Avifaunal communities of the River to River Corridors Project study area: October 2011 survey report

for
The River to River Corridors Project

InSight Ecology

December 2011

Avifaunal communities of the River to River Corridors Project study area: October 2011 survey report

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for

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December 2011

This is Report 5 in a series for the River to River Corridors Project - a joint initiative of the City of Ryde, Hunters Hill Council, Sydney Metropolitan Catchment Management Authority, local flora and fauna conservation organisations, Bushcare groups, and local residents, with funding from the NSW Environmental Trust.

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Photographs: Front cover (from top, then left to right down panel) –Lane Cove River from footbridge at end of Magdala Road; eucalypt gully forest in Lane Cove National Park (NP) between Lane Cove River and Delhi Road; recent riparian revegetation at Riverglade Reserve, Hunters Hill; Powerful Owl *Ninox strenua*; older eucalypt forest in Lane Cove NP near site shown in second photograph above; Gladesville bridge over Parramatta River, from Betts Park at Huntleys Point. All of these photographs were taken by InSight Ecology. Other photographs in this document without credits were taken by InSight Ecology.

Acknowledgements

This study was conducted under Section 132C of the National Parks and Wildlife (NPW) Act 1974 and Clause 22 of the NPW Regulation 2002, using Scientific Licence S11505 issued to Dr Andrew Huggett by NSW Department of Environment, Climate Change and Water (now the Office of Environment and Heritage in NSW Department of Premier and Cabinet).

This study is part of the River to River Corridors Project which is funded by the NSW Environmental Trust, City of Ryde, Sydney Metropolitan Catchment Management Authority, and Hunters Hill Council. The project is managed by Sam Cappelli (Manager, Environment at City of Ryde) and his team. A Community Reference Group for the project continues to meet regularly.

This report and the survey upon which it is based benefited from discussions with and information from a range of people and organisations in the Ryde-Hunters Hill district. They include Gith Strid-Nwulaekwe (City of Ryde), Jacqui Vollmer (Hunters Hill Council), Adam Smith (City of Ryde), Bev Debrincat and Kurtis Lindsay (Habitat Network and Ryde Hunters Hill Small Bird Project), and Cathy Merchant (Ryde-Hunters Hill Flora and Fauna Preservation Society). Historical bird data was referred to in NSW Atlas of Wildlife (OEH), Australian Museum Fauna Database, and Bird Atlasses I and II (Birds Australia). Gith, Jacqui and Bev also participated in some of the field surveys.

Permission to access publicly and privately owned land in the study area was obtained from Office of Environment and Heritage in NSW Department of Premier and Cabinet, City of Ryde, Hunters Hill Council, Holy Cross College Ryde, and Catholic Theological Union (for access to Villa Maria property, Hunters Hill). Rachel Danos and Michael McCormack of Holy Cross College Ryde were particularly supportive of the survey and overall project.

The support and enthusiasm of these organisations, groups and individuals is gratefully acknowledged.

Executive summary

Urban landscapes are complex interacting systems driven by constant change and re-adjustment. The urbanisation of Sydney has removed, fragmented and substantially modified habitat for native plants and animals. In inner zones such as Ryde-Hunters Hill these effects have been largely historical with the last phase of large-scale clearing of native vegetation occurring over 60 years ago. In outer areas, however, habitat continues to be lost or degraded as Sydney sprawls west, north-west and south-west.

As a consequence, episodes of local extinctions of native plants and animals have occurred and are still happening. Fauna species unable to move through parts of their former ranges now surrounded by a hostile matrix of sealed surfaces and unsuitable habitat have become isolated within increasingly small and pressured bushland remnants. For birds, these have been species dependent on ground and shrub cover and food and breeding resources provided by a diversity of quality habitats. In Ryde-Hunters Hill district, the extinction of bush birds such as Spotted Quail-thrush, Eastern Bristlebird, Speckled Warbler, Superb Lyrebird, Rockwarbler and White-fronted Chat – the latter a saltmarsh specialist now confined to just two small populations in Sydney – are cases in point. Other bushland bird species appear to be currently in population decline, placing them at risk of local extinction over time.

A total of 1,859 individual birds from 32 families, 56 species and 14 foraging guilds were recorded during the survey in the River to River Corridors Project study area. Bushland remnants accounted for 78.5% (44) of all bird species recorded in the survey - four of these species have been introduced from other countries. Twelve terrestrial foraging guilds occurred in bushland remnants and included native insectivores, nectarivores/insectivores, nectarivores, granivores, carnivores, omnivores, frugivores, and a frugivore/insectivore.

Bird communities of the study area are a mix of remnant indigenous forest species and ubiquitous native and introduced urban birds. Lane Cove River valley and its tributaries - Buffalo Creek, Brickmakers Creek, Kitty's Creek, and to a lesser extent, Tarban Creek - exert a strong and, in conservation terms, important influence over the structure and composition of these communities. Remnant sandstone and shale forest habitats along these zones still support small breeding populations of indigenous birds that have disappeared from much of urban Sydney, e.g. Eastern Yellow Robin, Golden Whistler, White-throated Treecreeper, Eastern Whipbird, Brown Thornbill and Striated Thornbill. Importantly, these habitats also function as corridors for the movement of migratory and nomadic birds such as flycatchers, gerygones, cuckoos and honeyeaters. A sole Bell Miner foraged in the small Sydney Turpentine-Ironbark Forest remnant at Mallee/Tyagarah Reserves. Breeding groups of White-browed Scrubwren and Variegated Fairy-wren were detected in small, isolated bushland remnants at Putney Point, Bedlam Bay, Betts Park, Mallee/Tyagarah Reserves, and Tarban Creek north bank site. Superb Fairy-wrens had bred in small bushland remnants at Betts Park, Bedlam Bay, and Tarban Creek north bank and larger bushland remnants in Field of Mars Reserve, Lane Cove NP and Boronia Park. Only one pair of Eastern Yellow Robin was recorded breeding in the study area - at Field of Mars Reserve (Wildlife Refuge). The threatened Powerful Owl was not recorded in the survey.

In contrast, urban neighbourhood, open parkland and revegetated parkland habitats were characterised by more individual birds but fewer species than found in bushland remnants.

Urban neighbourhood sites supported 898 birds from 19 different species including 4 introduced taxa across 9 guilds. Ground granivores - e.g. Rock Dove, Spotted Dove, Crested Pigeon and Galah, omnivores - Common Myna, Common Starling, Pied Currawong and Australian Raven, nectarivores/insectivores - Noisy Miner and Red Wattlebird, a nectarivore - Rainbow Lorikeet, a frugivore - Eastern Koel, a frugivore/insectivore - Channel-billed Cuckoo, and carnivores - Sacred Kingfisher (including one individual in a densely vegetated backyard) and Grey Butcherbird were the main urban neighbourhood guilds present. Open parkland sites comprised 255 birds from 24 species across 9 guilds which were dominated by ground granivores, ground insectivores and omnivores. Revegetated parkland sites supported 238 birds from 29 species and 10 guilds, the main guilds being ground insectivores, omnivores, nectarivores/insectivores and ground granivores. Revegetated parkland and small forest remnants - Riverglade Reserve, Mallee and Tyagarah Reserves, Betts Park - supported small, isolated populations of Variegated Fairy-wren, White-browed Scrubwren, and Yellow Thornbill. An individual Rufous Fantail was recorded foraging along Tarban Creek at Riverglade Reserve.

The indigenous urban-adaptees Noisy Miner (482 individuals) and Rainbow Lorikeet (457) were the most abundant birds recorded during the survey. Other abundant species included the introduced Common Myna (133), Welcome Swallow (85), Australian Magpie (61), Pied Currawong (60), and White-browed Scrubwren (58). Urban neighbourhood habitats accounted for more individuals of Noisy Miner, Rainbow Lorikeet, Australian Magpie, and Common Myna than other greenspace types. Superb Fairy-wren and Pied Currawong (a nest predator) were present in higher numbers in bushland remnants than other greenspace types. White-browed Scrubwren occurred only in bushland remnants and older revegetation sites.

Some changes in the bird communities of the study area were detected between both spring surveys. There was a small (3.6%) reduction in the total number of individual birds recorded across all greenspace types in spring 2011 compared with spring 2010. This was most obvious in bushland remnants which experienced 26.1% fewer individuals in spring 2011. This was offset by 13.3% and 11% more individuals, respectively, occurring in revegetated parkland and urban neighbourhood sites in spring 2011. The total number of bird species recorded also decreased (by 17.6%) in spring 2011. Again, bushland remnants contributed significantly to this result with 25.4% fewer species detected in the spring 2011 survey. Structural changes to bird communities of the study area also occurred. These featured marked decreases in the number of four major terrestrial foraging guilds present in spring 2011 – shrub insectivores (40% less), carnivores (40%), nectarivores/insectivores (33%), and ground insectivores (10%). Interaction between a suite of factors could explain why these changes occurred in bird communities of the study area. These may include, but are not limited to, variability in climate and its impact on the availability, amount and quality of food, competition and predation pressure, species-specific traits and habitat preferences, landscape effects, human-mediated impacts, and sampling effects.

Managing Ryde-Hunter Hill's avifauna and their habitat requires knowledge of how birds utilise greenspace and interact with each other and their environment at different spatial and temporal scales. This study is supplying new ecological data to help understand and manage these interactions for long-term conservation outcomes. This includes baseline monitoring and evaluation of the performance of proposed new corridor plantings as bird habitat.

Contents

1. Introduction

1.1 Project background

The importance of retaining and integrating viable habitat for biodiversity with human living space has been recognised worldwide (Secretariat of the Convention on Biological Diversity 2006; UNEP Convention on Biological Diversity 2007; Natural Resource Management Ministerial Council 2010). Central to this is a need to understand how biota interacts and functions in complex urban ecosystems, a task that has not yet been accomplished (McDonald et al. 2008; Pickett et al. 2011). Knowledge of how animals utilise different types and configurations of greenspace is essential to guide ecologically sustainable urban planning and design (Commonwealth of Australia 2005; Pickett and Cadenasso 2006; Alberti 2010).

In Sydney, there has been substantial investment in the revegetation of riparian zones, residential streets, parks and housing estates, major transport arteries, and former industrial sites over the past 30-40 years (NSW Department of Planning 2005, 2010). However, there has been little attention paid to determining whether this work is facilitating or hindering the movement and conservation of native fauna and their habitat in these landscapes. For instance, Sydney's inner-west councils have rehabilitated and revegetated tracts of native vegetation along the Cooks River (Cooks River Foreshores Working Group 2006). Similar work has been undertaken by City of Ryde and Hunters Hill Council in the study area at Mallee Reserve and along Tarban Creek at Riverglade Reserve (Ryde Flora and Fauna Study 2006-2008; Hunters Hill Council 2009). While these efforts are addressing soil erosion, urban water quality management, and habitat protection and restoration objectives, their contribution to facilitating the movement and dispersal of native fauna has not been properly assessed.

Associated with this is a pressing need to establish functional wildlife corridors across suitable areas of suburban Sydney. These aim to allow area- and dispersal-limited species to move between isolated patches of habitat to forage and reproduce. This project studies local bird communities to inform the design and implementation of two key wildlife corridors in Ryde-Hunters Hill district over the period 2010-2013 and beyond.

1.2 Objectives

The River to River Corridors Project will:

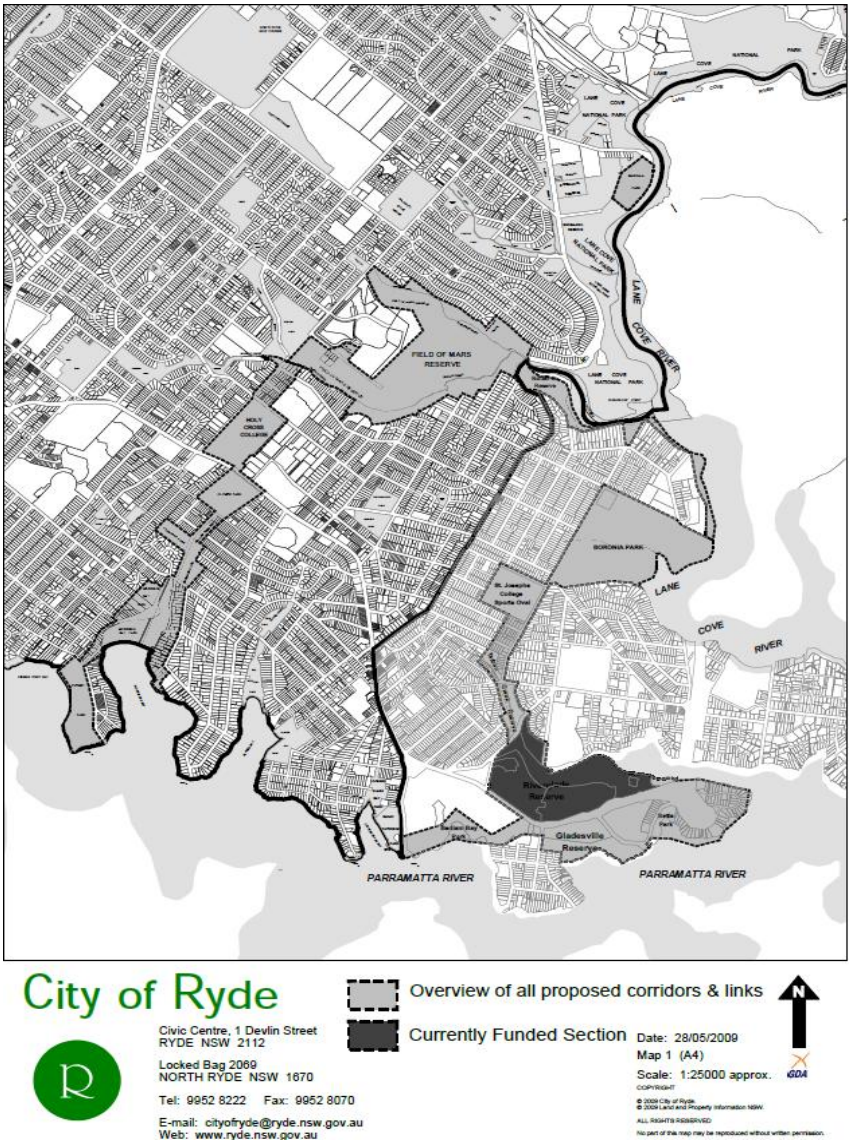
- Describe the composition, structure and habitat requirements of bird communities in different greenspace types in the study area (defined in Figure 1);
- Re-connect two corridors for bushland birds and other fauna based on data obtained from the baseline bird surveys and other studies, best-practice habitat rehabilitation techniques, and effective community participation;
- Enhance the connectivity and condition of existing urban bushland along both corridors;
- Promote community involvement in and ownership of the corridors, especially their monitoring and maintenance over time.

This document reports on the results of an avifaunal survey of the study area conducted in spring (October) 2011. This is the third in a set of four replicated field investigations of the

avifauna of this area – the first being the spring (October) 2010 survey (InSight Ecology 2011a) and the second was the autumn (April) 2011 (InSight Ecology 2011d). Specifically, this report:

- Describes the relative abundance, species richness, composition, and habitat use of bird communities in four different types of greenspace sampled during the survey;
- Provides baseline data to help inform the selection and management of corridor planting sites and provide key reference points for later assessment of corridor performance over time;
- Enhances current knowledge of the biology and ecology of birds of bushland remnants and open urban landscapes in Sydney.

Figure 1: Location of the River to River Corridors Project study area (image: City of Ryde)



2. Methods

2.1 Literature review

A review of existing information on the avifauna and habitats of the study area was undertaken prior to the commencement of the first (October 2010) avifaunal field survey. This included unpublished reports of past fauna surveys (e.g. Ryde Flora and Fauna Study 2006-2008), existing reserve management plans, and maps and reports of bush regeneration and habitat restoration projects conducted in the study area. Bird Atlases I and II (Birds Australia), Atlas of NSW Wildlife (OEH), and Australian Museum's Fauna Database were also reviewed for records of bird species in the study area.

2.2 Field survey

2.2.1 Selection of sites

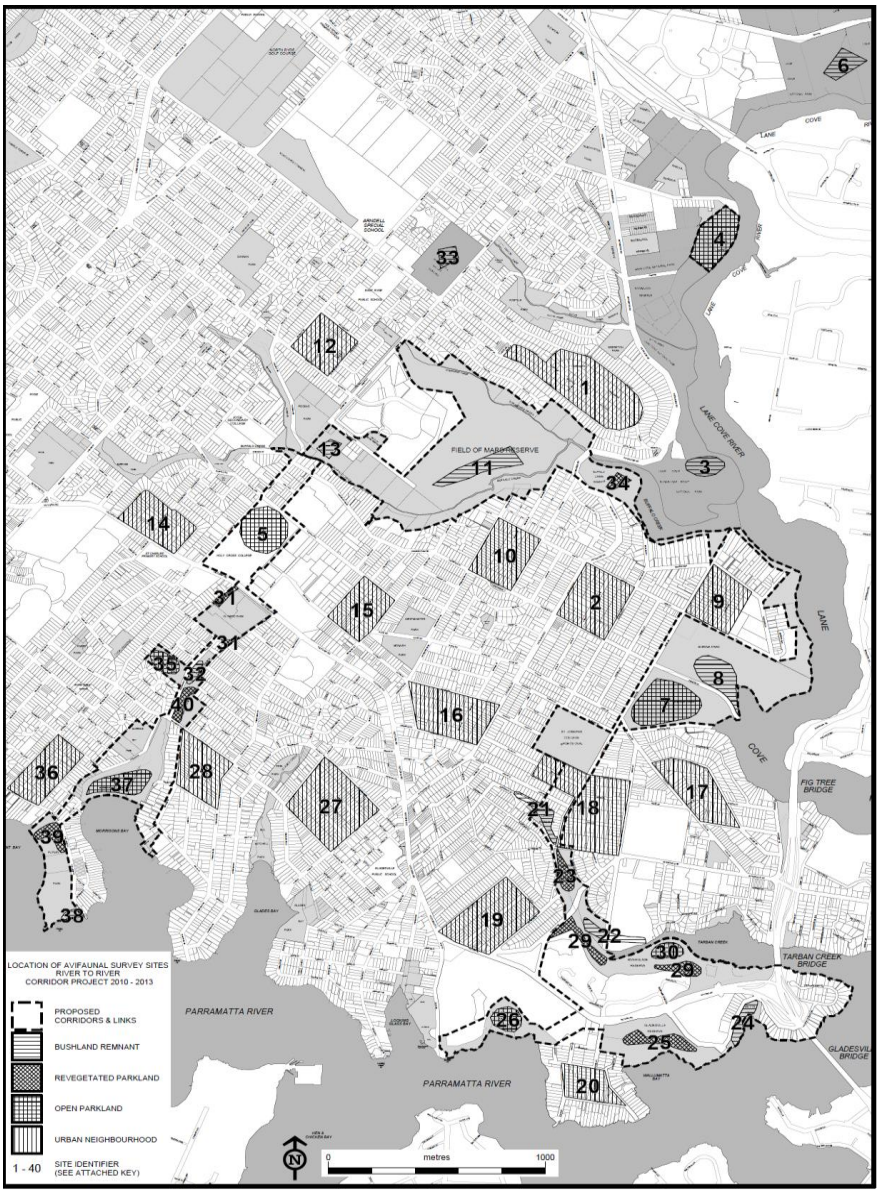
Inspections of the study area were undertaken in March 2008 and October 2010. A sampling design was developed based on the results of these visits, previous bird surveys of western Sydney greenspace undertaken by InSight Ecology, and discussions with City of Ryde and Hunters Hill Council staff.

