Botanical Survey and Vertebrate Fauna Assessment TMK 3-7-6-21: parcels 16, 17, 18 & 19 (78.324 acres) North Kona District, Island of Hawai‘i

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Introduction

This biological survey was prepared for Richard Wheelock, Member, KV3 LLC, to inventory the existing biological environment, assess the potential for biological impacts from proposed development in the survey area, and devise mitigation measures to avoid or minimize any impacts. The land in question ("the survey area") consists of four parcels situated mauka of Queen Ka‘ahumanu Highway, north of the Lako Street intersection, as shown in Figure 1. Two of the parcels are owned by KV3 LLC and are planned for residential and associated uses. The other two parcels are linear drainage ditches owned by the County of Hawai‘i.

The objectives of the botanical survey component of this survey were to 1) describe the vegetation; 2) list all species encountered; 3) determine the likelihood of the presence of rare, threatened or endangered (RTE) plant species; and 4) identify the locations of any RTE individuals found. The area was surveyed by Ron Terry in September 2017. Plant species were identified in the field and, as necessary, collected and keyed out in the laboratory. Special attention was given to the possible presence of any federally listed (USFWS 2017) threatened or endangered plant species, although the habitat did not indicate a high potential for their presence.

The work also included a faunal survey restricted to a tally of birds and introduced mammals, reptiles, or amphibians observed during the botanical fieldwork, as well as one additional one-hour bird observation. The field survey also assessed the general value of the habitat areas for native birds. Although there were no radar or ultrasound observations conducted that might have detected the endangered Hawaiian hoary bat, the general value of the habitat for the Hawaiian hoary bat was evaluated.

Generally not included in the survey was assessment of invertebrates, but the area was searched for the principal plant species in the area known to support the larvae and pupae of the endangered Blackburn's sphinx moth (*Manduca blackburnii*), the one listed endangered insect that is potentially present.

Vegetation: Influences and Previous Studies

The geologic substrate for most of the survey area is soil-covered pahoehoe lava flows from Hualālai dated between 5,000 and 10,000 years ago (Wolfe and Morris 1996). The soil here is classified as Waiaha medial silt loam, 2-10 or 10 to 20 percent slopes, depending on location. This soil forms on ash-covered pahoehoe flows and has a 10-25-inch depth to bedrock. It well drained but also has a high runoff potential (Sato et al

1973). The survey area varies in elevation from 330 to 690 feet above sea level, and receives an average annual rainfall of about 35-38 inches, increasing in the mauka direction (Giambelluca et al 2013).

The pre-human vegetation was likely Lowland Dry/Mesic Forest (per Gagne and Cuddihy 1990). This consisted of an open canopy forest dominated by a wide variety of trees, shrubs, herbs, vines and ferns. It likely had a diverse cover of native dry-forest trees and shrubs including lama (*Diospyros sandwicensis*) and alahe‘e (*Psydrax odoratum*), with a number of other species perhaps including now rare trees such as wiliwili (*Erythrina sandwicensis*), halapepe (*Pleomele sandwicensis*) and uhiuhi (*Mezoneuron kavaiense*). However, the general landscape of the Kailua-Kona area has been radically altered by centuries of settlements, over a century of grazing, and particularly by the development since 1960 of hotels, condominiums, resort homes, commercial facilities and associated infrastructure. Even on properties that experienced no development, introduced plants, animals and pests profoundly altered the biota. Prominent species in the survey area’s elevational zone now include the aliens haole koa (*Leucaena leucocephala*), opiuma (*Pithecellobium dulce*), and guinea grass (*Megathyrsus maximus*).

Although the survey area never underwent modern development except on its margins, archaeological studies (SCS 2016) indicate that it was used prior to Western contact for a variety of activities, leaving features associated with agriculture, habitation, burial, and transportation. In more recent times, the survey area was part of a large former cattle ranch and agricultural area started in the early 1900s. The lower portion of the project area is still used to pasture cattle, and extensive fencing, cattle walls, several corrals and cattle chutes are present. The project area and surrounding lands were bulldozed sometime between the 1940s and 1970s. Evidence of bulldozing is visible in aerial photographs as alternating bands of cleared bulldozer tracks and bands of push piles. Archaeologists confirmed that the linear bands evident in aerial imagery are bulldozer-cleared paths and linear piles of bulldozed rock along the cleared bulldozer paths.

