant winter-flowering food resources such as Spotted Gum and the Forest Red Gum, as well as abundant summer-flowering food resources such as Broad-leafed Ironbark (Eucalyptus fibrosa) and Narrow-leafed Ironbark (E. crebra). During the current surveys, similar foraging habitat was also found to be present immediately to the south, east and west of the HEZ site, including within Werakata National Park (Biosis Research 2008).

Approximately 5.2 ha of known foraging and potential breeding habitat of the Regent Honeyeater would be impacted (directly and indirectly) by the proposal and this represents approximately 0.1 % of potential habitat in the locality. Given the significance of the recent breeding event within the HEZ LEP study area, that Precinct 1 contains potential breeding habitat, and that the habitat to be impacted by the proposal is considered to be highly important for the long term survival of the species in the locality, and probably, for the species as a whole. Regent Honeyeaters have been detected nesting adjacent to Precinct 1 in its current state. However, the development will reduce the area of potential breeding habitat for this species and is likely to reduce the probability of a breeding event in the future. The cumulative impacts of the HEZ development (currently approved development and Precinct 1 Part 3A application) impact 151 ha of potential habitat for the Regent Honeyeater, which represents 2.6% of potential habitat within the locality, and this is considered likely to reduce the long-term viability of a local population of this species.

The distribution of mistletoe was mapped by Harper Somers O'Sullivan (as it is also a food and nesting resource for the Regent Honeyeater) and shown to be present over approximately 45% of the HEZ site, including a similar coverage within Precinct 1 (HSO 2004; Harper Somers O'Sullivan 2006). Mistletoe is also an important habitat feature for nesting as it provides a platform for the nests, especially in smooth-barked trees like the Spotted Gum (D. Geering, pers. comm.)." (p.4)

This report documented the breeding event, which was considered to be very successful, with a high proportion of fledged young to nests (D. Geering pers. comm.). The assessment of the potential impacts of Precinct 1 clearly determined that the impact upon Regent Honeyeaters would be significant locally. It should also be noted that a submission was made by the Swift Parrot Recovery Team for the Environmental Assessment for Precinct 1 of HEZ as well, which highlighted a number of issues surrounding the potential loss of significant areas of winter foraging habitat for Swift Parrots.

Precinct 1 for HEZ was approved by the (then) NSW Department of Planning in 2009, including a requirement for a monetary offset for impacts on Regent Honeyeaters. To date, no part of the (monetary) offset for Regent Honeyeaters has been received and no additional development has taken place on the site from users that were already established before the Precinct 1 approval.

2.4.5 Review of Species for the NSW Scientific Committee: Regent Honeyeater Anthochaera phrygia. (Debus 2008)

In November 2010, the NSW Scientific Committee made a Final Determination to upgrade the status of the Regent Honeyeater from Endangered to Critically Endangered (NSW Scientific Committee 2010).

As part of the review of the status of the species (Debus 2008), the following information was noted as being of significance to warrant the upgraded listing.

> *"Breeding populations fragmented: now mainly around Chiltern in north-east Victoria, Capertee Valley in central-eastern NSW, and Bundarra-Barraba region in northern inland NSW, but with minor and sporadic breeding in other areas such as Canberra, Warrumbungle NP, Pilliga forests, Mudgee-Wollar region, Hunter Valley and Clarence Valley.*
>
> *The global population was estimated as 1500 mature birds, with 1000 shared between the two major breeding sites (Capertee Valley and Bundarra-Barraba) in 1997, but numbers have declined since (Garnett & Crowley 2000). There were several hundred birds in the Capertee Valley in 1997, but since 2000 the Capertee population has declined from c. 140 birds in spring 2005 to 40 birds in spring 2006 (Regent Honeyeater Recovery Team data; NSW Field Ornithologists Club data). In the Bundarra-Barraba area, numbers have declined from c. 100 in the 1990s, to c. 50 birds in subsequent breeding seasons, and c. 30 birds in recent years (maxima in good flowering years: Bundarra-Barraba Ops Group data). Apart from the lower Hunter and Central Coast, where tens of birds are still sometimes reported, since 2000 there have been only trivial numbers (fewer than 10 birds) reported for each of the minor sites away from Capertee and Bundarra-Barraba. In 2007 there was no eucalypt flowering and no birds could be found in the Bundarra-Barraba region and northwards to Inverell-Ashford (S. Debus pers. obs.). In the Capertee Valley, there were 20 birds seen at the start of the breeding season (August), and this number declined to fewer than 10 through September and only two birds in October, then none thereafter when their food trees failed; there was no breeding detected in the Capertee in 2007 (D. Geering unpubl data; C. Probets pers. comm.; S. Debus pers. obs.). Some pairs (34 birds, 12 nests and 18 fledglings), perhaps the 'missing' birds from the main NSW sites, bred in the lower Hunter Valley in spring-summer 2007 (NSW Field Ornithologists Club data; A. Morris pers. comm.)."* (p.2-3)

As the vast majority of the known Regent Honeyeater population is widely recognised as occurring within NSW, the state listing of Critically Endangered could be extrapolated to describe the level of threat to the species as a whole.

2.5 Important Bird Areas

Important Bird Areas (IBAs) are areas considered to be of global significance to one or more types of species of conservation concern. Each IBA meets one (or more) of four criteria used by BirdLife International. IBAs are priority areas for bird conservation, where non-government organisations work with land-holders and other local people to conserve them. A

background on the IBA initiative and how sites are determined to be listed as an IBA has been published by Birdlife International (Birdlife International 2013).

Within the Lower Hunter there are three listed IBAs, being the Hunter Estuary, Hunter Valley and Lake Macquarie. The Hunter Estuary IBA has been listed due to the significance of that area to migratory shorebirds and bird congregations, whereas both the Hunter Valley and Lake Macquarie IBAs have been listed due to the importance of them to Regent Honeyeaters and Swift Parrots.

The IBAs themselves do not comprise all of "Lake Macquarie" or the "Hunter Valley" but rather take in a broad area around those parts of each region that have had the most numerous reports of Swift Parrots and Regent Honeyeaters and where the bulk of preferred habitat exists. In essence, the areas defined under the IBA maps include those areas henceforth identified as important within this report. Although there is no legislative authority or function from an area being deemed an IBA, it does add to the significance of those areas due to the strict criteria that is needed to be met to qualify as such.

A profile of both of these IBAs (including maps) is provided in Appendix D.

One of the most important components of assessing and maintaining IBA status is monitoring. At the time of writing, BirdLife International's World Congress is making assessments of threats and conservation issues facing many of the world's IBAs. Without monitoring data, such review processes cannot be made.

2.6 Data Review

A comprehensive set of records has been compiled for both species in the Lower Hunter. Figure 2 shows the distribution of records for both species prior to the data review. These data have been collated predominantly from the Swift Parrot and Regent Honeyeater Recovery Team databases (administered by BA) and NSW State wildlife database (administered by OEH). It was obvious from early on in the data review process that there were many records of both species collected by various organisations or individuals which were not submitted to relevant state or Recovery Team databases, or which have been submitted but have inaccurate coordinates assigned to them.

As an example, in Figure 3 there is an errant Regent Honeyeater record in the western end of the study area. This is actually a Capertee Valley record with incorrect coordinates. There were several other records similar to this example which were errant and required "cleaning out" from the projects data. It was also noted that there were a number of Swift Parrot records which were "desensitised" within the available OEH database, particularly in the vicinity of Kurri Kurri. Figures 4 and 5 show how the records in this area were originally arranged and how the data review resulted in a more accurate and thorough depiction of the reported distribution of Swift Parrots in that area.

To this end, an extension of the review of existing Recovery Teams and OEH database data required consultation of Hunter Bird Observers Club (HBOC) records, data contained within relevant publications (that may have not been submitted to authorities and/or that may have been desensitised) as well as direct communication with observers.

This part of the process resulted in a significant increase in the number and accuracy of records and enabled a very thorough supplementation of existing Recovery Team records. This was particularly true for records of both species from key years where significant flowering events clearly took place (e.g. 2002) as well as records from unpublished reports,

or where data had not been provided to the Recovery Team(s). It also enabled the accuracy of a number of records to be amended.

Finally, a number of people consulted are viewed as being "local experts" in terms of records of Swift Parrots and Regent Honeyeaters and hence contributed an important role in the efficacy and quality of the habitat modelling, which is considered an important supplement to appropriate and effective modelling techniques (Wintle *et al* 2005).

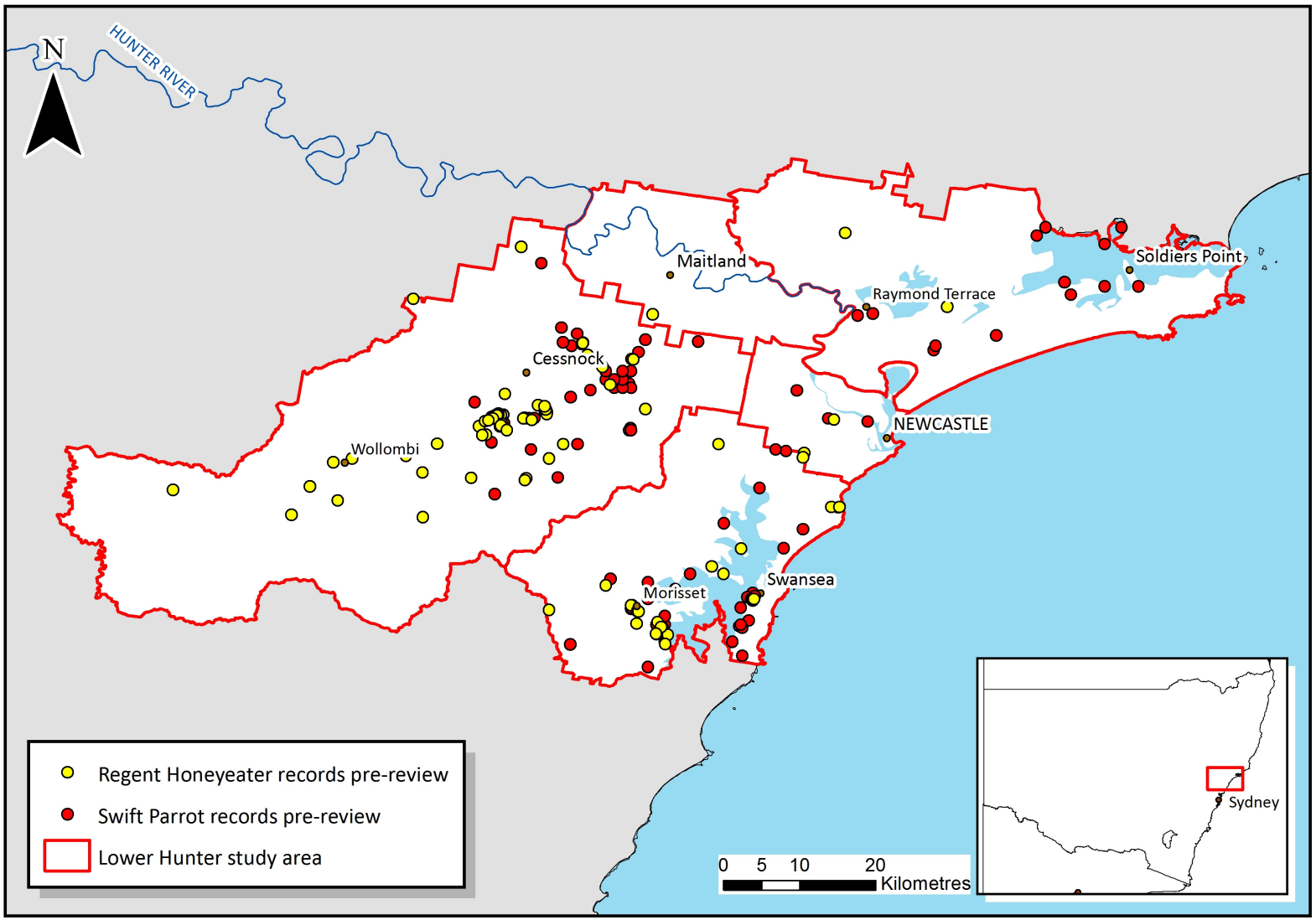


Figure 2: Location of Swift Parrot and Regent Honeyeater records within the study area before the commencement of data review and refinement.

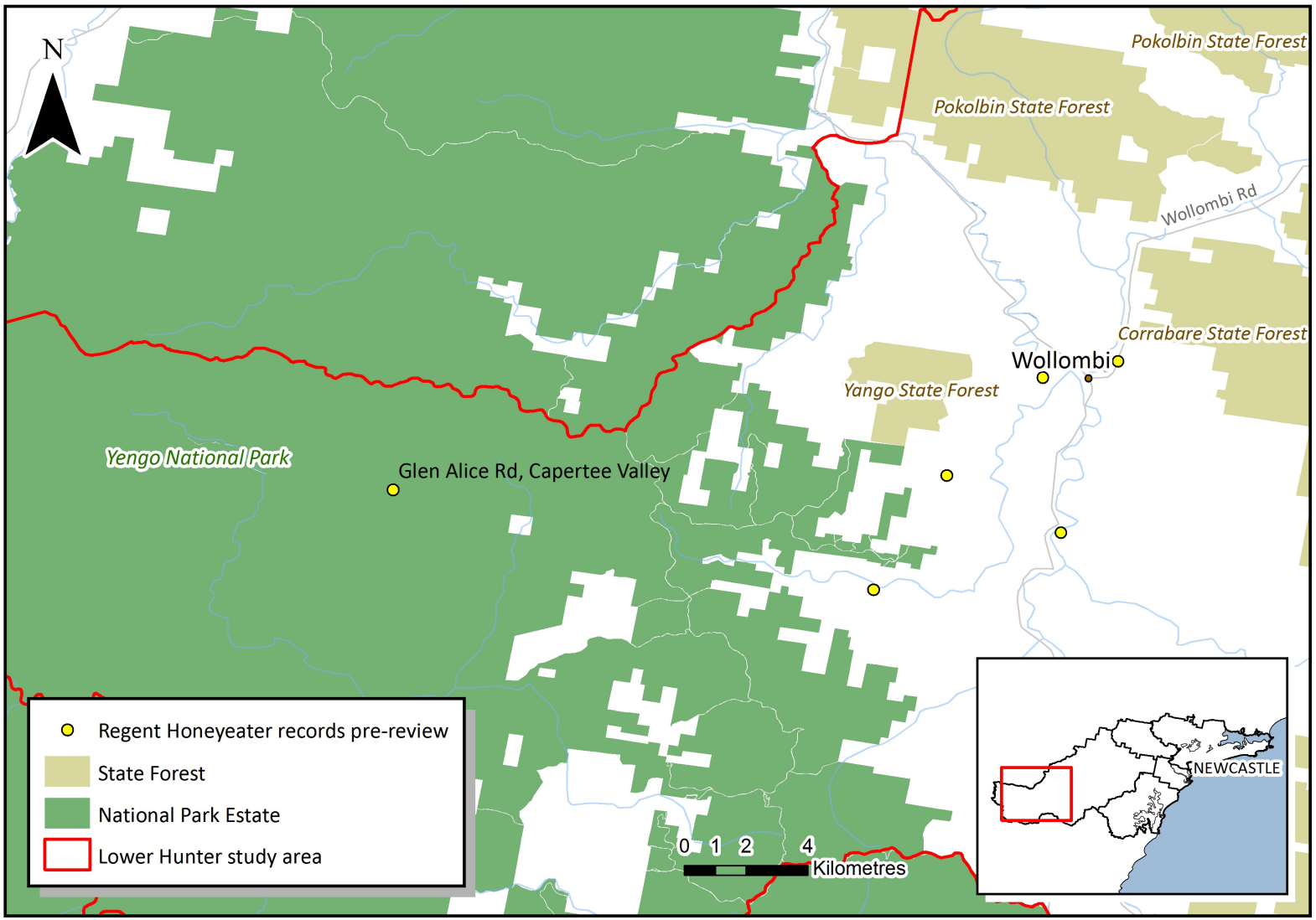


Figure 3: Example of an errant Regent Honeyeater record noted in the western end of the study area (note that when labelled it displays as being from Glen Alice Rd, Capertee Valley).

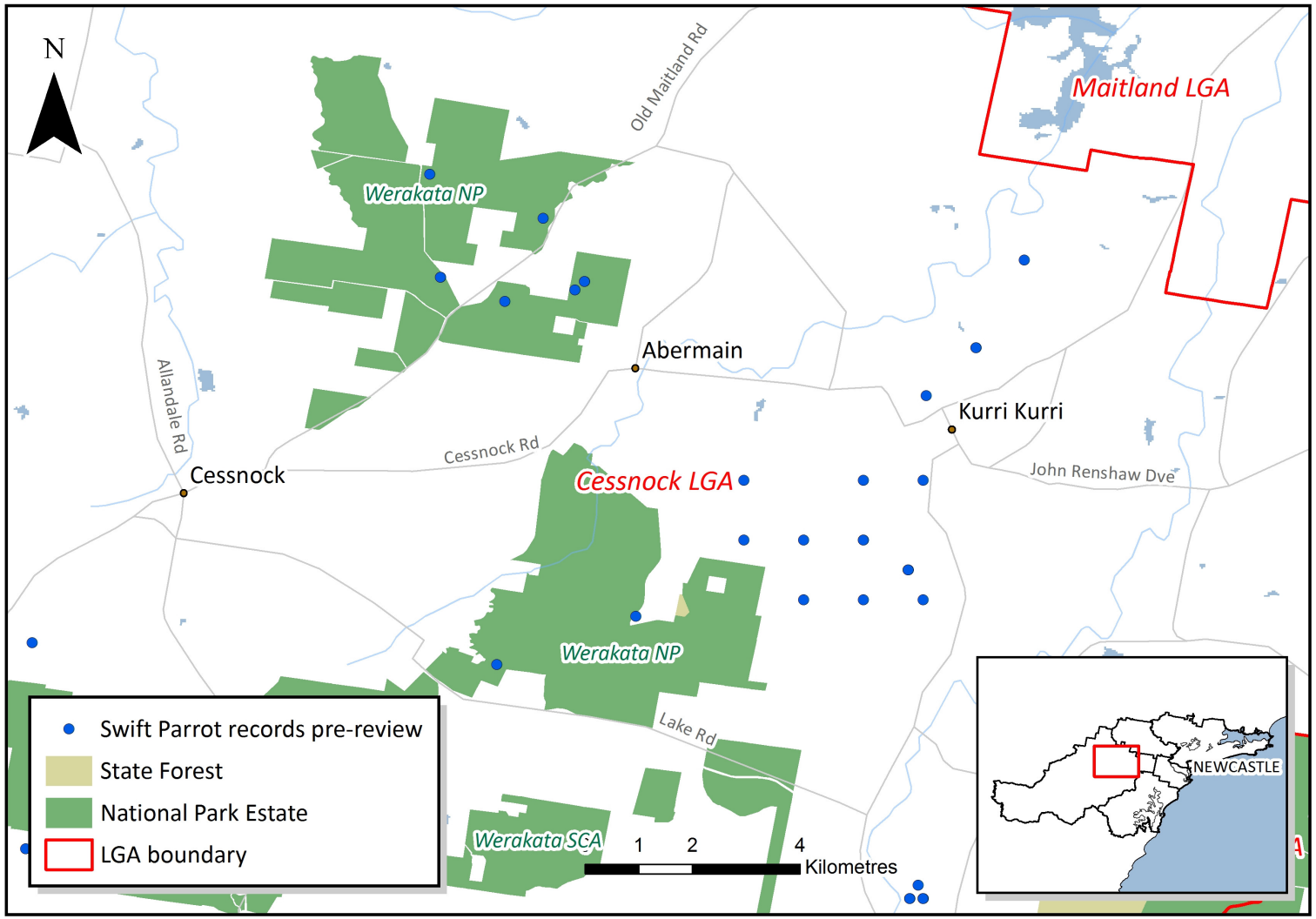


Figure 4: Inaccurate Swift Parrot records in the Cessnock LGA (note how they have been distributed in a grid fashion, suggesting serious accuracy issues). The location of these records has been clarified by consulting relevant publications and observers.