A total of 4 greenspace types were surveyed in the study area. These included bushland remnant, revegetated parkland, open parkland, and urban neighbourhood. Bushland remnant sites comprised mainly remnant indigenous vegetation characteristic of Sydney's formerly extensive forest and woodland that existed prior to intensive urban development. The main bushland remnants occur in Lane Cove NP, Field of Mars Reserve (Wildlife Refuge), Wallumatta NR and Boronia Park Reserve. The latter reserve contains the endangered ecological community (EEC) of Sydney Turpentine Ironbark Forest (STIF), open forest on exposed sandstone slopes (Sydney peppermint, red bloodwood and smooth-barked apple) and sandstone gully forest (blackbutt, blueberry ash and black wattle). Wallumatta NR supports sandstone-shale transition eucalypt forest while Tarban Creek Reserve contains a small pocket of open eucalypt forest on sandstone. Small isolated remnants were also surveyed at Betts Park, Putney Point and Mallee and Tyagarah Reserves, the latter supporting a STIF EEC. Revegetated parkland sites consisted of mostly native tree, shrub and ground cover species planted in blocks or strips at Buffalo Creek, Tarban Creek, Riverglade and Gladesville Reserves and Putney, Olympic and Bremner Parks. These were typically bush regeneration or beautification projects undertaken by City of Ryde, Hunters Hill Council and volunteer Bushcare groups. Open parkland sites featured areas dominated by open grassed and paved surfaces with some narrow rows or isolated beds of planted indigenous and exotic vegetation. These typified open recreational space and included several parks with playgrounds, picnic areas, sporting ovals, car parks, and facilities. Urban neighbourhood sites were blocks of usually four residential streets featuring sealed surfaces (roads, streets and footpaths), mown verges of planted and mostly established native and exotic trees and shrubs, overhead powerlines, and houses with or without planted native and exotic shrubs, trees and garden beds in their yards.

A total of 40 sites were surveyed for birds in the study area (Figure 2). Of these, 11 were bushland remnant, 7 revegetated parkland, 7 open parkland, and 15 urban neighbourhood sites. These include:

1 Moncrieff Drive, East Ryde (urban neighbourhood = UN)
2 Blaxland Street, Boronia Park (UN)
3 Lane Cove National Park at Sugarloaf Point (bushland remnant = BR)
4 Magdala Park, East Ryde (open parkland = OP)
5 Holy Cross College, Ryde (OP with planted strips of eucalypts)
6 Lane Cove National Park north (BR)
7 Boronia Park (OP)
8 Boronia Park (BR)
9 Park Road, Boronia Park (UN)
10 Westminster Road, Gladesville (UN)
11 Field of Mars Reserve (Wildlife Refuge) Site A (BR)
12 Badajoz Road, Ryde (UN)
13 Field of Mars Reserve (Wildlife Refuge) Site B (BR)
14 Beazley Street, Ryde (UN)
15 Monash Road, Gladesville (UN)
16 Eltham Street, Gladesville (UN)
17 Abigail Street, Hunters Hill (UN)
18 Mary Street, Hunters Hill (UN)
19 Hillcrest Avenue, Hunters Hill (UN)
20 Kelly Street, Henley (UN)
21 Tarban Creek Reserve, Gladesville (BR)
22 Tarban Creek north bank including Villa Maria property, Hunters Hill (BR)
23 Tarban Creek Reserve, Gladesville (revegetated parkland = RP)
24 Betts Park, Huntleys Point (BR)
25 Gladesville Reserve, Henley/Huntleys Point (RP)
26 Bedlam Bay Regional Park, Gladesville/Henley (OP with woody weeds and some remnant foreshore vegetation and old planted trees)
27 Western Crescent, Gladesville (UN)
28 Tennyson Road, Gladesville (UN)
29 Riverglade Reserve, Huntleys Cove (RP)
30 Riverglade Reserve, Huntleys Cove (OP)
31 Olympic Park, Ryde (RP)
32 Mallee Reserve, Ryde/Gladesville (BR)
33 Wallumatta Nature Reserve, North Ryde (BR)
34 Buffalo Creek Reserve, Hunters Hill (RP)
35 Tyagarah Reserve, Ryde (OP, and weedy bushland remnant along drainage line)
36 Stanley Street, Putney (UN)
37 Morrison Bay Park, Putney (OP)
38 Putney Point, Putney (BR)
39 Putney Park, Putney (RP)
40 Bremner Park, Gladesville (RP)

Figure 2: Location of avifaunal survey sites in the study area (courtesy City of Ryde)



2.2.2 Survey methods

Terrestrial bird species were surveyed at each site in the study area. In bushland remnants and larger parkland sites the area search technique (Loyn 1987; InSight Ecology 2008) was deployed. This involved the surveyor steadily walking a loop route in which different forward and return legs, separated where possible by a distance of at least 100 metres, were taken through the main habitats present at each site. In urban neighbourhood sites, a block defined by usually 4 streets was walked, at a steady pace, along footpaths so that each route enclosed the entire sampled block without duplication of the course taken. The area of each of these blocks varied between approximately 5 and 10 ha, depending on allotment size and configuration and street width and length. Single line transects were walked in smaller sites (ie. Riverglade Reserve, Putney Point, Putney Park, Mallee Reserve, Tyagarah Reserve, Bremner Park and Olympic Park) where it was not feasible to deploy the area search method.

The order of surveying sites was reversed for this survey from that used in the first spring (October 2010) sampling effort which involved working from the north of the study area to its south. That is, the October 2011 survey commenced in the central and southern sectors of the study area – ie. Olympic Park, Mallee Reserve, Tyagarah Reserve to Putney Park and around to Bedlam Bay, Gladesville Reserve, Betts Park, Riverglade Reserve, Tarban Creek Reserve and nearby urban neighbourhood sites – and continued to northern sites including Boronia Park, Field of Mars Reserve (Wildlife Refuge), Lane Cove National Park, Wallumatta Nature Reserve and nearby parkland and urban neighbourhood sites. This change was undertaken to minimise the potential for the introduction of location or geographic bias into bird abundance, species richness and community structure data collected. This can arise when the same or similar geographical routes are taken to survey especially resident bird communities over more than one season. In addition, sites surveyed in mornings in the first spring (October 2010) were, where possible, surveyed in afternoons in the second spring (October 2011). This helped to minimise the potential impact of time-of-day sampling bias in bird data obtained between each spring.

All area searches and block walks avoided recording the same bird twice, particularly flocking, communally-living, and fast or very frequently moving species such as Noisy Miner, Rainbow Lorikeet, Welcome Swallow, Galah and Long-billed Corella. Particular care was taken in some parkland sites where, due to the small size of the reserve, forward and return search legs occurred within 100 metres of each other. This also helped to avoid committing the same error with more sedentary species such as Masked Lapwing, Australian Magpie, Magpie-lark, and Grey Butcherbird that often employ stalking or "sit-and-wait" foraging strategies.

All birds observed or heard at a site or along a line transect were recorded, including individuals flying over the site. Data recorded included the species present, number of individuals observed, sampling period, date, time and location of record, greenspace type, behaviour (ie. foraging/feeding, breeding, calling, mobbing, resting, flying), use of habitat, and other relevant information such as age, species composition and condition of remnants, revegetation and urban neighbourhood vegetation, weather, and bird interactions (eg. predation, predator avoidance, mating/mate pursuits). Using nomenclature consistent with Christidis and Boles (2008), these data were entered into a MS Excel spreadsheet in taxonomic order. All observations were made by the same experienced observer (A.H.) using a pair of Zeiss 10x40BT® binoculars fixed to a Pro-Harness® chest-strap. The survey was undertaken over a 9-day period in autumn (October 23-31) 2011. Surveys were generally conducted in peak morning (0700-1000 hours) and afternoon (1600-1900 hours) bird foraging periods (survey sessions) on each survey day. No surveying occurred in windy or wet weather. Just over three sessions or 25% of total survey time (12 sessions) were lost to wet and/or windy weather. This was offset by including additional sessions within the 9-day sampling window.

A total of 21.09 hours was spent on surveying birds in the study area. This was comparable to the October 2010 total survey effort of 24.75 hours. Bushland remnant sites were surveyed more intensively than other greenspace types - for 9.17 hours (50 minutes per site) or 43.5% of the total survey effort. Urban neighbourhood sites, in contrast, were surveyed for a total of 5 hours (20 minutes per site) representing 23.7% of the total survey effort. Revegetated parkland sites were surveyed for 4.25 hours (36.4 minutes per site) or 20.1% of the total effort. Open parkland sites were surveyed for 2.67 hours (22.8 minutes per site) or 12.7% of total survey

time. This amount and distribution of survey effort across the different greenspace types was comparable with the spring (October 2010) and autumn (April 2011) survey programs.

This variance in proportionate survey effort between remnant bushland and parkland and urban neighbourhood sites was not considered to significantly affect the results obtained or their interpretation. Bushland remnants often provide a broader and more complex suite of bird habitats and thus support taxonomically richer avian assemblages than revegetated and developed sites. Thus, they may require more survey effort per unit area to obtain an accurate sample of bird abundance, species richness, community structure and habitat use.

To aid reading, this report generally presents the common names of birds. Their scientific names are provided in the appendices.

2.3 Habitat assessment

A suite of habitat attributes were recorded at representative sites in each greenspace type in the study area. These included dominant plant species and community present, height of main tree species present, habitat condition and connectivity (remnants and revegetation), vegetation structure (in bush remnants and revegetated parkland), bird use of habitats present, estimated age and species composition of plantings (in revegetated parkland and urban blocks), type of urban neighbourhood habitats (ie. street verge, built structures, front- and rear-yard vegetation), and extent and type of disturbance (i.e. presence of weeds, feral and domestic animals, evidence of predation, level of human incursion). Attributes of landscape context were also noted for selected sites in different greenspace types, i.e. distance of planted or remnant vegetation to nearest neighbouring vegetation patch, position in the local and regional landscape, pattern of vegetation distribution, and edge type and size.

The photographic library of vegetation types, birds, habitats, and landscapes present at each site compiled during the October 2010 and April 2011 surveys was added to during the October 2011 survey using a Canon PowerShot SX210 IS® 14x zoom digital camera. Images were stored in this library using Microsoft Office Picture Manager 2007® software. Some of these images are presented in this report. All images, data and related material were stored on a standard 500GB ATA HDD backed up to a 500GB external HDD.

2.4 Data analysis

Three key attributes of bird communities were selected for analysis from data collected at each site in each greenspace type in the study area. These were relative abundance, species richness, and composition of foraging guilds (as a key indicative component of bird community structure). A total of 40 replicates of greenspace type were used in analyses undertaken for this report. These were stratified across the surveyed sites and included 11 bushland remnant, 7 revegetated parkland, 7 open parkland, and 15 urban neighbourhood sites. Assignment of species recorded in the surveys to foraging guilds was based on existing professional knowledge and published data, especially from the authoritative “Handbook of Australian, New Zealand and Antarctic Birds (Volumes 1-7)” (various editors, see References). Bird use of habitat was analysed qualitatively from habitat attribute information collected during the spring (October 2010), autumn (April 2011), and current (spring 2011) surveys at representative sites within each greenspace type.

Bird survey data were examined for the total, mean, standard error and standard deviation from the mean for each greenspace type and for the overall study area using Microsoft Excel 2007® and SigmaPlot Version 11.2® (Systat Software, Inc. 2009), with the results presented in graphical and tabular form. Survey effort was calculated by greenspace type and for the study period. Conservation significance was assessed by comparing survey results with historical data for the study area and utilising expert ornithological knowledge.

3. Results

3.1 Relative abundance

A total of 1,856 individual birds were recorded during the spring (October 2011) survey in the study area (Appendix 1). Fourty-eight (48.4) percent (898 birds, mean 2.41, standard deviation [sd] 6.88) of these birds were recorded in urban neighbourhood sites. Bushland remnants accounted for 25.1% (468 birds, mean 1.25, sd 2.43) of the total. Revegetated parkland sites provided 12.8% of the total (238 birds, 0.63, sd 2.18). Open parkland contributed 13.8% of all birds recorded (255 birds, mean 0.68, sd 2.50). Figure 3 shows this variation in relative abundance of birds between the different greenspace types at the surveyed sites in the study area. Figure 4 depicts the mean number of birds recorded in each greenspace type.

Figure 3: Total number of birds recorded by greenspace type, October 2011

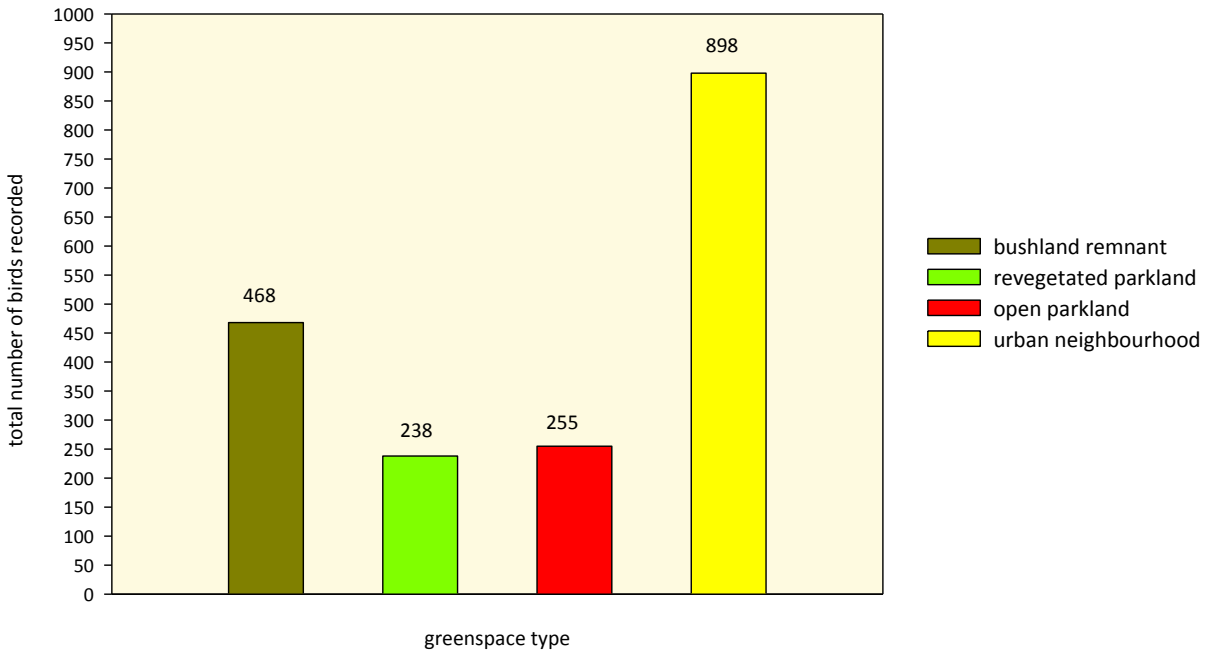
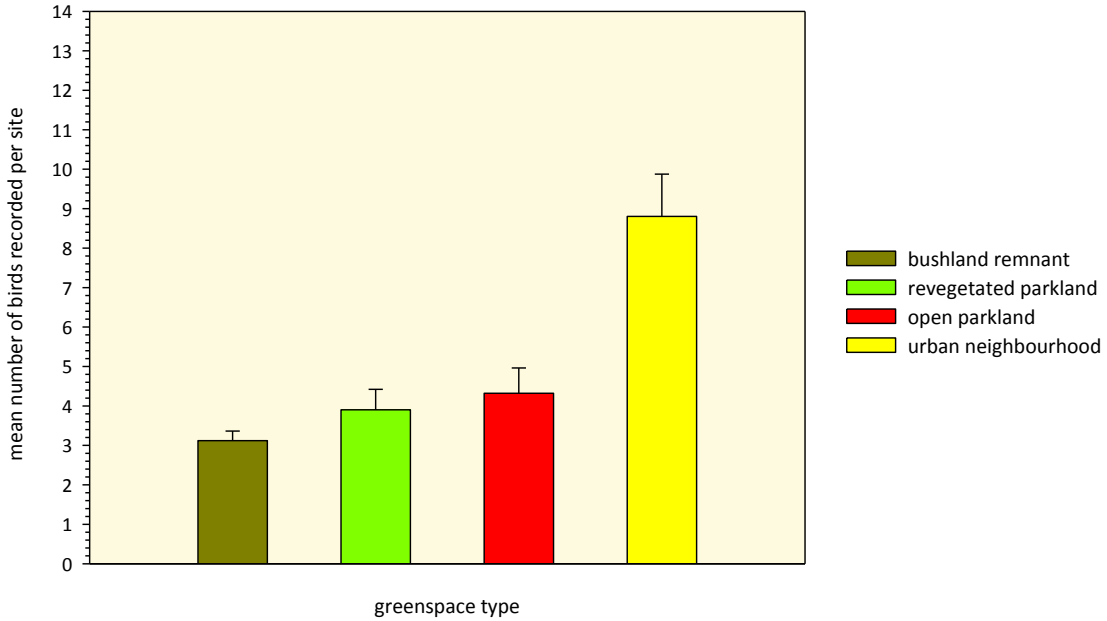


Figure 4: Mean number of birds recorded by greenspace type, October 2011 (per site, with standard error)



The most abundant bird species recorded across all greenspace types surveyed in the study area were Noisy Miner (482 individuals), Rainbow Lorikeet (457), the introduced Common Myna (133), Welcome Swallow (85), White-browed Scrubwren (58), Variegated Fairy-wren (39), Australian Raven (36), Silvereye (34), Crested Pigeon (32), and the introduced Spotted Dove (32). Bushland remnant sites were populated most abundantly by Rainbow Lorikeet (63 individuals), Noisy Miner (62), White-browed Scrubwren (44 – Plates 1-2), Pied Currawong (38), Variegated Fairy-wren (33 – Plates 3-4), Silvereye (30), Red Wattlebird (21), and Superb Fairy-wren (16). Revegetated parkland sites were dominated by Noisy Miner (70), Rainbow Lorikeet (29), Welcome Swallow (24), and Galah (17). Open parkland sites supported mostly Noisy Miner (49), Rainbow Lorikeet (49), Welcome Swallow (40), Sulphur-crested Cockatoo (19), and Australian Magpie (16. Urban neighbourhood sites were occupied mostly by Rainbow Lorikeet (316), Noisy Miner (301), Common Myna (119), Australian Magpie (31), Crested Pigeon (26), Spotted Dove (23), Welcome Swallow (18), and the introduced Rock Dove (17). No House Sparrow and only a small number of Common Starling (8) were recorded during the survey. The only other introduced species, Red-whiskered Bulbul, was recorded in low numbers (10) in four bushland remnants and one revegetated parkland site (Appendix 1).

The least abundant bird species recorded across all greenspace types surveyed in the study area were small-medium sized insectivores dependent on larger, contiguous tracts of quality forest, shrub and groundcover habitats. In the study area these habitats exist mostly within Lane Cove River NP, Field of Mars Reserve (Wildlife Refuge), and Boronia Park. These included summer breeding migrants - Australasian Figbird, Dollarbird, Sacred Kingfisher, and Rufous Fantail (Plates 5-8), small insectivores – Eastern Whipbird (Plate 9), Eastern Yellow Robin (Plate 10), Striated Thornbill, Brown Gerygone, Golden Whistler and White-throated Treecreeper, a canopy insectivore Bell Miner (Plate 11), three nectarivores/insectivores – Eastern Spinebill, New Holland Honeyeater (Plate 12), and Little Wattlebird, and a ground granivore – Red-browed Finch. The Powerful Owl was not recorded during the survey.

Plate 1: An adult female White-browed Scrubwren in dense understorey at Putney Point bushland remnant, 23 October 2011.

Plate 2: Putney Point remnant bushland and weedy ground cover where a group of adult and fledgling White-browed Scrubwrens were recorded (23/10/11).

Plate 3: Male Variegated Fairy-wren delivering prey to a nest in Lane Cove NP north bushland remnant (29/10/11).

Plate 4: An adult female Variegated Fairy-wren at the nest site shown in Plate 3 (regenerating after fire).

Plate 5: Australasian Figbird – an effective disperser of the seeds of figs and other trees along the eastern and northern Australian coast (en. wikipedia.org).

Plate 6: Dollarbirds are migratory aerial insectivores and were recorded nesting in older blackbutt spouts in Boronia Park bushland remnant during the survey (en.wikipedia.org).