RTE plants are well known from certain areas at this elevational zone in Kona, but, with few exceptions, they are generally found further to the north in slightly drier areas with more recent lava (Geometrician Associates 2004, 2005, 2007, 2009a, 2009b, 2014a, 2014b; Gerrish 2006, 2007a, 2007b, 2008, 2009). RTE plants noted in the surveys above in the Kealakehe to Palama Nui area include the endangered plants uhiuhi, ko‘oko‘olau (*Bidens micrantha* ssp. *ctenophylla*), halapepe (*Pleomele hawaiiensis*), wahine noho kula (*Isodendrion pyrifolium* – now extinct in the wild) and *Fimbristylis hawaiiensis*; the rare plants ‘ohe makai (*Polyscias sandwicensis* and maiapilo (*Capparis sandwichiana*) (both of which we also found to the south on the most recent lava in Kahalu‘u); and the increasingly uncommon wiliwili. No surveys that we have conducted mauka of Kuakini Highway between Palani Road and Honalo – an area with abundant soil that has led to intensive farming, ranching and settlement – have found any RTE plants.

In terms of RTE fauna, the most likely candidate would be the endangered Hawaiian hawk (*Buteo solitarius*). This wide-ranging raptor nests in large trees and forages in forests, farms and even residential neighborhoods, and is seen throughout forested areas of the island. Klavitter (2000) and Gorresen et al. (2008) summarized hawk sightings

around the island, finding instances in this area of Kona, but at generally low densities. According to one study: "Both native and exotic trees are used for nesting, but the majority of nests are built in mature ʻōhiʻa trees. Other nest trees include lama, koa, kōlea, eucalyptus, common ironwood, Christmas berry, coconut, macadamia nut, and mango" (USDA-NRCS 2007).

A number of other RTE birds are fairly unlikely to be found in the survey area. The Hawaiian goose or nēnē (*Branta sandvicensis*) is an endemic, federally listed endangered species that is only occasionally observed in urban Kona, although it is more abundant at Big Island Country Club in the Kekaha region of Kona. Some endangered Hawaiian petrels (*Pterodroma sandwichensis* or *ʻuaʻu*) and band-rumped storm-petrels (*Oceanodroma castro*), as well as threatened Newell's shearwaters (*Puffinus auricularis newelli*), may overfly the area between the months of June and October. All three of these pelagic seabird species nest high in the mountains in burrows. There is no suitable nesting habitat for any of these seabird species within or near the survey area. The primary cause of mortality in all these seabird species in Hawaiʻi is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is another significant cause. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds may collide with manmade structures. If they are not killed outright, the dazed or injured birds are easy targets for feral mammals (Banko 1980; Day et al 2003). Although not an RTE species, the Hawaiian endemic sub-species of the short-eared owl or pueo (*Asio flammeus sandwichensis*), a protected migratory bird, nests and hunts in tall grasslands and shrublands and could conceivably be occasionally present on the survey area.

The endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), the only native Hawaiian land mammal, is found in most areas on the island of Hawaiʻi and has been observed in the thorny forests of Kona. Hawaiian hoary bats are vulnerable to disturbance during the summer pupping season.

Finally, the one endangered insect found in many parts of Kona is the Blackburn's sphinx moth (*Manduca blackburnii*). It is generally associated with drier environments and ʻaʻa substrates. The native host plant aiea (*Nothocestrum* spp.) is extremely rare, but a substitute host, the prolific weed tree tobacco (*Nicotiana glauca*), quickly colonizes dry, disturbed lava flows. Neither host was considered likely to be within the survey area.

In general, we concluded that the probability of encountering RTE plant or animal species in the survey area was low, because of substrate, topography, elevation, history of grazing and evidence of prior surveys.

