

APPENDIX A PART TWO BIODIVERSITY ASSESSMENT

**Part Two Biodiversity Assessment
Jemalong Solar Farm:
Potential Operational Impacts on Bird Populations and
Recommendations for Bird Hazard Risk Management.**



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1. Introduction

The purpose of this report is to assess the potential impacts of the operation of the Jemalong Solar Station (the “proposed development”) on the status of local bird populations and, in particular, NSW threatened bird species listed under the schedules of the NSW *Threatened Species Conservation Act, 1995* (TSC Act) and nationally-listed threatened and migratory species listed under the Commonwealth *Environment and Biodiversity Protection Act, 1999* (EPBC Act).

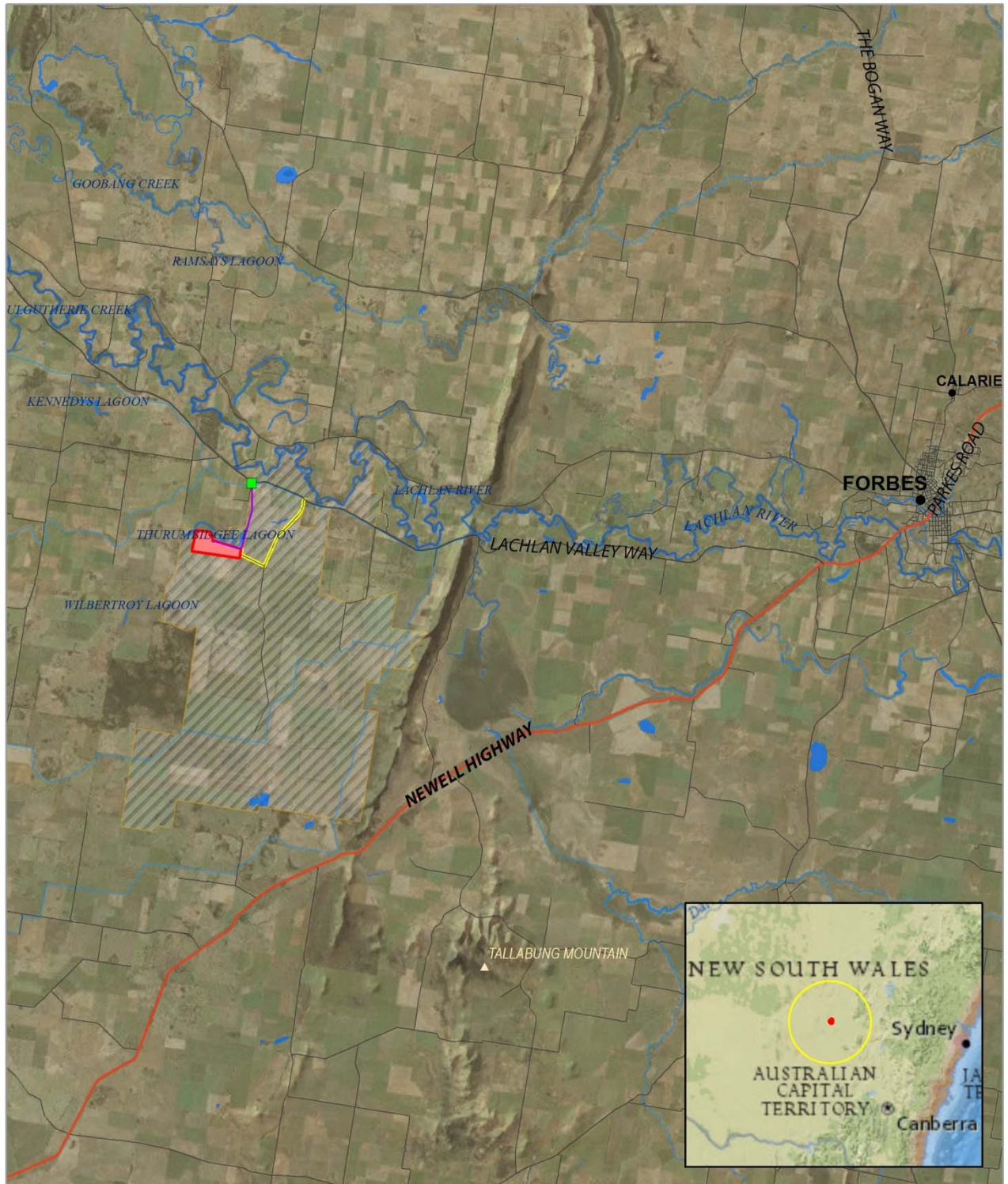
The assessment is based on:

- ❑ the bird species list compiled during the November 2014 site inspection conducted by NGH Environmental Pty Ltd and the inspection conducted by Dr Stephen Ambrose on 18 February 2015;
- ❑ database records (NSW BioNet, NSW Bird Atlas and Australian Bird Atlas) of species of conservation significance (threatened and migratory bird species) from within a 10 km radius around the subject site (the “locality”);
- ❑ the suitability of the subject site and adjoining areas, and impacted air-space above the subject site, as habitat for bird species of conservation significance and other high-risk bird species;
- ❑ identification of potential impacts on bird species and their habitats that may result from the proposed development, based on the potential use of the subject site and impacted air-space by bird species, and a review of the scientific literature that have assessed the avian impacts of similarly-designed solar farms elsewhere; and
- ❑ identification of measures for avoiding or mitigating significant impacts on local bird populations.