Plate 7: Sacred Kingfishers were recorded breeding in Field of Mars Reserve, calling in Lane Cove NP north bushland remnant, and foraging in a Monash Road backyard (en.wikipedia.org).

Plate 8: Lone Rufous Fantails were recorded foraging in bushland remnants at Bedlam Bay, Boronia Park and Field of Mars Reserve, often in association with scrubwrens and fairy-wrens (Greg Clancy).

Plate 9: A denizen of dense, well-connected ground cover and understorey habitat, one Eastern Whipbird was recorded in Field of Mars bushland remnant during the survey (Graeme Chapman).

Plate 10: Eastern Yellow Robins are ground insectivores requiring continuous forest in good condition. Only 3 birds were recorded in the survey – in Boronia Park and Field of Mars Reserve bushland remnants (en.wikipedia.org).

Plate 11: Bell Miners glean insects from foliage high in eucalypt forest canopies. A sole bird was recorded in the small turpentine-ironbark remnant at Mallee/Tyagarah Reserves during the survey, 23/10/11 (en.wikipedia.org).

Plate 12: New Holland Honeyeaters move around tracking seasonally available supplies of nectar and insects. Six birds were recorded in flowering banksia and *Lambertia formosa* shrubs in Field of Mars Reserve (Greg Clancy).

3.2 Bird species richness

A total of 56 bird species from 32 families were recorded during the survey in the study area (Appendix 1). This included 54 terrestrial species and 2 (Pacific Black Duck and White-faced Heron) aquatic and aquatic/terrestrial species. Five of these terrestrial species have been introduced to Australia – Rock Dove, Spotted Dove, Red-whiskered Bulbul, Common Starling and Common Myna. Three other exotics - European Goldfinch, House Sparrow and Common Blackbird - were not recorded during the survey.

Bushland remnants accounted for 78.5% (44 out of 56) of all bird species recorded during the survey. Small native forest insectivores dependent on larger contiguous tracts of quality forest and woodland were recorded only at the two Lane Cove NP sites, Field of Mars Reserve (Wildlife Refuge), and/or Boronia Park. They included Eastern Whipbird, Eastern Yellow Robin, Brown Gerygone, Striated Thornbill, Brown Thornbill, Golden Whistler, Spotted Pardalote, and White-throated Treecreeper.

Revegetated parkland sites supported 29 species or 51.8% of all avifauna recorded in the survey. Some native ground- and shrub-foraging insectivores such as White-browed Scrubwren, Variegated Fairy-wren, Superb Fairy-wren and Rufous Fantail were detected at these sites. The invasive Noisy Miner occurred at moderate levels in both revegetated parkland and bushland remnant sites.

Open parkland supported 24 species (42.8%) of all avifauna recorded during the survey and included 3 introduced species. Birds of open areas such as Welcome Swallow, Crested Pigeon, the introduced Rock Dove and Common Myna, Magpie-lark and Australian Magpie characterised these sites. Noisy Miner and Rainbow Lorikeet foraged in isolated planted trees around the edges of open parkland.

Urban neighbourhood sites were dominated by Rainbow Lorikeet, Noisy Miner, Common Myna, Spotted Dove, Australian Magpie and Crested Pigeon. These sites were the least diverse in species richness terms, accounting for 33.9% (19 species) of all avifauna surveyed. Figure 5 shows the variation in total bird species richness between the four greenspace types at the surveyed sites in the study area. Figure 6 displays the mean number of bird species recorded in each greenspace type.

Figure 5: Total number of bird species recorded by greenspace type, October 2011

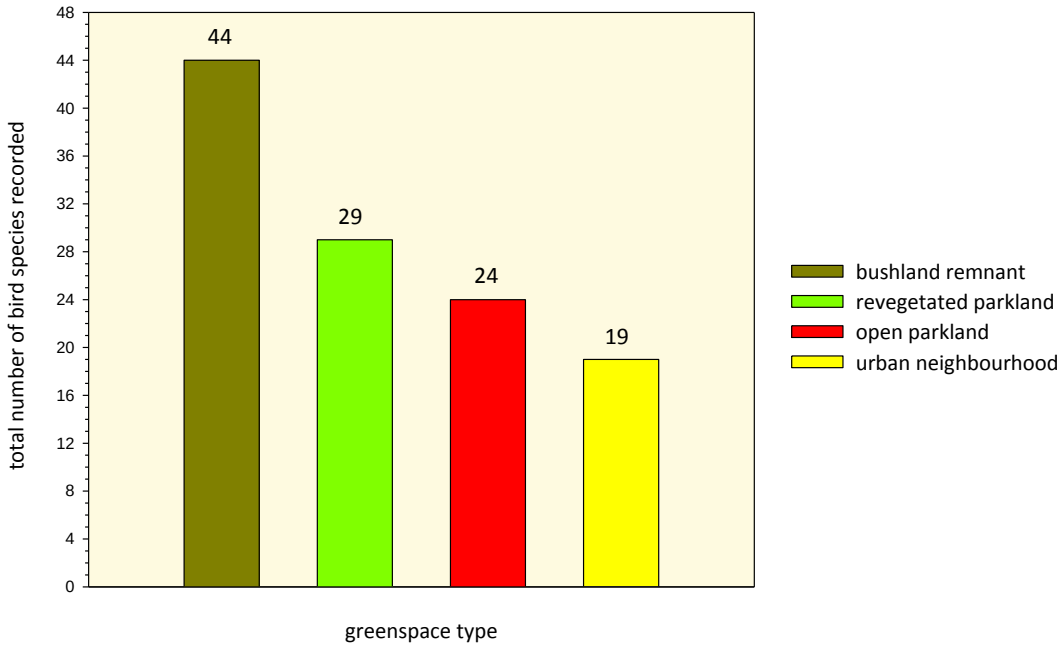
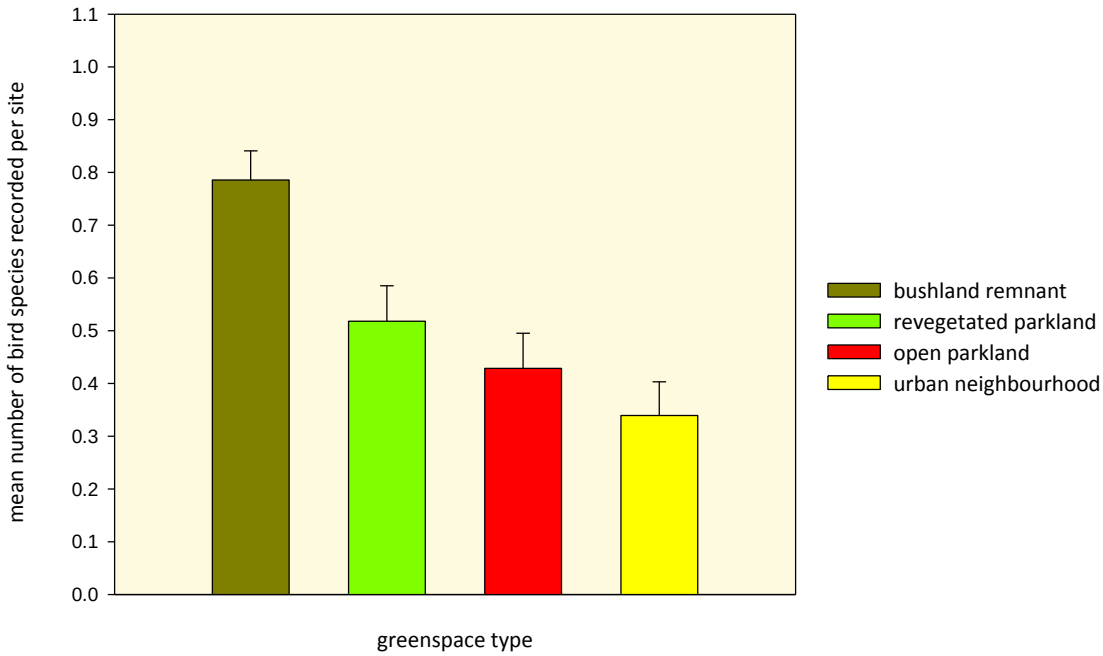


Figure 6: Mean number of bird species recorded by greenspace type, October 2011 (per site, with standard error)



3.3 Bird community structure and habitat

3.3. 1 Composition of bird foraging guilds

Foraging guild composition is a key indicative component of bird community structure (Ford 1989; Wiens 1989; Mills 2007). A total of 14 bird foraging guilds were recorded at the surveyed sites in the study area. These included 12 terrestrial guilds (Figure 7), one terrestrial/aquatic guild, and one aquatic guild.

The terrestrial guilds comprised ground insectivores (16.1% of all bird species recorded across all greenspace types), ground granivores (14.3%), omnivores (12.5%), shrub insectivores (10.7%), canopy insectivores (10.7%), nectarivores/insectivores (7.1%), carnivores (5.3%), frugivores (3.6%), frugivores/insectivores (3.6%), aerial insectivores (3.6%), canopy granivores (3.6%), and nectarivores (1.8%). The main ground insectivorous species recorded were White-browed Scrubwren, Australian Magpie, Superb Fairy-wren, Variegated Fairy-wren, Willie Wagtail, and Magpie-lark. Ground granivores were represented by Spotted Dove, Rock Dove, Crested Pigeon, Galah, Sulphur-crested Cockatoo, Long-billed Corella and Red-browed Finch. Omnivores included Common Myna, Common Starling, Pied Currawong, Silvereye, Australian Raven and Australian White Ibis. Key shrub insectivores were Rufous Fantail, Brown Thornbill, Yellow Thornbill, Brown Gerygone, and Golden Whistler. Canopy insectivores included Spotted Pardalote, Bell Miner, Black-faced Cuckoo-shrike and White-throated Treecreeper. Aerial insectivores recorded were Welcome Swallow, Tree Martin, Black-faced Cuckoo-shrike, and the summer breeding migrant, Dollarbird. Noisy Miner and Red Wattlebird were the main nectarivores/insectivores recorded while carnivores included Laughing Kookaburra, Grey Butcherbird and the breeding summer migrant, Sacred Kingfisher. Frugivores included Australasian Figbird and the summer breeding migrant and nest parasite Eastern Koel. The introduced Red-whiskered Bulbul and summer breeding migrant/nest parasite Channel-billed Cuckoo represented frugivores/insectivores.

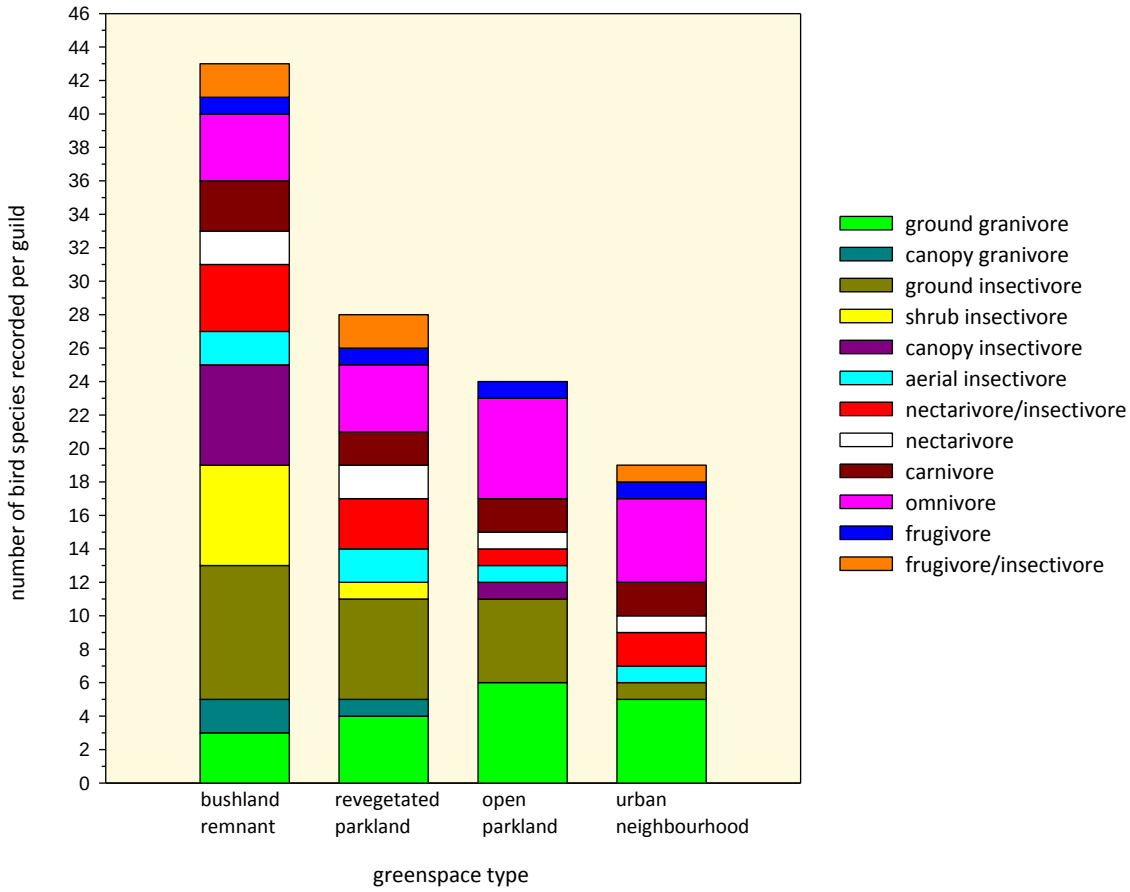
Bushland remnant sites supported taxonomically richer assemblages of birds particularly ground insectivores, shrub insectivores, canopy insectivores, canopy granivores, nectarivores/insectivores, and carnivores than did the other greenspace types (Figure 7). Many of these guilds included species that were not recorded or recorded in substantially lower numbers in the more open greenspace types. Ground granivores were relatively evenly distributed across each greenspace type.

Revegetated parkland sites mirrored, to some degree, assemblages recorded in bushland remnants featuring reasonably diverse ground insectivorous, nectarivorous/insectivorous and omnivorous taxa. Ground insectivores included a residual core of groundcover-utilising native small 'bush birds' - Superb Fairy-wren, Variegated Fairy-wren and White-browed Scrubwren. A shrub insectivore – Rufous Fantail – foraged along planted riparian trees and shrubs in Riverglade Reserve. Four honeyeaters – Noisy Miner, Red Wattlebird, Little Wattlebird and Eastern Spinebill – foraged in eucalypt, banksia and callistemon plantings.

Open parkland and urban neighbourhood sites supported more species-rich omnivorous and ground granivorous guilds which were comparable in number but not always composition to bushland remnant sites. Ground granivores included hardy, versatile birds – typically Rock Dove, Spotted Dove, Crested Pigeon, Galah, and Sulphur-crested Cockatoo. More omnivorous

species utilised open parkland and urban neighbourhood habitats than bushland remnants, typically including Australian Raven, Pied Currawong, Australian White Ibis, Common Starling and Common Myna. Greater numbers of the latter species were recorded wherever more rubbish occurred such as around bins, shopfronts and along street verges. e.g. at the Beazley Street, Badajoz Road and Western Crescent sites. Australian Raven presence again peaked around rubbish bins and playgrounds adjacent to Holy Cross College open parkland site.

Figure 7: Composition of terrestrial bird foraging guilds by greenspace type, October 2011



3.3.2 Bird habitats and their use

A range of bird habitats were recorded in each greenspace type during the survey in the study area. Bushland remnants were a mixture of larger generally contiguous patches of sandstone slope and gully forest, allocasuarina woodland and mangroves along Lane Cove River, Kittys Creek, Buffalo Creek and Brickmakers Creek and smaller (0.1-2 ha) isolated patches of Sydney Turpentine Ironbark Forest along Tarban Creek, Parramatta River foreshore (including Putney Point and Bedlam Bay sites), and Mallee and Tyagarah Reserves. These remnants are part of a once more extensive indigenous forest and woodland that occurred prior to Sydney's urbanisation (see Benson and Howell 1990a, 1994). These patches contain ground cover, shrub and canopy layer habitats for insectivorous, granivorous, frugivorous, omnivorous and nectarivorous birds. A core group of forest- and woodland-dependent endemics were recorded in the larger remnants within Lane Cove NP, Field of Mars Reserve (Wildlife Refuge) and

Boronia Park Reserve. These included Dollarbird, White-throated Treecreeper, Eastern Yellow Robin, Eastern Whipbird, Striated Thornbill, Brown Thornbill, Yellow Thornbill, Brown Gerygone, Striated Pardalote, Crimson Rosella, Australian King-Parrot, Golden Whistler, and the migratory Rufous Fantail. Other habitats occurring in the remnants were grass swards and rushes in Lane Cove NP near Buffalo Creek Reserve, a small number of standing dead trees (stags) in Tarban Creek Reserve, rock shelves and outcrops, fallen logs, and aquatic habitats (pools, running water and fringing vegetation) along Brickmakers, Kittys, Buffalo and Tarban Creeks.

Revegetated parkland sites provided a narrower suite of bird habitats than bushland remnants. The quality of these sites varied according to the age, size, floristic composition, areal extent and distance of the plantings from bushland remnants. Older (10-40 year-old) native mixed species plantings provided more layers of potential bird foraging, shelter and nesting habitat than younger plantings. Older planted sites surveyed included Putney Park, Olympic Park, Gladesville Reserve (oval and west), Riverglade Reserve (east) and Tarban Creek Reserve. Younger sites sampled were at Riverglade Reserve (west), Gladesville Reserve (east), Mallee Reserve, Bremner Park and Buffalo Creek Reserve. Older plantings offered a greater selection of perches, foraging microhabitat such as decorticating bark, leaf rolls and fallen debris, and potential breeding habitat for some indigenous and introduced passerines. In contrast, younger (ca. 3-6 year-old) indigenous plantings comprised fewer foraging, roosting and breeding opportunities, often consisting of only one canopy layer and some ground cover such as *Lomandra longifolia* clumps. A small group of native ground and shrub insectivores were recorded in older planted sites and included Superb Fairy-wren, Variegated Fairy-wren, White-browed Scrubwren, and Rufous Fantail. Some nectarivores/insectivores also utilised these plantings – Noisy Miner and Red Wattlebird nested in sites such as Riverglade Reserve. Tree hollows, stags, fallen decaying logs and in-situ rock substrates were generally rare or absent from revegetated parkland sites.

Open parkland habitats were structurally simpler than their revegetated counterparts. They included grassed open space, weed-infested stormwater drains and drainage lines, built structures (e.g. playgrounds, picnic amenities), isolated individual or single rows of planted trees, and air space. Magdala Park, Boronia Park (ovals), Riverglade Reserve (oval), Bedlam Bay Regional Park (oval) and Tyagarah Reserve (oval) typified open parkland habitats sampled in the study area. Holy Cross College and Morrison Bay Park sites contained a mixture of open playing fields, built structures and narrow planted strips of allocasuarina, tallowwood and other eucalypts, usually fringing ovals or canals. Birds of open parkland habitats were a mix of hardy indigenous and introduced species able to forage, roost, shelter and/or successfully breed in these more open environments. They included ground granivores - Spotted Dove, Rock Dove, Crested Pigeon, Galah, Sulphur-crested Cockatoo, Crested Pigeon, and Long-billed Corella, ground insectivores - Australian Magpie, Magpie-lark, Willie Wagtail, Masked Lapwing and Superb Fairy-wren, an aerial insectivore Welcome Swallow, a nectarivore/insectivore - Noisy Miner, a nectarivore - Rainbow Lorikeet, omnivores - Common Myna, Australian Raven, Australian White Ibis, Silver Gull, Pied Currawong, and Common Starling, and two carnivores – Laughing Kookaburra and Grey Butcherbird, and an aquatic/terrestrial insectivore.