Vegetation: Results

Our survey found two vegetation types that were distinguished primarily by management regimes (see Figure 2 for photos). The upper half of the survey area contains very few cattle and is intensely overgrown with guinea grass (Figure 2a). The area could be described as a scattered forest or thick savanna, dominated by koa haole, opiuma and

monkeypod (*Samanea saman*). These four plants compose most of the biomass and cover in this area. The lower half is moderately grazed and has a very similar but slightly more diverse tree flora, with kiawe (*Prosopis pallida*), klu (*Acacia farnesiana*), and several other non-native trees (Figure 2c). The understory contains a great diversity of non-native grasses, herbs, shrubs and vines, along with a very few natives, including ʻuhaloa (*Waltheria indica*) and ʻilima (*Sida fallax*).

Although a highly intermittent stream traverses the property, no aquatic or true riparian vegetation is present (Figure 2b).

Flora and Rare, Threatened or Endangered Plants

All plant species found in the survey area during the survey are listed in Table 1. Of the 65 species detected, five were indigenous (native to the Hawaiian Islands and elsewhere) and none were endemic (found only in the Hawaiian Islands). All native plants found are very common throughout the island of Hawaiʻi and the State, and no rare, threatened or endangered plant species were present. No tree tobacco, significant for its role as a potential host for an endangered moth, was found in the survey area.

Online maps from the U.S. Fish and Wildlife Service (USFWS) depict no critical habitat on or near the survey area (http://ecos.fws.gov/ecp/report/table/critical-habitat.html accessed September 2017).

Birds

The 15 species of birds detected during the survey were all non-native and typical of those found in similar areas of lowland disturbed habitat in Kona (Table 2). Most common were spotted dove (*Streptopelia chinensis*), northern cardinal (*Cardinalis cardinalis*), cattle egret (*Bubulcus ibis*) and parakeet (*Aratinga* sp.), Japanese white-eye (*Zosterops japonicus*) and house finch (*Carpodacus mexicanus*). No native birds were detected, and it is generally poor habitat for most native birds. The short-eared owl may utilize the survey area for foraging. The trees in the survey area are generally too short to serve as typical Hawaiian hawk nests, but it probably forages at least occasionally in the area.

Hawaiian Hoary Bat

Hawaiian hoary bats may very well utilize the survey area, as they have been observed in surrounding and similar areas. This survey took place in daylight, did not use any detection equipment, and was not designed to detect bats. However, the Hawaiian hoary bat should be presumed to be present. Bats may forage for flying insects over portions of the survey area on a seasonal basis, and they may find some of the larger shrubs and trees suitable nesting habitat.

Introduced Mammals, Reptiles, and Amphibians

The only live mammals seen during the survey were cattle (*Bos taurus*), feral pigs (*Sus scrofa* – which were abundant in the survey area), and small Indian mongooses (*Herpestes a. auropunctatus*). It is likely that feral cats (*Felis catus*), mice (*Mus* spp.), rats (*Rattus* spp.) and domestic dogs, (*Canis f. familiaris*) are occasionally present. There are no native terrestrial reptiles or amphibians in Hawai‘i. The only reptile observed during the survey was the day gecko (*Phelsuma* sp.). It is likely that other species of gecko as well as anoles and skinks are present. No amphibians were seen or heard. None of these alien mammals or reptiles have conservation value and all are deleterious to native flora and fauna.

Impacts and Mitigation Measures

As discussed above, no threatened or endangered plant species as listed by the U.S. Fish and Wildlife Service (2017) appear to be present in the survey area, nor are there uniquely valuable habitats. No existing or proposed federally designated critical plant (or animal) habitat is present in the survey area. There appears to be no potential to adversely affect RTE plant species.

If the project incorporates additional outdoor lighting, it may attract threatened and endangered Hawaiian seabirds, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of these threatened and endangered seabirds due to interaction with outdoor lighting, no construction using unshielded equipment maintenance lighting should be permitted after dark between the months of April and October. All additional permanent lighting should conform to the Hawai‘i County Outdoor Lighting Ordinance (Hawai‘i County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

The endangered Hawaiian hoary bat is vulnerable to disturbance while roosting with its juveniles in the pupping season. To minimize impacts, it is recommended that woody plants taller than 15 feet should not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15).