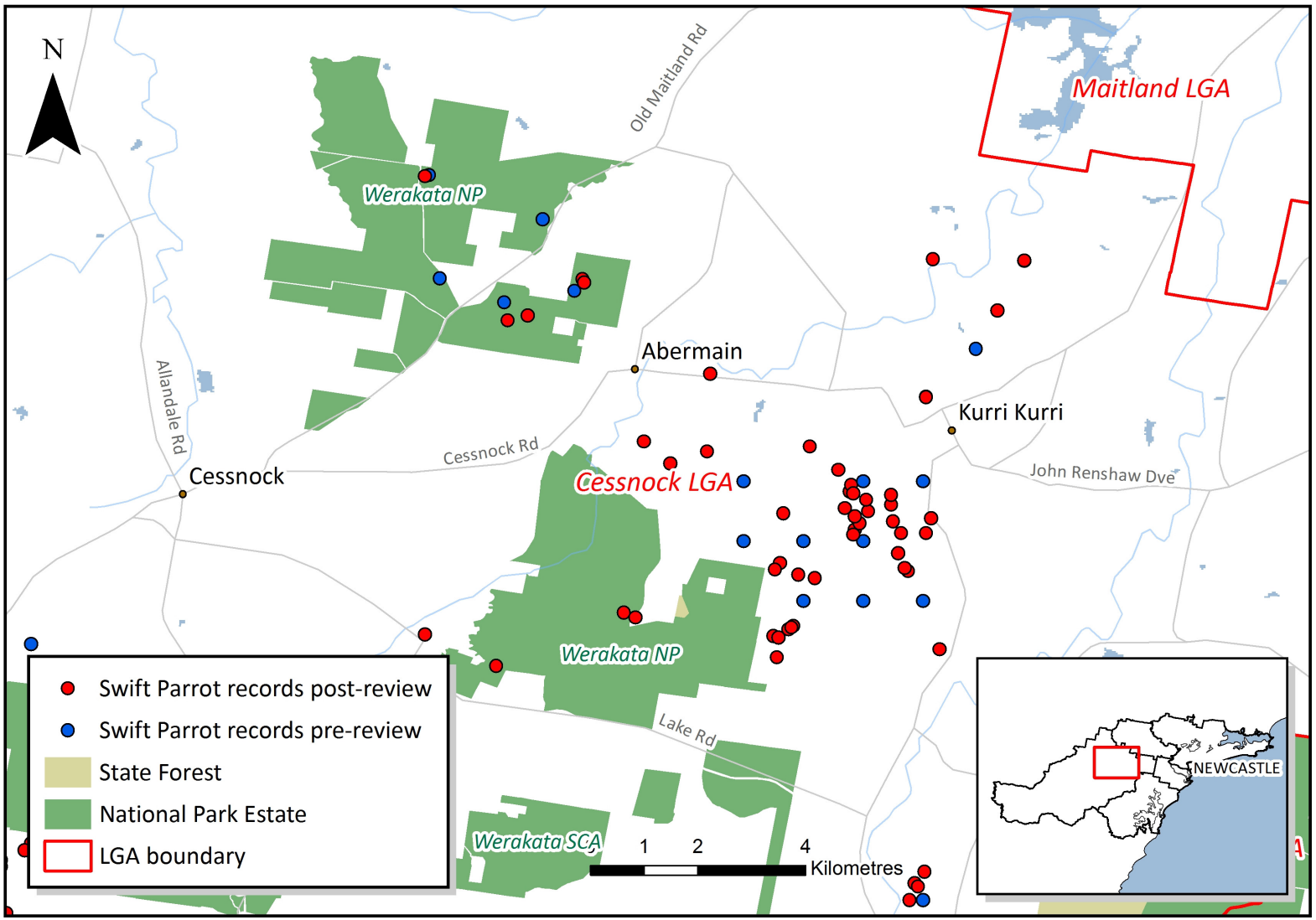


Figure 5: Records of Swift Parrots in the Cessnock LGA after the review process.

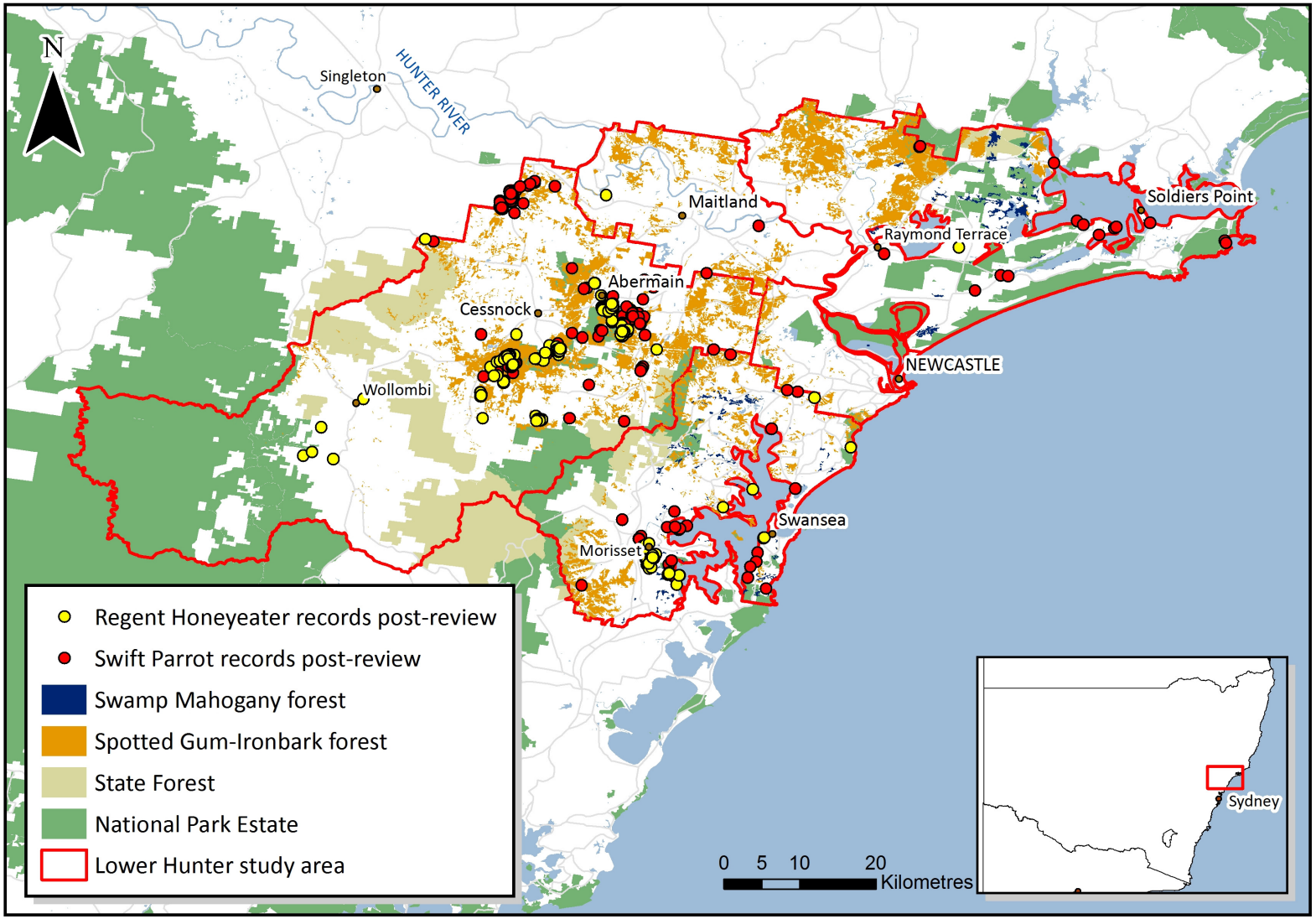


Figure 6: Records of Swift Parrots and Regent Honeyeaters showing identified priority vegetation types.

2.7 Summary of Literature and Data Review

Following the finalisation of the desktop analyses and data review, a final amended spreadsheet for each species was created and subsequently used at the habitat assessment and modelling stage as well as to inform land-use planning recommendations contained herein.

The key documents reviewed maintain that the habitats within the Lower Hunter study area are of high significance and importance to both Swift Parrots and Regent Honeyeaters. In the case of the latter, the habitat not only has been recognised as providing an important winter-forage / drought-refuge resource, but also provides ample opportunity for Regent Honeyeaters to breed, which indeed has occurred several times in recent years.

In terms of areas where records have been both ongoing and involving significant numbers of birds (e.g. >10 Swift Parrots and >1 Regent Honeyeater), the following could be construed from the assessment of available data as being the most important known areas (at a very broad scale only). The location of these important areas of habitat are shown in Figures 7 and 8 in Section 3 of the report.

For both species:

- Cessnock-Kurri Woodlands, comprising key sites at:
    - Hunter Economic Zone (HEZ)
    - Private properties at Quorrobolong
    - Pelton (Werakata State Conservation Area [SCA], Austar Coal Mine Land and surrounding private properties)
    - Kitchener / Abernethy (Werakata National Park [NP])
- Southern Lake Macquarie (western and eastern shores), comprising key sites at:
    - Morisset / Wyee Point
    - Swansea / Cams Wharf

For Swift Parrots predominantly:

- North Rothbury (predominantly the southern end of the Huntlee new township site)
- Parts of the Cessnock-Kurri woodlands (e.g. Werakata NP at Abermain / Nulkaba)
- Tilligerry Peninsula, Port Stephens (e.g. Lemon Tree Passage / Tanilba Bay)

For Regent Honeyeaters predominantly:

- Laguna / Murrays Run (Wollombi Brook catchment)

Other areas were noted as being significant but did not have ongoing records, such as privately-owned bushland south of Ellalong Lagoon where both species were recorded in 2012 (no prior records are known presumably due to access issues).

One of the obvious trends noticed in the literature available for review was the repeated emphasis on the greater Cessnock-Kurri woodlands, both in content of literature and in the

conclusions about the significance of the woodlands in that area to both species. It is possible that some other areas within the Lower Hunter could have been less well-studied and contain equally as significant habitat resources, as one of the key driving factors for the heavy weighting of "studies" done in the Cessnock-Kurri woodlands has been proposed developments in the area. These studies have been coupled with the fact that other vegetated portions of the Cessnock-Kurri woodlands were previously State Forest (and that are now under National Park estate) and have traditionally been used for recreational activities, including bird observation. However, it is considered that it is the habitat attributes of the Cessnock-Kurri woodlands that account for their significance to Swift Parrots and Regent Honeyeaters and indeed, other declining woodland birds.

Another obvious trend noted in the desktop assessment was the dominance of two "forest types" from which records were noted. These are the Spotted Gum-Ironbark dominated forests (particularly on valley floor areas) and the Swamp Mahogany forests of the coastal belt. Figure 6 shows the amended Swift Parrot and Regent Honeyeater records for the Lower Hunter overlaid on the current mapped distribution of these forest types.

2.7.1 Summary of Records within the Study Area Since 1992

Table 1 below provides a brief "snapshot" summary of the known occurrence of Swift Parrots and Regent Honeyeaters in the Lower Hunter each year since 1992. These records have been gleaned from various sources reviewed as part of this project as outlined previously (e.g. Recovery Team databases, OEH databases, HBOC records and personal communications).

Table 1: Summary Table of Records within the Study Area since 1992

Year	Swift Parrot	Regent Honeyeater
1992	100 birds in the Cessnock-Kurri area over 2 separate months	No records
1993	No records	15 birds in the Cessnock-Kurri area
1994	55 birds in the Cessnock-Kurri area	5 birds in the Cessnock-Kurri area
1995	30 birds in Cessnock-Kurri area, up to 10 birds in West Lake Macquarie	Up to 20 birds at East Lake Macquarie, 15 birds over 2 months at West Lake Macquarie. 2 birds in the Cessnock-Kurri area.
1996	<10 birds in Cessnock-Kurri area and at West Lake Macquarie	Single bird in Cessnock-Kurri area and up to 4 birds over 3 months in West Lake Macquarie
1997	50 birds in Cessnock-Kurri area, 25 at West Lake Macquarie	Up to 6 birds over 3 months in Cessnock-Kurri area and 15 birds in far west Cessnock LGA (with breeding recorded)
1998	Up to 200 birds in the Cessnock-Kurri area over 3 separate months	4 birds over 2 months at West Lake Macquarie and 8 birds in Cessnock-Kurri area
1999	6 birds in the Cessnock-Kurri area	No records

Year	Swift Parrot	Regent Honeyeater
2000	Recorded at numerous sites in the Cessnock-Kurri area over several months with up to 300 birds present. Also found in smaller numbers (up to 10 birds) in West Lake Macquarie.	Widely recorded over 4 months in the Cessnock-Kurri-Quorrobolong area with up to 63 birds at nesting recorded. 4 birds also in East Lake Macquarie
2001	8 birds in the Cessnock-Kurri area	No records
2002	Widely recorded within the study area with records from many sites in Cessnock-Kurri, West and East Lake Macquarie and several sites in Port Stephens. Maximum count in Cessnock LGA was 200 birds, in Lake Macquarie LGA 50 birds and Port Stephens LGA 120 birds. Likely to have been >300 birds in the study area	Up to 100 birds over 4 months at several sites in West Lake Macquarie, 8 birds at East Lake Macquarie and 4 birds in West Port Stephens
2003	Up to 10 birds over 2 months in the Cessnock-Kurri area and 10 birds in Port Stephens LGA	Up to 72 birds were in the Cessnock-Kurri area over 3 months with nesting recorded
2004	Single bird at West Lake Macquarie and 5 birds in the Cessnock-Kurri area	Single bird in Cessnock-Kurri area
2005	Up to 80 birds in several parts of the Cessnock-Kurri area and 5 birds in the Maitland LGA	3 birds over 2 months in the Cessnock-Kurri area
2006	Up to 5 birds over 2 months in the Cessnock-Kurri area	Up to 6 birds over 2 months in the Cessnock-Kurri area
2007	Widely recorded with up to 200 birds Up to 10 birds over 4 months in the Cessnock-Kurri area, up to 100 birds in East Lake Macquarie, 12 birds at West Lake Macquarie, 2 birds in Maitland LGA and 20 birds in Port Stephens LGA	Up to 50 birds in West Lake Macquarie and 40 birds over 5 months in the Cessnock-Kurri area with significant breeding event taking place
2008	Single bird in west of Cessnock LGA, up to 70 birds elsewhere in Cessnock-Kurri area and small numbers (<5) in East Lake Macquarie	Some birds still located at the Cessnock-Kurri breeding event, with up to 12 birds found later in the year elsewhere in the Cessnock-Kurri area
2009	Up to 25 birds over 3 months in the Cessnock-Kurri area	Up to 34 birds over 4 months at several sites in the Cessnock-Kurri area and 8 birds in the East Cessnock LGA
2010	5 birds in East Cessnock LGA and 2 birds in Cessnock-Kurri area	Up to 6 birds in the Cessnock-Kurri area and 3 birds in East Lake Macquarie

Year	Swift Parrot	Regent Honeyeater
2011	>100 birds in West Lake Macquarie and smaller numbers at other sites nearby and up to 24 birds in East Lake Macquarie and 2 birds in North Lake Macquarie LGA. 12 birds in Cessnock-Kurri area	Up to 15 birds in West Lake Macquarie over 4 months and a single bird in Maitland LGA
2012	Widely recorded at a number of sites within the Cessnock-Kurri area over 5 months, with likely 300 birds present during this time	Widely recorded and monitored at several sites in the Cessnock-Kurri area over 7 months of the year, with >100 birds likely (see below).
2013	Recorded thus far at 3 sites in the Cessnock-Kurri region at the time of writing (late May 2013)	Not recorded at time of writing (late May 2013)

2.7.2 Results of Monitoring of Subject Species within the Study Area in 2012

Concurrent with the review of previously collated data, there was a significant presence of both Swift Parrots and Regent Honeyeaters in the Lower Hunter. This was due to widespread flowering of Spotted Gum within the Cessnock-Kurri forests that saw an influx of nectivorous species in the area. The coastal forests did not produce any reports of either species, owing to the failure of the Swamp Mahogany trees to produce blossom. BA, along with volunteers from HBOC, undertook monitoring of these birds along with collecting records from other observers.

This monitoring showed that it was likely that more than 100 Regent Honeyeaters were present within the Lower Hunter during this time, representing potentially around 20-25% of the total known current population. Of importance, records spanned from mid-autumn (6th May) virtually until summer (28th November) and it is feasible that the species may have bred in the region but went undetected. Birds were distributed across seven main sites, which included two sites where the species had not been recorded previously. All sites were dominated by Spotted Gum-Ironbark forests. Refer to Roderick and Ingwersen (2012) for specific details.

Swift Parrots were also present in large numbers, recorded from mid-autumn (9th May) to mid-spring (26th September). It was estimated that between 200-300 birds were present in the Spotted Gum-Ironbark forests in the Cessnock-Kurri area during this time. A further approximately 100 birds were also present in Spotted Gum-Ironbark-Grey Box forests just outside of the study area north of the Broke-Cessnock Road.

2.7.3 Interim Results of Surveys within the Study Area in 2013

Searches for Swift Parrots and Regent Honeyeaters were carried out over the weekend of 18th/19th May within the study area as part of the national survey weekend co-ordinated by BA. Whilst no Regent Honeyeaters were found, up to 12 Swift Parrots were recorded in Werakata SCA near Pelton, within a broad location where they have been recorded in previous years on several occasions (M. Roderick pers. obs.). An unknown (but likely small) number of Swift Parrots were heard in the northern section of HEZ on the 17th May (S. Roderick pers. comm.) whilst 18 Swift Parrots were observed in the same vicinity on the 3rd

May (G. Masters pers. comm.).No blossom is apparent at any of these sites and birds were likely feeding on lerp.

2.7.4 Analysis of Threats to Subject Species

Although not reviewed in full as part of the desktop assessment, a number of threats to Swift Parrots and Regent Honeyeaters have been identified within the study area. Foremost, the historical loss and degradation of habitat for these species continues to place pressures on the local (and likely total) populations of both species. Both Swift Parrots and Regent Honeyeaters are "rich patch specialist" species that are dependent on high-yielding habitats on fertile soils, which have traditionally been the most cleared vegetation types in South-eastern Australia. Approximately 85% of Australia's temperate woodlands have been cleared since European settlement (Robinson and Traill 1996) and one in five obligate woodland bird species are now listed as threatened and up to one in four have been shown to be in decline (Ingwersen *et al* 2010).

Although wholesale clearing doesn't appear to be a major issue in coastal areas, the Swamp Mahogany forests are being increasingly fragmented by ongoing development along the NSW coast (with other associated pressures likely to result). Spotted Gum-Ironbark associations are under increased development pressures in areas such as many parts of the Hunter Valley, including the Lower Hunter. This is particularly so in the vicinity of Kurri Kurri (associated with HEZ), on privately owned land south of Ashtonfield and east of the Sugarloaf Range around Minmi-Wakefield, as depicted in development scenarios in the Regional Strategy. Incremental loss of habitat via smaller-scale developments will result in the further reduction of habitat available and will likely contribute to decreased mobility between larger patches of habitat. In general, the continued loss of habitat likely to occur as a result of identified development scenarios is likely to have detrimental impacts on Swift Parrots and Regent Honeyeaters.

Modified fire regimes are another threat that particularly impacts upon habitat in the Cessnock LGA. Rubbish dumping in the dry forests of the Cessnock LGA has been recognised as major problem facing land managers (NPWS rangers, pers. comms.) and in some cases the rubbish (including dumped vehicles) is set alight, resulting in a higher frequency of fires in the area. Arson has also been implicated as a problem. This contributes to the degradation of habitat in the area, as well as posing direct threats to birds themselves. It is worth noting that a large (200ha) fire burnt through the area within the HEZ where the majority of Regent Honeyeater nests were located during the 2007 breeding event in early January 2013.

Aggressive native species also pose a threat to the subject species. Direct observations have been made in the area by several observers (including the authors) of native species showing aggression towards both subject species, in particular larger species such as Rainbow Lorikeets *Trichoglossus haematodus* (towards Swift Parrots), Noisy Friarbirds *Philemon corniculatus* and Noisy Miners *Manorina melanocephalus* (to both species) as well as smaller species such as Fuscous Honeyeaters *Lichenostomus fuscus* (towards Regent Honeyeaters). Whilst this type of aggression is normally seen in a "natural" functioning environment, it is believed that the incidence (and hence impact) of such aggression has increased from some species over time, associated with the fragmentation of areas of habitat, making them more suitable to species that would not normally have been so prevalent. This is particularly true for Noisy Miners, and a Preliminary Determination has recently been made to list them as a Key Threatening Process (KTP) by the NSW Scientific Committee. Specifically, the KTP is titled "Decline in woodland and forest birds due to aggressive exclusion by abundant Noisy Miners" and it is considered that the processes leading to this determination apply to the Lower Hunter region.