Urban neighbourhood sites provided a range of novel and often floristically diverse habitats for bird species able to forage, roost, and, in some cases, breed in built-up residential areas. These habitats included sealed surfaces - roads, streets, gutters, footpaths, mown and vegetated

street verge - with brush box *Lophostemon confertus* as the dominant native street tree, commonly pruned to a maximum height of 5-16 m, built structures - houses, fences, roof-mounted antennae, powerlines, streetlight poles, stormwater drains and home gardens comprising usually exotic and some indigenous shrubs with dense foliage and nectar-rich flowers to 3 m, and up to 30 m tall indigenous (e.g. eucalypts, paperbarks, silky oak *Grevillea robusta*, allocasuarina) and exotic (e.g. jacaranda, date palm, poplar, oak, cypress, liquidambar, maple) trees in the front and rear yards of properties. Birds of these habitats were similar to those of open parkland sites. Typically they included ground granivores - Rock Dove, Spotted Dove, Crested Pigeon, Galah, and Sulphur-crested Cockatoo, only one ground insectivore - Australian Magpie, an aerial insectivore – Welcome Swallow, nectarivores/insectivores - Noisy Miner and Red Wattlebird, a nectarivore - Rainbow Lorikeet, omnivores - Australian White Ibis, Common Myna, Common Starling, Australian Raven and Pied Currawong, the frugivorous Eastern Koel, a frugivore/insectivore – Channel-billed Cuckoo, and two carnivores - Grey Butcherbird and Sacred Kingfisher. One individual of the latter species was detected foraging in a densely-planted backyard in the Monash Road site, approximately 600 m from the nearest bushland remnant (Buffalo Creek at Field of Mars Reserve). Supplementary feeding in backyards might help account for the presence of Grey Butcherbird and Laughing Kookaburra at some of these sites.

A suite of habitats, microhabitats and food types were used by birds and other fauna in the study area (Plates 13-24).

Plate 13: Fresh bandicoot foraging excavations in Wallumatta Nature Reserve bushland remnant site, 28/10/11.

Plate 14: Australian Brush-turkey mound at Buffalo Creek revegetated parkland site – the sealed walking trail is just to the left of the image – 31/10/11.

Plate 15: Common Ring-tailed Possum drey in planted eucalypt along Tyagarah Street at Mallee Reserve bushland remnant site, 23/10/11. The red arrow indicates location of the active drey.

Plate 16: Common Ring-tailed Possum in the drey shown in Plate 15. The animal's head occurs to the right of the centre of the photograph.

Plate 17: A waterfall and pools in upper Buffalo Creek provide bathing, drinking and foraging sites for Sacred Kingfisher, White-browed Scrubwren, Eastern Yellow Robin and other bush birds, Field of Mars site, 29/10/11.

Plate 18: Playing fields at Holy Cross College open park-land site again provided foraging and breeding habitat for Masked Lapwing – 2 of 3 recent fledglings are shown along the eastern boundary fence, 28/10/11.

Plate 19: Flocks of Sulphur-crested Cockatoo and Long-billed Corella foraged on recently mown grass surfaces at Magdala Park open parkland site, 29/10/11.

Plate 20: Moreton Bay Fig fruit provided copious food for bats and frugivorous and omnivorous birds in Morrison Bay Park open parkland site (edge), 23/10/11.

Plate 21: A tiny, weedy bushland remnant at Putney Point provided foraging and likely nest sites for a group of White-browed Scrubwren and Variegated Fairy-wren, Putney Point bushland remnant site, 23/10/11.

Plate 22: An adult female White-browed Scrubwren (below) was part of the group of small groundcover-utilising birds at the site shown in Plate 21.

Plate 23: A bamboo and turpentine canopy with lantana/ privet understorey provided foraging and possibly nesting habitat for White-browed Scrubwren and Variegated Fairy-wren along a drainage line in Tyagarah Reserve.

Plate 24: Dense layers of honeysuckle, lantana and privet provide ground- and understorey cover for small insect-ivores and nectar for honeyeaters along the western bank of Tyagarah Reserve bushland remnant site.

3.4 Interseasonal changes in bird communities

Some patterns of change were evident in bird communities of the study area between both spring seasons, ie. spring 2010 and spring 2011. From the data collected, these relate to variation in relative abundance, species richness, and composition of terrestrial foraging guilds. These are described below.

3.4.1 Relative abundance

There was a slight (69 individuals or 3.6%) decrease in the total number of birds recorded in this survey relative to the spring 2010 sample. Most of this change was attributable to 165 or 26.1% fewer birds recorded in bushland remnants and 20 or 7.3% less birds in open parkland sites. The main 'decreasers' or species that were present in fewer numbers in the spring 2011 survey than spring 2010 were Long-billed Corella (61.9% less), Red Wattlebird (55.7%), Rock Dove (52.5%), Spotted Dove (46.7%), Silvereye (35.8%), Pied Currawong (21%), and Crested Pigeon (20%). In addition, several species recorded in spring 2010 were not detected in the spring 2011

survey. These included four small insectivores of larger, better-connected remnants - Rufous Whistler, Grey Fantail, and the warm season migrants, Leaden Flycatcher and Black-faced Monarch, nomadic/dispersive honeyeaters - Yellow-faced Honeyeater and Noisy Friarbird, forest raptors - Brown Goshawk and Powerful Owl, a canopy granivore - Yellow-tailed Black-Cockatoo, and a frugivore - Olive-backed Oriole.

These losses were offset to a degree by increased numbers of birds recorded in spring 2011 in urban neighbourhood sites (89 birds or 11%) and revegetated parkland sites (28 or 13.3%). The principal 'increasers' were Galah (57.1%), Rainbow Lorikeet (28.2%), Welcome Swallow (28.2%), Australian Magpie (27.9%), Variegated Fairy-wren (23.1%), Sulphur-crested Cockatoo (22.7%), Common Myna (15.8%), Superb Fairy-wren (10.7%), and Noisy Miner (9.5%). More Channel-billed Cuckoos (4 or 50% more) were recorded in spring 2011 than spring 2010. Also, some species were recorded in spring 2011 but not spring 2010 - Fan-tailed Cuckoo, Bell Miner and Tree Martin.

3.4.2 Bird species richness

Twelve (12) or 17.6% fewer bird species were recorded in spring 2011 compared with spring 2010. This reduction occurred across all greenspace types but more in bushland remnants (15 or 25.4% fewer species) and urban neighbourhood sites (4 or 17.4% fewer species). Open parkland (3 or 11.1%) and revegetated parkland (2 or 6.4%) sites recorded smaller reductions. Species detected in spring 2010 but not spring 2011 were small forest insectivores, forest raptors, some honeyeaters, a canopy granivore, and a frugivore, as listed in Section 3.4.1.

3.4.3 Bird community structure

There were some notable changes in the structure of terrestrial bird communities of the study area between both spring sampling periods. Four of the eight main terrestrial bird foraging guilds recorded fewer member species in spring 2011 than in spring 2010. These were shrub insectivores (4 or 40% fewer species), carnivores (2 or 40%), nectarivores/insectivores (2 or 33.3%), and ground insectivores (1 or 10%). The composition of the other four guilds - ground granivores, canopy insectivores, omnivores and frugivores – remained relatively stable over this period.

When analysed by greenspace type, the most pronounced losses of species occurred in bushland remnants. These involved four guilds – ground granivores (57.1% fewer species in spring 2011 than spring 2010), shrub insectivores (33.3%), nectarivores/insectivores (33.3%), and carnivores (40%). Urban neighbourhood sites recorded a 66.7% loss of ground insectivores in spring 2011. Aside from this loss, guilds in urban neighbourhood remained stable across both springs. Stability of guild structure was also a characteristic of most revegetated parkland and open parkland sites, with only minor losses offset by gains of single species.

3.5 Breeding activity

A total of 117 records (111 in spring 2010) of direct and indirect bird breeding activity involving 30 species (35 in spring 2010) were obtained during the survey in the study area. Direct evidence of reproductive activity included nesting (construction and sitting), provisioning of young as nestlings or fledglings, mating, and moving about with dependent young birds. Indirect evidence involved courtship, territory calling with mate sighted and/or responding,

nest site inspection, active territory defence including pursuits to repel intruders, and mate pursuits. Specific calling for a prospective mate was not included since it could not be established if this activity led to successful pairings and mating. These records produced a total of 257 young birds (186 in spring 2010). These included fledglings and juveniles but not nestlings as estimates of the latter were too difficult to accurately obtain. This survey also targeted the production of young by Noisy Miner at the study sites. It obtained 34 records of direct breeding activity by this species, with an estimated total of 206 young birds produced across the surveyed sites. This represented 53.5% of all direct bird breeding records made during the survey. This was slightly (6.3%) more than the estimated spring 2010 breeding effort by Noisy Miner which produced 193 young birds (34 records) from the study sites.

Bird species recorded breeding during the survey were Pacific Black Duck, Spotted Dove, Masked Lapwing, Rainbow Lorikeet, Eastern Koel, Channel-billed Cuckoo, Laughing Kookaburra, Sacred Kingfisher, Dollarbird, White-throated Treecreeper, Superb Fairy-wren, Variegated Fairy-wren, White-browed Scrubwren, Brown Thornbill, Spotted Pardalote, Eastern Spinebill, Noisy Miner, Red Wattlebird, Little Wattlebird, New Holland Honeyeater, Black-faced Cuckoo-shrike, Golden Whistler, Grey Butcherbird, Australian Magpie, Pied Currawong, Willie Wagtail, Eastern Yellow Robin, Welcome Swallow, Red-whiskered Bulbul, and Common Myna (Appendix 1 and Plates 25-28).

Most of observed bird breeding activity occurred in bushland remnant and urban neighbourhood sites, with some records from older revegetated parkland sites. The larger bushland reserves – Field of Mars, Lane Cove NP and Boronia Park Reserve produced more breeding records across a greater range of bird species than did the smaller remnants. Only the more resilient species such as Noisy Miner, Red Wattlebird, Superb Fairy-wren and Spotted Dove were able to breed in the small bushland remnants. Some birds - Crested Pigeon, Spotted Dove, the parasitic Eastern Koel, Noisy Miner, Common Starling and Common Myna - bred in urban neighbourhood shrubs and street trees.

Plate 25: Noisy Miner nesting (3 nestlings close to fledging) in a planted eucalypt at the edge of Tyagarah Reserve open parkland site, 23/10/11.

Plate 26: Adult male Eastern Spinebill – observed in mate pursuits and calling territory in Field of Mars Reserve Site A bushland remnant, 29/10/11 (Greg Clancy).

Plate 27: A juvenile Pied Currawong in Putney Park revegetated parkland site. This bird was in the process of being weaned by its parents, 23/10/11.

Plate 28: Spotted Pardalotes were detected nesting in small eucalypt hollows at Field of Mars Reserve Site A and Lane Cove NP (Sugarloaf Point) bushland remnants. The pictured bird is a juvenile – adult birds are only 8-10 cm long (Greg Clancy).

3.6 Birds of conservation significance

No bird species of international conservation significance were recorded during the survey in the study area. However, 21 species listed under either or all three international conservation agreements – China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) – have been recorded in or near the study area over the past 27 years (see InSight Ecology 2010). These are intercontinental migratory waders that arrive in spring in Australia and depart in autumn for their northern Asian breeding grounds, thus avoiding the northern hemisphere winter. They also include White-throated Needletail, Fork-tailed Swift, White-bellied Sea-Eagle, Cattle Egret, Eastern Great Egret, Crested Tern, Common Tern and Oriental Cuckoo.

No bird species listed as endangered or vulnerable under the national Environment Protection and Biodiversity Conservation Act (1999) were recorded during the survey in the study area. However, 5 species listed under this legislation have been previously recorded in or near the study area. These include Swift Parrot (endangered, E1 listing), Eastern Bristlebird (E1), Regent Honeyeater (E1), Crested Shrike-tit (vulnerable), and White-fronted Chat (nominated for listing as vulnerable in September 2010). Three of these species - Eastern Bristlebird, Crested Shrike-tit and White-fronted Chat – have gone or are likely to have gone extinct in the study area (see InSight Ecology 2010).

A further two species - Cotton Pygmy-goose and Black-necked Stork – are listed as endangered in NSW under the NSW Threatened Species Conservation (TSC) Act (1995). These birds have been recorded in Lane Cove River valley in the last 14 years (InSight Ecology 2010) but were not detected during this or the previous two surveys conducted for the River to River Corridors Project. The Powerful Owl is listed as vulnerable under the NSW TSC Act 1995. It was recorded in the study area during both previous River to River Corridors Project surveys but not in the October 2011 survey. Therefore, a total of 8 nationally and NSW listed threatened bird species have been recorded in or near the study area. One additional species – White-bellied Sea-Eagle

– while not listed as threatened under NSW TSC Act 1995 is listed as Marine and Migratory under EPBC Act 1999.

A suite of 19 indigenous bird species of conservation significance within the highly fragmented regional and local Sydney urban landscape were recorded during the survey in the study area. These included 15 ground, shrub, canopy and aerial insectivores, a nectarivore (Eastern Spinebill), a carnivore (Sacred Kingfisher), and the canopy granivores Australian King-Parrot and Crimson Rosella. The most significant of these species in conservation terms within the highly urbanised local and regional environment are the ground-foraging Eastern Whipbird, Eastern Yellow Robin, White-browed Scrubwren, Variegated Fairy-wren and Superb Fairy-wren, shrub insectivores Rufous Fantail, Yellow Thornbill, Brown Thornbill, Striated Thornbill, Brown Gerygone and Golden Whistler, canopy insectivore Bell Miner, bark-gleaning White-throated Treecreeper, nectarivore/insectivore New Holland Honeyeater, and hollow-nesters Sacred Kingfisher and Dollarbird.

4. Discussion

4.1 Bird assemblages of the study area – patterns and processes

4.1.1 Bird responses to changes in Sydney's urban greenspace

Over the past 223 years, Sydney's native vegetation cover has been systematically removed and converted to housing for what are now more than 4 million people. All that remains are some small, highly fragmented patches that are experiencing further decline in habitat condition from invasive species and edge impacts. Today's pattern of habitat distribution, size, connectivity and condition in the study area generally reflects this broad-scale process of change to the configuration, composition and continuity of habitats across the Sydney region. It is a process characteristic of the impact of broad-scale landscape change on biodiversity across cities in Australia (e.g. Perth - Recher and Serventy 1991; How and Dell 2000; Adelaide - Tait et al. 2005; Melbourne - van der Ree 2004, White et al. 2005; Sydney - Benson and Howell 1990b; Flannery 1999; Brisbane - Garden et al. 2006) and worldwide (see UNEP Convention on Biological Diversity 2007).

Counteracting this landscape-scale process of extensive habitat loss, fragmentation and modification, have been episodes of revegetation, mostly on publicly owned land over at least the past three decades. At the local and regional scale, this has introduced an array of indigenous and exotic vegetation into this landscape. Coupled with earlier plantings along streets, on private properties and in parks, these activities have shaped the type, amount, quality and condition of habitats available to birds and other fauna. In effect, there has been an incremental transformation of this landscape, especially in Sydney's inner-west, south and north-west, from one of mainly sealed surfaces with minimal vegetation cover to a complex mosaic of ribbons, patches and conduits of green interwoven with 'red-roof suburbia'.

Bird assemblages have responded to these changes over time by either adapting, colonising or disappearing from habitats in this landscape. A cohort of medium to large bodied indigenous and introduced birds dominates the native and exotic vegetation planted in parks, along streets, and in the front- and rear-yards of houses across the study area and other districts. These are opportunistic, highly adaptable and often aggressive species that survive, reproduce,

and have ultimately colonised these novel urban habitats. These include Noisy Miner, Rainbow Lorikeet, Red Wattlebird, Crested Pigeon, Australian Raven, Australian Magpie, Magpie-lark, Grey Butcherbird and Pied Currawong. The introduced species are the ground-foraging granivores, Spotted Dove and Rock Dove, and the ubiquitous omnivores, Common Myna and Common Starling.

Bird assemblages in the smaller, highly isolated bushland remnants of the study area are much less taxonomically and functionally diverse than those occupying the larger contiguous remnants (Lane Cove River valley and its tributaries – Buffalo, Kittys, and Brickmakers Creeks). The smaller remnants at Betts Park, Tarban Creek, Putney Point, Mallee and Tyagarah Reserves and Wallumatta NR support only a relatively small number of resilient species which are the residual of what were once, prior to intensive urbanisation, much richer guilds. Historical records confirm the incremental loss of small woodland and forest ground and shrub insectivores and nectarivores/insectivores from these and other small Sydney bushland remnants (Blakers et al. 1984; Barrett et al. 2003). Species now apparently extinct from these smaller, isolated remnants include mostly forest and some grassland dependent endemics - Grey Shrike-thrush, Crested Shrike-tit, Varied Sittella, Spotted Quail-thrush, Yellow-tufted Honeyeater, Speckled Warbler, Jacky Winter (despite some more recent reports), Little Grassbird, Diamond Firetail and Australasian Pipit. Small numbers of the ground-foraging insectivore Eastern Yellow Robin still occur in small isolated remnants such as Betts Park and Tarban Creek Reserve.

Other native ground-foraging insectivores - White-browed Scrubwren, Variegated Fairy-wren and Superb Fairy-wren - seem to be maintaining small breeding populations in weedy undergrowth of Mallee and Tyagarah Reserves, Tarban Creek, and Bedlam Bay Regional Park. In the larger remnants of Field of Mars Reserve (Wildlife Refuge), Lane Cove NP and Boronia Park Reserve, birds that have gone locally extinct over the past 50 or more years include Superb Lyrebird, Rockwarbler, Eastern Bristlebird, Crested Shrike-tit, Pheasant Coucal, Eastern Barn Owl, Noisy Pitta, White-fronted Chat, and the introduced Nutmeg Mannikin and Common Greenfinch. Powerful Owls, however, appear to be expanding their Sydney urban population with Lane Cove River forest providing key roosting, nesting and foraging habitat.

4.1.2 The Noisy Miner conquest

The most abundant and successful of the 'urban adaptees' are the Noisy Miner and Rainbow Lorikeet, followed by Spotted Dove and Red Wattlebird. The Noisy Miner is a colony-living 'honeyeater' that aggressively protects food sources and breeding territories, repelling intruders and competitors through mobbing behaviour. This species has rapidly colonised almost all urban greenspace types and their habitat niches across Sydney over at least the past decade (see Higgins et al. 2001; Parsons et al. 2003; French et al. 2005; Parsons et al. 2006). In doing so, Noisy Miners may have either pushed out other species or taken over habitat niches vacated by species during earlier rounds of extinction, although further work is needed to confirm this.

In the study area, species that may have been adversely affected by the Noisy Miner could include smaller honeyeaters such as Yellow-faced Honeyeater, Eastern Spinebill and White-plumed Honeyeater, small shrub and canopy-foraging insectivores – Striated Pardalote, Brown Thornbill, Golden Whistler, Striated Thornbill and Brown Gerygone, and the once-common

introduced House Sparrow and Common Blackbird. Neither of these two latter species was recorded during the survey. Competition for food and nest sites from Spotted Dove, Common Myna and Common Starling, predation by Grey Butcherbird, Pied Currawong and Australian Raven and mammalian carnivores, and a reduction in the amount of suitable nest sites may have been other key factors implicated in the recent decline of these two species across suburban Sydney. It is also feasible that the relatively low numbers of Willie Wagtail recorded in this study may reflect these combined pressures of competition from Noisy Miners and predation by avian and mammalian carnivores, although further work would be needed to confirm this. The Willie Wagtail is an indigenous, open-nesting, ground-foraging insectivore usually considered to be resilient and relatively well adapted to urban life.

Habitats offering open canopies, nectar-rich plants such as grevillea cultivars, banksia, callistemon, strelitzia and camellia, dense foliage supplying nest sites and insects (e.g. eucalypts, paperbark, camellia and brush box – especially pruned brush box street trees that produce prolific flowers and attract insects and have many multiple branches with dense foliage), supplementary food and water supplies (often from houses and parks), and plenty of edge habitat have contributed to the success of the Noisy Miner in Sydney and other highly urbanised landscapes such as Melbourne (see, e.g., White et al. 2005) and Brisbane (see Catterall 2004; Garden et al. 2006). Where these conditions are less favourable, such as in the more closed and continuous canopies of Lane Cove NP and Field of Mars Reserve (Wildlife Refuge), Noisy Miners are absent or confined to the edges. Strategic management of urban greenspace for biodiversity conservation should, if possible, utilise this knowledge of Noisy Miner ecology.