No tree tobacco, the principal current host for the endangered Blackburn’s sphinx moth, was observed during our surveys. Because of the weedy, extremely fast-growing and spreading nature of the plant after landclearing and the difficult process necessary to determine if pupae are present in the ground under the plant after larvae have finished their life cycle, it is recommended that the landowner/developer prevent any infestations from growing. Although it is advisable to consult DLNR and or USFWS before removing any plants, juvenile plants less than two feet tall are not generally utilized by the larvae and may be safely removed, subject to discussions with these agencies.

Report Limitations

No biological survey of a large area can claim to have detected every species present. Some plant species are cryptic in juvenile or even mature stages of their life cycle. Dry conditions can render almost undetectable plants that extended rainfall may later invigorate and make obvious. Thick brush can obscure even large, healthy specimens. Birds utilize different patches of habitat during different times of the day and seasons, and only long-term study can determine the exact species composition. The findings of this survey must therefore be interpreted with proper caution; in particular, there is no warranty as to the absence of any particular species.

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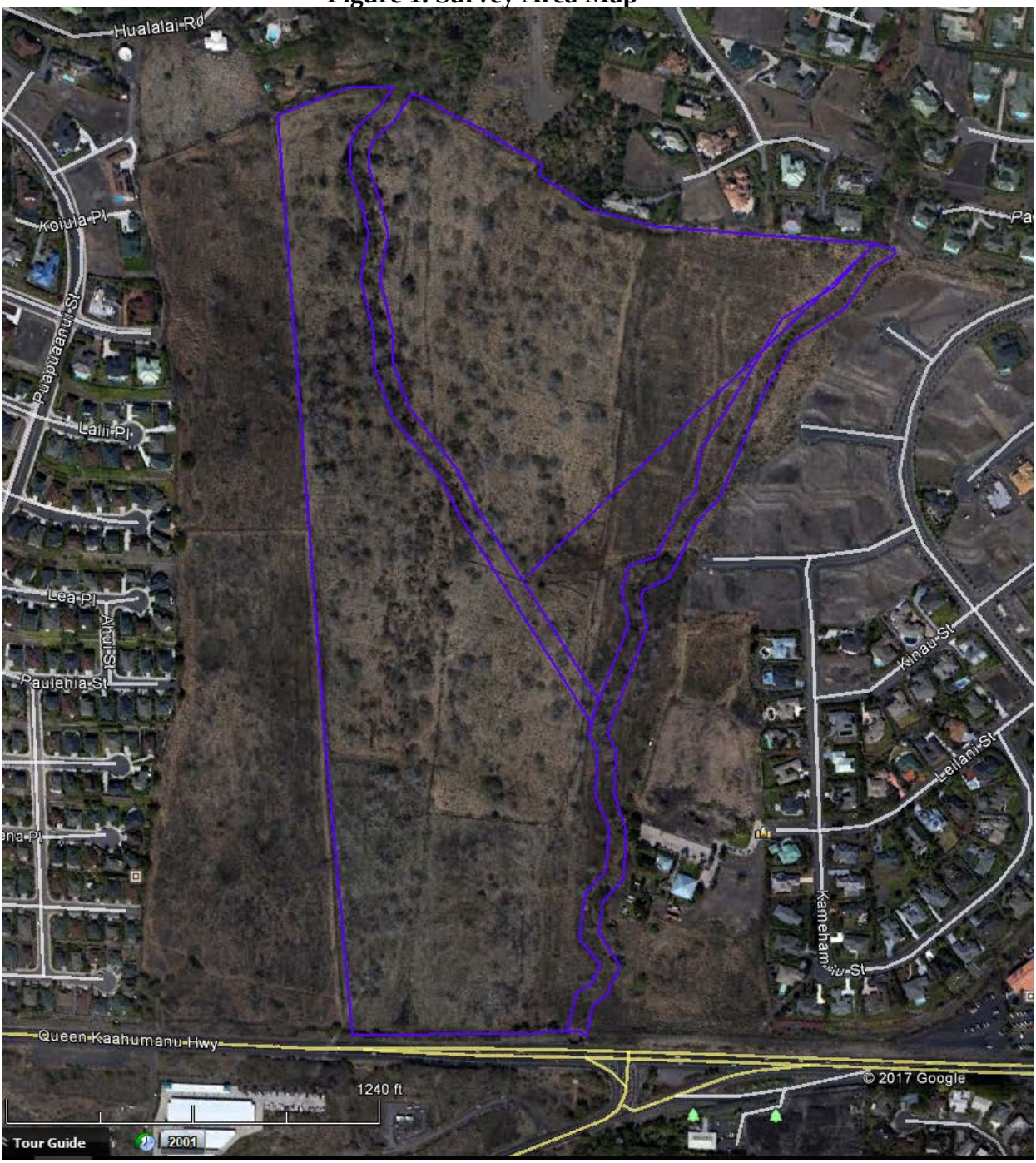
Figure 1. Survey Area Map