3. HABITAT ASSESSMENT AND MODELLING

3.1 Habitat Assessments at Known Sites

Following the detailed review of extant records across the study area, a habitat pro-forma was created aimed at garnering the most important on-ground features of areas where Swift Parrots and Regent Honeyeaters had been recorded, including those listed below (See Appendix B).

- vegetation type and diversity
- dominant tree species and diversity
- land tenure
- site topography, aspect, gradient and elevation
- habitat patch size, connectivity and distance to edge
- shrub and ground layer cover
- mistletoe abundance
- availability of water
- site disturbance
- food resources

A sub-set of presence sites were assessed with emphasis placed on areas where multiple records had been noted in order to capture the most important habitat attributes. This was considered particularly important in areas where ongoing records were noted (i.e. those spanning several seasons), as opposed to sites that may have had a single cluster of records from one season.

A total of 69 sites of 2ha in size across the study area were assessed for selected habitat attributes between 22nd August and 25th September 2012. The following is a synthesis of the habitat data collected across all sites.

3.2 Vegetation Type and Diversity

Spotted Gum-Ironbark dominated open forest was the most common vegetation community, recorded at 47 (68%) of the habitat assessment sites. Swamp Mahogany dominated habitat was the next most common vegetation type recorded at 9 (13%) of the sites. The various vegetation types recorded at the survey sites is provided in Table 1 overleaf.

A feature of many sites that support Swift Parrots and Regent Honeyeaters in the Lower Hunter is the high level of tree species diversity. This is particularly the case for Regent Honeyeaters. At 34 (49.2%) of the habitat assessment sites, tree species diversity was recorded as high (four or more species). At 26 (37.6%) of the sites, tree species diversity was scored medium (three species) and only 9 (13%) sites recorded a score of low tree species diversity (only one or two).

Table 2: Vegetation Types at Habitat Survey Sites

Vegetation type	Number of sites	Percentage of sites
Spotted Gum - Ironbark dominated forest	47	68.1
Swamp Mahogany dominated	9	13.0
Grey Gum - Stringybark dominated	4	5.8
Grey Box dominated	2	2.9
Forest Red Gum dominated	1	1.4
Blackbutt - Smooth-barked Apple dominated	1	1.4
Red Gum – Narrow-leaved Ironbark dominated	1	1.4
(Highly modified)	4	5.8
Total	**69**	**100**

3.3 Dominant Tree Species and Diversity

A total of 24 tree species were recorded on habitat assessment sites (Appendix C). These mostly comprised species of the genus *Eucalyptus* (16 species) but also present was *Angophora* (3 species), *Corymbia* (1 species), *Syncarpia* (1 species) and *Melaleuca* (3 species).

Corymbia maculata (Spotted Gum) was the dominant overstorey species at 41 (60.2%) of the 69 habitat assessment sites. It was most commonly associated with *Eucalyptus fibrosa* (Broad-leaved Ironbark) and *E. punctata* (Grey Gum) which together make up the dominant species within the Lower Hunter Spotted Gum-Ironbark vegetation community that dominates some of the Cessnock-Kurri forested areas. *Eucalyptus mollucana* (Coastal Grey Box), and *E. crebra* (Narrow-leaved Ironbark) were also found in association with Spotted Gums, though to a lesser extent.

In coastal areas *E. robusta* (Swamp Mahogany) was the dominant tree species at 10 (14.7%) of sites assessed, though it was recorded at all but one of the non-disturbed sites within Lake Macquarie LGA.

The remainder of the sites supported vegetation communities dominated by various other Eucalypts including *E. tereticornis* (Forest Red Gum), *E. eugenioides* (Thin-leaved Stringybark) and *E. pilularis* (Blackbutt).

Given the history of extensive land clearing across the study area, and the degree to which much of the area has continued to suffer from high levels of disturbance and destructive land uses, much of the habitat available for Swift Parrots and Regent Honeyeaters is in a regenerative state. Therefore, at most sites the habitat exists as a relatively even-aged stand of young trees with few large trees present. Across all sites that were assessed for habitat attributes, the mean tree size was 29 cm diameter at breast height over bark

(DBHOB). Vegetation height at the majority of sites was also quite low given the young age of the trees. The mean height of trees across all sites was 15.6m.

3.4 Land Tenure

37 sites were on privately-owned land and 32 sites were on public land.

3.5 Site Topography, Aspect, Gradient and Elevation

Both Swift Parrots and Regent Honeyeaters are known for their preference to use richer and more fertile sites that are lower in the landscape and often along gullies or on lower slopes (Swift Parrot Recovery Plan; Regent Honeyeater Recovery Plan). Data from the habitat assessments confirm this with 27 (39.4%) sites being on lower slopes, 12 (17.3%) sites being mostly flat, 11 (16%) flat, 7 (10.1%) along creeklines and 5 (7.2%) in gullies. The remainder of the sites were flat with undulations (4.3%, n = 3), on a steep slope (4.3%, n = 3) or ridge (1.4%, n = 1).

Many of the habitat sites were flat and thus recorded a zero aspect score. For those sites with some topographic relief, most (18.8%, n = 13) had a northerly aspect, 13.5% (n = 9) had a westerly aspect and 10.1% (n = 7) had an easterly aspect.

Again for gradient, 24 (35%) of sites were flat with a zero gradient. However most sites (53.6%, n = 37) had a gradient slope of between 1-5 degrees. Habitat sites assessed ranged in elevation from 6m to 218m above sea level (ASL). Mean elevation of habitat assessment sites was 81.7m ASL.

3.6 Habitat Patch Size, Connectivity and Distance to Edge

Although both Swift Parrots and Regent Honeyeaters occur in a variety of landscape settings (e.g. large forest blocks, roadside vegetation, town reserves), they are both primarily considered to be open forest/woodland specialists. Data from the habitat assessments confirms this. Of the 69 sites assessed, 40 (60%) were in patches of forested habitat of ≥1000ha in size. Sixteen sites (24%) were in forested patches of 101-1000ha. Only two sites (2.9%) were in areas of <1ha.

In terms of habitat 'connectivity', sites were scored against the following criteria:

High = immediately adjacent or connected to intact bushland

Medium = connected to intact bushland via corridor or fragmented wooded areas

Low = isolated from other bushland areas

Of the sites that were assessed, 59 (85.5%) were scored 'high', 8 sites (11.5%) were scored 'medium' and two sites (3%) were scored 'low'.

'Distance to edge' was another habitat attribute measured and refers to the proximity of the site to the nearest forest edge (assuming the site was in a forest patch context). Most sites (35%, n = 24) were in the <25 m to the nearest edge category. Remaining sites (43.6%, n = 30) were mostly within 200m of the nearest edge.

3.7 Shrub and Ground Layer Cover

Neither Swift Parrots nor Regent Honeyeaters rely heavily on the low shrub layer or ground habitat components of any site where they occur, but data on habitat attributes such as

percentage shrub cover, percentage grass cover and percentage leaf cover were measured to assess if there was a preference for sparsely or densely shrubbed and/or grassed areas.

The assessment showed that 43.4% (n = 30) of the habitat sites comprised a low shrub layer of 10-20% ground cover. 35.8% (n = 24) of sites comprise a grass cover of 40-50%. This data suggests they occupied sites with a sparse low shrub/grass cover.

3.8 Mistletoe Abundance

Mistletoe is a recognised key habitat component for Regent Honeyeaters for a number of reasons (Regent Honeyeater Recovery Plan). Nests are often situated in the relatively dense foliage afforded by mistletoe clumps, the nectar they produce during flowering often provides a direct food source and they also attract a wide variety of insects which in turn form a major part of the diet of the Regent Honeyeater.

In terms of measuring mistletoe abundance, sites were scored against the following criteria:

High = >20 clumps per site

Medium = 5-20 clumps per site

Low = <5 clumps per site

Zero = no mistletoe

It was determined that 28 sites (40.5%) scored a 'medium' level of mistletoe abundance, 14 sites (20.2%) scored 'low', 12 sites (18%) scored 'high' and 15 sites (21.7%) scored zero mistletoe.

3.9 Water Availability

It is often observed that Regent Honeyeaters in particular have some connection to standing water at sites where they occur, such as dams, creeks, puddles (authors pers. obs.). Though the presence of standing water can vary significantly over the course of a year depending on season and recent rainfall, it was considered appropriate that some form of measurement be taken to record the availability of water at each of the habitat assessment sites. For the purpose of this study, 'proximity of water' was measured against the following criteria:

Very good = water usually available within quadrat.

Good = water usually available just outside quadrat.

Moderate = water available within or in proximity to quadrat but ephemeral.

Poor = no water available in the vicinity.

37 sites (53.7%) recorded a 'poor' score, 20 sites (29%) recorded a 'moderate' score, 10 sites (14.5%) recorded a 'good' score and 2 sites (2.8%) recorded a 'very good' score.

3.10 Site Disturbance

Habitat for Swift Parrots and Regent Honeyeaters throughout the study area is highly variable in terms of its condition and intactness. Both the amount and type of human disturbance at any given site can vary significantly between sites. At the habitat assessment sites in this study, past clearing was the most common form of site disturbance recorded at 34 (49.2%)

of sites, followed by vehicle track construction (33.3%, n = 23), fire (7.2%, n = 5), rubbish dumping (4.3%, n = 3), grazing (2.8%, n = 2) and others, such as erosion, (2.8%, n = 2).

3.11 Food Resources

Foliage insects and blossom; the two principal foraging resources used by Swift Parrots and Regent Honeyeaters in the Lower Hunter, were recorded on habitat assessments but are not considered useful data because the habitat assessments were made regardless of current conditions in terms of food availability. Foliage insects and blossom are both highly dynamic and somewhat unpredictable in their occurrence. This information was collected incidentally and not at all sites.

3.12 Modelling of Predicted Habitat

The predictive modelling in this report was conducted using MaxEnt v3.3.3k (Phillips *et al* 2006, Phillips and Dudik 2008, Phillips 2008). This method is being increasingly used as a means to model predicted areas of occurrence for species, and the strength of the software is that it has been developed specifically to deal with presence-only datasets. The software analyses species records in combination with a suite of user-defined environmental layers, providing a robust model showing areas of predicted occurrence.

Records of both Swift Parrots and Regent Honeyeaters were used after the data evaluation process. In order to make the modelling accurate to current vegetation and extent, only records from 1980 onwards were included in the analyses. Once the data were prepared for MaxEnt after the desktop review process, they were pared down to a simple set of coordinates (latitude and longitude in decimal degree format). A total of 250 Swift Parrot records and 262 Regent Honeyeater records were used.

A suite of 59 environmental layers were used in an initial run of Maxent (Appendix E), and were provided by CSIRO from a 250m (9 second) dataset (Williams *et al* 2010a; 2010b; 2012). However, many of these variables were considered too closely correlated and the results not representative of the true situation, so the final models produced and presented herein were the result of use of a sub-set of only 15 variables (highlighted yellow in Appendix E). These background environmental layers were clipped down to the boundary of the five Lower Hunter LGAs. Due to the apparent importance of vegetation to the occurrence of both species as determined by the desktop review and field assessments, it was deemed imperative that a layer for vegetation was incorporated into the environmental layers utilised by MaxEnt in at least one model (used to compare with a run of the model using only non-vegetation environmental layers). To do this the Greater Hunter Native Vegetation Mapping (Sivertson *et al* 2011) was used, with mapped vegetation within the boundary of the five LGAs merged together to create a study-wide vegetation layer. This was then modified into 250m x 250m grids in order to allow use in MaxEnt. During this process any 250m grids containing two or more habitat types, such as Yellow Bloodwood and Spotted Gum-Ironbark, were classified according to which habitat was predominant in that grid (e.g. if 80% of a grid cell was Spotted Gum and 20% Yellow Bloodwood, it was nominally assigned as Spotted Gum). This is a requirement of the MaxEnt program. MaxEnt was then run using standard settings as outlined in Phillips (2008).

3.13 Results of Habitat Modelling

In a broad sense, the results demonstrate what was suggested by the data review and desktop analysis, with vegetation being the environmental variable which contributed most to the output of the model when included in the environmental layers analysed by Maxent.

Vegetation was the variable contributing most to the results of both species' modelling, comprising 27% for Swift Parrot predictions and 23% for Regent Honeyeater results. Other factors that appeared to contribute included evaporation, humidity, minimum coolest temperatures and elevation. When vegetation was removed from the analysis, the biggest factors driving predicted species occurrence included those mentioned above - evaporation, humidity, and elevation. However, the overall result of the model didn't change dramatically, with key areas (covered later in this report) still falling well within areas of high value determined by both models. In this report, two versions of the model have been presented, one including vegetation and one without, which shows how the broader Maxent model can be refined and focussed when factors such as vegetation are considered (see Figures 7 and 8). Using these overlay models in conjunction with layers for land use, tenure, and urban growth boundaries would allow for easy identification of key parcels of land, while also allowing for determination of areas of recoverable habitat (e.g. the corridor between Huntlee and the Cessnock woodlands is a key predicted area for Swift Parrots and would be a worthy target of on-ground conservation initiatives aimed at restoring habitat).

Figures 7 and 8 provide overviews of the areas modelled to that provide the best available environmental and vegetation conditions for the two species across the study area. In order to show these areas of highest importance in the modelled results, thresholds values that best reflected the species known distribution were used to classify the images. For both species, this involved converting the Maxent output 'asci' file a raster in ArcMap, for display using a stretched colour ramp symbology. Figure 9 shows the practical application of this data layer for Swift Parrot habitat assessments in the Ellalong / Pelton / Kitchener area, whilst Figure 10 shows the practical application of this layer for Regent Honeyeater habitat in the vicinity of Morisset.

For the purposes of these maps, areas depicted as "High" are those which are likely to be important in terms of extant or potentially recoverable areas of habitat for the subject species, "Medium" are of less significance but also still potentially important in terms of buffers or supplementary habitat, whilst "Low" refers to areas shown by the modelling unlikely to be used or of importance to the subject species.

It is important to note that there are limitations to the modelled outputs and with knowledge of the localities one might notice that some areas containing less than optimal vegetation have been modelled as "high value" or where species are "likely" to occur. This is a caveat of any computer modelling used to determine predicted habitat for fauna species. Whilst every effort can be made to use the most relevant environmental variables in a model, the end result often predicts areas outside those expected (particularly more extensive than the key variables might otherwise suggest, such as vegetation). It is therefore recommended that the modelling be used a 'guide' to identifying the broad-scale priority areas of habitat only and that for specific area assessments that it be combined with fine-scale vegetation mapping and ground-truthing.

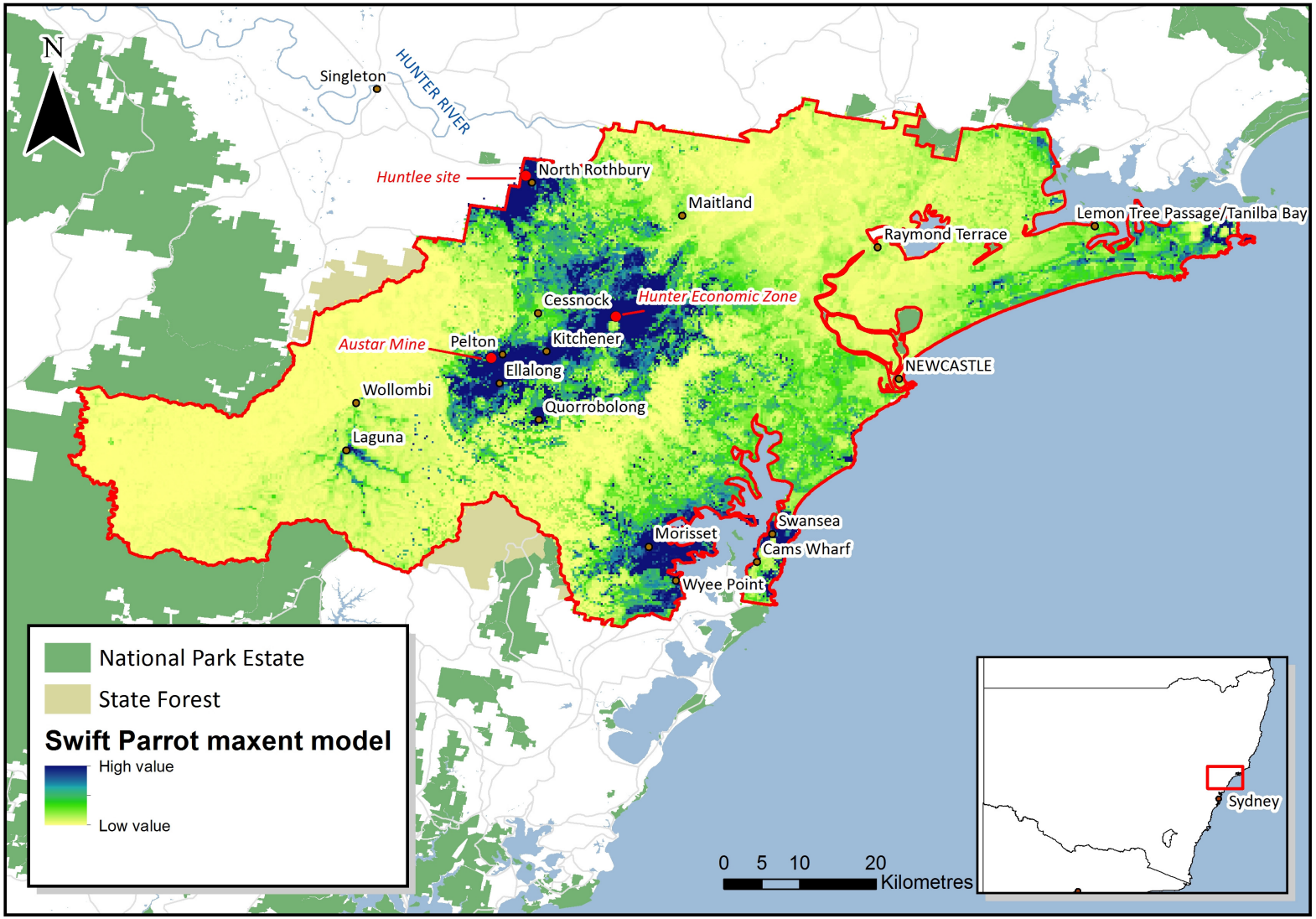


Figure 7: Modelling results across the study area for Swift Parrots.

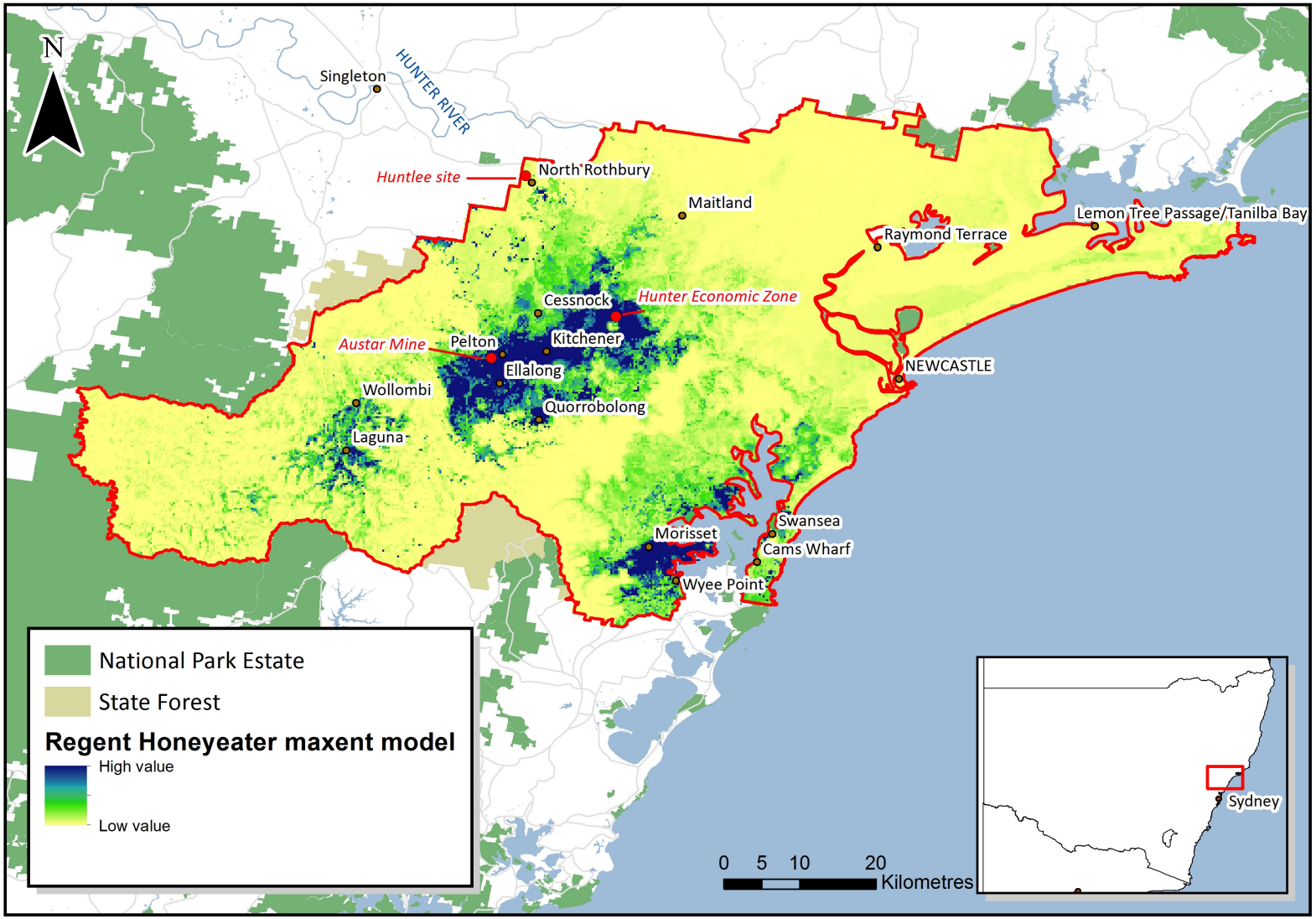


Figure 8: Modelling results across the study area for Regent Honeyeaters.