The broadening of Noisy Miner diet to include grain-based food scraps available from outdoor café tables, rubbish bins and footpaths (A.H. pers obs) suggests that this species is fast acquiring omnivore status in suburban Sydney. Consequently, Noisy Miners are able to directly compete for food with the introduced Common Myna and Common Starling, although nest site preferences differ markedly between these species. Co-existence rather than exclusion, however, seems the more likely long-term outcome for these three species in this landscape.

In these ways, Noisy Miners may be viewed as potential 'engineers' of structural change in Sydney's urban bird communities. Their ability to readily and frequently (up to 3-4 clutches per season) breed in and thus rapidly colonise urban habitats, broaden their diet and adapt their foraging strategy, and potentially displace other indigenous and exotic species, from within and possibly outside their foraging guild, has established the Noisy Miner, together with the Rainbow Lorikeet, as the dominant bird species in suburban Sydney. This has important implications for the strategic conservation management of other avifauna and their habitat, and indeed overall biodiversity values, in Ryde-Hunters Hill and neighbouring LGAs.

4.1.3 Interseasonal changes in bird communities

Variation in the number, species richness, and structure of terrestrial bird communities surveyed between spring 2010 and spring 2011 can be attributed to potential interaction between a suite of factors. These include variability in climate and its impact on the availability, amount and quality of food, competition and predation pressure, species-specific traits and habitat preferences, landscape effects, human-mediated impacts, and sampling effects.

Most of the spring 2011 decrease in bird abundance and species richness and consequent changes in foraging guild structure happened in bushland remnants. This may have occurred in response to interseasonal and interannual variation in local climate and food supplies in these remnants. Fine-scale variation in the timing, magnitude and spatial distribution of rainfall, temperature and humidity can strongly influence the amount, availability and quality of avian food supplies such as invertebrates and nectar (Ford 1989). This, in turn, can affect the timing, duration and success of bird breeding behaviour. For example, early or late eucalypt flowering times mediated by rainfall and temperature fluxes can affect the numbers of blossom-nomads such as Noisy Friarbird and Yellow-faced Honeyeater, both of which were recorded in spring 2010 but not during this survey. When combined with potential increases in competition for food, shelter and nest sites from other bird species and possibly increased predation by cats and foxes, particularly on ground and shrub insectivores, this could account for the reduced number of birds and apparent losses of species from insectivorous guilds recorded in bushland remnants.

Conversely, spring 2011 increases in bird abundance that occurred in urban neighbourhood and revegetated parkland sites are more likely to have reflected human-mediated impacts. These include supplementary feeding, provision of watering points, and planting of shrub and tree species in home gardens, street verges and public reserves that produce almost year-round supplies of nectar, insects and other food. Invariably, these were the resilient, adaptable species that readily exploit human-created suburban habitats – ground granivores, omnivores, carnivores, and a small group of ground insectivores and nectarivores/insectivores.

Species-specific traits including dispersal, migration and habitat selection patterns may help explain the spring 2011 decline in abundance and species richness in the bushland remnants. Some migratory insectivores that breed in spring/summer in southern Australian forests and woodlands - Leaden Flycatcher, Black-faced Monarch, and Grey Fantail – were recorded in spring 2010 but not in spring 2011. Local climatic variation, availability of more attractive alternative foraging and nesting habitat in other remnants near the study area such as Lane Cove River valley or within the region – ie. national parks to Sydney's north, and delays in departure from northern wintering habitats are factors possibly implicated in the observed result. Behavioural mechanisms operating at the species and individual levels may also have been implicated in the spring 2011 outcome in remnants. These include, for example, avian utilisation of experience-based knowledge of patch quality and threats to preferentially select breeding territories and nest sites. Older birds are often more adept in deploying this knowledge and consequently may achieve higher reproductive success rates (see Huggett 2000). However, more information on the age-related structure of and microhabitat selection by breeding bird populations in the bushland remnants of the study area is needed.

Landscape effects or how what happens within the study area's broader landscape affects the organisms that live in it may also be implicated in the observed results. Local and regional variation in the amount, quality, configuration and connectivity of habitat has been well recognised as an important potential determinant of bird abundance, species diversity and community structure in highly fragmented landscapes such as Sydney (see, e.g., Parsons et al. 2006; InSight Ecology 2008, 2011b; Crates et al., 2011). Reductions in the number of birds and species in bushland remnants in spring 2011 may have been influenced by an increased availability of alternative habitat in other remnants within the landscape. Increased spring 2011 bird abundance in urban neighbourhood and revegetated parkland sites may have been partly

due to birds such as Rainbow Lorikeet, Noisy Miner and especially Common Myna moving in from neighbouring urban and parkland areas where foraging and/or nesting conditions had become less attractive.

Human-mediated impacts also most likely contributed to the observed changes between both spring periods. An example was evident at the small Betts Park bushland remnant where native foreshore trees and shrubs had been recently removed to presumably improve waterscape views for an adjacent property. This site provided important habitat for Eastern Yellow Robin, White-browed Scrubwren and other small insectivores that are trying to persist in the highly fragmented urban bushland landscape. Other pertinent impacts include predation by feral and domestic cats and habitat disturbance by dogs and humans. Ongoing incursion of cats and dogs into core forest habitats in bushland remnant sites at Lane Cove NP, Field of Mars Reserve, Tarban Creek north bank, Bedlam Bay, and Putney Point was noted during the surveys.

Sampling effects may also have been implicated in the observed changes in bird communities between the two spring seasons. These relate to the difficulty in sampling highly mobile organisms such as birds over specific areas and habitats and repeating this effort over ensuing seasons. Changes in the number, diversity and structure of and habitat use by bird communities are difficult to accurately detect over time. Surveys need to be replicated over several years and seasons in order to detect clear trends of change in these attributes. The set of four River to River Corridors Project surveys have, however, been designed to obtain estimates of change in relative abundance, species richness, foraging guild composition and habitat use by bird communities present in the study area. This is providing valuable baseline information on the nature and quality of bird communities before the planting of new corridors take place. This will allow assessment of the contribution of these corridors to re-connecting isolated bush bird populations over time in the study area.

Interseasonal changes in the structure of terrestrial bird communities surveyed in the study area also occur in other bird communities in Melbourne, Adelaide and Sydney (see, for example, White et al. 2005; Tait et al. 2005; InSight Ecology 2008, 2011a,b). These are also driven by spatial and temporal fluctuations in food supply, habitat quality, amount, configuration and connectivity, predation, fire, inter- and intra-specific competition for mates, nest sites and shelter, autecological factors such as resilience and adaptive capacity, population size and fecundity, and behavioural characteristics, and landscape-scale factors (see InSight Ecology 2011b).

4.2 Urban greenspace as bird habitat in the study area

4.2.1 Habitat connectivity: the importance of greenspace networks

The bushland remnants of the study area provide a diverse suite of habitats for bird assemblages that are richer in species composition and community structure than many of their counterparts in nearby local government areas such as Canada Bay, Strathfield, Auburn and Burwood. They support insectivores which can be considered to be at risk of local extinction given the high level of habitat fragmentation and isolation in this landscape and pressure on key foraging, refuge and breeding resources from competitors, predators and humans.

Alleviation of this pressure warrants continued conservation action in the study area, as does the protection of remnants against threats and improvement of the condition of their habitats.

The impetus for reducing pressure on these resources is already available in parts of the study area. A combination of established allocasuarina, paperbark, eucalypt and shrub-based other plantings along Tarban Creek at Riverglade Reserve, in Boronia Park Reserve and at Gladesville Reserve will, in time, establish denser understorey vegetation to help reduce the attractiveness of these areas for Noisy Miner invasion. Although, for this to be effective dense understorey plantings are needed across a larger scale and should be strategically integrated with existing bushland patches. Best-practice bush regeneration (including staged removal of heavily weed-infested areas) of existing dense ground cover vegetation in Mallee and Tyagarah Reserves is also needed to minimise any impact of weed removal on small breeding Variegated Fairy-wren and White-browed Scrubwren populations.

Enhancing and re-establishing habitat connectivity in the study area for particularly dispersal-limited avifauna is the focus of the River to River Corridors Project. This will target key points within the two identified potential wildlife corridors with strategic revegetation and habitat rehabilitation and protection activities.

4.2.2 Revegetated parkland: valuable bird habitat or Noisy Miner utopia?

Revegetated parkland provided foraging habitat for 51% of all bird species observed during the survey. However, most of these species were aggressive, resilient, invasive or predatory birds - Noisy Miner, Rainbow Lorikeet, Red Wattlebird, Pied Currawong, and Grey Butcherbird. These species are commonly associated with structurally simpler, more open canopy habitats characterised by substantial amounts of edge and flowering tall trees and shrubs.

Only a small suite of remaining woodland/forest species appeared able to exploit the food, shelter and nesting resources of revegetated parkland. This was largely because of the high numbers of edge-affiliated species present, particularly Noisy Miner and, to a lesser extent, Red Wattlebird and the young age of many plantings. The latter species has become a relatively recent colonist of this type of greenspace in Sydney. Other factors included the number of nest predators present (Grey Butcherbird, Pied Currawong, Australian Raven), stage of growth (many stands were less than 10 years old), narrow width and moderate-high angularity of stands, lack of stand structural complexity, poor habitat condition (weed-invaded, fire-affected), minimal or little connectivity between revegetation patches, and frequent disturbance by humans, cats and dogs.

The real value of Ryde-Hunters Hill's revegetated parkland lies in its potential to connect highly isolated remnants, riparian habitat and urban neighbourhood vegetation across the local landscape. In doing so, plantings will contribute to restoring habitat linkages and potential wildlife corridors at the local *and* regional scale. If focus is given to increasing the structural complexity of habitats - especially creating wide, denser understorey plantings to exclude Noisy Miners - and the variety of microhabitats while also improving their condition, then these plantings should help restore a level of ecological function to the study area. More direct interventions may also need to be considered.

4.2.3 Urban neighbourhood habitats: looking beyond footpath and fence

Ryde and particularly Hunters Hill are older established Sydney suburbs. Successive phases of planting of native and introduced vegetation have occurred along the streets and in residential front- and rear-yards since this time, culminating in the insertion and maintenance of brush box, paperbark tea-tree, elms and oaks as the main street tree species. As a result, urban neighbourhoods are well foliaged and appear to provide food and suitable foraging, nesting and refuge habitats for a range of birds, bats and insects. Proximity to, and some connections with, old established parks and newer, bush-regenerated open space could theoretically enhance these functions.

The ornithological and ecological reality, however, is that urban neighbourhood habitats in the study area mostly cater for a cohort of resilient, urban-adapted species. With the exception of Superb Fairy-wren and occasionally Silvereye and Sacred Kingfisher, small bush birds are usually excluded from these sites. This reflects, in part, the lack of structural complexity of habitats available for exploitation by these smaller species. Competitive and predatory interactions between species and disturbance and predation by cats, rats, dogs and humans are also implicated. Supplementary feeding and water provisioning of birds by residents and planting of grevillea, callistemon and other high nectar-producing species in gardens have also favoured the colonisation of urban neighbourhood habitats by larger birds, especially the Noisy Miner, Red Wattlebird and Rainbow Lorikeet and regular visitation by the carnivorous Laughing Kookaburra and Grey Butcherbird. Landscape attributes such as distance from nearest remnant or revegetation patch and poor habitat connectivity may also be factors that have contributed to this dearth of small native birds.

There is a need to view urban neighbourhood habitats as more than just streetscape vegetation, without devaluing the contribution of street trees to the structure of Australian urban bird communities (see Young et al. 2007). The role and function of front- and rear-yard habitats in providing viable foraging, breeding and shelter habitat for birds need to be properly understood. These habitats include mown lawns, cultivated garden beds, planted ground cover, shrubs and trees, individual remnant trees, and garden ornaments such as ponds, fountains and birdbaths. How do these habitats function to facilitate the movement of small birds into and through urban neighbourhoods? Would they perform better in this role if species such as the Noisy Miner and Pied Currawong were present in fewer numbers? What specific actions would represent best value for money and effort invested in helping to re-connect previously isolated Eastern Yellow Robin, White-browed Scrubwren, Variegated Fairy-wren and Superb Fairy-wren populations? These are examples of the types of questions that need to be addressed prior to planning and implementing bush revegetation for small birds on publicly and privately owned urban neighbourhood habitats.

Potential therefore exists to provide suitable habitat to attract some small bush birds back into Ryde-Hunters Hill's urban neighbourhood. The building blocks of interstitial or 'stepping stone' habitat are there, at least for species capable of foraging in, moving through, and possibly breeding in planted garden hedges, shrubs and lawns such as the Superb Fairy-wren and possibly White-browed Scrubwren. However, a long-term (10 years+) community-based program is needed to plan and implement the strategic revegetation of key parts of this landscape for other bushland bird species. This is one of the key goals of the current initiative but will require further funding beyond the life of this project.

4.3 Conservation targets – focusing management action

A cornerstone of best-practice ecosystem management involves identifying and protecting, through strategic intervention, species, communities and habitats of conservation significance. Several opportunities exist to enhance current biodiversity conservation management activities and protect bird communities and their habitats in the study area. The emphasis is on protecting small bush birds because they appear to have declined markedly in Australian urban landscapes over the past two decades (Recher and Serventy 1991; Sewell and Catterall 1998; Barrett et al. 2003; Parsons et al. 2006). However, other bird species with intermediate sensitivities to the loss of habitat size, shape, connectivity and condition would be also benefited by these actions.

Protection of the condition and ecological integrity of the three key larger bushland remnants in the study area against degrading impacts should be of high priority and continued to be pursued through existing bushland management plans. This will require reduction of threats to birds and other fauna posed by feral and domestic cats, rats, dogs and foxes, weed reduction and management, fire protection, and management of human incursions such as removal of native vegetation, rubbish dumping and trailbike use. Strategic planting and best-practice bush regeneration will be needed to improve the ecological condition and, where feasible, the connectivity of smaller bushland remnants.

The restoration of riparian habitats and strategic revegetation of parkland are other opportunities to improve the quality, connectivity and functional value of these greenspace types for small bush birds in the study area. Here the emphasis is on improving the structural complexity and floristic diversity of local indigenous plantings (including denser plantings), widening revegetation strips to reduce the amount of edge habitat for the Noisy Miner and other invasive species, filling gaps between plantings to improve connectivity at the local and landscape scales, and considering direct control of Noisy Miner numbers.

Conservation targets in urban neighbourhood and open parkland habitats should complement those pursued in adjoining revegetated parkland and bush remnants. These focus on targeting the linkage of ‘stepping stones’ or ‘corridors’ for small birds through new and existing strategic plantings in streets and home gardens, adoption of small bird-friendly practices - garden re-design, pet management (especially cat and dog control), reduction of watering points and reduction of supplementary feeding, and coordination with adjoining councils as part of the larger and interconnected urban landscape.

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Appendix

Appendix 1: All individual birds recorded by InSight Ecology during the 23-31 October 2011 survey of the study area
* introduced species. Breeding activity is shown in bold in the "Behaviour" column.

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
1	Pacific Black Duck	*Anas superciliosa*	261011	1615-1725	29	Riverglade Reserve	0	9	0	0	foraging, bred with ducklings	2 groups: 1adult in small artificial pond trackside; 2 adults and 6 young flushed out and attacked by 2 dogs at newly excavated Waruda Pond east end reserve
2	Rock Dove *	*Columba livia*	231011	1705-1735	37	Morrison Bay Park	0	0	1	0	flyover	
3	Rock Dove *	*Columba livia*	231011	1740-1755	36	Stanley Street	0	0	0	3	flyover	
4	Rock Dove *	*Columba livia*	241011	1645-1715	21	Tarban Creek Reserve	1	0	0	0	perched	
5	Rock Dove *	*Columba livia*	251011	1015-1035	27	Western Crescent	0	0	0	4	foraging, perching	
6	Rock Dove *	*Columba livia*	271011	1035-1055	17	Abigail Street	0	0	0	2	perched	rooftop
7	Rock Dove *	*Columba livia*	281011	1010-1025	2	Blaxland Street	0	0	0	5	flyover	
8	Rock Dove *	*Columba livia*	281011	1745-1805	14	Beazley Street	0	0	0	1	perched	balcony of units along Victoria Road
9	Rock Dove *	*Columba livia*	281011	1845-1910	15	Monash Road	0	0	0	2	foraging	
10	Spotted Dove *	*Streptopelia chinensis*	231011	0745-0850	32	Mallee & Tyagarah Reserves	3	0	0	0	calling, **nesting**	in dense privet
11	Spotted Dove *	*Streptopelia chinensis*	251011	0830-0900	26	Bedlam Bay (Parramatta Regional Park)	4	0	0	0	perched, flying	

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
12	Spotted Dove *	*Streptopelia chinensis*	251011	0945-1005	19	Hillcrest Avenue	0	0	0	2	perched	
13	Spotted Dove *	*Streptopelia chinensis*	251011	1015-1035	27	Western Crescent	0	0	0	3	foraging, perching	
14	Spotted Dove *	*Streptopelia chinensis*	261011	1615-1725	29	Riverglade Reserve	0	2	0	0	foraging	
15	Spotted Dove *	*Streptopelia chinensis*	261011	1840-1900	16	Eltham Street	0	0	0	2	perched	
16	Spotted Dove *	*Streptopelia chinensis*	281011	1745-1805	14	Beazley Street	0	0	0	7	foraging, calling, **nesting**	
17	Spotted Dove *	*Streptopelia chinensis*	281011	1815-1835	12	Badajoz Road	0	0	0	7	foraging, calling, flying	
18	Spotted Dove *	*Streptopelia chinensis*	281011	1845-1910	15	Monash Road	0	0	0	2	calling, likely **nesting**	
19	Crested Pigeon	*Ocyphaps lophotes*	231011	0905-0930	35	Tyagarah Reserve (oval)	0	0	1	0	foraging	
20	Crested Pigeon	*Ocyphaps lophotes*	231011	1740-1755	36	Stanley Street	0	0	0	4	foraging, perching	perched on roof antennae
21	Crested Pigeon	*Ocyphaps lophotes*	251011	1015-1035	27	Western Crescent	0	0	0	5	foraging, perching	perched on roof antennae
22	Crested Pigeon	*Ocyphaps lophotes*	251011	1045-1100	28	Tennyson Road	0	0	0	1	foraging	
23	Crested Pigeon	*Ocyphaps lophotes*	261011	0735-0840	25	Gladesville Reserve	0	1	0	0	foraging	
24	Crested Pigeon	*Ocyphaps lophotes*	261011	1050-1120	18	Mary Street	0	0	0	2	foraging	
25	Crested Pigeon	*Ocyphaps lophotes*	261011	1535-1555	30	Riverglade Reserve	0	0	2	0	foraging	on oval
26	Crested Pigeon	*Ocyphaps lophotes*	261011	1840-1900	16	Eltham Street	0	0	0	2	foraging, perched	
27	Crested Pigeon	*Ocyphaps lophotes*	271011	1005-1015	7	Boronia Park	0	0	2	0	foraging	
28	Crested Pigeon	*Ocyphaps lophotes*	281011	0930-1005	1	Moncrieff Drive	0	0	0	3	foraging	