The subject site is located approximately 35 km west of Forbes, south of Thurumbidgee Lagoon, which is located on the floodplain of the southern side of the Lachlan River (Figure 1). The proposed footprint of the solar station would be in the western part of the subject site, and the site would be accessed via Wilbertroy and Naroo Lanes on the southern side of Lachlan Valley Way

The proposed development is a 30 MW concentrated solar thermal (SCT) plant with thermal energy storage, made up of 89 modules, with each module consisting of a heliostat field and a 27 m high receiving tower. The heliostats would be 2.2 m high, located 30 to 100 m from the receiving tower. A solar tracking system would drive the heliostats to beam solar energy to the receiving towers during daylight hours. The receiving towers would be lattice structures approximately 25 m high with a 2 m high receiving device mounted at the top. The receivers would reach temperatures in excess of 450°C and a 3 to 4 m envelope around each receiver would reach high temperatures. The proposed layout of the solar farm is shown in Figure 3.

Figure 1 LOCATION OF SUBJECT SITE



- | | | |
|------------------------------|------------------------|--|
| ● Town | ▲ Topographic features | — Major drainage line |
| ● Village | — Highway | — Minor drainage line |
| ■ Substation | — Major road | ■ Waterbody |
| — Proposed transmission line | — Local road | ▨ Jemalong Station (involved properties) |
| ■ Proposal site | — Proposed access | |

0 2.5 5 10 Kilometres



Figure 2 PROPOSED SOLAR FARM FOOTPRINT

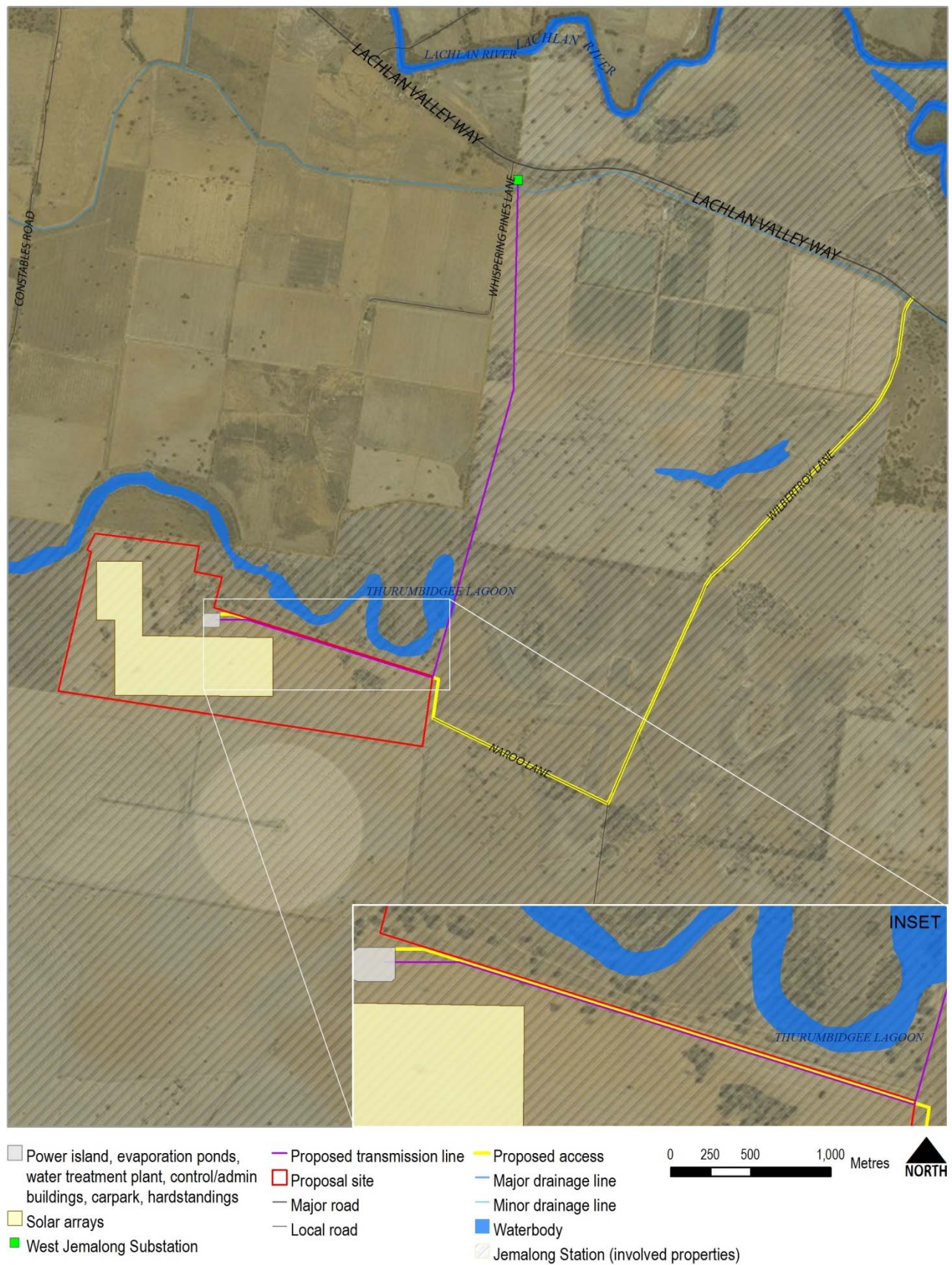
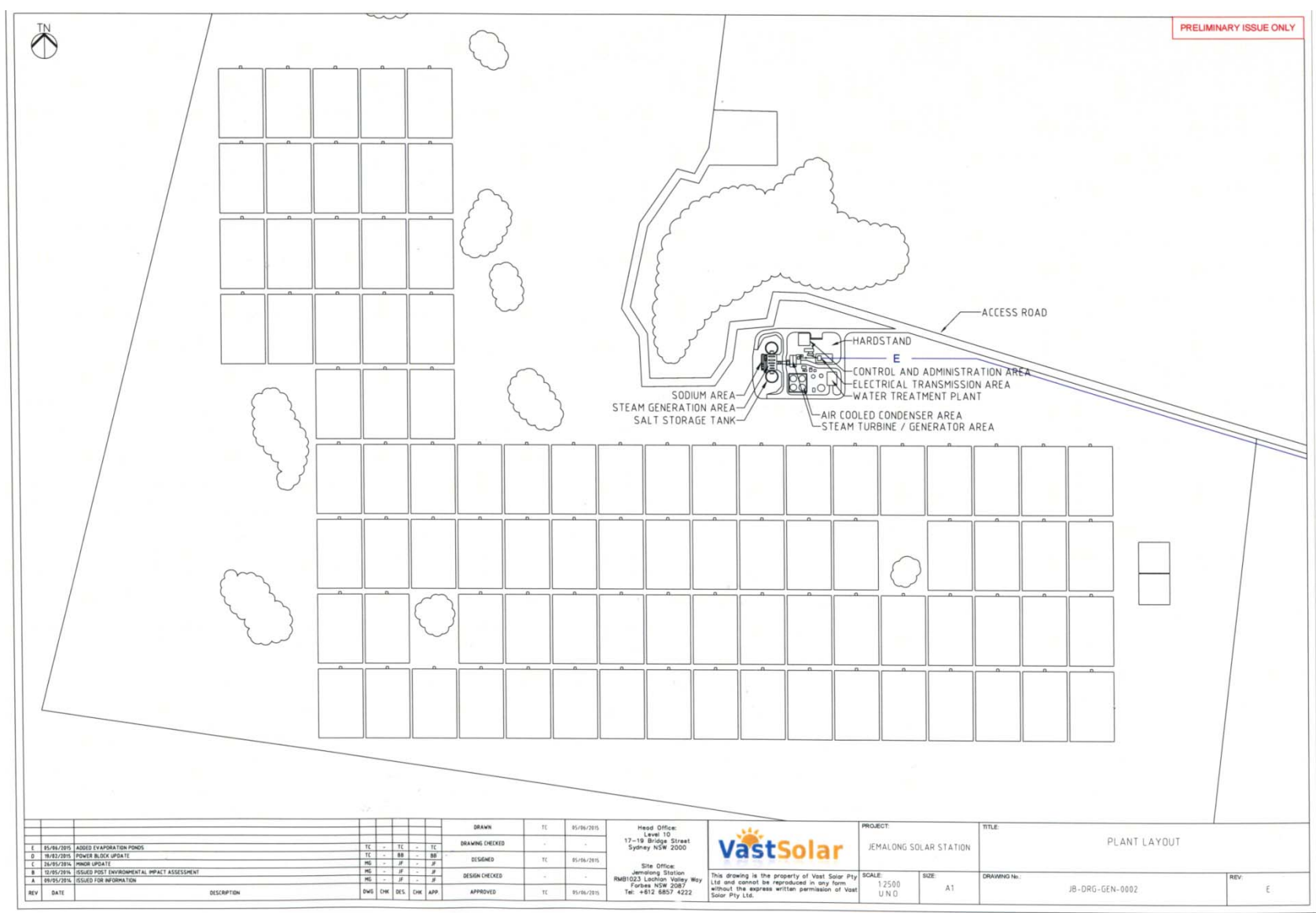