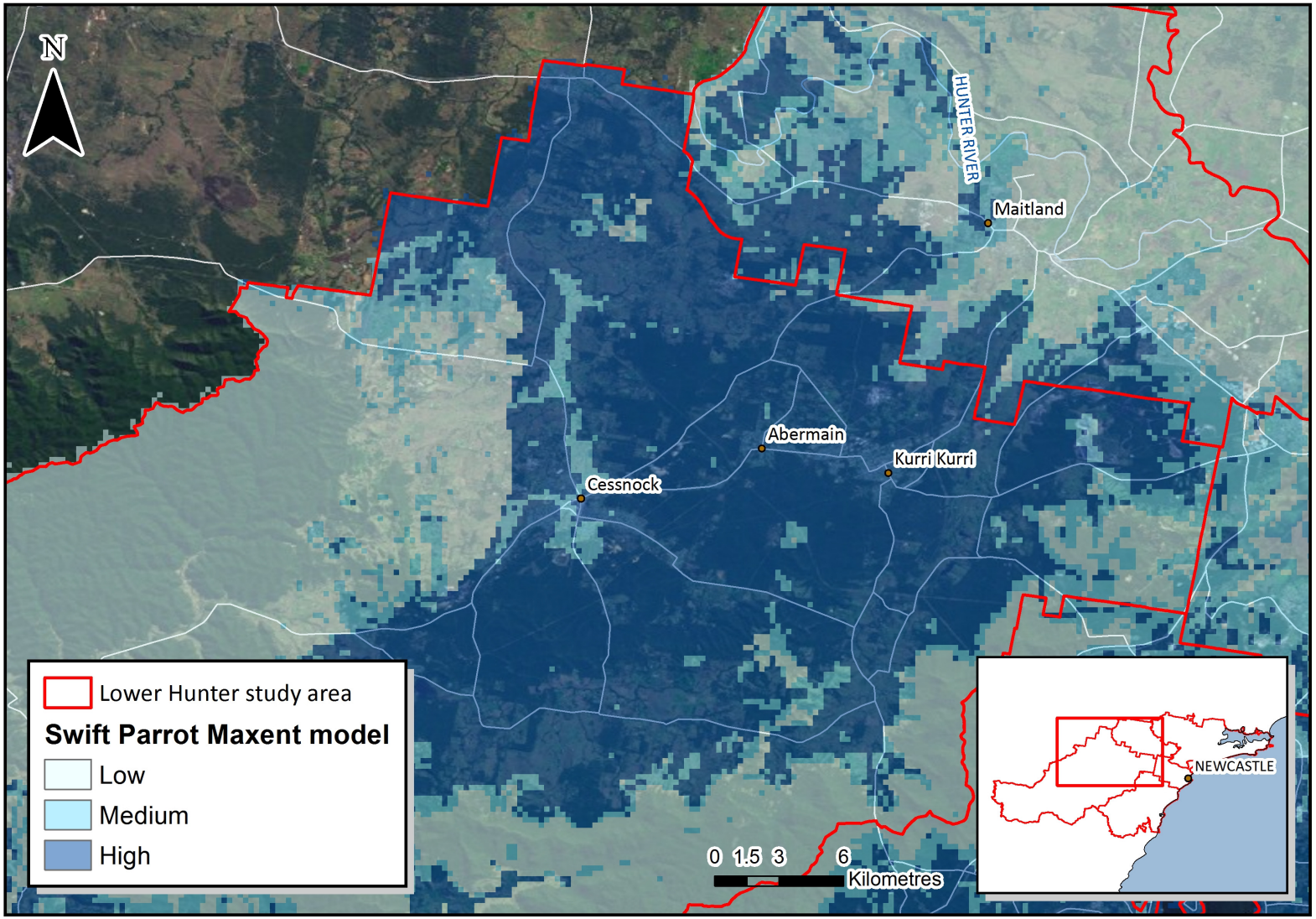


Figure 9: Modelling results for Swift Parrots in the Ellalong / Pelton / Kitchener area.

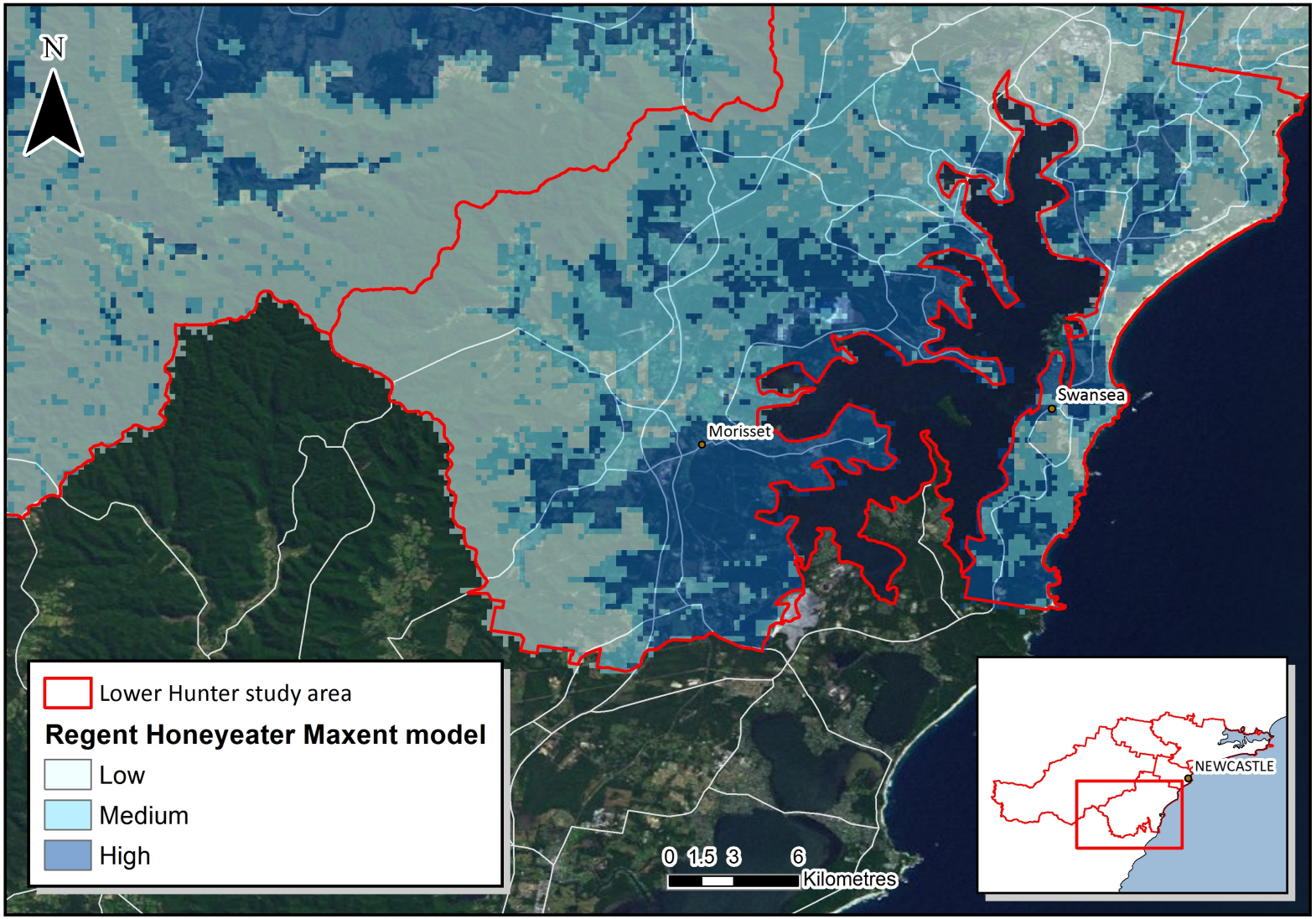


Figure 10: Modelling results for Regent Honeyeaters around Morisset.

4. STRATEGIC PLANNING INTEGRATION

4.1 Background

Two key planning documents were consulted during the study, being the **Lower Hunter Regional Strategy** (Department of Planning 2006) and the **Lower Hunter Regional Conservation Plan** (DECCW 2009).

The Regional Strategy is the key document that provides a blueprint for future development in the five Lower Hunter LGAs. It recognises that the key environmental challenges for the area are to accommodate significant population growth whilst:

- *protecting and managing the biodiversity and conservation values of the key green corridors of the Region; and*
- *maintaining or improving the biodiversity value of the Region.*

It recognises that:

> *"Much of the native vegetation remaining in the Region is of high conservation significance and provides habitat for numerous threatened species."* (p8)

The document was produced in 2006 for the period 2006 to 2031 and the intention was that it be reviewed every five years. The first review of the strategy is currently underway and although some minor amendments have been noted at this stage, such as additional residential releases, no significant major developments have been tabled. As such, for the purposes of this project, the scenarios outlined in the 2006 document have been used for review.

As a strategic document, the Lower Hunter Regional Strategy takes into account broader objectives within the State Plan. One of the notable objectives is for:

- *Better environmental outcomes for biodiversity and waterways.*

It is relevant to note then that there is a responsibility within the Regional Strategy to plan for better outcomes for biodiversity in the region.

The Regional Conservation Plan was written as the supporting document to the Regional Strategy in an attempt to ensure that significant biodiversity values were recognised and protected whilst taking into account the projected growth and development scenarios outlined in the Regional Strategy.

With regards to Swift Parrots, the Regional Conservation Plan states:

> *"The Lower Hunter forests within the Cessnock-Kurri Kurri-Branxton area are of state significance for the nationally endangered Swift Parrot as well as supporting a suite of typically western avifauna."* (p 17)

Reference to Regent Honeyeaters could also have been made in that sentence, although it is acknowledged that the report was written prior to the 2007 breeding event. However, it is noteworthy that the Regional Conservation Plan has recognised that the Cessnock-Kurri woodlands support a "suite of typically western avifauna". This provides a key to the woodlands significance to Regent Honeyeaters, given that they seem to have a preference for habitats on the western slopes when breeding (e.g. two of the three accepted "core" breeding areas [Chiltern, Victoria and Bundarra/Barraba, NSW] are west of the Great Dividing Range).

These same woodlands are known to support breeding populations of other threatened bird species more often associated with western habitats, such as Brown Treecreeper *Climacteris picumnus* and Black-chinned Honeyeater *Melithreptus gularis,* as well as housing a considerable diversity of Eucalypts (including undescribed *Eucalyptus* species known to be used by Regent Honeyeaters) and a perceived abundance of mistletoe.

> *"The Hunter Valley lowlands continue to be subject to high levels of threat from clearing, logging and other forms of degradation. The fauna species found in lowland forests are therefore particularly vulnerable."* (p 19)

West Lake Macquarie is also identified as an important part of the Lower Hunter to be targeted for conservation.

> *"…additional conservation areas in West Lake Macquarie are clearly the next highest priority for the future. DECC will be actively working to improve conservation of priority lands in the West Lake Macquarie area by improved conservation practices on other crown tenures, through private land partnerships or as the sites for conservation offsets."* (p. 32)

Although neither Swift Parrots nor Regent Honeyeaters are mentioned in the text, this study has established that this part of the Lower Hunter is of high importance for these species and it is appropriate that these areas were recognised in the Regional Conservation Plan.

The priorities afforded to the Cessnock-Kurri woodlands and West Lake Macquarie is consistent with recommendations herewith pertaining to Swift Parrots and Regent Honeyeaters in the study area.

4.2 Discussion of Strategic Planning for Subject Species

Broad-scale analysis of the modelling done to identify "hotspots" for Swift Parrots and Regent Honeyeaters clearly show two broad areas that have been identified as the most important for these species, being the Cessnock-Kurri woodlands and southern Lake Macquarie. Significant portions of these important areas were earmarked in the 2006 Regional Strategy for a variety of land-uses contrary to conservation objectives, predominantly as employment lands and urban release areas.

Other potentially important areas earmarked in the 2006 Regional Strategy were also included as employment lands, freight hub or proposed urban areas.

The most relevant of these are discussed below. Note that this analysis has been done using GIS layers provided by the NSW DPI which correlate with the Lower Hunter Regional Strategy Map (but that in some cases appear to be more "broadly depicted" on the maps than would be expected on the ground).

4.3 Development Scenarios in Known Habitat Areas

Hunter Economic Zone – HEZ

Mapped within the Regional Strategy as "Employment Lands" and rezoned to enable industrial development in 2002, the HEZ represents the most incongruous development proposal associated with important habitat for Swift Parrots and Regent Honeyeaters. Documentation and background information has been discussed elsewhere in this report (e.g. Saunders 2002; Biosis Research 2008). The HEZ and adjacent Werakata NP has been shown to be one of the most frequently-used areas in the Hunter Valley, and indeed the entire coastal belt of NSW, by both species in recent years and of critical importance, was the site of a semi-

communal breeding event by Regent Honeyeaters in 2007/2008. Virtually all of the known nest sites were on land zoned 4(h) Industrial (now "IN1").

It is considered that should this development proceed as proposed, significant impacts upon both species would likely result, particularly for the Regent Honeyeater with regards to loss of important breeding and foraging habitat. Such conclusions are supported by previous assessments carried out (e.g. Saunders 2002; Biosis Research 2008).

Below are two images provided by photographer David Miller taken during the 2007/2008 breeding event within HEZ.

Plate 1:

Regent Honeyeater tending to chick in nest within HEZ, January 1st 2008 (David Miller)

The species was not recorded nesting at other key breeding sites (such as the Capertee Valley) during that season.

Plate 2:

Regent Honeyeater fledgling being fed by adult within HEZ, January 5th 2008 (David Miller)

The ratio of fldedged birds to nests was considered to be high during this breeding event.

Refer to Discussion (Section 5) for more information pertaining to HEZ.

Huntlee New Town

A large proposed residential area near North Rothbury, previously discussed for its likely significance to Swift Parrots, given ongoing records from recent years. No records of Regent Honeyeaters have been confirmed to date, however the site contains suitable habitat. Despite the fact that a large area of bushland will be retained as a conservation reserve, significant areas of habitat known to be used by Swift Parrots (regularly in recent years) will be removed.

Kitchener

Residential release area of 115ha in size situated adjacent to one of the most notable sites for both Swift Parrots and Regent Honeyeaters in recent years (Kearsley South Fire Trail, Werakata NP). Parts of the land earmarked under the 2006 mapping include areas where Swift Parrots were recorded in 2012 and where Regent Honeyeaters were recorded in 2009. It also contains remnant Spotted Gum-Ironbark vegetation that have not been surveyed and that would provide habitat for these species in the vicinity of a known area of contemporary-used habitat.

Austar Mine

One of the key parcels of land in the study area is the Austar Coal Mine, south-west of Cessnock, owned by Yancoal Australia Pty Ltd. Land administered by the Austar Coal Mine is adjacent to Werakata SCA at Pelton and is predominantly forested and contains large tracts of Lower Hunter Spotted Gum-Ironbark forest, as well as patches of Forest Red Gum / Stringybark dominated vegetation. Along with HEZ and private properties at Quorrobolong, the Pelton / Ellalong area (including Austar land) represents one of the most frequented areas by both species, but in particular Regent Honeyeaters, with records showing that it is one of the areas where site fidelity is displayed.

In 2009, a significant number of Regent Honeyeaters (as well as Swift Parrots) were recorded in the Pelton / Ellalong area, including on Austar property during surveys conducted by (the then) Birds Australia and the (then) NSW Department of Environment, Climate Change and Water. Up to 50 Regent Honeyeaters were recorded during this time, but given the widespread nature of records noted once access was gained to the (Austar) private holdings, it is possible that higher bird numbers could have been present. It is worth noting also that both Swift Parrots and Regent Honeyeaters were again present in this area in the winter of 2012, with records spanning May to September and including behaviour that appeared to be consistent with pre-breeding activities (such as nest site evaluation) that was noted on Austar land.

Austar is also proposing longwall mining in other areas, such as beneath parts of Werakata SCA and in the Quorrobolong Valley, including parts of properties where ongoing records of both Swift Parrots and Regent Honeyeaters exist.

Hunter Expressway

The Hunter Expressway is nearing completion though it should be pointed out that some large areas of forested areas were cleared to make way for the freeway corridor. This included Spotted Gum-Ironbark dominated forests within and at the foothills of the Sugarloaf Range, as well as large tracts of habitat at Greta / Branxton that was similar to the Huntlee site and hence could have been important for Swift Parrots. Such large infrastructure projects are difficult to find alternatives for, but it is worth flagging that the Hunter Expressway did in

fact remove areas of habitat that could have been used by the subject species and will contribute to the further fragmentation of habitat within the Lower Hunter.

Morisset

A large expansion of Morisset township was flagged in the 2006 Regional Strategy. This has been projected to expand to the north and south of the current township, including areas where ongoing records of both Swift Parrots and Regent Honeyeaters have been noted. This area is considered to be particularly important for Regent Honeyeaters as it is an area that has been shown to be used regularly, including significant numbers (>100 birds) in 2002 and again in lower numbers (up to 15) as recently as 2011. The habitat type being used in this area is Swamp Mahogany-dominated forests and although this habitat occurs predominantly along drainage lines in this area (and hence would be conserved by default), it would likely result in many pressures associated with residential expansion being introduced to this key area.

4.4 Other Development Areas Overlapping with Potentially Important Habitat

Cessnock East

Proposed residential release area (approximately 100ha in size) situated immediately east of Cessnock (north of Aberdare). Although some of this area is degraded, it does contain habitat features (such as Spotted Gum-Ironbark dominated forests) and has been at least partly included within the "National Park Corridor" under the Cessnock BMP, thus forming part of a potentially important movement corridor for the subject species.

Bellbird Heights

Residential release area on mostly degraded land south and east of Bellbird. Past records exist for both Swift Parrots and Regent Honeyeaters on the site and therefore although degraded, should be recognised as supplementary habitat as a minimum.

Freight Hub

The area depicted as the "Freight Hub" in the 2006 Regional Strategy is the largest development area shown in the document and at 3266ha is a considerable size and spans three Council LGAs (Cessnock, Maitland and Newcastle). The majority of this area is vegetated according to available aerial photographs, though it is known that large areas have been cleared in recent years in this area for mining and light-industrial subdivision purposes (see Plate 3 for clearing as part of the Freeway Business Park, which is part of this broader area). Although only one record for Swift Parrots and no records for Regent Honeyeaters exist within this area, the vast majority of the land is private property (predominantly large mine holdings) and therefore access for observers has not been available (the Swift Parrot record was from a roadside near one of the large mine boundaries). However, the dominant vegetation type in this area is Spotted Gum-Ironbark Forest and given its proximity to the Cessnock-Kurri forests, it must be viewed as having high potential for both species to occur. At the very least it is likely that this area would serve as a corridor for birds moving from west to east in times when conditions in the coastal forests are more favourable.