Base Map © Google Earth

Figure 2. Survey Area Photos

2a. Dense guinea grass/opiuma vegetation of mauka half ▲

▼ 2b. Natural drainageway

Figure 2. Survey Area Photos

2c. Semi-open vegetation of makai half ▲

▼ 2d. Corral and surrounding vegetation

Table 1. Plant Species Observed in Survey Area

Scientific Name	Family	Common Name	Life Form	Status*
FERNS:				
Nephrolepis multiflora	Nephrolepidaceae	Sword Fern	Herb	A
Phymatosorus grossus	Polypodiaceae	Maile Scented Fern	Herb	A
Pteris cretica	Pteridaceae	‘Oali	Fern	I
FLOWERING PLANTS:				
Abutilon grandifolium	Malvaceae	Hairy Abutilon	Herb	A
Acacia farnesiana	Fabaceae	Klu	Shrub	A
Aleurites moluccana	Euphorbiaceae	Kukui	Tree	P
Amaranthus viridis	Amaranthaceae	Slender Amaranth	Herb	A
Bidens alba	Asteraceae	Beggar’s Tick	Herb	A
Bidens cynapiifolia	Asteraceae	Blue Bidens	Herb	A
Bidens pilosa	Asteraceae	Beggar’s Tick	Herb	A
Buddleia asiatica	Scrophulariaceae	Buddleia	Shrub	A
Caesalpinia decapetala	Fabaceae	Wait-a-bit	Vine	A
Chamaecrista nictitans	Fabaceae	Partridge Pea	Pea	A
Chamaesyce hirta	Euphorbiaceae	Garden Spurge	Herb	A
Chamaesyce hypericifolia	Euphorbiaceae	Graceful Spurge	Herb	A
Chloris barbata	Poaceae	Swollen Fingergrass	Herb	A
Coccinia grandis	Cucurbitaceae	Ivy Gourd	Vine	A
Crotalaria sp.	Fabaceae	Rattlebox	Herb	A
Cynodon dactylon	Poaceae	Bermuda Grass	Herb	A
Desmanthus virgatus	Fabaceae	Slender Mimosa	Shrub	A
Desmodium incanum	Fabaceae	Desmodium	Vine	A
Digitaria ciliaris	Poaceae	Crabgrass	Herb	A
Digitaria insularis	Poaceae	Sourgrass	Herb	A
Digitaria setigera	Poaceae	Crabgrass	Herb	A
Dysphania carinata	Chenopodiaceae	Dysphania	Herb	A
Eleusine indica	Poaceae	Goose Grass	Herb	A
Eragrostis tenella	Poaceae	Lovegrass	Herb	A
Hyptis pectinata	Lamiaceae	Comb Hyptis	Shrub	A
Indigofera suffruticosa	Fabaceae	Indigo	Shrub	A
Ipomoea obscura	Convolvulaceae	Obscure Morning Glory	Vine	A
Kalanchoe pinnata	Crassulaceae	Air Plant	Herb	A
Lantana camara	Verbenaceae	Lantana	Shrub	A
Leonotis nepetifolia	Lamiaceae	Lion’s Ear	Herb	A
Leucaena leucocephala	Fabaceae	Haole Koa	Shrub	A
Malvastrum coromandelianum	Malvaceae	False Mallow	Shrub	A
Megathyrsus maximus	Poaceae	Guinea Grass	Herb	A
Melinis repens	Poaceae	Natal Red Top	Herb	A
Merremia tuberosa	Convolvulaceae	Woodrose	Vine	A
Mimosa pudica	Fabaceae	Sensitive Plant	Herb	A
Momordica charantia	Cucurbitaceae	Bitter Gourd	Vine	A