Figure 3 PROPOSED SOLAR FARM LAYOUT



2. Risk Factors

2.1 Site in High Risk Area

The subject site is located near the intersection of three NSW bioregions identified by Reid (2014) as Inland Central Riverine Plains (Region 10), Western Slopes Woodland (Region 3) and Eastern Mallee, Mulga, Callitris Tall, Semi-arid Shrublands and Poplar Box Woodlands (Region 6). Region 10 is characterised by arid and semi-arid land-bird, waterbird and shorebird species; Region 3 by waterbird and land-bird species that are absent from coastal NSW; and Region 6 by rare land and waterbird species of semi-arid and arid, grassy, chenopod and floodplain habitats (Reid 2014). Reid also states that many of the bird species in Regions 3 and 6 are species of conservation significance.

The subject site is also located in a part of NSW that Cooper *et al.* (2014) demonstrate to have avian communities that are characterised by species that:

- ❑ are resident throughout the year;
- ❑ migrate southwards from northern NSW and beyond, and from inland areas, for spring and summer;
- ❑ migrate northwards from southern NSW, Victoria and Tasmania, and high-elevation areas of the Great Dividing Range;
- ❑ are nomadic, especially inland species, when there is a temporary abundance of resources (e.g. nectar, seeds, fruits and aquatic habitats).

Consequently, the subject site is located in a 10-minute latitudinal/longitudinal block where between 101 and 150 bird species have been recorded (Cooper *et al.* 2014), which is considered to be moderately high bird species richness in NSW.

Bird mortality or injury from energy developments occur at sites which are located in high-use areas for birds or at sites, where there are particular bird taxa or groups (e.g. age groups, gender groups, migratory or nomadic populations). There are few studies of these impacts in Australia, and those that have been conducted are at wind farms, and none at solar farms. Most of what is known about the impacts of solar farms on bird populations is based on a study by Kagan *et al.* (2014) at three solar farms in the United States (southern California) that used different solar designs (photovoltaic cells at the Desert Sunlight Facility, a trough system with parabolic mirrors at the Genesis Facility, and power towers as focal points for solar flux at the Ivanpah Facility).