Plate 3:

The Freeway Business Park in the extreme north-west corner of Newcastle LGA is a good example of large-scale clearing of potentially important habitat in an area where few large patches remain.

Black Hill

Land at Black Hill is zoned either as "Rural" (Cessnock) or "Environmental Living" (Newcastle) in areas dominated by Spotted Gum-Ironbark Forests and hence potential habitat for the subject species. Much of this area is actually encompassed by the broader "Freight Hub" area outlined in the 2006 Regional Strategy.

Minmi-Edgeworth

Large area (>1000ha) of bushland on the western edge of Newcastle LGA's developed area (and at the northern end of Lake Macquarie LGA) situated along the northern and southern sides of the Newcastle Link Road. Much of this bushland is Spotted Gum-Ironbark dominated and hence could provide preferred habitat resources for both of the subject species, although being situated on the eastern side of the Sugarloaf Range suggests that it may not be used as often as the Cessnock-Kurri forests. This could potentially serve as an important part of a corridor between these 'western woodlands' in Cessnock LGA and coastal forests.

A significant portion of this remnant is proposed for urban purposes and in March 2013, it was declared as a State Significant Site in Schedule 3 of State Environmental Planning Policy (Major Development) 2005 (the "Major Development SEPP"). The Concept Plan for the urban development (up to 3,300 dwellings and two mixed use centres) at Minmi, Newcastle Link Road, and dedication of 1,561 hectares of conservation lands, at Stockrington and associated infrastructure is currently being assessed by the DPI.

West Wallsend

Situated at the foothills of the Sugarloaf Range and proximate to the Minmi-Edgeworth development scenarios discussed above. This refers to a residential release area north of Barnsley and potential employment lands west of West Wallsend. Again, much of this area is dominated by Spotted Gum-Ironbark forests that could support these species and could also provide part of an important link between the Cessnock-Kurri forests and the coastal forests of Lake Macquarie.

Wakefield

A large area (>300ha) has been mapped as "Employment Lands" on the western side of Lake Macquarie in an area where mining has and is currently taking place. Closer to the lake, this includes areas of Swamp Mahogany-dominated forest and hence includes areas of potential habitat for Swift Parrots and Regent Honeyeaters.

Myuna Bay / Eraring

Similar to the Wakefield scenario, other large portions of land on the western side of Lake Macquarie at Myuna Bay and Eraring (totalling >1000ha) were mapped as "Employment Lands". These areas are likely to be associated with the existing mining and power station developments in those areas. However, there are patches of Swamp Mahogany-dominated forests therein and as such, potential habitat for Swift Parrots and Regent Honeyeaters exists on those parcels.

Wyee Point

Zoned 10(a) "Investigation" under the Lake Macquarie LEP 2004, this area to the west of the Wyee Point village has been under investigation for residential subdivision for many years and has been the site of several Swift Parrot and Regent Honeyeater sightings in the Swamp Mahogany-dominated forests therein. Recent information from Lake Macquarie City Council reveals that the entirety of the Swamp Mahogany forest has been proposed for environmental protection zoning. Urban encroachment on the preferred habitat for the subject species could have a detrimental impact upon the viability of the habitat though, particularly for Regent Honeyeaters.

Wyee Township

Both proposed residential and employment lands exist within areas containing Swamp Mahogany-dominated forests around Wyee township and on the nearby power station associated land at Wyee / Mannering Bay. Although no records of either species have been noted here, suitable habitat exists and there have been previous records from nearby Wyee Point (refer to comments under Lake Macquarie City Council planning instruments).

Wallarah Peninsula

A very large residential release area (>600ha) was included in the original 2006 Regional Strategy, with subsequent legal proceedings in the NSW Land and Environment Court. Although much of the site is / was proposed for conservation, some areas containing potential habitat for the subject species (both Spotted Gum-Ironbark and Swamp Mahogany-dominated habitat) would likely be removed. Furthermore, an isolated area north of Cams Wharf (where Swift Parrot records exist) has been mapped as "Employment Lands" and is zoned for "General Business" under Council planning instruments. This area contains potential habitat in the form of Forest Red Gum-dominated forests.

Belmont

A small area of approximately 10ha immediately adjacent to the existing Belmont TAFE complex has been mapped as "Employment Lands". This is Swamp Mahogany forest and therefore should be recognised as providing potential habitat for the subject species (and a single past record for Swift Parrots exists from the site). Another small area of Spotted Gum-Ironbark forest overlaps with another mapped "Employment Lands" to the north-west of Belmont.

Thornton

This refers to a residential release area where an isolated remnant of Lower Hunter Spotted Gum / Ironbark Forest exists. Although no records for either species have been noted from here, it must be viewed as providing some potential habitat, in particular for mobile Swift Parrots.

North Raymond Terrace

Large area (>500ha) slated for residential development on the northern edge of Raymond Terrace known as the "Kings Hill" development. This is the only part of Port Stephens Council that has been zoned under the Standard Instrument, although the area is slightly different to that depicted in the Regional Strategy (with the Standard Instrument zoned area overlapping with much more vegetated areas than the Regional Strategy originally depicted). Although no records for either of the subject species exist from this area, it does contain some Spotted Gum-Ironbark-dominated forested areas and hence should be viewed as providing some potential habitat. It is likely that this area has also been under-surveyed given that it is on private property.

Karuah

Small (<50ha) area south of the township of Karuah earmarked as a residential release that has potential for Swift Parrots to occur given that Swamp Mahogany-dominated forests occur and likely other important trees such as Forest Red Gums. Swift Parrots have been recorded in other parts of Karuah previously.

Other

Other development scenarios on land with forest types not generally preferred by the subject species (but that could provide occasional habitat for in particular Swift Parrots) or that may affect very small parcels of preferred habitat, also exist at Tanilba Bay, Medowie, Fennell Bay, Heddon Greta and Jewells.

Furthermore, since the publication of the 2006 Regional Strategy, BA have become aware that some of these scenarios have changed. For example, land at Paxton that was originally included within the Regional Strategy as urban release has now been shelved, but with a significant conservation outcome still achieved by the purchase of Ellalong Lagoon as an offset for the proposed 4th coal terminal (by Port Waratah Coal Services).

4.5 Council Planning Instruments and Other Relevant Documents

Various relevant planning instruments at the Council level were consulted for each LGA, as summarised below. Each is available on the relevant Council website at the links provided in the Reference section to this report.

Amended Local Environmental Plans have been prepared in accordance with the Standard Instrument (Local Environmental Plans) Order, 2006.

Lake Macquarie

- Local Environmental Plan (2012). The draft 2012 LEP is now on public exhibition.

Newcastle

- Local Environmental Plan (2012). The amended LEP was gazetted on Friday 15 June 2012 and replaces the 2003 version.

Port Stephens

- Local Environmental Plan (2013). The Draft Port Stephens LEP was adopted by Council on the 26 March 2013..

Cessnock

- Local Environmental Plan (2011). The amended LEP was gazetted on Friday 23 December 2011 and replaces the 1989 version.

Maitland

- Local Environmental Plan (2011). The amended LEP was gazetted on Friday 16 December 2011 and replaces the 1993 version.

Traditionally, (7)-grouped zonings were afforded to environmental protection and management and (8)-grouped zonings applied to formally reserved areas such as national parks. Under the new Standard Instrument, the following objectives apply to Environmental Protection zonings.

- **Zone E1 – National Parks and Nature Reserves**
- **Zone E2 – Environmental Conservation**
- **Zone E3 – Environmental Management**
- **Zone E4 – Environmental Living**

Zone E1 – National Parks and Nature Reserves

Objectives of zone:

- *To enable the management and appropriate use of land that is reserved under the National Parks and Wildlife Act 1974.*
- *To enable uses authorised under the National Parks and Wildlife Act 1974.*

Zone E2 Environmental Conservation

Objectives of zone:

- *To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.*
- *To prevent development that could destroy, damage or otherwise have an adverse effect on those values*

Zone E3 Environmental Management

Objectives of zone:

- *To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.*
- *To provide for a limited range of development that does not have an adverse effect on those values.*

Zone E4 – Environmental Living

Objectives of zone:

- *To provide for low-impact residential development in areas with special ecological, scientific or aesthetic values.*
- *To ensure that residential development does not have an adverse effect on those values.*

Whilst it is largely beyond the scope of this study to make comment on the adequacy or otherwise of LEPs in protecting important habitat areas for the Regent Honeyeater and Swift Parrot, some important habitat areas are protected in E1 National Parks and Nature Reserves zone (e.g. Werakata NP) or in E2 Environmental Conservation zones (e.g. Swamp Mahogany Forests along the coastal zone). However, it is feasible that many of the objectives of the various environmental protection zonings are either not being met or have not taken into consideration the significance of some areas for these species. Some previous planning decisions have been made to rezone land that resulted in poor outcomes for the subject species. This is exemplified by HEZ (e.g. HEZ DCP E.6 2006 – incorporates the Environmental Management Strategies, including Habitat Management Strategy), which has been discussed elsewhere.

There are clear examples where some LEPs in the region could be utilised to provide increased protection for Swift Parrot and Regent Honeyeater habitat. A good example is within Cessnock LGA, where 107,138 hectares of RU ("Rural") zoned land occurs, of which 71,615 hectares has been mapped as containing woody native vegetation under OEH vegetation mapping. This means that 67% of current mapped native vegetation within the Council area, including important habitat areas for the subject species is zoned for rural land-use. Where important habitat exists for these species, areas could be rezoned for environmental protection (eg. Zone E2 or E3).

4.6 Relevant Strategic Council Documents

The following list of strategic documents relevant to land-use planning for significant biodiversity features such as Swift Parrot and Regent Honeyeater habitat has been compiled. In some instances the content has been expanded.

4.6.1 Maitland

Maitland City Council Greening Plan (2002)

This plan includes brief outlines of biodiversity issues within the Maitland LGA and an Appendix containing more specific information pertaining to biodiversity in the area. No specific mention is made for the subject species apart from appearing in a list of threatened fauna in Appendix 6.

Recreation & Open Space Strategy (2004)

Although biodiversity is not included in the document it could be relevant to some areas containing potential habitat.

4.6.2 Port Stephens

Port Stephens Planning Strategy (2011)

This strategy incorporates components of the Regional Strategy and Regional Conservation Plan as well as highlighting the significant biodiversity features of the Port Stephens LGA.

> *"The PSPS builds on the extensive conservation framework of the LGA, including the Green Corridor, the Port Stephens Great Lakes Marine Park, and the National Park Estate. It seeks to establish conservation priorities in order to reduce uncertainty and to provide an optimal balance between development and biodiversity."* (p.2)

4.6.3 Lake Macquarie

Biodiversity Planning Policy and Guidelines for (LEP) Rezoning Proposals (2012)

This policy outlines Lake Macquarie City Council's policies for rezonings with specific reference to biodiversity. Within the objectives it pre-empts the possible impacts upon biodiversity where it is stated that:

> *"It aims to ensure that biodiversity issues are considered and resolved early in the land-use planning process"* (p.2)

Draft Lifestyle 2030 Strategy (2012)

This document updates the 2020 Lifestyle Strategy that listed as the first of its "strategic directions" for Lake Macquarie City to be a city that "protects and enhances its biodiversity". The 2020 strategy also established a Green Systems Map to act as the basis of a strategic approach to biodiversity. A "Biodiversity Background Technical Report" underpins the 2030 strategy and identified the need for a Council Biodiversity Strategy that would include:

- *Analysis of data gaps and determine which aspects or indicators of biodiversity should be measured into the future*
- *Setting management priorities and desired outcomes*
- *Establishing management programs, including rehabilitation goals, data collection and collation, monitoring etc*
- *Data collection, maintenance of databases' data collation and monitoring*
- *Improved management of important habitats such as old growth forest and woodlands, sandy beaches and seagrass*
- *Retention and improvement of ecological connectivity*
- *Improved management of biodiversity on private land*
- *Rehabilitation strategies and targets*
- *Bushfire and weed management* (p.9)

Draft Plan of Management for Community Land (2011)

This draft plan is aimed at planning for the management of Council owned and managed areas. The core objectives listed in the plan under "Natural Areas" are:

> *(a) To conserve biodiversity and maintain ecosystem function in respect of the land, or the feature or habitat in respect of which the land is categorised as a natural area, and*
> *(b) To maintain the land, or that feature or habitat, in its natural state and setting, and*
> *(c) To provide for the restoration and regeneration of the land, and*
> *(d) To provide for community use of and access to the land in such a manner as will minimise and mitigate any disturbance caused by human intrusion, and*
> *(e) To assist in and facilitate the implementation of any provisions restricting the use and management of the land that are set out in a recovery plan or threat abatement plan prepared under the Threatened Species Conservation Act 1995 or the Fisheries Management Act 1994.* (p.20)

Newcastle–Lake Macquarie Western Corridor Planning Strategy (2010)

This document deals with the corridor of largely vegetated areas at the foothills of the Sugarloaf Range on the western and north-western edges of Newcastle and Lake Macquarie Cities respectively. It applies to the areas previously discussed under Minmi / Edgeworth, Black Hill, West Wallsend and Wakefield within the areas mapped under the 2006 Regional Strategy.

Other documents

Lake Macquarie City Council also has its own Flora and Fauna Assessment Guidelines (2012) and is also currently drafting an environmental offsets policy (R. Economos pers. comm.).

4.6.4 Newcastle

Newcastle Biodiversity Strategy (2006)

This document outlines the significant biodiversity features of Newcastle City Council LGA and proposes to be the first step in having biodiversity issues recognised "as an important and integrated part of decision-making, especially in relation to strategic land use planning". There is reference to Swift Parrots and Regent Honeyeaters in the list of threatened fauna for the LGA.

Newcastle–Lake Macquarie Western Corridor Planning Strategy (2010)

See above.

4.6.5 Cessnock

Cessnock Biodiversity Management Plan (BMP)

Strategic "map" produced by the Department of Environment, Climate Change and Water (now OEH) using "Biodiversity Forecasting Tools" to highlight the components of Cessnock LGA's significant biodiversity issues that required the most attention and on-ground action

(with a view to informing stakeholders of key issues). It recognised "Woodland Birds" as being a potential "Landscape Facilitation Project", with the following text:

> ***Objective**:*
>
> *Identify & facilitate protection & restoration of priority woodland bird habitat. There are a number of threatened woodland birds occurring in the study area, including the Regent Honeyeater, Swift Parrot, Brown Treecreeper, Grey-crowned Babbler, and the Turquoise Parrot. The effective conservation of these species is dependent upon effective implementation of the landscape conservation plan.*
>
> ***Broad actions required:***
>
> *Targeted survey, community awareness and education, liaise with landholders, implementation of on-ground threat abatement and habitat restoration.*
>
> ***Sample existing and recent recovery action:***
>
> ** NSW Nature Conservation Trust collaboration project with Birds Australia covenanting private properties that provide habitat for threatened and declining woodland birds.*
>
> ** Hunter-Central Rivers CMA collaboration with Hunter Bird Observers Club on an educational program focussing on threatened and declining woodland birds of the Cessnock-Kurri area.*
>
> ** Birds Australia national recovery efforts for woodland birds via the "Woodland Birds for Biodiversity" program, including surveys for the nationally endangered Swift Parrot and Regent Honeyeater.*

The Cessnock BMP is considered to be a very good model for "strategic biodiversity conservation" and is supported for identifying the area's importance to Swift Parrots and Regent Honeyeaters.

Cessnock City Council is currently drafting a Biodiversity Strategy (I. Turnbull pers. comm.) and has adopted the Lower Hunter Central Coast Regional Environmental Strategy Flora and Fauna Survey Guidelines (2002) for impact assessment purposes.

4.7 Role of Impact Assessment in Planning for Appropriate / Protection Management of Habitat

Adequate environmental impact assessment is a cornerstone of effective decision-making in the planning process. BA has concerns about how planning processes can be affected by inadequate impact assessment with some obvious examples in the study area noted. Under Part 4 and Part 5 of the NSW *Environment Protection and Assessment Act 1979* the onus of environmental assessments is placed on Councils and other determining authorities (such as OEH) when potential environmental impacts are considered in the assessment process. Several issues can arise during the assessment process that can influence decision-making including, resourcing of Councils and government agencies, competence and resourcing of proponents / consultants, and the level of information and data available. Also, there is a difficulty in taking potential cumulative impacts into account when projects are assessed on an individual basis.

This report aims to provide a comprehensive and contemporary report on the conservation status and identification of important areas for Swift Parrot and Regent Honeyeater in the

Lower Hunter, to provide relevant and landscape-scale information to support effective planning decision-making.

The best example of this in the context of Regent Honeyeaters and Swift Parrots in the study area is a recent Development Application for a proposed development within the HEZ site (RPS Australia East Pty Ltd 2012). This area has been recognised as being of national significance to Swift Parrots (e.g. Saunders 2002) and Regent Honeyeaters (e.g. Biosis Research 2008, Roderick and Ingwersen 2012) with the latter being the site for a well-known breeding event in 2007, which was the largest known breeding event for the species in that spring/summer (D. Geering pers. comm.). The information presented to Cessnock City Council reads:

> *"This species was not recorded within HEZ during the formal ECMP fauna surveys (see HSO 2004); however, the species was addressed due to two Atlas of Wildlife records within the HEZ both within the 4(h) zone in the northern section of the site. Subsequent to the ECMP surveys, the Regent Honeyeater has been recorded within the HEZ on at least two occasions and breeding of the species has been recorded within the adjacent Werakata National Park. Within HEZ, the Regent Honeyeater was recorded during Swift Parrot surveys conducted in July 2005. This record was of a single bird within a Spotted Gum tree in an ecotonal area between KSSW to LHSGIF in the north-eastern corner of the 4(h) zone, within DECC Deferred Conservation Area No.7. In 2007 RPS Ecologists recorded a single Regent Honeyeater within the edge of Hunter Lowland Redgum Forest and adjacent to the 7(b) corridor and the Spine Road. It appears that the species has been recorded several times within the HEZ area between 1993 and 2000 and more recently in 2007, in numbers of up to 15 individuals. It is considered likely that this species is an irregular visitor to the HEZ during appropriate periods (such as the winter flowering of tree species such as Corymbia maculata and Eucalyptus tereticornis). No nesting records exist from within the HEZ, although nesting attempts have been made by the species within the adjacent Werakata National Park (Biosis Research pers. comm)."* (p.37)

This Development Application has not considered all available information for the HEZ site and understates the significance of the HEZ by not taking into account many known and recent records of the species therein, which shows that the area is used frequently. For example, the report should have included all available information, such as records of Regent Honeyeaters in the area (including 20+ birds in an area only 1km to the south) during winter 2012, available records of nesting within the HEZ and reports that identify use of the site by at least 26 birds. The statement that "no nesting records exist from within the HEZ" is of most concern as it demonstrates a lack of research or access to available information. The reference to "up to 15 individuals" is also erroneous and understates the importance of the site, which was known to support at least 26 individuals (Biosis Research 2008) but likely closer to 40 birds in 2007/08 (Stuart 2008; D. Geering; A. Morris pers. comms.).

It is very important that the latest information is provided to local councils and other decision makers, as well as to those undertaking environmental impact assessments of proposed developments in the region. It is also appropriate that survey guidelines for EPBC Act-listed threatened bird species (DEWHA 2010) be followed when surveying for Swift Parrots and Regent Honeyeaters in the area and that appropriate local guidelines for assessment are developed and implemented. For example, Lake Macquarie City Council's Flora and Fauna Survey Guidelines recognises that specific effort should be made to survey for Regent Honeyeater and Swift Parrot during winter months and that emphasis on summer surveys would overlook these species. While containing generally accurate and current information, these guidelines could be further improved by noting that Swift Parrots may also be detected

in the region in September, that Regent Honeyeaters may be detected at any time of the year and that Regent Honeyeaters should not be listed under the JAMBA agreement.

4.8 Comment on Offsetting Principles

Appendix 1 with the Regional Conservation Plan outlines the State government's offsetting principles. Three of the thirteen principles are copied below.

1. Impacts must be avoided first by using prevention and mitigation measures. Offsets are then used to address remaining impacts.