Table 1, continued				
Scientific Name	**Family**	**Common Name**	**Life Form**	**Status***
Paederia foetida	Rubiaceae	Maile Pilau	Vine	A
Parthenium hysterophorus	Asteraceae	Santa Maria	Herb	A
Passiflora edulis	Passifloraceae	Lilikoi	Vine	A
Phyllanthus debilis	Euphorbiaceae	Niruri	Herb	A
Pithecellobium dulce	Fabaceae	Dulce	Tree	A
Plumbago auriculata	Plumbaginaceae	Leadwort	Shrub	A
Plumbago zeylanica	Plumbaginaceae	‘Ilie’e	Herb	I
Portulaca pilosa	Portulacaceae	Hairy Pigweed	Herb	A
Prosopis pallida	Fabaceae	Kiawe	Tree	A
Psidium guajava	Myrtaceae	Common Guava	Tree	A
Rivina humilis	Phytolaccaceae	Coral Berry	Herb	A
Ricinus communis	Euphorbiaceae	Castor Bean	Shrub	A
Schinus terebinthifolius	Anacardiaceae	Christmas Berry	Shrub	A
Samanea saman	Fabaceae	Monkeypod	Tree	A
Senna occidentalis	Fabaceae	Coffee Senna	Shrub	A
Sida fallax	Malvaceae	Ilima	Shrub	I
Sida rhombifolia	Malvaceae	Sida	Herb	A
Sida spinosa	Malvaceae	Sida	Herb	A
Sonchus oleraceus	Asteraceae	Sow Thistle	Herb	A
Solanum americanum	Solanaceae	Popolo	Herb	I
Solanum seaforthianum	Solanaceae	Vining Solanum	Herb	A
Spathodea campanulata	Bignoniaceae	African Tulip	Tree	A
Thevetia peruviana	Apocynaceae	Be-Still Tree	Tree	A
Thunbergia fragrans	Acanthaceae	White Thunbergia	Vine	A
Triumfetta rhomboidea	Tiliaceae	Bur Bush	Shrub	A
Waltheria indica	Sterculiaceae	‘Uhaloa	Shrub	I

* A=Alien E=Endemic I=Indigenous PI= Polynesian END=Federal and State Listed Endangered (none)

Table 2. Bird Species Observed in Survey Area

Scientific name	**Common name**	**Status**
Acridotheres tristis	Common Myna	Alien Resident
Aratinga sp.	Parakeet	Alien Resident
Bubulcus ibis	Cattle Egret	Alien Resident
Cardinalis cardinalis	Northern Cardinal	Alien Resident
Carpodacus mexicanus	House Finch	Alien Resident
Francolinus pondecerianus	Black Francolin	Alien Resident
Geopelia striata	Zebra Dove	Alien Resident
Leiothrix lutea	Red-billed Leiothrix	Alien Resident
Lonchura punctulata	Nutmeg Mannikin	Alien Resident
Padda oryzivora	Java Sparrow	Alien Resident
Passer domesticus	House Sparrow	Alien Resident
Serinus mozambicus	Yellow-Fronted Canary	Alien Resident
Sicalis flaveola	Saffron Finch	Alien Resident
Streptopelia chinensis	Spotted Dove	Alien Resident
Zosterops japonicus	Japanese White-eye	Alien Resident