Kagan *et al.* (2014) recorded mortality or injury to 71 bird species across the three solar farms, representing a broad range of ecological types. Each solar farm is located in significant migratory paths of bird species, and sampling was conducted in October 2013, during the southward autumn migration period. Impacted bird species ranged in size from hummingbirds to pelicans; in ecological type from strictly aerial feeders (swallows) to aquatic feeders (grebes) to ground feeders (roadrunners) to raptors (hawks and owls). The species identified were equally divided among resident and non-resident species, and nocturnal as well as diurnal species were represented. However, despite the relatively high number of species impacted, the total number of impacted birds found across all three solar farms was low (233 individuals).

On 14 January 2015, about 115 bird mortalities were recorded during a 4.25-hr test run of the TSE Crescent Dunes Solar Energy Project (CDSEP), a 110 MW solar thermal facility in the Mojave Desert, Nevada (Lightfoot 2015). The CDSEP is a much larger and a vastly different design to the proposed Jemalong Solar Farm. It consists of 17,500 heliostat mirrors that collect and focus the sun's thermal energy to heat molten salt flowing through a single 160-m tall receiving tower. In comparison, the Jemalong Solar Farm would consist of 89 receiving towers, each 27 m in height, each surrounded by 700 heliostats, and overall is generating less power (30 MW). Therefore, the intensity and pattern of reflected solar energy at the Jemalong Solar Farm would be different to those occurring at the CDSEP. Moreover, the bird mortality recorded at the CDSEP occurred when about 3,000 heliostats surrounding the receiving tower were positioned to reflect light and heat to a concentrated point above the tower (approximately 360 m above the ground) during the test run. Lightfoot (2015) stated that a halo of energy was visible from the ground, and the heat was so intense that birds flying into the halo were immediately burned and smoke was clearly evident. Normal operation of CDSEP would require the heliostats to reflect the solar energy to rather than above the receiving tower, reducing the risk of energy concentration points occurring in flight paths of bird flocks. Subsequent test runs at the CDSEP, where solar energy is focused at a point above the tower, are limited to the use of 150 heliostats at any one time, but avian mortality data under this regime are not yet available.

Estimated annual bird mortality rates in North America (number of birds killed per year) from other anthropogenic sources include 1.4 – 3.7 billion from predation by cats (Loss *et al.* 2013), 98 – 980 million from collisions with buildings and windows (Klem 2009; Loss *et al.* 2014), tens of thousands to 174 million from collisions and/or electrocution from power lines (Erickson *et al.* 2001), 60 – 80 million from collisions with road and rail vehicles (Erickson *et al.* 2001), 6.8 million from collisions with communication towers (Longcore *et al.* 2012), 500,000 – 1 million at oil field waste water facilities (USFWS 2009), 209,059 – 330,010 from collisions with wind turbines (Erikson *et al.* 2001), and 4,722 from collisions with aircraft (Dolbeer & Wright 2009). Therefore, preliminary studies suggest that bird mortality and injury at solar facilities are likely to be much lower than those caused by other anthropogenic sources.

2.2 Overview of Types of Risks

Risks to birds at solar farms in the United States that have been identified by Kagan *et al.* (2014) and Erikson *et al.* (2014), and which are applicable to the proposed development of the subject site, include:

- ❑ loss of bird habitat;
- ❑ collision risks with solar farm infrastructure (heliostats, towers and cables);
- ❑ solar flux burns and related trauma;
- ❑ heliostats and reflected light perceived by birds as wetlands;
- ❑ attraction of birds to bright lights at night;
- ❑ attraction to insects culls and live swarms; and
- ❑ stranding and predation.

All bird species recorded on the subject site in November 2014 (Table 1) have the potential to fly through or over the subject site at altitudes below the maximum height of the proposed towers and their receivers. Nearly all the birds observed on the subject site were observed flying or engaged in other activities (e.g. resting, feeding or foraging) less than 20 m above

the ground (C. Radford, *pers. comm.*), which is within the each species' expected flight height range. An assessment of the magnitude and the types of potential risks posed to these species by the proposed development is presented in Table 1 and discussed in detail in Sections 2.3 to 2.10.

2.3 Habitat Loss

Establishment of the heliostat fields would result in the clearance or modification of about 100 ha of potential bird habitat. Additional land on the subject site would also be used for the establishment of a 66 kV transformer station and switchgear, a 66 kV overhead or underground line to connect with the existing power line, a site office and maintenance building, and internal access tracks to allow for site maintenance.

The proposed development would be confined largely to areas of the subject site that have been cleared for agriculture, and more ecologically significant areas such as remnant woodland in the northern part of the site would be retained. The proposed development footprint provides potential foraging habitat for common ground-foraging bird species, such as Masked Lapwings, Sulphur-crested Cockatoos, Galahs, Little Corellas, Crested Pigeons, Magpie-larks, Australian Magpies and Australian Pipits. The farm dam, irrigation channers and water-logged soils provide potential bathing and drinking habitat for woodland and grassland birds, waterbirds, egrets and herons, rails and ibises. All these species have a widespread distribution within the locality and in the broader geographical region.

Impact resulting from loss of habitat (i.e. construction of the development) on all fauna assemblages, including birds, has been assessed in the document titled Part 1 Biodiversity Assessment, Jemalong Solar Farm (NGH Environmental 2015). It is assessed that impact from habitat loss to birds is unlikely to significantly limit resources available to them.

2.4 Collision Risks

2.4.1 Introduction

Newton (2008) indicates that most bird migration over low land occurs within 1500 m of the ground. Kerlinger (2001) also indicates that most night migrating birds fly at heights between 410 and 2,000 m. However, most bird movements through or over the subject site are likely to be less than 30 m above the ground, especially if individuals are using habitats on or adjacent to the site (e.g. woodland, grassland and wetlands). Nearly all the birds observed on the subject site in November 2014 were within 20 m of the ground (see Section 2.2).