- *Clearing or development can only proceed where offsets (and conservation actions) improve or maintain biodiversity.*

6. Offsets should aim to result in a net improvement in biodiversity over time

10. Offsets must be targeted – they must offset impacts on a like-for-like or better basis

In terms of Regent Honeyeaters and Swift Parrots, it is considered that these three principles may not have been fully taken into account in the decision-making process, with particular reference to the HEZ as an example. The Concept Plan for Precinct 1 Subdivision, Pelaw Main By-Pass, and Station Street Extension (Major Project 07_0128) was approved on 28 April 2009. In the first instance, those areas that have been shown to be used by both species on an ongoing basis, and in particular those areas that have not only been frequented by Regent Honeyeaters but where they have also bred, should be avoided where practical prior to the consideration of mitigation measures and/or offsetting.

A monetary offset for Regent Honeyeaters as part of the approval for Precinct 1 of HEZ was stipulated by the then Department of Planning (following recommendations from OEH). This is a good example of a monetary offset being required because there was no like-for-like habitat available for offsetting purposes. In any case, it is considered that habitat that has been used by Regent Honeyeaters as a site for a semi-communal breeding event should be avoided. It is not clear how a monetary offset (which is still yet to be provided) would benefit Regent Honeyeaters (and biodiversity) such that there would be an improvement or maintenance of biodiversity.

The Australian Government also lists ten principles in its *EPBC Act* Environmental Offsets Policy (DSEWPaC 2012). Amongst these principles, the policy states that suitable offsets must:

"deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action."

It also states that in assessing the suitability of an offset, government decision-making will be:

"informed by scientifically robust information and incorporate the precautionary principle in the absence of scientific certainty."

Again, in relation to HEZ these principles have not been fully taken into account. The improvement or maintenance of the viability of habitat for Swift Parrots and Regent Honeyeaters on that site is highly unlikely to occur as a result of development of the area. Furthermore, whilst much information does exist for the area (e.g. the ECMP) there is little in

the way of "scientifically robust" information for the subject species and the vast majority of records for both have been a result of incidental observations or short-term monitoring of birds after such observations have come to light. BA recognises that to gather such scientifically robust information would be difficult and time-consuming, though proposes that the precautionary principle be applied in its absence as outlined in the assessment of suitability above.

An important area of habitat for Regent Honeyeaters and Swift Parrots is likely to be reserved as an offset for a proposed coal terminal expansion in the Hunter River Estuary (which is an area where offsets for the loss of significant areas of migratory shorebird / threatened waterbird habitat under prior developments are still yet to be realised). Whilst the overall conservation outcome in this scenario is likely to be highly beneficial it does show that the general principles for offsetting are not being followed because the offset does not target the species threatened by the proposed development and is remote (some 40km) from the area of impact in an entirely different habitat / landscape.

Also of potential relevance was a recent judgement made by the NSW Land and Environment Court to overturn an approval previously made by the Minister for Planning [*Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Limited*]. The Land and Environment Court recognised that the proponent provided no avoidance measures and little in the way of mitigation strategies as part of the development (refer to point 1. above). The court also concluded that the proposed offsets would not result in the protection of the threatened entities that would be affected, predominantly because they would not result in a net improvement of biodiversity in the long-term and that the offsets for threatened fauna were remote to the impact area (refer to points 6. and 10. above). This decision provides a case law example of how offsetting principles are required to be adhered to and is considered relevant in the context of comments made above.

4.9 Comment on NSW Biodiversity Assessment Tools - BioBanking Assessment Methodology and Biodiversity Certification Assessment Methodology

The BioBanking Assessment Methodology (BBAM) and Biodiversity Certification Assessment Methodology (BCAM) are increasingly being used to inform environmental assessments in NSW, such as for major projects and land rezoning proposals. Under BBAM and BCAM and the associated OEH 'Threatened Species Profile Database' both the Swift Parrot and Regent Honeyeater are classed as 'ecosystem credits' (i.e. not requiring a targeted threatened species survey) that can withstand loss within the H-CR CMA region.

There are some valid scientific principles behind classing both species as 'ecosystem credit' as they can be reliably predicted by habitat surrogates, such as vegetation type and condition, and are generally assumed to be present on a development or conservation site. However, this approach poses several significant limitations, particularly for the Regent Honeyeater, which is listed as critically endangered under the TSC Act 1995.

In relation to the Regent Honeyeater, this study has identified potential risks with the current assessment approach under BBAM, BCAM and the Threatened Species Profile Database, namely that:

- **Targeted surveys are not required for the Regent Honeyeater (as it is assumed to be present).** The species is relatively cryptic, total population is extremely low, and some aspects of its ecology (e.g. dispersal patterns, key habitat sites) are not well known (e.g. see determination of NSW Scientific Committee). So the actual predictability at a site is considered to be relatively low.

The significance of the Lower Hunter for the species long-term survival has only been confirmed in recent years, due largely to targeted surveys in key remnant areas. However, a number of other key sites and 'stepping-stones' in the chain of productive habitat may occur elsewhere in the Hunter Valley, but have not been subject to adequate surveys. Therefore, such areas may be inadvertently lost to the significant detriment of the conservation of the species as a whole. This is particularly relevant for remnant areas in the Mid to Upper Hunter which are mainly on private land and subject to significant development pressures.

- **The species is able to withstand loss within the Hunter-Central Rivers CMA region (which includes the Lower Hunter).** Habitat loss and fragmentation are considered to be major threats for the ongoing survival of the species.
- **Important habitat areas and known communal breeding sites (such as in the HEZ) are not considered to be 'red flag' areas of high biodiversity conservation value.** Reliance on associated vegetation, such as Lower Hunter Spotted Gum Ironbark Forest EEC, triggering a red flag is not considered an appropriate level of protection for a critically endangered species.

On the basis of this review and in consideration of determination of the NSW Scientific Committee, which is of the opinion that the Regent Honeyeater is facing an extremely high risk of extinction in New South Wales in the immediate future, it is highly recommended that the OEH Threatened Species Profile Database is modified to reflect the conservation status of this species. This should include listing the Regent Honeyeater as a 'species credit' fauna species that cannot withstand further loss in the H-CR CMA region.

Further, it is considered that a review of the treatment of the Swift Parrot under the OEH Threatened Species Profile Database is also warranted, as loss and ongoing degradation of important habitat sites in the lower Hunter is a major threat for the ongoing survival for this species.

5. DISCUSSION

The Lower Hunter has been demonstrated to provide important habitat for both Swift Parrots and Regent Honeyeaters, including a potentially underestimated importance for the latter than previous literature may have suggested. Some of the more pertinent issues within this report are discussed below, with conclusions and recommendations provided in Section 6.

5.1 Data and Literature Review

The data review undertaken within this project was successful in identifying numerous erroneous records and/or gaps in the records of the subject species. The literature review has confirmed that there was background documentation alluding to the importance of the Lower Hunter for both species. It also resulted in identifying other knowledge gaps that had previously not been privy to the respective recovery program managers. To this end, we have compiled the most comprehensive collection of information available for Regent Honeyeaters and Swift Parrots, which has in turn enabled a thorough review of the significance of not just the Lower Hunter region, but individual areas therein.

Some of the key issues identified during the literature reviews and desktop assessments included those listed below:

- 'Gaps' in the records of both species that has been made available to the respective Recovery Team databases (in particular on private properties where studies have been undertaken);
- Existence of errant records for both species, with many potentially as simple as data-entry issues;
- Lack of systematically collated habitat data from known sites for both species;
- Lack of existing information that clearly identifies the most important areas for the two species in the Lower Hunter (i.e. many references to important areas are to a large extent generic);
- Lack of security of much of the identified important areas of habitat for both species, and suggestion that many areas not currently afforded protection should warrant conservation status due to their importance to Swift Parrots and Regent Honeyeaters;
- A current paucity of reliable and/or ground-truthed vegetation data to inform any habitat modelling or predicted extent of priority habitat for both species;
- Taxonomic uncertainty surrounding the identification of some of the important eucalypt species within the Spotted Gum-Ironbark dominated forests; in particular a stringybark species (with affinities to *E. capitellata* and *E. agglomerata*) that is likely to represent a new taxon of *Eucalyptus* but that has been noted to be used regularly by Regent Honeyeaters in recent years; and
- With regards to Regent Honeyeaters, an element of 'separation' of the Lower Hunter from the Capertee Valley could be considered appropriate due to the near-annual / significant records of the species in the Lower Hunter in the past 15+ years, including several breeding efforts. That is, the Lower Hunter could be recognised as a critically important area for Regent Honeyeaters in its own right.

5.2 Importance of the Lower Hunter for Subject Species

In some years, the Regent Honeyeater and Swift Parrot may be highly dependent on habitat resources within the Lower Hunter. The Hunter Region, with its coastal rainfall influence, provides a key refuge for these species when drought reduces resource availability (e.g. flowering of key Eucalypts) in other parts of their range(s). This scenario is likely to be exacerbated with the predicted changes to rainfall patterns, and timing and frequency of flowering events as a consequence of climate change, in which areas west of the Great Dividing Range are considered to be particularly vulnerable. Hence, a greater reliance and significance is likely to be placed on the woodlands / forests of the Hunter Valley. Therefore large developments in areas of identified significant habitat in the Lower Hunter have the potential to place both species at further risk of extinction.

As previously stated within this report, the significance of the Lower Hunter was again highlighted during 2012, when substantial numbers of both species were found within the Lower Hunter. This was due to widespread blossoming of *Corymbia maculata* (Spotted Gum) within the Cessnock-Kurri forests. It is likely that at least 100 Regent Honeyeaters were present within the study area in 2012 (see Roderick and Ingwersen 2012), representing potentially around 20-25% of the total known current population. Of importance, records spanned from mid-autumn (6th May) virtually until summer (28th November) and it is feasible that the species may have bred in the region but went undetected. Swift Parrots were also present in large numbers (estimated to be between 200-300 birds) and were recorded from mid-autumn (9th May) to mid-spring (26th September). A further approximately 100 birds were also present in Spotted Gum-Ironbark-Grey Box forests just outside of the study area north of the Broke-Cessnock Road.

Following this, and after analysing available data, it is considered that the most important part of the Lower Hunter for Regent Honeyeaters and Swift Parrots is the Cessnock-Kurri woodlands. This area stretches from approximately Wallis Creek (south of Kurri Kurri) west to about Millfield, north to Keinbah and south to Quorrobolong. Disjunct areas of habitat that would once have been linked to this broader mosaic of forested remnants still exist at North Rothbury and on Department of Defence lands in the far north-west corner of Cessnock LGA along Broke Road. The dominant forest-type here is Spotted Gum-Ironbark dominated, with many other Eucalypts occurring within these vegetation assemblages. The four main (broad) areas where both species have been recorded here are:

- The broader Hunter Economic Zone remnant (incorporating adjacent Crown Lands and parts of Werakata NP);
- Private properties at Quorrobolong;
- Pelton (Werakata SCA, Austar Coal Mine Land and surrounding private properties); and
- Kitchener / Abernethy (Werakata NP).

Other important areas include the North Rothbury area (particularly for Swift Parrots) and other parts of Werakata NP/SCA, such as near Abermain and Nulkaba. The forested remnant comprising the proposed Huntlee township has been shown to be used regularly by Swift Parrots and clearing of habitat in that area will further contribute to the decline of preferred habitat within the Lower Hunter.

In terms of Regent Honeyeaters, outside of the previously recognised "core" breeding areas at Chiltern, Bundarra-Barraba and Capertee Valley, few areas across the species range

appear to have had as much site fidelity displayed as the Cessnock-Kurri woodlands. The same could be said for breeding attempts, with a number of nesting efforts made (including one very successful one in 2007/2008) in the past decade. Indeed, in the past decade there has probably been more records / numbers / breeding efforts made in the Lower Hunter than there has been at the former two of the aforementioned core areas (i.e. Chiltern and Bundarra-Barraba).

It is worth noting that much of the Cessnock-Kurri woodlands occur (broadly) on private property and/or is zoned for non-conservation purposes. Potential implications of this forms the basis for some of the recommendations outlined herein. It is worth noting however, that one of the key properties at Quorrobolong has recently entered into a conservation covenant agreement with the Nature Conservation Trust of NSW, thus assisting the maintenance of habitat for both of the subject species with an in-perpetuity conservation agreement.

The other area that appears to be frequently used is the southern half of Lake Macquarie. Generally, this part of Lake Macquarie has suffered less clearing than other parts of the lake and in those areas where Swamp Mahogany forests prevail there is always potential for either species to be present when flowering is occurring (indeed, many records for both species were noted from linear patches, mostly along drainage lines). The two core areas within the southern part of Lake Macquarie appear to be:

- Morisset / Wyee Point; and
- Swansea / Cams Wharf.

The conservation status of these areas appears to be more secure than the drier forests of the Cessnock-Kurri area, though fragmentation and other pressures associated with urban encroachment would likely have some deleterious effects upon these areas.

Other parts of the study area that were also noted as being potentially important were:

- Tilligerry Peninsula, Port Stephens (e.g. Lemon Tree Passage / Tanilba Bay); and
- Laguna / Murrays Run (Wollombi Brook catchment).

It is considered that there is insufficient data to draw conclusions and recommendations on these areas. However, as with the Swamp Mahogany-dominated forests of the Lake Macquarie LGA, there does seem to be more emphasis on conservation of these areas within Port Stephens LGA, given that these areas are included within Endangered Ecological Communities and have been 'captured' within the Port Stephens "Comprehensive Koala Plan of Management" as primary habitat for Koalas, and hence presumably recognised as being of importance to local biodiversity. However, this has not been formalised by including the vast majority of these areas within conservation reserves and hence could be considered to be at a reasonable level of threat.

There do not appear to be any development or similar adverse conservation scenarios in the Laguna / Murrays Run part of the Cessnock LGA.

Furthermore, the importance of the Lower Hunter should be adequately recognised in the Recovery Plans for both species and it is noted that a revision of the Regent Honeyeater Recovery Plan has recently addressed this.

5.3 Specific Discussion on HEZ

One key outcome from this project is how significant the HEZ and adjacent parts of Werakata NP appears to be to both Regent Honeyeaters and Swift Parrots. The reasons for the apparent site fidelity in this part of the Cessnock-Kurri woodlands are not fully understood, but it is notable that many other threatened and declining woodland birds are known to occur therein. It is feasible that the many years of 'research' (predominantly done by ecological consultants for impact assessment purposes) have resulted in a slight bias of survey effort over the area. Notwithstanding, the HEZ has been identified as one of the most important areas for the subject species in the study area.

The HEZ site is subject to complex planning controls and approvals, including a threatened species 'Assumed Concurrence', Part 3A concept approval and listing as a potential State Significant Site (under the *Environment Planning and Assessment Act 1979*). The central portion of the industrial zoned lands has also obtained conditional approval under the Commonwealth EPBC Act (2004/1417). Further controls are also provided under the Cessnock LEP 2011 and Council-adopted environmental management strategies.

Whilst the situation is complex, very few users are actually established within the site and the DoP has only approved the first "Precinct" of the broader project. The original ethos of the HEZ concept, which was to see large blocks of land with significant vegetated buffers retained (see objectives within Cessnock City Council Development Control Plan 2006 E.6 HEZ), does not appear to have translated into the development that has occurred to date. Rather, the recent proposals for the site are for much smaller blocks, resulting in more users and significantly smaller vegetated buffers (resulting in indirect impacts, such as increases in invasive species). The monetary offset that was directed as part of this approval has yet to be provided.

OEH is currently seeking to review the conservation outcomes across the HEZ site as part of the review of the Lower Hunter Regional Conservation Plan, with the aim of streamlining and simplifying environmental approvals, and providing a balanced development and conservation outcome which provides equity to other landholders within HEZ (L. Grenadier pers. comm.). Furthermore, approvals gained from the then Commonwealth Department of Environment and Heritage stipulated that "not less than 10% of mature trees over 50cm DBH within the development lands are retained and managed to ensure their ongoing viability" (EPBC Approval 2004/1417, point 9). Therefore, this approved the clearance up to 90% of identified mature trees on the developable lands within the HEZ and, should this level of clearance be undertaken, the loss of one of the most important individual sites for these species. This study found that protecting substantially more than 10% of mature trees within HEZ would be important in providing an adequate conservation outcome for these species within the region.

5.4 Benefits for Other Declining Woodland Bird Species

Whilst the focus of this report has been upon Swift Parrots and Regent Honeyeaters, it should be noted that each of the identified "core areas" (particularly within the Cessnock LGA), also provide habitat for several other threatened and declining woodland bird species. The Regional Conservation Plan alluded to this when it recognised that the Cessnock-Kurri woodlands contained a range of typically "western" species. This has potential relevance to the fact that Regent Honeyeaters have bred in the area (and have at least nested over several recent years) and suggests that the Cessnock-Kurri woodlands are in fact a unique sub-coastal example of dry sclerophyll forest frequented by a range of declining woodland birds that are now only found commonly further west in the Hunter Valley.

Whilst the focus of this project is on the two nationally endangered species, the flow-on benefits to other woodland-dependent species in the future are clear.

5.6 Existing and Potential Corridors

The importance of wildlife corridors was recognised in the 2006 Regional Strategy with "Green Corridors" mapped in strategic locations such as the Watagans to Stockton Bight, which has also been the subject of community campaigning. These broad-scale corridors would provide good linkages from areas to the west of the Sugarloaf Range to coastal habitats and conservation reserves have already been established in those areas (though at the same time many areas continue to be threatened).

As far as smaller sub-regional corridors within important areas are concerned the Cessnock BMP has identified six corridors that are determined to be the most important for biodiversity movements within the lowland parts of the Cessnock LGA (OEH 2012).

- 'Bow Wow Corridor' – linking the Watagan Forests to the forested areas north and south of Lake Road.
- 'Richmond Vale Corridor' – linking the forested areas north and south of Lake Road with the Sugarloaf Range.
- 'National Park Corridor' – linking the Kearsley / Neath sectors of Werakata NP with the Nulkaba / Keinbah sectors of Werakata NP.
- 'Molly Morgan Corridor' – linking the Nulkaba / Keinbah sectors of Werakata NP with the forested areas around North Rothbury.
- 'Mount View Corridor' – linking the forested areas around Millfield / Pelton with the Pokolbin / Corrabare State Forests.
- 'Ellalong Corridor' – linking forested areas in Paxton / Ellalong (including Werakata SCA) with the Watagan Forests.

Each of these corridors serve important functions and it is likely that both Regent Honeyeaters and Swift Parrots would use these linkages, particularly those on the floor of the valley (such as the National Park and Molly Morgan Corridors) and those that would facilitate movement towards coastal areas (such as the Richmond Vale Corridor).

The identified important habitats around the southern half of Lake Macquarie are reasonably well-connected, with possible gaps in the Cooranbong-Dora Creek area and at Mannering Park. Several types of corridors (such as Riparian, Rehabilitation, Inter-LGA Corridors, as well as narrow [<200m] corridors) have been addressed in Council's Native Vegetation and Corridors Map (Lake Macquarie City Council 2011). This resource is considered comprehensive and adequate for addressing the maintenance of movements of the subject species.

It is recommended that these vegetation corridors should be maintained and no significant loss of vegetation should occur therein. There is also scope for improving these habitat linkages (refer to "Recoverable Habitat" below). Furthermore, the existing Green Corridor network under the Lower Hunter Regional Strategy could be expanded to include the sub-regional corridors identified in (but not limited to) the Cessnock BMP and Lake Macquarie's corridor mapping above and it is considered appropriate that this be included in the revised planning strategies.

5.7 Recoverable Habitat

Whilst it is much more preferable and appropriate to conserve extant functioning habitat, there is also scope for recovering habitat in areas where clearing or fragmentation has occurred. It is difficult to pin-point any one area where this should happen as much of Lower Hunter has been subject to clearing and many areas could benefit from revegetation. However, supplementation of wooded areas within the identified vegetation corridors above would be considered appropriate.

Importantly, there would need to be revegetation carried out with the ultimate habitat goal in mind, as opposed to simple re-planting of preferred feed trees. A working example of this would be the "Experimental Revegetation of Endangered Ecological Communities in the Lower Hunter" (University of Newcastle 2010), which includes the recreation of Lower Hunter Spotted Gum / Ironbark Forest south of Kurri Kurri. Habitat recovery should build upon some of the initial findings of this long-term project that seeks to restore actual vegetation assemblages. Other successful habitat restoration projects that have been aimed at restoring habitat for the subject species, such as at Lurg Hills (Victoria) and Capertee Valley (NSW), could also be consulted as models for how such habitat recovery can happen.