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29	Crested Pigeon	*Ocyphaps lophotes*	281011	1815-1835	12	Badajoz Road	0	0	0	4	foraging	
30	Crested Pigeon	*Ocyphaps lophotes*	281011	1845-1910	15	Monash Road	0	0	0	5	foraging	
31	White-faced Heron	*Egretta novaehollandiae*	231011	1805-1820	38	Putney Point	1	0	0	0	flyover	
32	Australian White Ibis	*Threskiornis molucca*	281011	0745-0820	5	Holy Cross College	0	0	3	0	flyover	
33	Australian White Ibis	*Threskiornis molucca*	281011	1745-1805	14	Beazley Street	0	0	0	3	flyover	to Royal Ryde Rehab grounds
34	Masked Lapwing	*Vanellus miles*	231011	0715-0740	31	Olympic Park	0	3	0	0	foraging, calling	on freshly mown open area
35	Masked Lapwing	*Vanellus miles*	231011	1705-1735	37	Morrison Bay Park	0	0	2	0	foraging	
36	Masked Lapwing	*Vanellus miles*	281011	0745-0820	5	Holy Cross College	0	0	7	0	foraging, calling, **watching fledglings**	2 adults + 3 fledglings along factory boundary fence, 2 other adults on top oval nr classrooms
37	Silver Gull	*Chroicocephalus novaehollandiae*	231011	1705-1735	37	Morrison Bay Park	0	0	1	0	flyover	
38	Galah	*Eolophus roseicapillus*	231011	1705-1735	37	Morrison Bay Park	0	0	2	0	flyover	
39	Galah	*Eolophus roseicapillus*	231011	1825-1850	39	Putney Park	0	2	0	0	perched	
40	Galah	*Eolophus roseicapillus*	241011	1720-1745	23	Tarban Creek Reserve	0	13	0	0	flyover	
41	Galah	*Eolophus roseicapillus*	261011	1025-1045	20	Kelly Street	0	0	0	3	flyover	
42	Galah	*Eolophus roseicapillus*	261011	1840-1900	16	Eltham Street	0	0	0	2	flyover	
43	Galah	*Eolophus roseicapillus*	281011	0745-0820	5	Holy Cross College	0	0	2	0	flyover	
44	Galah	*Eolophus roseicapillus*	281011	1010-1025	2	Blaxland Street	0	0	0	2	flyover	

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
45	Galah	*Eolophus roseicapillus*	311011	0855-0920	34	Buffalo Creek Reserve	0	2	0	0	flyover	
46	Long-billed Corella	*Cacatua tenuirostris*	281011	0745-0820	5	Holy Cross College	0	0	1	0	flyover	
47	Long-billed Corella	*Cacatua tenuirostris*	291011	0720-0745	4	Magdala Park	0	0	7	0	foraging	digging corms from oval grass with SCockatoos
48	Sulphur-crested Cockatoo	*Cacatua galerita*	241011	1720-1745	23	Tarban Creek Reserve	0	1	0	0	perched	
49	Sulphur-crested Cockatoo	*Cacatua galerita*	261011	1615-1725	29	Riverglade Reserve	0	1	0	0	flying, calling	
50	Sulphur-crested Cockatoo	*Cacatua galerita*	281011	0745-0820	5	Holy Cross College	0	0	1	0	perched on wires	
51	Sulphur-crested Cockatoo	*Cacatua galerita*	281011	1745-1805	14	Beazley Street	0	0	0	1	flying, calling	toward Royal Ryde Rehab
52	Sulphur-crested Cockatoo	*Cacatua galerita*	291011	0720-0745	4	Magdala Park	0	0	18	0	foraging, calling	with LBCorella digging out oval grass corms
53	Rainbow Lorikeet	*Trichoglossus haematodus*	231011	0715-0740	31	Olympic Park	0	2	0	0	flying, calling	
54	Rainbow Lorikeet	*Trichoglossus haematodus*	231011	0745-0850	32	Mallee & Tyagarah Reserves	4	0	0	0	calling, foraging	
55	Rainbow Lorikeet	*Trichoglossus haematodus*	231011	0905-0930	35	Tyagarah Reserve (oval)	0	0	4	0	flyover	
56	Rainbow Lorikeet	*Trichoglossus haematodus*	231011	0945-1005	40	Bremner Park	0	3	0	0	flyover	
57	Rainbow Lorikeet	*Trichoglossus haematodus*	231011	1705-1735	37	Morrison Bay Park	0	0	4	0	flyover	
58	Rainbow Lorikeet	*Trichoglossus haematodus*	231011	1740-1755	36	Stanley Street	0	0	0	6	flyover, foraging	foraging in callistemon
59	Rainbow Lorikeet	*Trichoglossus haematodus*	231011	1825-1850	39	Putney Park	0	4	0	0	perched, foraging	

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60	Rainbow Lorikeet	*Trichoglossus haematodus*	241011	1645-1715	21	Tarban Creek Reserve	8	0	0	0	foraging	
61	Rainbow Lorikeet	*Trichoglossus haematodus*	241011	1720-1745	23	Tarban Creek Reserve	0	4	0	0	foraging, flying	
62	Rainbow Lorikeet	*Trichoglossus haematodus*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	6	0	0	0	flying, pursued CB Cuckoo	
63	Rainbow Lorikeet	*Trichoglossus haematodus*	251011	0905-0920	26	Bedlam Bay (Parramatta Regional Park)	0	0	2	0	flyover from hospital area	
64	Rainbow Lorikeet	*Trichoglossus haematodus*	251011	0945-1005	19	Hillcrest Avenue	0	0	0	10	flyover	
65	Rainbow Lorikeet	*Trichoglossus haematodus*	251011	1015-1035	27	Western Crescent	0	0	0	42	flyover, perching	perched in front yard/street verge eucalypts; flying to/from Bremner/Mallee directions
66	Rainbow Lorikeet	*Trichoglossus haematodus*	251011	1045-1100	28	Tennyson Road	0	0	0	16	flyover	to/from Putney Pk/Morrison Bay Pk directions
67	Rainbow Lorikeet	*Trichoglossus haematodus*	261011	0735-0840	25	Gladesville Reserve	0	10	0	0	flyover	
68	Rainbow Lorikeet	*Trichoglossus haematodus*	261011	1025-1045	20	Kelly Street	0	0	0	20	foraging, flying, calling	
69	Rainbow Lorikeet	*Trichoglossus haematodus*	261011	1050-1120	18	Mary Street	0	0	0	36	foraging, flying, calling, **feeding fledglings**	in flowering street verge and yard TW, Jacaranda, backyd Grey Gum, street verge callistemon
70	Rainbow Lorikeet	*Trichoglossus haematodus*	261011	1615-1725	29	Riverglade Reserve	0	4	0	0	foraging, calling, flying	
71	Rainbow Lorikeet	*Trichoglossus haematodus*	261011	1535-1555	30	Riverglade Reserve	0	0	22	0	flyover	
72	Rainbow Lorikeet	*Trichoglossus haematodus*	261011	1840-1900	16	Eltham Street	0	0	0	2	flyover	

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
73	Rainbow Lorikeet	*Trichoglossus haematodus*	271011	0900-1000	8	Boronia Park	9	0	0	0	calling, foraging, **nesting**	nesting in tall BBt gully
74	Rainbow Lorikeet	*Trichoglossus haematodus*	271011	1005-1015	7	Boronia Park	0	0	9	0	flyover	to Boronia Pk BR/LC NP
75	Rainbow Lorikeet	*Trichoglossus haematodus*	271011	1020-1030	9	Park Road	0	0	0	16	foraging, calling, flying	foraging backyd flwoering TW & callistemon; flying to LC NP
76	Rainbow Lorikeet	*Trichoglossus haematodus*	271011	1035-1055	17	Abigail Street	0	0	0	18	flyover	to/from LC NP
77	Rainbow Lorikeet	*Trichoglossus haematodus*	281011	0745-0820	5	Holy Cross College	0	0	8	0	flyover	to/from Field of Mars BR
78	Rainbow Lorikeet	*Trichoglossus haematodus*	281011	0830-0920	33	Wallumatta NR	7	0	0	0	**nesting**, calling, perched	in Angophora and euc hollows
79	Rainbow Lorikeet	*Trichoglossus haematodus*	281011	0930-1005	1	Moncrieff Drive	0	0	0	22	foraging, flying	foraging in flowering street verge callistemon
80	Rainbow Lorikeet	*Trichoglossus haematodus*	281011	1010-1025	2	Blaxland Street	0	0	0	7	flyover	to Field of Mars
81	Rainbow Lorikeet	*Trichoglossus haematodus*	281011	1030-1045	10	Westminster Road	0	0	0	52	foraging, flying, calling	in silky oak & s/verge callistemon, flying to/from Field of Mars
82	Rainbow Lorikeet	*Trichoglossus haematodus*	281011	1745-1805	14	Beazley Street	0	0	0	19	calling, foraging, flying	foraging backyd flowering silky oak & Jacaranda
83	Rainbow Lorikeet	*Trichoglossus haematodus*	281011	1815-1835	12	Badajoz Road	0	0	0	14	foraging, calling, flying	
84	Rainbow Lorikeet	*Trichoglossus haematodus*	281011	1845-1910	15	Monash Road	0	0	0	36	foraging, calling, flying	foraging euc buds and peppercorns in front & backyards

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85	Rainbow Lorikeet	*Trichoglossus haematodus*	291011	0815-0915	6	Lane Cove NP north	14	0	0	0	foraging, calling, **nesting**	nesting (2 prs) in Angophora; foraging in flowering Christmas Bush after fire
86	Rainbow Lorikeet	*Trichoglossus haematodus*	291011	1820-1905	13	Field of Mars Reserve Site B	4	0	0	0	foraging, calling	
87	Rainbow Lorikeet	*Trichoglossus haematodus*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	11	0	0	0	flying, calling, foraging	
88	Rainbow Lorikeet	*Trichoglossus haematodus*	311011	0855-0920	34	Buffalo Creek Reserve	0	2	0	0	flyover	
89	Australian King-Parrot	*Alisterus scapularis*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	1	0	0	0	perched	adult male in tall BBt
90	Australian King-Parrot	*Alisterus scapularis*	261011	1615-1725	29	Riverglade Reserve	0	4	0	0	flyover	into Tarban Ck North bank site
91	Australian King-Parrot	*Alisterus scapularis*	291011	0815-0915	6	Lane Cove NP north	1	0	0	0	foraging, calling	
92	Crimson Rosella	*Platycercus elegans*	291011	0815-0915	6	Lane Cove NP north	1	0	0	0	perched	
93	Eastern Rosella	*Platycercus eximius*	271011	1005-1015	7	Boronia Park	0	0	1	0	foraging	grass seed around edge Oval 2
94	Eastern Koel	*Eudynamys orientalis*	231011	0715-0740	31	Olympic Park	0	1	0	0	calling	
95	Eastern Koel	*Eudynamys orientalis*	231011	0745-0850	32	Mallee & Tyagarah Reserves	1	0	0	0	male calling	
96	Eastern Koel	*Eudynamys orientalis*	231011	0945-1005	40	Bremner Park	0	1	0	0	calling male	
97	Eastern Koel	*Eudynamys orientalis*	251011	1015-1035	27	Western Crescent	0	0	0	1	perched	in backyard tree (male)
98	Eastern Koel	*Eudynamys orientalis*	291011	1715-1800	11	Field of Mars Reserve Site A	2	0	0	0	calling, foraging, **mate pursuits**	

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99	Eastern Koel	*Eudynamys orientalis*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	1	0	0	0	calling (,ale)	
100	Channel-billed Cuckoo	*Scythrops novaehollandiae*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	1	0	0	0	calling (male)	pursued by RL
101	Channel-billed Cuckoo	*Scythrops novaehollandiae*	251011	0830-0900	26	Bedlam Bay (Parramatta Regional Park)	2	0	0	0	flying, calling, likely **mate pursuit**	mobbed by 2 PC
102	Channel-billed Cuckoo	*Scythrops novaehollandiae*	261011	1615-1725	29	Riverglade Reserve	0	2	0	0	calling, flying	towards Villa Maria property
103	Channel-billed Cuckoo	*Scythrops novaehollandiae*	281011	0830-0920	33	Wallumatta NR	1	0	0	0	perched, calling	mobbed by 6 NM and 3 PC in angophora in middle of rem
104	Channel-billed Cuckoo	*Scythrops novaehollandiae*	281011	1030-1045	10	Westminster Road	0	0	0	2	flying	from Field of Mars & heading south
105	Shining Bronze-Cuckoo	*Chalcites lucidus*	291011	1715-1800	11	Field of Mars Reserve Site A	1	0	0	0	calling	
106	Fan-tailed Cuckoo	*Cacomantis flabelliformis*	291011	0815-0915	6	Lane Cove NP north	1	0	0	0	mate-calling	
107	Fan-tailed Cuckoo	*Cacomantis flabelliformis*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	1	0	0	0	mate calling	
108	Laughing Kookaburra	*Dacelo novaeguineae*	231011	1705-1735	37	Morrison Bay Park	0	0	1	0	flyover	mobbed by nesting Nminers
109	Laughing Kookaburra	*Dacelo novaeguineae*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	2	0	0	0	calling, flying, likely **nesting**	in tall BBt
110	Laughing Kookaburra	*Dacelo novaeguineae*	251011	0830-0900	26	Bedlam Bay (Parramatta Regional Park)	2	0	0	0	perched, flying	
111	Laughing Kookaburra	*Dacelo novaeguineae*	271011	0900-1000	8	Boronia Park	2	0	0	0	calling, **likely nesting**	tall Bbt gully

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112	Laughing Kookaburra	*Dacelo novaeguineae*	291011	0720-0745	4	Magdala Park	0	0	1	0	foraging	mown grass surface of smaller oval nr river fringe
113	Laughing Kookaburra	*Dacelo novaeguineae*	291011	0815-0915	6	Lane Cove NP north	2	0	0	0	foraging, calling, likely **breeding**	nesting in Angophoras or eucs?
114	Laughing Kookaburra	*Dacelo novaeguineae*	291011	1820-1905	13	Field of Mars Reserve Site B	2	0	0	0	**likely nesting**	in Angophoras/BBt lower slopes nr creek
115	Laughing Kookaburra	*Dacelo novaeguineae*	311011	0855-0920	34	Buffalo Creek Reserve	0	1	0	0	foraging	
116	Sacred Kingfisher	*Todiramphus sanctus*	271011	0900-1000	8	Boronia Park	1	0	0	0	mate calling	male in BBt gully
117	Sacred Kingfisher	*Todiramphus sanctus*	281011	1845-1910	15	Monash Road	0	0	0	1	foraging	obs foraging in dense Macadamia backyard of 12 College st (cnr College & Monash) @1900, approx. 600 m from FoM
118	Sacred Kingfisher	*Todiramphus sanctus*	291011	0815-0915	6	Lane Cove NP north	1	0	0	0	calling (male)	
119	Sacred Kingfisher	*Todiramphus sanctus*	291011	1820-1905	13	Field of Mars Reserve Site B	2	0	0	0	**likely pair nesting**	upper slope BBt, area of drilled nestholes in old tree termite nests
120	Dollarbird	*Eurystomus orientalis*	271011	0900-1000	8	Boronia Park	2	0	0	0	calling, **nesting**	tall BBt gully
121	Dollarbird	*Eurystomus orientalis*	291011	0815-0915	6	Lane Cove NP north	1	0	0	0	calling	
122	Dollarbird	*Eurystomus orientalis*	291011	1715-1800	11	Field of Mars Reserve Site A	1	0	0	0	calling	
123	White-throated Treecreeper	*Cormobates leucophaea*	291011	0815-0915	6	Lane Cove NP north	1	0	0	0	calling male	

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124	White-throated Treecreeper	*Cormobates leucophaea*	291011	1715-1800	11	Field of Mars Reserve Site A	2	0	0	0	foraging, calling, **likely breeding**	pair
125	White-throated Treecreeper	*Cormobates leucophaea*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	2	0	0	0	calling, **likely nesting**	one male, one female
126	Superb Fairy-wren	*Malurus cyaneus*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	2	0	0	0	foraging, calling, possibly **nesting**	1 adult male, 1 adult female; in same area as WBS & VFW at Tarban Ck weir (N bank - dense lantana)
127	Superb Fairy-wren	*Malurus cyaneus*	251011	0905-0920	26	Bedlam Bay (Parramatta Regional Park)	0	0	5	0	foraging, calling, **bred (with juvs)**	2 adult males, rest females/juvs Foreshore Walk planted lomandra and vines strip
128	Superb Fairy-wren	*Malurus cyaneus*	261011	0735-0840	25	Gladesville Reserve	0	4	0	0	calling, **with juveniles**	in thick lantana nr Henley BC edge; thus likely **bred**
129	Superb Fairy-wren	*Malurus cyaneus*	261011	0845-0930	24	Betts Park	4	0	0	0	foraging, **with fledglings**	**bred**, obs in usual ferny/weedy below road drain area nr WBS
130	Superb Fairy-wren	*Malurus cyaneus*	261011	1615-1725	29	Riverglade Reserve	0	3	0	0	foraging, with **1 juvenile**	at excavated Waruda Pond east end of reserve
131	Superb Fairy-wren	*Malurus cyaneus*	271011	0900-1000	8	Boronia Park	5	0	0	0	foraging, **with juveniles**	2 grps: sealed access road to wharf verge (2) & upper Brickmakers Ck (3 incl juvs)
132	Superb Fairy-wren	*Malurus cyaneus*	291011	1820-1905	13	Field of Mars Reserve Site B	2	0	0	0	foraging, calling	one adult male & female north bank of Buffalo Ck
133	Superb Fairy-wren	*Malurus cyaneus*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	3	0	0	0	foraging, calling, **bred**	2 adults, 1 juv

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134	Variegated Fairy-wren	*Malurus lamberti*	231011	0745-0850	32	Mallee & Tyagarah Reserves	4	0	0	0	calling, foraging, **bred**	1 adult male, 2 adult females, 1 juv just downstream of sewer pipe mains (usual spot)
135	Variegated Fairy-wren	*Malurus lamberti*	231011	1805-1820	38	Putney Point	3	0	0	0	foraging, calling	1 adult male, 1 adult female, 1 indet. - same spot as WBS grp (dense weedy section)
136	Variegated Fairy-wren	*Malurus lamberti*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	2	0	0	0	foraging, calling, possibly **nesting**	1 adult, 1 female - could be nesting nearby & same dense lantana section nr Tarban Ck weir with WBS & SFW
137	Variegated Fairy-wren	*Malurus lamberti*	251011	0830-0900	26	Bedlam Bay (Parramatta Regional Park)	8	0	0	0	foraging, calling	2 grps: along walking grid area to boatshed
138	Variegated Fairy-wren	*Malurus lamberti*	261011	0735-0840	25	Gladesville Reserve	0	6	0	0	foraging, calling, **taking food to nest**	2 grps: 1 in biketrack area and 2nd nr lantana beside Henley Bowling Club (female delivering food to nest)
139	Variegated Fairy-wren	*Malurus lamberti*	291011	0815-0915	6	Lane Cove NP north	8	0	0	0	calling, food to **nestlings**	pr delivering food to nestlings in nest under bracken fern; 3 other adults in 2nd grp
140	Variegated Fairy-wren	*Malurus lamberti*	291011	1715-1800	11	Field of Mars Reserve Site A	4	0	0	0	foraging, calling, **likely nesting**	adult male, adult female and 2 indet birds
141	Variegated Fairy-wren	*Malurus lamberti*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	4	0	0	0	foraging, calling, likely **breeding**	1 adult female & male, other indet birds

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
142	White-browed Scrubwren	*Sericornis frontalis*	231011	0745-0850	32	Mallee & Tyagarah Reserves	2	0	0	0	calling, foraging	one adult male, one adult female in usual dense privet/bamboo/honeysuckle ck section nr AGL track
143	White-browed Scrubwren	*Sericornis frontalis*	231011	1805-1820	38	Putney Point	4	0	0	0	foraging, calling, with 2 fledged young being fed so likely **bred**	1 adult male, 1 adult female & 2 young; likely bred in this tiny remnant (dense groundcover exotic ferns, lantana, Pittosporum), E of ferry road
144	White-browed Scrubwren	*Sericornis frontalis*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	4	0	0	0	foraging, calling, **nesting**	2 grps: with 1 adult male & 1 adult female each - 1st group nr Tarban Creek weir (dense lantana) - male aggressively guarding likely nest site, lots of territory calls thus likely **nesting** & second in Villa Maria (breeding status unknown)
145	White-browed Scrubwren	*Sericornis frontalis*	251011	0830-0900	26	Bedlam Bay (Parramatta Regional Park)	4	0	0	0	foraging, calling	2 grps: 1 adult male, 1 adult female walking grid area; 1 adult male, 1 adult female (Foreshore Walk lomandra strip)
146	White-browed Scrubwren	*Sericornis frontalis*	261011	0735-0840	25	Gladesville Reserve	0	6	0	0	foraging, calling, **with fledged young**	total = 2 fledglings in 2 groups