The proposed height of the receiving towers at the Jemalong Solar Facility is 27 m and the heliostats would be 3 m high when orientated perpendicularly to the ground.

2.4.2 Risk of Collision with Heliostats

Glass panels that reflect trees and other attractive habitat are involved in a higher number of bird collisions in comparison with panels that do not reflect habitat (Klem 1990, 2006; Klem *et al.* 2004; Loss *et al.* 2014). Kagan *et al.* (2014) found that impact trauma was the most significant cause of avian mortality at the Ivanpah Solar Flux Facility, the collision risk being greatest when the heliostats were orientated vertically. However, the heliostats are generally

directed upward towards the sky and are usually orientated vertically only when being washed or installed.

Birds that are most at risk of colliding with the proposed heliostats at Jemalong are open-country species that fly fast and low over the ground when moving between suitable habitat areas (e.g. Swift Parrots; small, migratory honeyeater species), soar low over the ground when feeding on aerial insects (e.g. Welcome Swallows, White-throated Needletails and Fork-tailed Swifts), diurnal and nocturnal raptors when diving or swooping for prey on or close to the ground, and to a lesser extent, waterbirds landing or taking off from the subject site. The heliostats are likely to be orientated upwards most of the time, thus reflecting the sky rather than the surrounding landscape, and so are not likely to be a collision risk to the extent that they would significantly affect the status of local bird populations.

2.4.3 Risk of Collision with Receiving Towers

The receiving towers are a potential collision risk to birds flying low over the subject site at night (e.g. waterbirds, nocturnal raptors) or during heavy fog conditions. Patterson *et al.* (2012) indicate that these types of collisions are avoided or minimised by having flashing red lights, as opposed to continuously burning white lights, at regular intervals along the lengths of the towers.

2.4.4 Risk of Collision with Power Line

Although there have been numerous studies of bird collisions with power lines overseas, few studies of this nature have been conducted in Australia.

Winning & Murray (1997) observed a mean rate of 0.53 collisions per 1000 flights across a power line adjacent to Shortland Wetlands near Newcastle, New South Wales during observations conducted over two successive breeding seasons. They inferred that the mortality rate from these collisions, based on the number of birds located during ground searches was around 0.04 mortalities per 1000 flights. These equated to a total of 77 observed collisions with power lines, resulting in six observed bird deaths. Ground searches conducted over the same period revealed 31 dead birds, nearly all of them being large waterbirds (ibises, egrets, swans, cormorants and a spoonbill).

Over a 12-month period, Goldstraw & Du Guesclin (1987) retrieved the bodies of 130 individuals from 20 bird species from a 6 km transect under power lines that passed over farmland that had a mosaic of wetlands in south-western Victoria. Black Swans (*Cygnus atratus*) and Straw-necked Ibis (*Threskiornis spinicollis*) accounted for 64% of the casualties.

The results of these two studies suggest that bird collision and mortality rates with the new power line on the subject site are likely to be extremely low and would not pose a significant risk to local bird populations. Moreover, the risk of bird collisions can be minimised by placing reflective marker balls at intervals along the power line or avoided if the power line is placed underground.

2.5 Solar Flux Burns and Related Trauma

Birds flying through areas where the heliostats focus the sun's energy (the solar flux) can suffer significant, often fatal burns. McCrary *et al.* (1986) and Kagan *et al.* (2014) indicate

that small birds are particularly vulnerable to solar flux burns, with burns generally limited to the feathers, but more serious internal injuries relating to impact trauma following the heat damage to feathers and the subsequent loss of flight ability. According to Kagan *et al.* (2014) solar flux-related death in birds is attributable to:

- ❑ impact trauma following feather damage;
- ❑ starvation and/or thermoregulatory dysfunction following direct heat damage to feathers;
- ❑ shock;
- ❑ soft tissue damage following whole-body exposure to high heat; and/or
- ❑ ocular damage following exposure to bright light.

Solar flux levels above 50kW/m² (approximately 50 times the brightness of the sun) and temperatures above 450°C poses an elevated risk to avifauna. Flux Modelling for Jemalong predicts that the distance from the receiver at which the maximum flux drops below 50kW/m² occurs between the 14 m and 16 m flux planes. However, over the vast majority of the area at the 12 and 14 m flux planes falls below the threshold. The peak flux at 14m occurs in a very small area circled in the corner of the flux plane. Overall, the High Flux Zone for a receiving tower occupies a relatively small area, ranging from 11.2 m² (0.4% of bounding area) when looking east to 52.8 m² (2.8% of bounding box area) when looking north. The High Flux Zone is predicted to be 66.4 m² when viewed from above (i.e. aerially), representing 0.9% of the bounding box area. There would be 89 receiving towers and receivers at the facility.

The receiver at the top of the tower and the pipes external to the receiver will have elevated temperatures that are likely to be fatal to birds. The front of the receiver tubes and the upper supporting structure are expected to reach temperatures in excess of 450°C, but these high temperatures would dissipate before they reach the tower structure.