5.8 Local Council Biodiversity Strategies

The reading of the various Council biodiversity strategies (and similar documents) revealed that only one Council area (Lake Macquarie) has in-place a series of strategic documents that gives focus to biodiversity issues and promotes the protection of significant biodiversity values at the same time. Greater protection of important areas of habitat and wildlife corridors could be achieved in the other Lower Hunter Councils if they adopted strategies similar to those put forward by Lake Macquarie City Council.

It is acknowledged that Cessnock City Council is preparing such a strategy and has the advantage of a targeted Biodiversity Management Plan developed by OEH as an existing reference point for other land managers and decision makers.

6. CONCLUSION AND RECOMMENDATIONS

As outlined in this report, both the Swift Parrot and Regent Honeyeater are under considerable threat in the Lower Hunter from urban, industrial and infrastructure projects and other threatening processes. From a strategic planning perspective, both species have not been adequately protected due to a combination of cumulative impacts, a lack of complete information in some environmental impact assessments, decision-making in the planning process and a general lack of certainty within perceived conservation areas. Reduction in the distribution / extent of both species is likely unless enhanced conservation outcomes can be achieved in the key conservation sites in the Lower Hunter such as the HEZ.

The future conservation status is uncertain for both of the subject species, as are the potential ramifications of broad-scale impacts such as climate change. Outlined below are conclusions that address the key issues identified in this report, with subsequent recommendations designed to assist in the protection and management of habitat on a regional scale.

6.1 Conservation Options at Key Sites

The key sites for the subject species within the region are listed below and have been mapped previously in Figures 7 and 8.

For both species:

- Cessnock-Kurri Woodlands, comprising key sites at:
    - Hunter Economic Zone (HEZ)
    - Private properties at Quorrobolong
    - Pelton (Werakata SCA, Austar Coal Mine Land and surrounding private properties)
    - Kitchener / Abernethy (Werakata NP)
- Southern Lake Macquarie (western and eastern shores), comprising key sites at:
    - Morisset / Wyee Point
    - Swansea / Cams Wharf

For Swift Parrots predominantly:

- North Rothbury (predominantly the southern end of the Huntlee new township site)
- Parts of the Cessnock-Kurri woodlands (e.g. sections of Werakata NP at Abermain / Nulkaba)
- Tilligerry Peninsula, Port Stephens (e.g. Lemon Tree Passage / Tanilba Bay)

For Regent Honeyeaters predominantly:

- Laguna / Murrays Run (Wollombi Brook catchment)

It is important for the conservation of these species that the suitable habitat within existing reserves is maintained and actively managed, with specific actions for these species. It is,

however, feasible to suggest that the existing reserve network (e.g. Werakata NP / SCA) does not provide adequate levels of reservation for both species. This could be because some parts do not appear to be preferred by the subject species, there is a high incidence of rubbish-dumping, unsympathetic uses (e.g. trail bikes and dogs) and deliberately lit fires. Mining exploration is also permissible in the SCA parts of the reserve.

Where feasible, areas of high conservation value identified in this report that are currently outside of the conservation area network (such as the HEZ, Austar Mine, Huntlee site and habitat on private lands at other important sites listed above) should be formally protected and managed for conservation purposes. The revised Regional Conservation Plan should provide a landscape-scale approach to identification of high priority conservation areas and provide greater certainty to conservation outcomes through outlining appropriate planning mechanisms, such as land-use zoning.

Consideration should be given to providing improved conservation outcomes than have previously been proposed for the HEZ. Given that this area has been identified as one of the key sites for both species within the study area, the protection of actual functioning habitat within the site itself would be highly favourable. Progressing this would require stakeholder engagement and an assessment of potential options. Any conservation outcomes would also have the flow-on benefit of conserving habitat for a range of threatened and declining woodland bird species, as outlined in Section 5.4.

The situation at HEZ is very complex. However, it is considered that there are potential options available to decision-makers, such as utilising high conservation value HEZ lands as an offset for urban development elsewhere in the region. The revision of the Regional Strategy and Regional Conservation Plan could provide opportunities for consideration of these options.

It is also appropriate that conservation options be explored within other identified key sites, including the Austar Coal Mine site. The quality and extent of habitat within Austar holdings is considered to be of critical importance to both subject species and various conservation mechanisms should be considered.

Options for conserving habitat within key sites should not be limited to the larger development sites flagged here (i.e. HEZ and Austar). Where feasible, conservation options at other key sites that would see those areas conserved and managed in-perpetuity should be explored. This could include the targeting of such areas for offsetting purposes for developments elsewhere within the Lower Hunter. This study has found that large remnants of important habitat for the subject species exists in the Lower Hunter and that there are significant opportunities for those areas that are not formally protected to be conserved in-perpetuity.

The establishment of Biobank sites and Bio-certification under the TSC Act are possibilities for conservation mechanisms that could be applied to these and other areas. Already there have been significant successes realised using private land conservation tools on smaller parcels of land in the area (see Section 6.2 below) and it is appropriate that as many options as possible be considered on the larger, key sites.

Furthermore, the Green Corridor network established under the existing Lower Hunter Regional Strategy should be expanded to include the sub-regional corridors identified in (but not limited to) the Cessnock Biodiversity Management Plan and Lake Macquarie's corridor mapping. The current review of the Regional Strategy provides an opportunity to have this corridor network expanded.

Recommendations for Conservation Options at Key Sites

It is recommended that:

- suitable habitat within existing reserves (such as Werakata NP / SCA) is maintained and actively managed, with specific actions for these species;
- extensive stakeholder engagement occurs for the HEZ site to assess the feasibility of additional conservation options (including use of portions of the site containing the highest quality habitat as a potential offset for development elsewhere in the region) taking into consideration the findings of this report concerning the significance of the site to Swift Parrots and Regent Honeyeaters;
- the Austar mine site be considered in a similar manner to the HEZ in terms of considering the range of conservation options amongst various stakeholders;
- the Regional Conservation Plan strategically assess other areas outside of the existing reserve network that are known (or found) to regularly support Swift Parrots and/or Regent Honeyeaters, including the key sites listed above, as well as other development sites overlapping with potentially important habitat, such as Cessnock East, Wyee Point, Kitchener, Black Hill and Minmi-Edgeworth (refer to Sections 4.3 and 4.4 of the report) and provide a landscape scale approach to conservation of these species and their habitats;
- Biobanking and Bio-certification are included as potential options for conservation mechanisms; and
- the Green Corridor network be expanded to include important linkages identified in this report for Swift Parrots and Regent Honeyeaters.

6.2 Private Land Conservation Initiatives

Given that a large proportion of potential habitat for the subject species occurs on private properties, private land conservation initiatives could be promoted to target this, until-recent, untapped potential for adding to the protection of important areas of habitat in the Lower Hunter. For example, a successful conservation covenant has been placed over the key property at Quorrobolong where Regent Honeyeaters have occurred in the majority of the most recent 10 years (including 50+ birds in 2012) and where nesting has also taken place. This approach targeted properties within pre-defined high priority areas. This provides solid evidence that pro-active private land conservation actions can achieve significant results.

Recommendations for Private Land Conservation Initiatives

It is recommended that:

- pro-active conservation programs be undertaken to enable known priority areas to be targeted; and
- options be considered for private holdings with habitat for Swift Parrots and Regent Honeyeaters, such as Biobank sites (under the TSC Act 1995), Conservation Agreements and Wildlife Refuges (under the National Parks and Wildlife Act 1974), Nature Conservation Trust of NSW trust agreements (under the Nature Conservation Trust Act 2001) or Property Vegetation Plans (under the Native Vegetation Act 2003).

6.3 Offset and Biodiversity Assessment Policies

As discussed in Section 4.8, offsetting principles at both State and National levels (including the application of the precautionary principle) should be utilised in decision-making with regards to future development within the region.

The way that offsets for developments at key sites are targeted is also relevant. A discussion paper titled *"The Lower Hunter over the next 20 years: A Discussion Paper"* (NSW DPI 2013) was tabled by the NSW Government in March 2013. In relation to biodiversity offsetting measures the discussion paper states that:

> *"The Office of Environment and Heritage (OEH) and the Department of Planning and Infrastructure are reviewing biodiversity offsetting processes to find an efficient solution that continues to provide offsets for impacts to biodiversity while also facilitating development in the Lower Hunter."* (p. 30).

It is envisaged that the process of revising the Lower Hunter Regional Strategy and Regional Conservation Plan could provide an opportunity for protecting habitat at key sites.

This study found that a number of improvements could be made to the assessment approach for the Swift Parrot and Regent Honeyeater under the NSW BioBanking Assessment Methodology, Biodiversity Certification Assessment Methodology and the associated OEH Threatened Species Profile Database to improve conservation outcomes for these species.

Recommendations for Biodiversity Assessment Policy

It is recommended that:

- the precautionary principle be applied regarding the assessment of suitability of offsets.
- the OEH Threatened Species Profile Database be revised to reflect the conservation status of Swift Parrots and Regent Honeyeaters; and
- the Regent Honeyeater is listed as a 'species credit' fauna species under the NSW BioBanking Assessment Methodology and Biodiversity Certification Assessment Methodology.

6.4 Impact Assessment Considerations

Ecological consultants and consent authorities undertaking impact assessments should consider all existing information (including this report) to inform themselves of significant areas of habitat for Swift Parrots and Regent Honeyeaters in the Lower Hunter. Survey guidelines for EPBC Act-listed threatened bird species (DEWHA 2010) should also be followed when surveying for Swift Parrots and Regent Honeyeaters in the area. There is scope for consultants to seek advice from organisations that have expertise in performing field surveys for these species. Field surveys should be designed on a case by case basis, given the number of variables likely to impact upon the appropriateness of each field survey situation.

In order to provide some focus for consultants and government alike with regards to these species, some key issues are outlined below for due consideration when undertaking such assessments. These include but are not limited to:

- The recognition of the importance of the Lower Hunter to the subject species with impact assessment to include the broader context of the conservation status of both species;
- The impacts of clearing any remnant vegetation within the "Lower Hunter Valley floor" and how it may contribute to the incremental loss of a habitat resource that both subject species rely upon; and
- The effects of fragmentation, including exacerbation of edge effects, erosion of corridors and promotion of suitable habitat for introduced and native aggressive bird species (see Section 2.7.3).

It is also important that consultants submit records of Swift Parrots and Regent Honeyeaters (e.g. to OEH under scientific licence requirements), as their role is often pivotal in keeping abreast of the occurrences of the subject species in the Lower Hunter.

Recommendations for Impact Assessment Considerations

It is recommended that:

- the most recent and complete information regarding Swift Parrots and Regent Honeyeaters should be made publicly available, where practical;
- appropriate survey guidelines be followed by consultants when performing fieldwork for the subject species;
- that when performing assessments, consultants give full recognition to the Lower Hunter as a recognised important area for the subject species and in particular the significance of "valley floor" remnant vegetation;
- aside from loss of habitat, that associated impacts, such as fragmentation and increased opportunities for invasive and aggressive bird species be duly considered within any assessments done by consultants and/or consent authorities; and
- any sightings of Swift Parrots and Regent Honeyeaters are reported to OEH (eg. under scientific licence requirements) and to the species recovery teams.

6.5 Further Research Opportunities and Priorities

Whilst it is clear that the Lower Hunter represents an important area of habitat for both Regent Honeyeaters and Swift Parrots, there has been little systematic survey work done. The vast majority of records have come from either incidental observations or from biased survey effort when the species are known to be present within the region. Systematically collected data would provide more robust information and could include some of the information collected as part of the habitat surveys for this project that may not have otherwise been noted (e.g. cover of leaf litter, frequency of mistletoe etc). It could also include other information (such as climate) at the time of survey. Such information would best be collected over a long-term. This information could contribute to the monitoring of one or both of the IBAs recognised internationally for the subject species within the Lower Hunter (which is currently happening on an *ad hoc* basis only).

Habitat surveys done within this project were carried out at sites where either or both species had been recorded previously. Such assessments could be strengthened by including

randomly selected absence sites to be able to gain a better understanding of the habitat attributes that the species are reliant upon.

Furthermore, given that Regent Honeyeaters have bred in the area (and could potentially have done so in 2012/2013) the results of colour-banding birds in an attempt to better understand movements are particularly important. However, that said, very few re-captures or re-sightings occur and it is evident that more detailed studies are required to gain a better understanding. Such detailed studies could include radio-tracking (which has already been carried out on Regent Honeyeaters) or employing advanced technology using satellite telemetry. Such work could provide important information on how Regent Honeyeaters move between core areas and how corridors in fragmented landscapes are utilised.

It is also apparent that aerial photograph availability for making broad-scale habitat assessments is lacking. It would be prudent for high resolution aerial photography to be made available to inform any future assessments made for these species. With regards to habitat modelling, Wintle *et al* (2005) states that:

> *"We recommend the use of model prediction in an adaptive framework whereby models are iteratively updated and refined as new data become available."* (in Abstract)

This is particularly relevant to new vegetation data that is being collated for parts of the study area within the broader Sustainability Regional Development Program. Once this information is available (and indeed for other parts of the study area) it should be applied to strengthen the outputs of habitat modelling.

Recommendations for Further Research Opportunities and Priorities

It is recommended that:

- systematic surveys be carried out at known sites (in particular those listed in Section 6.1) to gather further data for both species over a long-term period;
- further habitat investigations are carried out to identify the critically important habitat attributes at known sites (apart from vegetation);
- support for further research of the ecology of Regent Honeyeaters (such as the post-breeding dispersal movements, breeding ecology and interactions with aggressive native bird species), be considered by government agencies to increase the understanding of this critically endangered species;
- where available, recent and high resolution aerial photography should be made available to stakeholders to enable more thorough assessments and investigations to occur;
- habitat modelling carried out as part of this project be adaptive as new information comes to light, particularly with regards to vegetation mapping.

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APPENDIX A – Depiction of the Hunter Economic Zone (HEZ)

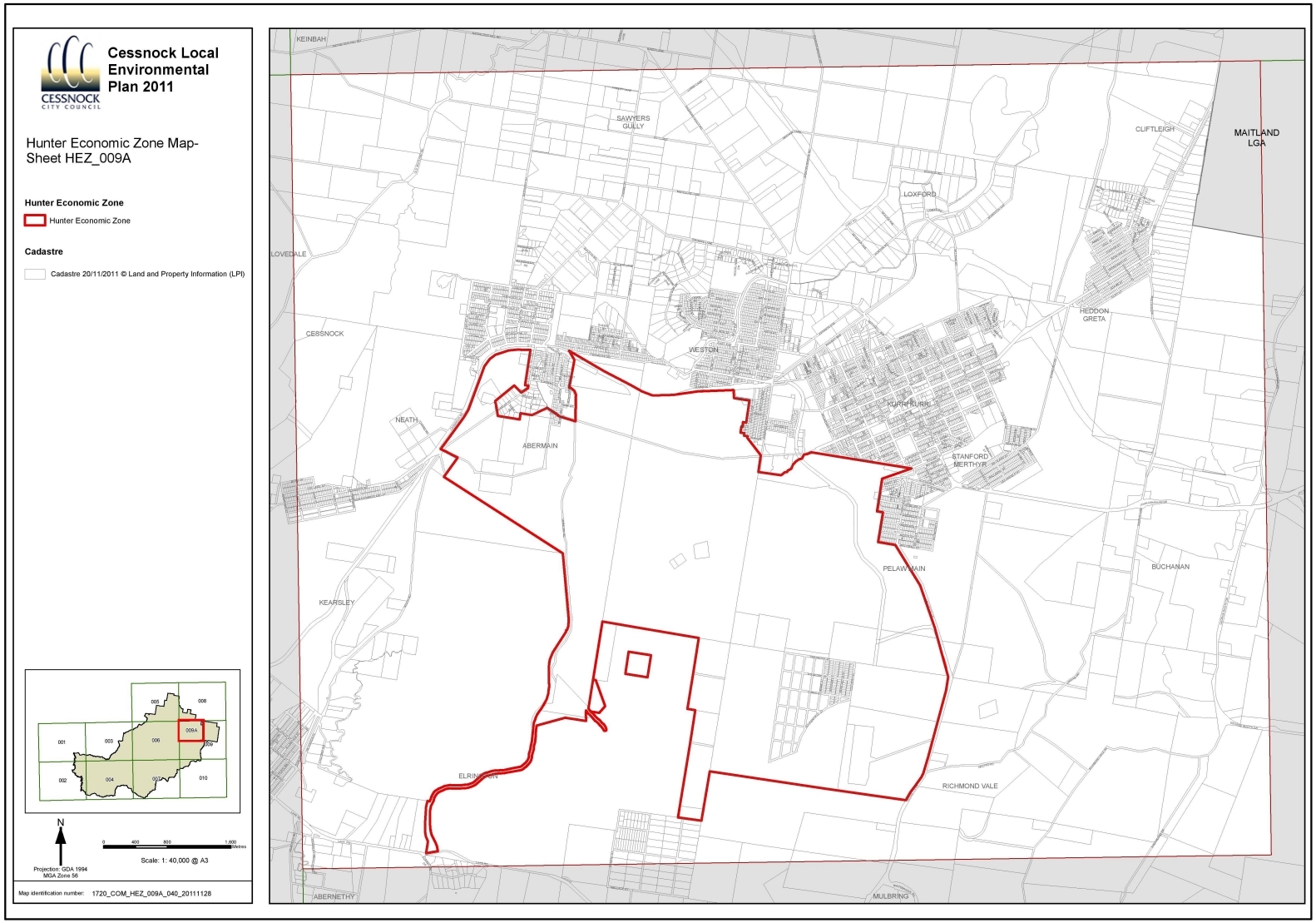

Figure A1 – Hunter Economic Zone (HEZ) Boundary Defined Under the Cessnock Local Environmental Plan 2011

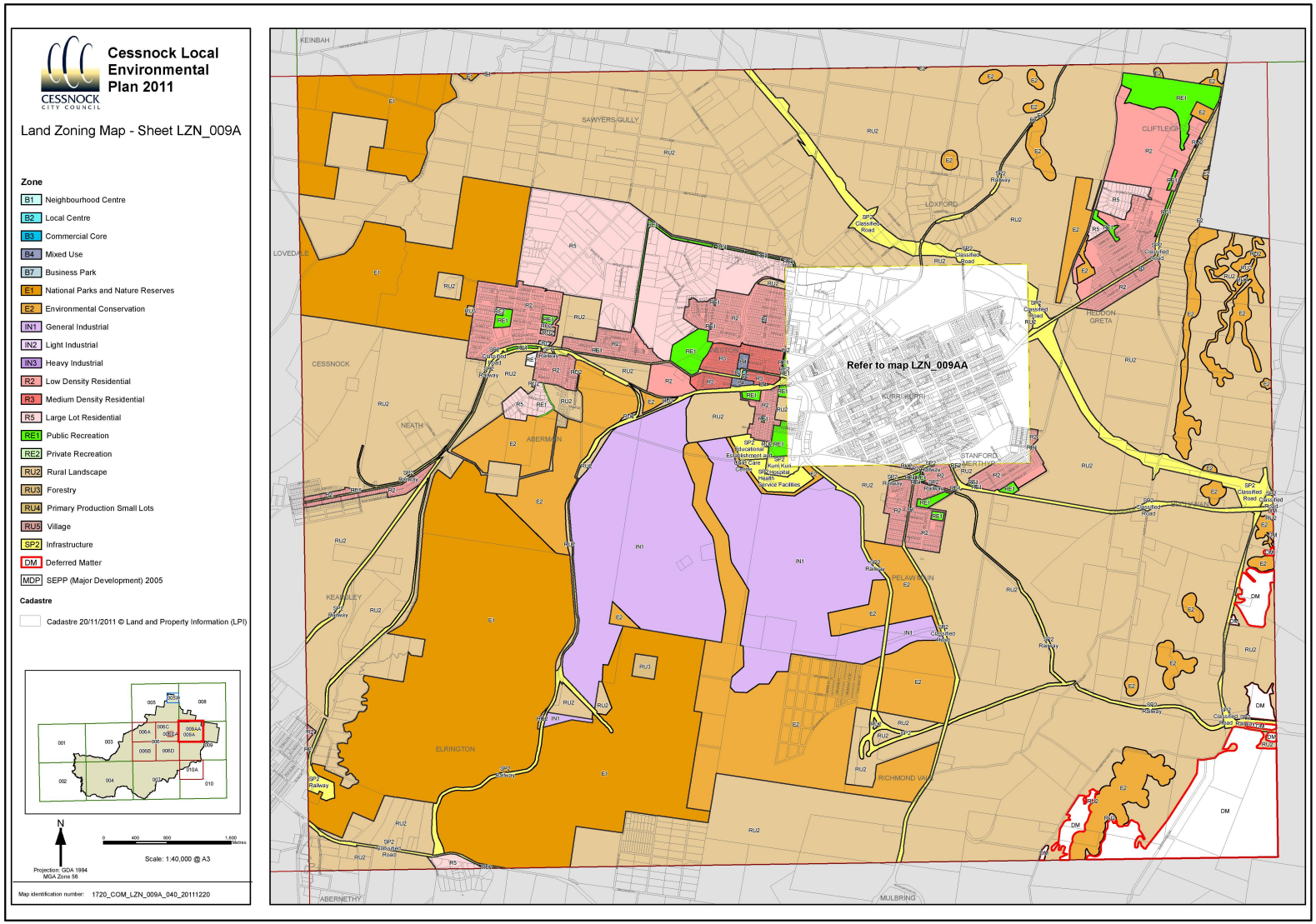

Figure A2 – Hunter Economic Zone (HEZ) Zoning Map Under the Cessnock Local Environmental Plan 2011

Appendix B – Habitat Survey Pro-forma

Regent Honeyeater / Swift Parrot habitat pro-forma

Recorded by: Date

Site details Photo ref #.....