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
147	White-browed Scrubwren	*Sericornis frontalis*	261011	0845-0930	24	Betts Park	4	0	0	0	foraging, **with fledglings**	total= 2 fledglings, nr usual dense below road drain area
148	White-browed Scrubwren	*Sericornis frontalis*	261011	1615-1725	29	Riverglade Reserve	0	5	0	0	foraging, calling, **bred**	2 grps: one nr weir in main ck (adult pr + 1 juv); second = 2 juvs in reedy small just off main walktrack, with SFWs
149	White-browed Scrubwren	*Sericornis frontalis*	271011	0900-1000	8	Boronia Park	1	0	0	0	calling, foraging, **likely breeding**	male territory calling
150	White-browed Scrubwren	*Sericornis frontalis*	291011	0815-0915	6	Lane Cove NP north	3	0	0	0	foraging, calling, **bred**	2 adults (m/f) and 1 juvenile
151	White-browed Scrubwren	*Sericornis frontalis*	291011	1715-1800	11	Field of Mars Reserve Site A	9	0	0	0	foraging, territory defence, **bred**	at least 3 grps of 3 (ie. both parents & 1 juv) = 9
152	White-browed Scrubwren	*Sericornis frontalis*	291011	1820-1905	13	Field of Mars Reserve Site B	9	0	0	0	foraging, calling, **territory defence, with juvs**	2 grps with 2 and 3 juvs = total young 5, rest adults along Buffalo Ck north bank
153	White-browed Scrubwren	*Sericornis frontalis*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	4	0	0	0	calling, foraging, **bred**	adult pair with 2 juvs
154	White-browed Scrubwren	*Sericornis frontalis*	311011	0855-0920	34	Buffalo Creek Reserve	0	3	0	0	foraging, calling	adult male & 2 adult females
155	Brown Gerygone	*Gerygone mouki*	291011	1715-1800	11	Field of Mars Reserve Site A	2	0	0	0	foraging, calling	
156	Brown Gerygone	*Gerygone mouki*	291011	1820-1905	13	Field of Mars Reserve Site B	3	0	0	0	foraging, calling	in privet & pittosporum N bank Buffalo Ck & BBt

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
157	Striated Thornbill	*Acanthiza lineata*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	4	0	0	0	foraging, calling	
158	Yellow Thornbill	*Acanthiza nana*	271011	0900-1000	8	Boronia Park	5	0	0	0	calling, foraging	in BBt gully (Brickmakers Ck)
159	Yellow Thornbill	*Acanthiza nana*	291011	0815-0915	6	Lane Cove NP north	2	0	0	0	foraging, calling	
160	Yellow Thornbill	*Acanthiza nana*	291011	1715-1800	11	Field of Mars Reserve Site A	4	0	0	0	foraging, calling	in *Acacia parramattensis*
161	Brown Thornbill	*Acanthiza pusilla*	271011	0900-1000	8	Boronia Park	2	0	0	0	foraging, calling, **territory defence**	upper Brickmakers Ck paperbark teatree above falls
162	Brown Thornbill	*Acanthiza pusilla*	291011	0815-0915	6	Lane Cove NP north	4	0	0	0	calling, territory defence, foraging, likely **nesting**	territorial dispute between 2 males, ie. 2 prs
163	Brown Thornbill	*Acanthiza pusilla*	291011	1715-1800	11	Field of Mars Reserve Site A	2	0	0	0	foraging, territory defence, likely **nesting**	adult male & female
164	Brown Thornbill	*Acanthiza pusilla*	291011	1820-1905	13	Field of Mars Reserve Site B	2	0	0	0	foraging, territory defence thus **likely nesting**	in upper slope section nr vehicular access trail opp cemetery
165	Brown Thornbill	*Acanthiza pusilla*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	7	0	0	0	mate calling, foraging, **likely nesting**	
166	Spotted Pardalote	*Pardalotus punctatus*	271011	0900-1000	8	Boronia Park	1	0	0	0	**mate calling**	male
167	Spotted Pardalote	*Pardalotus punctatus*	291011	0815-0915	6	Lane Cove NP north	1	0	0	0	**male calling**	

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168	Spotted Pardalote	*Pardalotus punctatus*	291011	1715-1800	11	Field of Mars Reserve Site A	2	0	0	0	calling, likely **nesting**	pair
169	Spotted Pardalote	*Pardalotus punctatus*	291011	1715-1800	11	Field of Mars Reserve Site A	2	0	0	0	foraging, calling, **likely nesting**	
170	Spotted Pardalote	*Pardalotus punctatus*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	2	0	0	0	mate calling, foraging, **likely nesting**	one male, one female
171	Eastern Spinebill	*Acanthorhynchus tenuirostris*	291011	1715-1800	11	Field of Mars Reserve Site A	2	0	0	0	foraging, calling, **likely nesting**	one male, one female
172	Eastern Spinebill	*Acanthorhynchus tenuirostris*	291011	1820-1905	13	Field of Mars Reserve Site B	1	0	0	0	foraging, calling	one male - lower slopes along Buffalo Ck
173	Eastern Spinebill	*Acanthorhynchus tenuirostris*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	1	0	0	0	calling, foraging	one male
174	Eastern Spinebill	*Acanthorhynchus tenuirostris*	311011	0855-0920	34	Buffalo Creek Reserve	0	2	0	0	males foraging	one chased out of 10m planted eucs, teatree & callistemon by NMs
175	Bell Miner	*Manorina melanophrys*	231011	0745-0850	32	Mallee & Tyagarah Reserves	1	0	0	0	perching, foraging	in crown of roughbarked angophora in STIF remnant
176	Noisy Miner	*Manorina melanocephala*	231011	0715-0740	31	Olympic Park	0	8	0	0	foraging, **bred**	in flowering callistemon & tallowwood, with 3 fledged young = total 3 young
177	Noisy Miner	*Manorina melanocephala*	231011	0745-0850	32	Mallee & Tyagarah Reserves	17	0	0	0	foraging, calling, **bred**	3 groups of 2 fledglings each = total 6 young

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
178	Noisy Miner	*Manorina melanocephala*	231011	0905-0930	35	Tyagarah Reserve (oval)	0	0	10	0	foraging, calling, **nesting & with fledglings**	one nest (3 nestlings nr fledging) in euc at park edge; 2 fledged young in another euc) = total 5 young; observed gathering small lawn insects & carrying back to nestlings
179	Noisy Miner	*Manorina melanocephala*	231011	0945-1005	40	Bremner Park	0	6	0	0	foraging, **feeding nestlings**	3 nestlings in creekline callistemon = total 3 young
180	Noisy Miner	*Manorina melanocephala*	231011	1705-1735	37	Morrison Bay Park	0	0	16	0	foraging, calling, **nesting, feeding nestlings**	total 5 prs feeding nestlings - incl 2 recently hatched 8m up euc over walk path E side = total 10 young
181	Noisy Miner	*Manorina melanocephala*	231011	1740-1755	36	Stanley Street	0	0	0	18	foraging, **feeding fledglings**, calling	at least 3 groups of adults and fledglings = total 10 young
182	Noisy Miner	*Manorina melanocephala*	231011	1825-1850	39	Putney Park	0	21	0	0	foraging, calling, **feeding young**	min 4 sets fledglings and nestlings = 14 young
183	Noisy Miner	*Manorina melanocephala*	231011	1805-1820	38	Putney Point	6	0	0	0	foraging, calling	no dependent young
184	Noisy Miner	*Manorina melanocephala*	241011	1645-1715	21	Tarban Creek Reserve	4	0	0	0	foraging, calling	in flowering TW, no dep young
185	Noisy Miner	*Manorina melanocephala*	241011	1720-1745	23	Tarban Creek Reserve	0	8	0	0	foraging, **nesting & feeding young**	2 sets of young - 2 fledglings & 2 nestlings in BBT (10m) = total 4 young

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186	Noisy Miner	*Manorina melanocephala*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	4	0	0	0	foraging, calling	no dependent young
187	Noisy Miner	*Manorina melanocephala*	251011	0830-0900	26	Bedlam Bay (Parramatta Regional Park)	6	0	0	0	foraging, calling, **bred**	1 juv bird = total 1 young
188	Noisy Miner	*Manorina melanocephala*	251011	0945-1005	19	Hillcrest Avenue	0	0	0	12	foraging, calling, **nesting**	total: 5 nestlings from 2 nests, 1 in Tibouchina outside 13 Isler st, other 1 Hillcrest Av frontyard 10 m up in euc = total 5 young
189	Noisy Miner	*Manorina melanocephala*	251011	1015-1035	27	Western Crescent	0	0	0	24	foraging, calling, **feeding nestlings, feeding fledglings**	estimated 4 pairs nesting & 2 other prs with fledglings - in street verge flowering callistemon, exotic yard trees (eg. 54 Western cres) = total 14 young
190	Noisy Miner	*Manorina melanocephala*	251011	1045-1100	28	Tennyson Road	0	0	0	9	foraging, flying, **nesting & feedling fledglings**	2 sets with young - one with 3 nestlings (flats at 3 Bayview backs onto Morrison Bay Pk - pics) & with 2 fledglings S end Kemp St = total 5 young
191	Noisy Miner	*Manorina melanocephala*	261011	0735-0840	25	Gladesville Reserve	0	16	0	0	foraging, calling, **feeding fledglings**	4 fledglings = total 4 young
192	Noisy Miner	*Manorina melanocephala*	261011	0845-0930	24	Betts Park	4	0	0	0	foraging, **with fledglings**	total 2 young (fledglings)

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193	Noisy Miner	*Manorina melanocephala*	261011	1025-1045	20	Kelly Street	0	0	0	28	foraging, calling, **feeding fledglings**	total=14 young (fledglings), in street verge flowering callistemon, Bbx, front/rear yard eucs, exotics
194	Noisy Miner	*Manorina melanocephala*	261011	1050-1120	18	Mary Street	0	0	0	31	foraging, flying, calling, **feeding fledglings & nestlings**	total young = 11 (9 fledglings, 2 nestlings) - latter in Mary St verge BBx
195	Noisy Miner	*Manorina melanocephala*	261011	1615-1725	29	Riverglade Reserve	0	6	0	0	flying, calling, foraging	all adults
196	Noisy Miner	*Manorina melanocephala*	261011	1840-1900	16	Eltham Street	0	0	0	22	foraging, calling, **nestlings & fledglings**	total young = 6 fledglings (Oxford st tibouchina) & 6 nestlings (Oxford st tibouchina & Norfolk Isl Pine cnr Gerrish & Eltham sts) = 12
197	Noisy Miner	*Manorina melanocephala*	271011	0900-1000	8	Boronia Park	1	0	0	0	foraging	upper Brickmakers Ck margins above falls
198	Noisy Miner	*Manorina melanocephala*	271011	1005-1015	7	Boronia Park	0	0	1	0	foraging	on recently-mown oval grass for insects
199	Noisy Miner	*Manorina melanocephala*	271011	1020-1030	9	Park Road	0	0	0	9	foraging, calling, **feeding fledglings**	total young (fledglings) = 5 (cnr Gaza & High sts & Baron Cres eucs & callistemon)

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200	Noisy Miner	*Manorina melanocephala*	271011	1035-1055	17	Abigail Street	0	0	0	24	foraging, calling, **feeding fledglings**	total=12 young (all fledglings), in crepe myrtle (3 - cnr Abigail st & Ryde rd), 21 Abigail (2), cnr Abigail & Figtree (Jacaranda - 3), 6 Abigail st crepe myrtle (2), cnr Martin & Abigail (2 in BBx)
201	Noisy Miner	*Manorina melanocephala*	281011	0745-0820	5	Holy Cross College	0	0	22	0	foraging, calling, **feeding fledglings,** mobbing AR	total=8 young (all fledglings): 4 grps of 2 y each in flowering TWs along Cressy & Buffalo Rd boundaries and internally
202	Noisy Miner	*Manorina melanocephala*	281011	0830-0920	33	Wallumatta NR	20	0	0	0	foraging, calling, **feeding fledglings**	total=9 (all fledglings); more along E and W edges of NR, 20-40m fr houses on W edge
203	Noisy Miner	*Manorina melanocephala*	281011	0930-1005	1	Moncrieff Drive	0	0	0	35	foraging, calling, **feeding fledglings & nestlings**	total=14 young (2 nestlings, 12 fledglings) - in paperbarks outside 31 & 41 Melba st, in euc frontyd 105 Melba, 79 Melba; nest in tibouchina cnr Elliott & Moncrieff

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204	Noisy Miner	*Manorina melanocephala*	281011	1010-1025	2	Blaxland Street	0	0	0	15	foraging, calling, **feeding fledglings & nestlings**	total = 6 young (4 nestlings, 2 fledglings) - nest in Banksia cnr Blaxland&High, and in Lillipilli 170A Pittwater Rd, fledglings at rear 27B Blaxland St
205	Noisy Miner	*Manorina melanocephala*	281011	1030-1045	10	Westminster Road	0	0	0	12	foraging, **feeding fledglings**, calling	total = 6 young (all fledglings) - in pine @ 37 Thompson st
206	Noisy Miner	*Manorina melanocephala*	281011	1745-1805	14	Beazley Street	0	0	0	5	foraging, calling, **feeding fledgling**	total young = 1 (in s/verge callistemon)
207	Noisy Miner	*Manorina melanocephala*	281011	1815-1835	12	Badajoz Road	0	0	0	35	foraging, calling, **feeding fledglings**	total = 12 young (all fledglings) - cnr Callaghan & John Miller sts, rear 31 Quarry rd, 36 Quarry Rd lillipilli, 21A Quarry (Camphor Laurel), in lillipilli front 18 Badajoz & callistemon @ 2 Badajoz Rd
208	Noisy Miner	*Manorina melanocephala*	281011	1845-1910	15	Monash Road	0	0	0	22	foraging, calling, **feeding fledglings**	total = 10 young (all fledglings) eg. outside 2A Orient st
209	Noisy Miner	*Manorina melanocephala*	311011	0855-0920	34	Buffalo Creek Reserve	0	5	0	0	foraging, calling	all adults
210	Little Wattlebird	*Anthochaera chrysoptera*	231011	0745-0850	32	Mallee & Tyagarah Reserves	2	0	0	0	foraging, calling, **courtship**	in dense privet bank nr AGL track

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211	Little Wattlebird	*Anthochaera chrysoptera*	261011	1615-1725	29	Riverglade Reserve	0	2	0	0	foraging, calling, flying	
212	Little Wattlebird	*Anthochaera chrysoptera*	291011	1715-1800	11	Field of Mars Reserve Site A	1	0	0	0	foraging, calling	
213	Little Wattlebird	*Anthochaera chrysoptera*	291011	1820-1905	13	Field of Mars Reserve Site B	3	0	0	0	foraging, calling	
214	Red Wattlebird	*Anthochaera carunculata*	231011	0745-0850	32	Mallee & Tyagarah Reserves	1	0	0	0	foraging	
215	Red Wattlebird	*Anthochaera carunculata*	231011	0745-0850	32	Mallee & Tyagarah Reserves	1	0	0	0	calling, foraging	
216	Red Wattlebird	*Anthochaera carunculata*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	3	0	0	0	foraging, **feeding fledgling**	both parents feeding 3 wk old fledgling flying ants (warm evening)
217	Red Wattlebird	*Anthochaera carunculata*	251011	0830-0900	26	Bedlam Bay (Parramatta Regional Park)	8	0	0	0	foraging, calling	
218	Red Wattlebird	*Anthochaera carunculata*	261011	1615-1725	29	Riverglade Reserve	0	2	0	0	foraging, calling	
219	Red Wattlebird	*Anthochaera carunculata*	261011	1615-1725	29	Riverglade Reserve	0	2	0	0	foraging, calling, potentially **nesting**	
220	Red Wattlebird	*Anthochaera carunculata*	271011	0900-1000	8	Boronia Park	3	0	0	0	calling, foraging, **likely nesting**	
221	Red Wattlebird	*Anthochaera carunculata*	281011	1845-1910	15	Monash Road	0	0	0	2	foraging, calling	in frontyard flowering Jacaranda cnr Monash rd & College st
222	Red Wattlebird	*Anthochaera carunculata*	291011	1715-1800	11	Field of Mars Reserve Site A	1	0	0	0	calling	

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223	Red Wattlebird	*Anthochaera carunculata*	291011	1820-1905	13	Field of Mars Reserve Site B	2	0	0	0	foraging, calling, **likely nesting**	
224	Red Wattlebird	*Anthochaera carunculata*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	2	0	0	0	carrying stick to **nest**	
225	New Holland Honeyeater	*Phylidonyris novaehollandiae*	291011	1715-1800	11	Field of Mars Reserve Site A	4	0	0	0	calling, foraging, **likely breeding**	mostly lower slopes toward Buffalo Ck
226	New Holland Honeyeater	*Phylidonyris novaehollandiae*	291011	1820-1905	13	Field of Mars Reserve Site B	2	0	0	0	foraging, calling	
227	Eastern Whipbird	*Psophodes olivaceus*	291011	1820-1905	13	Field of Mars Reserve Site B	1	0	0	0	male location calling	just male call heard, no female response & along Buffalo Ck
228	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	1	0	0	0	perched	
229	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	261011	1535-1555	30	Riverglade Reserve	0	0	1	0	flyover	
230	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	291011	1715-1800	11	Field of Mars Reserve Site A	2	0	0	0	foraging, calling, **likely nesting**	in Bbt/Angophoras
231	Golden Whistler	*Pachycephala pectoralis*	291011	1715-1800	11	Field of Mars Reserve Site A	2	0	0	0	male **mate & territory calling**	one male, one female
232	Australasian Figbird	*Sphecotheres vieilloti*	231011	0905-0930	35	Tyagarah Reserve (oval)	0	0	1	0	calling	
233	Grey Butcherbird	*Cracticus torquatus*	231011	0715-0740	31	Olympic Park	0	2	0	0	calling	
234	Grey Butcherbird	*Cracticus torquatus*	231011	0745-0850	32	Mallee & Tyagarah Reserves	1	0	0	0	calling	

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235	Grey Butcherbird	*Cracticus torquatus*	231011	0905-0930	35	Tyagarah Reserve (oval)	0	0	3	0	foraging, adult with 2 juvs = **bred**	in tall euc, likely bred here or nearby
236	Grey Butcherbird	*Cracticus torquatus*	241011	1645-1715	21	Tarban Creek Reserve	1	0	0	0	perched	
237	Grey Butcherbird	*Cracticus torquatus*	241011	1720-1745	23	Tarban Creek Reserve	0	1	0	0	perched	
238	Grey Butcherbird	*Cracticus torquatus*	261011	1025-1045	20	Kelly Street	0	0	0	1	perched	on Sherwin St sign (pic)
239	Grey Butcherbird	*Cracticus torquatus*	261011	1615-1725	29	Riverglade Reserve	0	1	0	0	perched	juvenile
240	Grey Butcherbird	*Cracticus torquatus*	281011	0745-0820	5	Holy Cross College	0	0	1	0	calling adult	
241	Grey Butcherbird	*Cracticus torquatus*	281011	0830-0920	33	Wallumatta NR	3	0	0	0	calling, perched	incl 1 immature bird
242	Grey Butcherbird	*Cracticus torquatus*	281011	0930-1005	1	Moncrieff Drive	0	0	0	2	calling, perched	
243	Grey Butcherbird	*Cracticus torquatus*	281011	1745-1805	14	Beazley Street	0	0	0	1	calling	adult
244	Grey Butcherbird	*Cracticus torquatus*	291011	0815-0915	6	Lane Cove NP north	1	0	0	0	calling	immature
245	Grey Butcherbird	*Cracticus torquatus*	291011	1820-1905	13	Field of Mars Reserve Site B	1	0	0	0	calling	
246	Australian Magpie	*Cracticus tibicen*	231011	0715-0740	31	Olympic Park	0	2	0	0	foraging, calling, likely **nesting**	nest 14 m up in euc nr playground
247	Australian Magpie	*Cracticus tibicen*	231011	0905-0930	35	Tyagarah Reserve (oval)	0	0	1	0	foraging	
248	Australian Magpie	*Cracticus tibicen*	231011	1705-1735	37	Morrison Bay Park	0	0	3	0	foraging, **bred**	with 1 juvenile
249	Australian Magpie	*Cracticus tibicen*	231011	1740-1755	36	Stanley Street	0	0	0	4	foraging, **bred**	with 2 juvs
250	Australian Magpie	*Cracticus tibicen*	231011	1825-1850	39	Putney Park	0	2	0	0	foraging	