Most open-country and wetland bird species, and some woodland bird species recorded on the subject site in November 2014 have the potential of flying through High Flux Zones (see Table 1). Species groups that are most likely to be at risk include:

- ❑ aerial foragers (swallows, swifts and needletails);
- ❑ diurnal and nocturnal raptors when diving or swooping for prey on or close to the ground;
- ❑ seed-eating parrots and cockatoos that forage on the ground in open areas (e.g. Galahs, corellas, Major Mitchell's Cockatoos, Sulphur-crested Cockatoos, Cockatiels and Turquoise Parrots);
- ❑ open-country species that forage for invertebrates on the ground (e.g. Australian Magpie, Magpie-lark, Willie Wagtail) or scavenge carcasses (e.g. corvids);
- ❑ parrot species (e.g. Swift Parrots and Superb Parrots) and migratory honeyeaters that fly fast and low over open country when moving between suitable woodland habitat areas;
- ❑ waterbird and shorebird species that are attracted to water bodies on or adjacent to the subject site after heavy rains and/or diversion of water into these areas by irrigation channels.

However, the High Flux Zones occupy a negligible amount of the air-space that could potentially be used by birds to fly through or over the subject site. Therefore, the risk of individual birds flying through these zones by chance is relatively small. However, there is a significantly increased risk of insectivorous birds and raptors chasing insect-feeding birds

flying through High Flux Zones if aggregations of insects are attracted there (See Section 2.6).

Species most at risk of burns or heat-stress as a result of the high temperatures around the receivers are those that may attempt to use receivers or their external piping as vantage points to search for or feed on prey (e.g. falcons and kites) or for resting (e.g. cockatoos, artamids and corvids). Bird species that are least at risk of experiencing solar flux burns or associated traumas are those that have the inability to disperse widely from woodland remnants into open country habitats. These species are generally weak fliers and seldom fly more than 100 m between suitable staging and landing points (e.g. Brown Treecreepers).

2.6 Attraction to Insects

Kagan *et al.* (2014) observed that bird species affected by solar flux included both insectivores (e.g. swallows, swifts, and Old World flycatchers and warblers) and raptors that feed on insect-feeding birds. They believe that the bright light generated by solar flux attracts large numbers of insects (especially butterflies, dragonflies and other large insects), which in turn attracts insectivores and predators of insectivores. At Ivanpah, birds were observed perching and feeding on railings at the top of the receiving towers, apparently in response to receiving towers there.

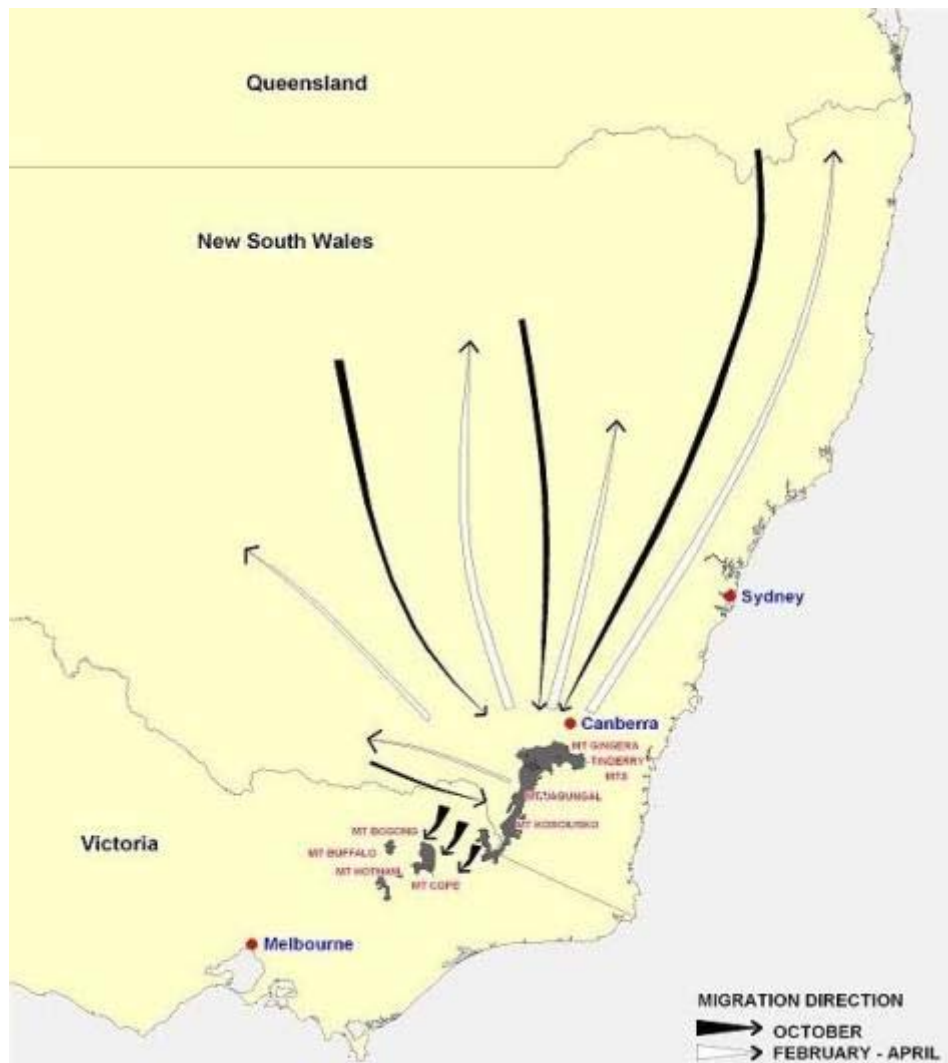
This is a potentially the most significant ecological issue for the proposed development because the solar flux is likely to attract large insect aggregations from nearby wetlands and associated habitats, especially after mass insect breeding events following significant rainfall.