Locality description……Tenure: Public / Private

Lat/Longs:..32……151……..Elevation……..

Site is: Flat / Mostly flat / Flat with undulations / Gentle slope / Steep slope / Gully / Ridge / Creekline

Aspect: (N/A) / N / NE / E / SE / S / SW / W / NW Gradient of slope (deg): 0 / 1-5 / 6-10 / 11-15 / 15+

Patch size: <1ha / 1-5ha / 6-20ha / 21-100ha / 100-1000ha / 1000+ ha Connectivity: High / Medium / Low

Distance to nearest edge: <50m / 50-100m / 100-200m / 200-500m / 500-1000m / 1000m+

Habitat details

Vegetation type (community or description)……..

Tree layer diversity: High (4 or more spp.) / Medium (3 spp.) / Low (1 or 2 spp.).

Species	Rank	Av. DBH	Max. DBH	# >60cm DBH	Max height

Understorey spp: ……..% cover……..

Shrub layer % cover: .....Notes:……

% groundcover: Grass……Leaf litter……Bare……Fallen timber……Herbs/Forbs……..

Other (specify):……

Mistletoe: High(>20) / Medium (5-20) / Low (<5) / Zero. If present, spp.:……..

Incidence of weeds: Very high / High / Medium / Low / Zero
Notes:……

Availability of / Proximity to water (e.g. dam, puddles etc): Very good / Good / Moderate / Poor

Disturbance: Track construction / Fire / Rubbish dumping / Grazing / Past clearing / Other……..

Foliage insects present at time: Yes / No Blossom present: Yes / No.
Details……..

Bird species present

Short list of dominant bird species present:

……
……
……
……
……
……..

Habitat appraisal for RH/SP

Assess suitability of the site for RH/SP, taking into account the timing of the survey etc:

……
……
……
……
……
……
……

Which species has been previously recorded at the site?

Swift Parrot only / Regent Honeyeater only / both spp.

Other relevant information

……
……
……
……
……
……
……

APPENDIX C – Overstorey Tree Species Recorded at the 69 habitat Assessment Sites

Overstorey Tree Species Data from the Habitat Assessment Sites

Rank values refer to the number of times each tree species was scored per each rank category (*e.g*. *Corymbia maculata* was ranked 1, at 41 of the 69 sites assessed).

Species	**Mean DBHOB (cm)**	**Mean height (m)**	**Rank 1**	**Rank 2**	**Rank 3**	**Rank 4**	**Rank 5**
Angophora bakeri	15	9	1		1		
Angophora costata	25.8	14.8		4	2		2
Angophora floribunda	24.7	12.1			2	3	1
Corymbia maculata	31.6	17.2	41	3	2	1	1
Eucalyptus sp. aff. *agglomerata*	25	15		1		1	
Eucalyptus ampifolia	30	25		1			
Eucalyptus botryoides	Not recorded	Not recorded					
Eucalyptus capitellata	25.5	14.1		5	4	3	2
Eucalyptus crebra	33.3	19.5	2		5	6	
Eucalyptus eugenioides	24.5	16.7	1	1		1	
Eucalyptus fergusonii	30	15				1	
Eucalyptus fibrosa	28.6	15.6	3	29	6	4	1
Eucalyptus mollucana	27.5	18.7	2	3	1	1	
Eucalyptus pilularis	50	20	1				
Eucalyptus piperita	48.3	16.6		2	1	1	
Eucalyptus punctata	32.8	17.3	4	9	22	7	1
Eucalyptus robusta	38.5	15.9	10	1	2		
Eucalyptus signata	40	15				1	
Eucalyptus tereticornis	27.7	16.6	2	2	1	2	
Eucalyptus umbra	35	15					1
Melaleuca linariifolia	20	10	1				
Melaleuca quinquenervia	26.5	15	3			2	
Melaleuca stypheloides	20	12	1				
Syncarpia glomulifera	21.2	13			1		2

APPENDIX D – IMPORTANT BIRD AREA PROFILES

1. Lake Macquarie Important Bird Area

Country/Territory	Australia
Administrative region(s)	New South Wales (and ACT)
Central coordinates	151^{O} 32.65' East 33^{O} 7.63' South
Area	12149 ha
Delineation status	4. refined polygon
Delineation notes	
Endemic Bird Area(s)	
Biome(s)	
Altitude	0 - 50m
Qualification status	confirmed
Criteria	A1
Year of assessment	2008
Criteria notes	LF 2/3/09
Other notes	

Summary This IBA supports significant numbers of the endangered Swift Parrot and Regent Honeyeater in years when their favoured trees are flowering.

Site description Lake Macquarie is a large coastal lake north of Sydney. The Lake Macquarie IBA is defined as the southern edges of the lake, which support swamp mahogany, ironbark, forest red gum and spotted gum, which are key food species of Swift Parrot and Regent Honeyeater. This area covers the southern margins of the lake south of the town of Belmont, including Belmont Lagoon and Blacksmiths Reserves, from the lake to the sea; then between the lake shore and the Pacific Highway, south from the lake outlet at Swansea; then between the lake shore and the Sydney-Newcastle freeway

to Dora Creek; then between the lake shore and Wangi Road north to Kilaben Bay. The area is primarily residential blocks with many large trees. Many coal mines extend under the IBA and there are two power stations.

Habitat	Habitat detail	Level/percentage cover
Artificial landscapes (terrestrial)	Urban parks & gardens	major
Forest	Eucalypt open forests, Eucalypt tall open forests	major
Coastline	Mangrove wetlands	minor
	Notes: mangroves abutting *Casuarina glauca* swamps	

Land-use	Level/percentage cover
nature conservation and research	20%
urban/industrial/transport	75%

Land ownership: communal, private, state

New South Wales state parks; private freeholds; traditionally owned lands; council foreshore and other reserved lands.

Ornithological information Masked Owl; Ospreys nest regularly (this is the southernmost regular breeding site for this species in eastern Australia).

Species	Season	Year	Abundance	Min-Max	Quality	Criteria
Swift Parrot *Lathamus discolor*	non-breeding	1997	-	50	medium	A1
	Population notes: 50 at Wyee Point, 30 at Morisset and 30 at Galgabba Point in May-Aug 2002; up to 25 at Coornaga, Bonsville, Swansea, Goodman Park, Wood Point, Blackall Point Reserve in 1997, 2000, 2004, 2007 and previous years (New South Wales Annual Bird Reports).					
Regent Honeyeater *Xanthomyza phrygia*	non-breeding	1997	-	70	medium	A1
	Population notes: At least 70 at Morisset in July 2002, at least 50 at Morisset in May 2007 and up to 25 at Buttaba, Wyee Point, Belmont Swamp and Galgabba Point in 1998, 2000, 2002, 2007 and previous years (New South Wales Annual Bird Reports).					

Threats Swamp Mahogany and other key trees need to be actively protected by the Lake Macquarie City Council.

Protection status Wallarah National Park

Galgabba Point Reserve

Lake Macquarie State Conservation Area

Protected area (extent in ha)	Relationship	Overlap (ha)	Designation
Galgabba Point Reserve	protected area contained by site	0	Reserve
Lake Macquarie	protected area contained by site	676	State Conservation Area
Wallarah	protected area overlaps with site	36	National Park

Conservation responses Lake Macquarie City Council and local Landcare groups have helped regenerate bush and control weeds at Galgabba Point Reserve and elsewhere.

Acknowledgements Hunter Bird Observer Club and bird reports. Nomination prepared by Alan Morris with consultation with Alan Stuart.

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Regent Honeyeater recovery team database (2007).

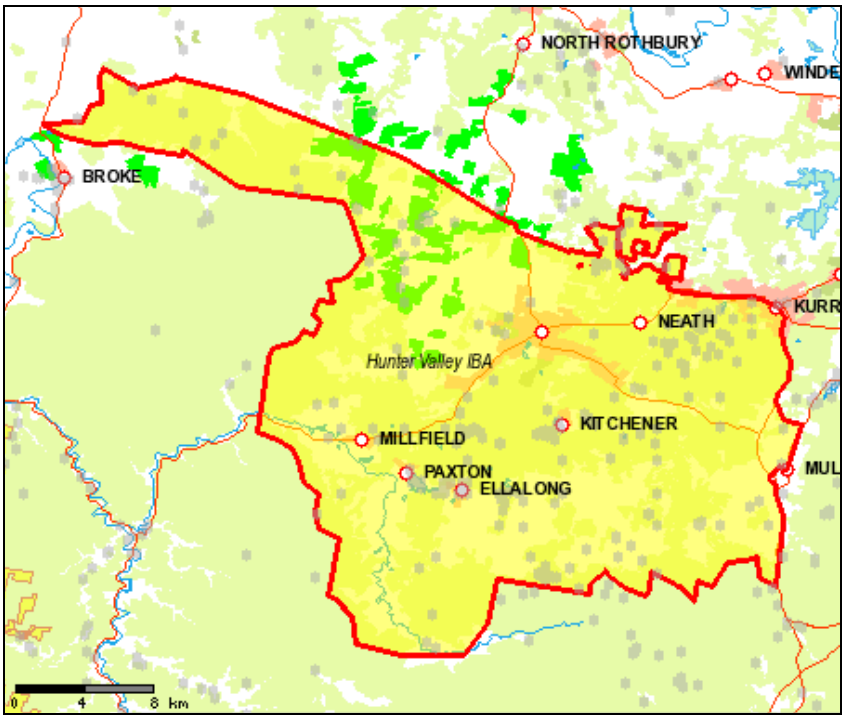
Swift Parrot recovery team database (2007).

Citation BirdLife International 2007 BirdLife's online World Bird Database: the site for bird conservation. Version 2.1. Cambridge, UK: BirdLife International. Available: http://www.birdlife.org (printed 3rd May 2010)

2. Hunter Valley Important Bird Area

Country/Territory	Australia
Administrative region(s)	New South Wales (and ACT)
Central coordinates	151^{O} 19.78' East 32^{O} 51.65' South
Area	55964 ha
Delineation status	4. refined polygon
Delineation notes	
Endemic Bird Area(s)	
Biome(s)	
Altitude	100 - 300m
Qualification status	confirmed
Criteria	A1
Year of assessment	2008
Criteria notes	LF 27/2/09
Other notes	

Summary The IBA regularly supports significant numbers of the endangered Swift Parrot and Regent Honeyeater.



Site description The IBA is located around Cessnock in central-eastern New South Wales. It is defined by Spotted Gum and Box-Ironbark woodlands and remnants used by Swift Parrots and Regent Honeyeaters. The IBA includes Aberdare State Forest, Pelton SF, Broke Common, Singleton Army Base (where few records of Regent Honeyeaters reflect infrequent access by birdwatchers), Pokolbin, Quorrobolong, Abermain, Tomalpin, patches of bush around the towns of Paxton and Ellalong and private bush land owned by mining companies. The IBA extends north of Cessnock to include all of Werakata National Park (multiple records of Swift Parrots), west as far as Broke, and south to the

edge of the Pokolbin, Corrabare and Heaton State Forests and Watagans National Park, as the key birds do not use these hilly forests. An arbitrary eastern boundary is taken as Highway 82 north to Mulbring, then minor roads north to Maitland. The boundary could be extended south-west to include Laguna and Wollombi where 12 Regent Honeyeaters nested in 1999. Extensive areas are used for underground and open-cut coal mining, and other areas are are used for vineyards, residential development, industrial development and military training.

Habitat	Habitat detail	Level/percentage cover
Artificial landscapes (terrestrial)	Improved grassland & pasture	major
	Notes: Cattle grazing	
Forest	Eucalypt woodlands	major
	Notes: Box-ironbark and Spotted Gum	
Savanna	Eucalypt open woodlands	major
	Notes: Cattle grazing	

Land-use	Level/percentage cover
forestry	major
rangeland/pastureland	major
military	major
nature conservation and research	major
urban/industrial/transport	major

Land ownership: federal, private, state

Commonwealth/Federal (Department of Defence); state government (Department of Environment and Climate Change); private leasehold.

Ornithological information The IBA provides habitat for a variety of birds. For example, 132 species of bird, including 12 species listed as threatened at state level or above, have been recorded in Werakata National Park (NSW NPWS 2007). The near threatened Diamond Firetail is locally uncommon around Broke (A. Morris pers. comm. 2008).

Species	Season	Year	Abundance	Min-Max	Quality	Criteria
Swift Parrot *Lathamus discolor*	non-breeding	1996	-	120	medium	A1
	Population notes: Probably regular in significant numbers but under-recorded. Counts in New South Wales Annual Bird Reports include: 2000 (max 90 at Ellalong, 15+ at Aberdare SF, 20 at Pelton, max 30 at Quorrobolong), 2004 (three at Quorrobolong), 2005 (84-120 at North Rothbury, Aberdare SF, Pelton and Werekata NP from May to August, 30 at Singleton Army Base in July).					
Regent Honeyeater *Xanthomyza phrygia*	resident	1996	-	72	medium	A1
	Population notes: Regularly reported in significant numbers; records					

Species	Season	Year	Abundance	Min-Max	Quality	Criteria
	in New South Wales Annual Bird Reports include: 1997 (10 at Ellalong 30 Mar-21 Apr and 5 August), 1998 (eight at Ellalong 9-10 May, two at Pokolbin 25 July-18 Aug), 2000 (35 at Aberdare SF 18 June-9 July, max 63 including two nests at Quorrobolong 29 July-19 Aug, 13 at Ellalong 13 Sept), 2003 (72 at Quorrobolong 2 Aug-3 Sept plus one nest), 2004 (10 at Quorrobolong 9-10 Aug), 2005 (three or more at Pelton SF 8 June-13 July), 2006 (six at Abermain 30 June-1 July, tens in Aberdare SF), 2007 (eight plus two nests at Quorrobolong Aug-Sep; 30 or more adults, seven juveniles and 13 fledged young at Tomalpin Nov-Jan 2008) but no reports in 1996, 1999 or 2001.					

Threats Ensure that industrial development does not occur on remnant Spotted Gum or Box-Ironbark woodlands. Ensure that coal mining does not occur on these woodlands.

Protection status Werakata National Park

Protected area (extent in ha)	Relationship	Overlap (ha)	Designation
Watagans	protected area overlaps with site	36	National Park
Werakata	protected area contained by site	2140	National Park

Acknowledgements Thanks to Alan Morris as compiler of the nomination.

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Citation BirdLife International 2007 BirdLife's online World Bird Database: the site for bird conservation. Version 2.1. Cambridge, UK: BirdLife International. Available: http://www.birdlife.org (printed 3rd May 2010)

APPENDIX E – ENVIRONMENTAL VARIABLES USED IN HABITAT MODELLING

Short name	Variable	Units	Classification 1
ADEFMINe	Precipitation deficit - monthly minimum	mm	moisture
ADEFMAXe	Precipitation deficit - monthly maximum	mm	moisture
ADEFMEANe	Precipitation deficit - monthly mean	mm	moisture
tnmine	Minimum temperature - monthly minimum	°C	Temperature
tnmaxe	Minimum temperature - monthly maximum	°C	Temperature
tnmeane	Minimum temperature - monthly mean	°C	Temperature
txmine	Maximum temperature - monthly minimum	°C	Temperature
txmeane	Maximum temperature - monthly mean	°C	Temperature
trmine	Diurnal range temperature - monthly minimum	°C	Temperature
trmaxe	Diurnal range temperature - monthly maximum	°C	Temperature
trmeane	Diurnal range temperature - monthly mean	°C	Temperature
ptmine	Precipitation - monthly minimum	mm	Precipitation
ptmaxe	Precipitation - monthly maximum	mm	Precipitation
ptmeane	Precipitation - monthly mean	mm	Precipitation
evmine	Evaporation - monthly minimum	mm	Evaporation
evmaxe	Evaporation - monthly maximum	mm	Evaporation
evmeane	Evaporation - monthly mean	mm	Evaporation
ramine	Solar radiation (rainfall-cloudiness modified) - monthly minimum	MJ/m2/day	solar radiation
ramaxe	Solar radiation (rainfall-cloudiness modified) - monthly maximum	MJ/m2/day	solar radiation
rameane	Solar radiation (rainfall-cloudiness modified) - monthly mean	MJ/m2/day	solar radiation
rh2mine	Humidity - month max relative	%	Humidity
rh2maxe	Humidity - annual mean relative	%	Humidity
rh2meane	Humidity - month min relative	%	Humidity
slrain0e	Precipitation - annual (log) seasonality index	index	Precipitation
slrain1e	Precipitation - summer or winter (log) season	index	Precipitation
slrain2e	Precipitation - spring or autumn (log) season	index	Precipitation
rain_amjjase	precipitation over six months from April to September	mm	
rain_ondjfme	precipitation over six months from October to March	mm	
rain_djfe	precipitation over three months from December to February (summer)	mm	
rain_jjae	precipitation over three months from June to August (winter)	mm	
rain_mame	precipitation over three months from March to May (autumn)	mm	
rain_sone	precipitation over three months from September to Mnovember (spring)	mm	
aus01e	Temperature - annual mean (Bio01)	°C	Temperature
aus02e	Temperature - diurnal range mean (Bio02)	°C	Temperature
aus03e	Temperature - isothermality (Bio03)	%	Temperature
aus04e	Temperature - seasonality (Bio04)	index	Temperature
aus05e	Temperature - warmest period max (Bio05)	°C	Temperature
aus06e	Temperature - coldest period min (Bio06)	°C	Temperature

Short name	Variable	Units	Classification 1
aus07e	Temperature - annual range (Bio07)	°C	Temperature
aus12e	Precipitation - annual (Bio12)	mm	Precipitation
aus13e	Precipitation - wettest period (Bio13)	mm	Precipitation
aus14e	Precipitation - driest period (Bio14)	mm	Precipitation
aus15e	Precipitation - seasonality (Bio15)	index	Precipitation
aspect	Aspect (9 sec digital elevation model)	degrees	topography
mrrtfv6g-3a	Ridge top flatness (9 sec digital elevation model)	index	topography
mrvbfv6g-3a	Valley bottom flatness index (9 sec digital elevation model)	index	topography
slope	Slope (9 sec digital elevation model)	%	topography
minfertfe	Lithology - inherent fertility rating	index	Substrate
bdensity50ne	soils - bulk density from Atlas Australian Soils	Mg/m^3	Substrate
clay50ne	soils - clay fraction from Atlas Australian Soils	%	Substrate
coarsene	Soils - coarse fragments from Atlas Australian Soils	%	Substrate
nutrientsne	nutrient status (gross rating) from Atlas Australian Soils	index	Substrate
bd30e	soils - bulk density in top 30cm from ASRIS best composite mapping	Mg/m^3	Substrate
pawc1me	soils - plant available water holding capacity 0-1m from ASRIS best composite mapping	mm	Substrate
lf7rupwef	topographical position	category	Topography
aspect3se	aspect in degrees sampled from 3sec DEM-s terrain attribute	degrees	
elvfr1000e	elevation focal range within 1000m sampled from 3sec DEM-s terrain attribute	m	
elevfr300e	elevation focal range within 300m sampled from 3sec DEM-s terrain attribute	m	