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251	Australian Magpie	*Cracticus tibicen*	241011	1720-1745	23	Tarban Creek Reserve	0	1	0	0	foraging	
252	Australian Magpie	*Cracticus tibicen*	251011	0905-0920	26	Bedlam Bay (Parramatta Regional Park)	0	0	3	0	foraging	
253	Australian Magpie	*Cracticus tibicen*	251011	0945-1005	19	Hillcrest Avenue	0	0	0	1	flyover	
254	Australian Magpie	*Cracticus tibicen*	251011	1015-1035	27	Western Crescent	0	0	0	1	foraging	
255	Australian Magpie	*Cracticus tibicen*	251011	1045-1100	28	Tennyson Road	0	0	0	1	foraging	
256	Australian Magpie	*Cracticus tibicen*	261011	0735-0840	25	Gladesville Reserve	0	4	0	0	foraging, **bred**	with 1 juvenile
257	Australian Magpie	*Cracticus tibicen*	261011	1025-1045	20	Kelly Street	0	0	0	1	foraging	
258	Australian Magpie	*Cracticus tibicen*	261011	1050-1120	18	Mary Street	0	0	0	4	foraging, calling, **bred**	with 1 juvenile
259	Australian Magpie	*Cracticus tibicen*	261011	1615-1725	29	Riverglade Reserve	0	1	0	0	perched	
260	Australian Magpie	*Cracticus tibicen*	261011	1840-1900	16	Eltham Street	0	0	0	2	foraging	
261	Australian Magpie	*Cracticus tibicen*	271011	1005-1015	7	Boronia Park	0	0	2	0	foraging	
262	Australian Magpie	*Cracticus tibicen*	271011	1020-1030	9	Park Road	0	0	0	1	foraging	
263	Australian Magpie	*Cracticus tibicen*	271011	1035-1055	17	Abigail Street	0	0	0	1	foraging	
264	Australian Magpie	*Cracticus tibicen*	281011	0745-0820	5	Holy Cross College	0	0	2	0	foraging	
265	Australian Magpie	*Cracticus tibicen*	281011	0830-0920	33	Wallumatta NR	2	0	0	0	foraging, calling	
266	Australian Magpie	*Cracticus tibicen*	281011	0930-1005	1	Moncrieff Drive	0	0	0	6	foraging, **bred**	2 juveniles

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267	Australian Magpie	*Cracticus tibicen*	281011	1030-1045	10	Westminster Road	0	0	0	4	foraging, calling, **nesting**	nesting outside 14 High st
268	Australian Magpie	*Cracticus tibicen*	281011	1745-1805	14	Beazley Street	0	0	0	5	foraging, calling, **bred**	2 juveniles & 3 adults
269	Australian Magpie	*Cracticus tibicen*	291011	0720-0745	4	Magdala Park	0	0	5	0	foraging, calling, **bred**	1 juvenile
270	Australian Magpie	*Cracticus tibicen*	291011	1820-1905	13	Field of Mars Reserve Site B	2	0	0	0	perched	
271	Pied Currawong	*Strepera graculina*	231011	0715-0740	31	Olympic Park	0	2	0	0	foraging	
272	Pied Currawong	*Strepera graculina*	231011	0745-0850	32	Mallee & Tyagarah Reserves	4	0	0	0	calling, foraging	
273	Pied Currawong	*Strepera graculina*	231011	0905-0930	35	Tyagarah Reserve (oval)	0	0	1	0	perching	
274	Pied Currawong	*Strepera graculina*	231011	1705-1735	37	Morrison Bay Park	0	0	1	0	**nesting**	on nest 18 m up in same euc as NM E side over walk path
275	Pied Currawong	*Strepera graculina*	231011	1825-1850	39	Putney Park	0	3	0	0	foraging, **feeding fledgling**, calling	nested at site (2 adults, 1 fledgling)
276	Pied Currawong	*Strepera graculina*	241011	1645-1715	21	Tarban Creek Reserve	1	0	0	0	foraging	
277	Pied Currawong	*Strepera graculina*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	2	0	0	0	foraging	
278	Pied Currawong	*Strepera graculina*	251011	0830-0900	26	Bedlam Bay (Parramatta Regional Park)	3	0	0	0	calling, mobbing CB Cuckoo, thus **likely nesting**	
279	Pied Currawong	*Strepera graculina*	251011	0945-1005	19	Hillcrest Avenue	0	0	0	1	perched	

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280	Pied Currawong	*Strepera graculina*	261011	1025-1045	20	Kelly Street	0	0	0	1	perched	
281	Pied Currawong	*Strepera graculina*	261011	1050-1120	18	Mary Street	0	0	0	3	foraging, calling	
282	Pied Currawong	*Strepera graculina*	261011	1615-1725	29	Riverglade Reserve	0	1	0	0	mobbing CB Cuckoo, thus **likely nesting**	
283	Pied Currawong	*Strepera graculina*	261011	1840-1900	16	Eltham Street	0	0	0	2	foraging, perched	
284	Pied Currawong	*Strepera graculina*	271011	0900-1000	8	Boronia Park	5	0	0	0	calling, foraging, likely **nesting**	tall Bbt gully
285	Pied Currawong	*Strepera graculina*	271011	1020-1030	9	Park Road	0	0	0	1	foraging	
286	Pied Currawong	*Strepera graculina*	271011	1035-1055	17	Abigail Street	0	0	0	1	perched	
287	Pied Currawong	*Strepera graculina*	281011	0830-0920	33	Wallumatta NR	4	0	0	0	calling, perched, foraging	incl old nest
288	Pied Currawong	*Strepera graculina*	281011	0930-1005	1	Moncrieff Drive	0	0	0	1	calling, perched	
289	Pied Currawong	*Strepera graculina*	281011	1010-1025	2	Blaxland Street	0	0	0	2	perched, calling	
290	Pied Currawong	*Strepera graculina*	281011	1745-1805	14	Beazley Street	0	0	0	1	perched	
291	Pied Currawong	*Strepera graculina*	281011	1845-1910	15	Monash Road	0	0	0	1	perched	
292	Pied Currawong	*Strepera graculina*	291011	0815-0915	6	Lane Cove NP north	11	0	0	0	foraging, calling	foraging on ground and lower shrubs in burnt area
293	Pied Currawong	*Strepera graculina*	291011	1715-1800	11	Field of Mars Reserve Site A	5	0	0	0	foraging, calling	patrolling' upslope boundary with private property
294	Pied Currawong	*Strepera graculina*	291011	1820-1905	13	Field of Mars Reserve Site B	2	0	0	0	foraging, calling	

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295	Pied Currawong	*Strepera graculina*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	1	0	0	0	perched	
296	Rufous Fantail	*Rhipidura rufifrons*	251011	0830-0900	26	Bedlam Bay (Parramatta Regional Park)	1	0	0	0	foraging, calling	adult nr WBS group walking grid area
297	Rufous Fantail	*Rhipidura rufifrons*	261011	1615-1725	29	Riverglade Reserve	0	1	0	0	calling	nr Tarban Ck North Bank site edge
298	Rufous Fantail	*Rhipidura rufifrons*	271011	0900-1000	8	Boronia Park	1	0	0	0	calling, foraging	
299	Rufous Fantail	*Rhipidura rufifrons*	291011	1715-1800	11	Field of Mars Reserve Site A	1	0	0	0	calling, foraging	
300	Willie Wagtail	*Rhipidura leucophrys*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	1	0	0	0	foraging, calling, creek edge	
301	Willie Wagtail	*Rhipidura leucophrys*	251011	0905-0920	26	Bedlam Bay (Parramatta Regional Park)	0	0	2	0	foraging, **possibly nesting** in edge trees	
302	Willie Wagtail	*Rhipidura leucophrys*	271011	0900-1000	8	Boronia Park	1	0	0	0	calling, foraging	access road edge
303	Willie Wagtail	*Rhipidura leucophrys*	291011	1820-1905	13	Field of Mars Reserve Site B	2	0	0	0	mobbing RWB thus **likely nesting**	
304	Australian Raven	*Corvus coronoides*	231011	0905-0930	35	Tyagarah Reserve (oval)	0	0	1	0	flyover	
305	Australian Raven	*Corvus coronoides*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	1	0	0	0	calling	
306	Australian Raven	*Corvus coronoides*	251011	0905-0920	26	Bedlam Bay (Parramatta Regional Park)	0	0	5	0	flyover fr hospital area	
307	Australian Raven	*Corvus coronoides*	251011	0945-1005	19	Hillcrest Avenue	0	0	0	1	flyover	

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308	Australian Raven	*Corvus coronoides*	261011	0735-0840	25	Gladesville Reserve	0	4	0	0	foraging, calling	
309	Australian Raven	*Corvus coronoides*	261011	0845-0930	24	Betts Park	3	0	0	0	perched, calling	
310	Australian Raven	*Corvus coronoides*	261011	1050-1120	18	Mary Street	0	0	0	3	flyover	
311	Australian Raven	*Corvus coronoides*	271011	1035-1055	17	Abigail Street	0	0	0	2	foraging	
312	Australian Raven	*Corvus coronoides*	281011	0745-0820	5	Holy Cross College	0	0	8	0	foraging, calling	mobbed by NMs
313	Australian Raven	*Corvus coronoides*	281011	1030-1045	10	Westminster Road	0	0	0	4	flyover	
314	Australian Raven	*Corvus coronoides*	291011	1820-1905	13	Field of Mars Reserve Site B	2	0	0	0	foraging, calling	
315	Australian Raven	*Corvus coronoides*	311011	0715-0830	3	Lane Cove NP at Sugarloaf Point	2	0	0	0	bathing	in escarpment rock pool
316	Magpie-lark	*Grallina cyanoleuca*	231011	1705-1735	37	Morrison Bay Park	0	0	2	0	foraging	
317	Magpie-lark	*Grallina cyanoleuca*	231011	1825-1850	39	Putney Park	0	1	0	0	foraging	
318	Magpie-lark	*Grallina cyanoleuca*	251011	0830-0900	26	Bedlam Bay (Parramatta Regional Park)	1	0	0	0	foraging	
319	Magpie-lark	*Grallina cyanoleuca*	261011	1535-1555	30	Riverglade Reserve	0	0	2	0	foraging	
320	Magpie-lark	*Grallina cyanoleuca*	291011	0720-0745	4	Magdala Park	0	0	1	0	foraging	
321	Eastern Yellow Robin	*Eopsaltria australis*	271011	0900-1000	8	Boronia Park	1	0	0	0	**territory calling**	verge off wharf access road (male)

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322	Eastern Yellow Robin	*Eopsaltria australis*	291011	1820-1905	13	Field of Mars Reserve Site B	2	0	0	0	foraging, **territory calling**, **possible nesting**	likely pair - male territory calling @ 1840, 1845-46 upper slope(BBt, angophora, sheoak) nr pedestrian walkway fenceline - open enough due to current bush regen this section of bush
323	Silvereye	*Zosterops lateralis*	231011	0745-0850	32	Mallee & Tyagarah Reserves	9	0	0	0	foraging, calling	in creekline honeysuckle & lantana
324	Silvereye	*Zosterops lateralis*	241011	1800-1900	22	Tarban Creek North Bank (incl Villa Maria)	3	0	0	0	calling, foraging	
325	Silvereye	*Zosterops lateralis*	251011	0830-0900	26	Bedlam Bay (Parramatta Regional Park)	7	0	0	0	foraging, calling	
326	Silvereye	*Zosterops lateralis*	271011	0900-1000	8	Boronia Park	6	0	0	0	foraging	
327	Silvereye	*Zosterops lateralis*	291011	1715-1800	11	Field of Mars Reserve Site A	2	0	0	0	foarging, calling	
328	Silvereye	*Zosterops lateralis*	291011	1820-1905	13	Field of Mars Reserve Site B	3	0	0	0	foraging, calling	in honeysuckle, privet & lantana clumps
329	Silvereye	*Zosterops lateralis*	311011	0855-0920	34	Buffalo Creek Reserve	0	4	0	0	foraging, calling	
330	Welcome Swallow	*Hirundo neoxena*	231011	0715-0740	31	Olympic Park	0	16	0	0	foraging	over mown lawn surface
331	Welcome Swallow	*Hirundo neoxena*	231011	0745-0850	32	Mallee & Tyagarah Reserves	2	0	0	0	foraging, calling	
332	Welcome Swallow	*Hirundo neoxena*	231011	0905-0930	35	Tyagarah Reserve (oval)	0	0	1	0	foraging	

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
333	Welcome Swallow	*Hirundo neoxena*	231011	0945-1005	40	Bremner Park	0	1	0	0	foraging	
334	Welcome Swallow	*Hirundo neoxena*	231011	1705-1735	37	Morrison Bay Park	0	0	6	0	foraging	
335	Welcome Swallow	*Hirundo neoxena*	231011	1740-1755	36	Stanley Street	0	0	0	2	foraging	
336	Welcome Swallow	*Hirundo neoxena*	251011	0905-0920	26	Bedlam Bay (Parramatta Regional Park)	0	0	9	0	foraging, calling	over oval grass surface (not freshly mown)
337	Welcome Swallow	*Hirundo neoxena*	261011	0735-0840	25	Gladesville Reserve	0	1	0	0	foraging	
338	Welcome Swallow	*Hirundo neoxena*	261011	1050-1120	18	Mary Street	0	0	0	12	foraging, calling, **courtship**	flying low cnr Mary & Gladesville St verge & St Joeys oval opposite
339	Welcome Swallow	*Hirundo neoxena*	261011	1615-1725	29	Riverglade Reserve	0	2	0	0	foraging, calling, **courtship**	
340	Welcome Swallow	*Hirundo neoxena*	261011	1535-1555	30	Riverglade Reserve	0	0	10	0	foraging, calling, **courtship**	
341	Welcome Swallow	*Hirundo neoxena*	271011	1005-1015	7	Boronia Park	0	0	2	0	foraging	
342	Welcome Swallow	*Hirundo neoxena*	281011	0745-0820	5	Holy Cross College	0	0	6	0	foraging over older mown grass	
343	Welcome Swallow	*Hirundo neoxena*	281011	0830-0920	33	Wallumatta NR	1	0	0	0	flyover	
344	Welcome Swallow	*Hirundo neoxena*	281011	1845-1910	15	Monash Road	0	0	0	4	foraging, calling, flying	
345	Welcome Swallow	*Hirundo neoxena*	291011	0720-0745	4	Magdala Park	0	0	6	0	foraging, calling	low over mown oval surface
346	Tree Martin	*Petrochelidon nigricans*	261011	1615-1725	29	Riverglade Reserve	0	6	0	0	foraging, calling	

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
347	Red-whiskered Bulbul *	*Pycnonotus jocosus*	231011	0745-0850	32	Mallee & Tyagarah Reserves	1	0	0	0	calling	
348	Red-whiskered Bulbul *	*Pycnonotus jocosus*	291011	0815-0915	6	Lane Cove NP north	1	0	0	0	mate-calling	nr Fairyland
349	Red-whiskered Bulbul *	*Pycnonotus jocosus*	291011	1715-1800	11	Field of Mars Reserve Site A	3	0	0	0	calling, likely **breeding**	lower slopes and edge
350	Red-whiskered Bulbul *	*Pycnonotus jocosus*	291011	1820-1905	13	Field of Mars Reserve Site B	4	0	0	0	foraging, calling, **mate pursuits, territory defence**	lower slopes and creek margin
351	Red-whiskered Bulbul *	*Pycnonotus jocosus*	311011	0855-0920	34	Buffalo Creek Reserve	0	1	0	0	foraging, calling	
352	Common Starling *	*Sturnus vulgaris*	251011	0905-0920	26	Bedlam Bay (Parramatta Regional Park)	0	0	1	0	foraging oval edge	
353	Common Starling *	*Sturnus vulgaris*	251011	1015-1035	27	Western Crescent	0	0	0	1	flyover	
354	Common Starling *	*Sturnus vulgaris*	261011	1025-1045	20	Kelly Street	0	0	0	1	perched	
355	Common Starling *	*Sturnus vulgaris*	291011	0720-0745	4	Magdala Park	0	0	5	0	foraging	on mown oval surface
356	Common Myna*	*Sturnus tristis*	231011	0745-0850	32	Mallee & Tyagarah Reserves	2	0	0	0	foraging along edge	
357	Common Myna*	*Sturnus tristis*	231011	0945-1005	40	Bremner Park	0	2	0	0	foraging	scraps nr oval
358	Common Myna*	*Sturnus tristis*	231011	1740-1755	36	Stanley Street	0	0	0	2	foraging	
359	Common Myna*	*Sturnus tristis*	251011	0905-0920	26	Bedlam Bay (Parramatta Regional Park)	0	0	2	0	foraging oval edge	

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360	Common Myna*	*Sturnus tristis*	251011	0945-1005	19	Hillcrest Avenue	0	0	0	7	foraging, perched, calling	
361	Common Myna*	*Sturnus tristis*	251011	1015-1035	27	Western Crescent	0	0	0	20	foraging, perching, calling, flying	around old eaves, rubbish bins, street litter
362	Common Myna*	*Sturnus tristis*	261011	1615-1725	29	Riverglade Reserve	0	2	0	0	perched nr creek edge	
363	Common Myna*	*Sturnus tristis*	261011	1535-1555	30	Riverglade Reserve	0	0	2	0	foraging	on oval
364	Common Myna*	*Sturnus tristis*	261011	1840-1900	16	Eltham Street	0	0	0	5	foraging, perched	
365	Common Myna*	*Sturnus tristis*	281011	1010-1025	2	Blaxland Street	0	0	0	4	perched, calling	
366	Common Myna*	*Sturnus tristis*	281011	1030-1045	10	Westminster Road	0	0	0	12	foraging & fighting	fighting with NM at 41 Thompson st (stood up to NM!)
367	Common Myna*	*Sturnus tristis*	281011	1745-1805	14	Beazley Street	0	0	0	22	flying, calling, **delivering food to nest**	obs delivering food to nest in eaves 1 Prince St
368	Common Myna*	*Sturnus tristis*	281011	1815-1835	12	Badajoz Road	0	0	0	26	foraging, calling, flying	around small shopping centre in Callaghan/Badajoz and around bins, rubbish in streets
369	Common Myna*	*Sturnus tristis*	281011	1845-1910	15	Monash Road	0	0	0	21	foraging, calling, roosting, likely **breeding**	taking insects in silky oak (flowering) backyards
370	Common Myna*	*Sturnus tristis*	291011	0720-0745	4	Magdala Park	0	0	4	0	foraging	on mown grass surface
371	Red-browed Finch	*Neochmia temporalis*	231011	0745-0850	32	Mallee & Tyagarah Reserves	1	0	0	0	calling	

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372	Red-browed Finch	*Neochmia temporalis*	291011	0815-0915	6	Lane Cove NP north	2	0	0	0	calling, foraging	