The subject site is within the migratory corridor of the Bogong Moth *Agrotis infusa* (Lepidoptera: Noctuidae) (Figure 4). Tens of millions of Bogong Moths migrate from larval feeding areas in inland Queensland, New South Wales and South Australia to alpine and sub-alpine areas of south-eastern Australia in October where they form large congregations in crevices and caverns above 1400 m. The moths migrate back to their breeding grounds in late summer and autumn, usually between February and April (Common 1954). Moonlight reflected from heliostats may attract aggregations of moths at night and potentially suitable resting areas (e.g. shaded areas under the heliostats, the framework of the receiving towers) may potentially attract considerable numbers during the day, while on migration.

The subject site is also located within a region of NSW that experiences periodic locust outbreaks, following heavy rainfall periods after prolonged dry weather. A large swarm of Australian Plague Locust *Chortoicetes terminifera* (Orthoptera: Acrididae) nymphs was observed moving through the subject site and surrounding woodland areas in February 2015. This locust outbreak was first reported in Central West NSW in September 2014 and nymphal bands are expected to pass through the region around Forbes until at least April 2015 (Australian Department of Agriculture website, <http://www.agriculture.gov.au/pests-diseases-weeds/locusts/bulletins/locust-bulletin-feb-2015>, accessed 1 March 2015).

Bird species that are likely to be attracted to insect aggregations if they occur on the subject site include lapwings, swallows, swifts, needle-tails, insectivorous honeyeaters, wagtails and fantails, cuckoo-shrikes, artamids and songlarks. Falcons and kites are potential aerial predators of insectivorous birds that are attracted to insect aggregations and/or which have sustained solar-flux injuries. Owls may also be significant predators if small insectivorous birds are attracted to insect aggregations at night.

Figure 4 **MIGRATORY ROUTES OF BOGONG MOTH (adapted from Common 1954)**



2.7 **Heliostats and Reflected Light Perceived as Wetlands**

The subject site is located on the floodplain of the Lachlan River, the closest part of the river being approximately 3.5 km north of the site, on the northern side of Lachlan Valley Way.

Numerous, mostly ephemeral, wetlands of varying sizes, ephemeral creeks, and permanent irrigation channels surrounding paddocks occur on the floodplain on both sides of Lachlan Valley Way.

Lake Cowal is approximately 22 km south-west of the subject site. This wetland is the largest natural inland lake and one of the most significant waterbird concentration areas in NSW, covering an area of 13,000 ha when full. It is an important site for migratory birds, and supports a high diversity of bird species with 172 bird species recorded there, including breeding populations of 82 species, of which 30 species are waterfowl (Australian Register of the National Estate <http://www.environment.gov.au/topics/heritage/heritage-places/register-national-estate>). Grey Teal (*Anas gracilis*), Eurasian Coot (*Fulica atra*) and the Australian Pelican (*Pelecanus conspicillatus*) are the most abundant species. The Eastern Great Egret (*Ardea modesta*), Royal Spoonbill (*Platalea regia*), Pacific Black Duck (*Anas superciliosa*),

Australasian Shoveler (*Anas rhynchos*), Masked Lapwing (*Vanellus miles*), Latham's Snipe (*Gallinago hardwickii*) and Silver Gull (*Chroicocephalus novaehollandiae*) are also common species (Lake Cowal Foundation <http://www.lakecowalfoundation.org.au/lake-cowal>).

Thurumbidgee Lagoon is located approximately 400 m to the north of the subject site, with River Red Gum forest along its banks. Pooled water observed in the south-eastern corner of the subject site during the November 2014 surveys is likely to be overflow from one of the irrigation channels outside the site. Therefore, it is probable that waterbirds (waterfowl, gallinules, egrets, herons, ibises and spoonbills) and small numbers of migratory shorebirds fly low over the subject site when moving between wetlands, as well as occurring on the site during floods or runoff from irrigation channels.

Waterbirds are known to land on a large surface that reflects polarised light because of its resemblance to a large body of water from the air. This can lead to waterbirds suffering burns when flying through areas where heliostats are focusing the sun's energy (the solar flux) on at night while attempting to land on a heliostat, as shown by McCrary *et al.* (1986) and Kagan *et al.* (2014). However, Kagan *et al.* (2014) found that waterbirds accounted for only 10% of bird casualties at the solar flux installation at Invanpah, compared with 44% at the photovoltaic solar facility at Desert Sunlight and 19% at the parabolic trough solar facility at Genesis. This led to Kagan *et al.* to conclude that a solar flux arrangement has the least impact on waterbird mortality.

Erikson *et al.* (2014) predict that arrays of mirrors or solar panels are more of a collision risk than a burns risk to waterbirds because these species usually attempt to land on them at night. They also indicate that such collisions usually do not result in direct mortality because the angle of collision is relatively shallow and benign. Some waterfowl species (e.g. large ducks, swans and geese) have difficulty becoming airborne again after collisions with other man-made structures (e.g. parking lots and train yards) because they are adapted to taking off from water rather than dry land. Most waterbird and wading species that are likely to occur in the locality would be shallow-water rather than deep-water species because of the shallow and ephemeral nature of many of the wetlands. These species generally do not have a difficulty taking flight from land or small water bodies. Therefore, if on rare occasions, waterbirds do land on heliostats at night, it is likely that they will become airborne again. The heliostats will also be orientated near vertically at night, which should reduce the likelihood of waterbirds mistaking the heliostat field as a body of water.

2.8 Stranding and Predation

Kagan *et al.* (2014) speculate that levels of bird predation at solar facilities are likely to be elevated, but admit that they are difficult to quantify. Birds that are most susceptible to predation are those that are stranded due to injury from non-lethal collisions or solar flux and/or those that are attracted to insect aggregations and thus attract insect-feeding raptors.

2.9 Light Pollution

If the subject site is lit at night, then there is potential for some light spillage into retained woodland areas and nearby wetland habitats. Male songbirds near artificially illuminated areas start their dawn chorus significantly earlier in the morning than those in habitat areas that are not affected by artificial light. Birds that sing earlier may be getting less sleep and may be at a higher risk of predation. Moreover, females gauge the reproductive fitness of

males from the timing, duration and quality of their singing; therefore, females may be attracted to mate with lower-quality males who have been impacted by light pollution (Kempenaers *et al.* 2010).

Light pollution impacts can be reduced significantly by installing luminaires that would minimise the intensity of artificial night light on the subject site. Luminaires could be positioned to illuminate the area around the transformer station, maintenance building, pedestrian paths, roads and parking areas on the subject site, but located and orientated to minimise or eliminate upward and backward light spill, and thus aim to avoid light pollution to retained woodland on the subject site and nearby wetland areas.

2.10 Cumulative Flight Risks

Table 1 assigns a Cumulative Flight Risk Score (CFRS) in relation to the proposed development for all species that were observed on the subject site in November 2014 and/or February 2015. The CFRS is an index of the potential for mortality or injury to individuals of each species as a result of flying through High Flux Zones, high temperature zones, impact trauma and increased predation risk. The CFRS ranges from 0 (no risk) to 7 (high risk) and each CFRS category is defined in the legend accompanying Table 1.

Factors considered in assigning a CFRS to each species include the relative abundance of the species in the locality (number of database records), residency status in locality (e.g. vagrant, seasonal migrant, nomad, resident in locality throughout the year), the relative importance of the subject site and neighbouring areas as habitat for the species, relative abundance of the species on the subject site throughout the year (e.g. single or paired birds, small family or communal groups, large flocks), the likelihood of the species passing through the proposed development footprint to reach habitat resources, home ranges and sizes of territories, heights at which each species could fly over or through the subject site, and if the species would be attracted to the subject site as a result of the proposed development (e.g. attraction to insects or insect-feeding birds).

Birds belonging to open-country guilds are most at risk of injury or mortality as a result of the operation of the solar farm. Eight species (33.3% of open-country species recorded on the subject site) are placed in the high risk category (CRFS = 7), compared with six species (25.0%) in the medium risk category (CRFS = 4, 5 or 6) and ten species (41.7%) in the no or low risk category (CRFS = 0 to 3). The high risk species are resident seed-eating birds that forage for seeds in large flocks on open ground (Sulphur-crested Cockatoo, Little Corella, Galah, Red-rumped Parrot, Crested Pigeon and Common Starling), aerial insectivores (Welcome Swallows) and birds that could be attracted to insect aggregations (Willie Wagtails).

All woodland bird species observed on the subject site are considered to have a low risk of injury or mortality from the operation of the solar farm. These species have no or limited abilities to move long distances over open-country between woodland remnants, more likely to move through woodland around the proposed development area than through it, or are not attracted to open-country habitats.

No wetland species observed on the subject site are considered to have a high risk of injury or mortality from operation of the solar farm. Two species (White-faced Heron and Australian Wood Duck) are placed in a medium risk category (CRFS = 4), whereas ten species (83.3%

of wetland species) were considered to be at low risk because they are likely to be infrequent visitors to the subject site, and/or fly over the site at altitudes or habitats on the site which would not be impacted by the proposed development.

However, all species that are potentially impacted, except for the Superb Parrot and Turquoise Parrot, are abundant and widespread in NSW and it is unlikely that the proposed development would significantly impact on their status, either at a local or broader geographical level. Potential impacts on the Superb and Turquoise Parrots and other threatened bird species are considered further in Section 3 and Appendix A.

3. Threatened Species

3.1 Overview

Threatened bird species that have been recorded within the locality (10 km radius around the subject site), their habitat requirements and their likelihood of occurrence on the site, and the nature and magnitude of potential impacts from the proposed development are shown in Table 2.

3.2 NSW Threatened Species

Four bird species listed as threatened under the schedules of the TSC Act were recorded on the subject site in November 2014. These were the Spotted Harrier, Superb Parrot, Brown Treecreeper and Grey-crowned Babbler. A fifth threatened species, the Turquoise Parrot, was recorded in woodland areas of the subject site in February 2015.

An additional 29 threatened bird species have the potential of occurring on the subject site at other times, or fly low over the site in search of prey or while moving between habitats close to the site. These species are raptors (Black-breasted Buzzard, Little Eagle, Square-tailed Kite, Grey Falcon, Black Falcon and Barking Owl), aquatic birds (Maggie Goose, Blue-billed Duck and Freckled Duck), shorebirds and other wading birds (Australasian Bittern, Australian Painted Snipe and Curlew Sandpiper), cockatoos and parrots (Major Mitchell's Cockatoo, Little Lorikeet and Swift Parrot), other woodland birds (Bush Stone-curlew, Speckled Warbler, Regent Honeyeater, Pied Honeyeater, Painted Honeyeater, Black-chinned Honeyeater, Varied Sittella, Hooded Robin, Scarlet Robin, Flame Robin and Diamond Firetail) and grassland and shrubland birds (Brolga, Australian Bustard and White-fronted Chat.

Seven-part Tests of Significance (Appendix A) concluded that the status of threatened bird species recorded in the locality, and their habitats, would not be significantly impacted by the proposed development.

Remnant woodland that would be retained near the northern boundary of the subject site and the River Red Gum Forest along the banks of Thurumbidgee Lagoon are potential habitat areas for threatened woodland birds in the locality. Threatened woodland bird species would be unable to disperse over open areas of the subject site to move between remnants and are likely to move through the woodland corridors away from the proposed development area. Therefore, the status of threatened woodland bird species and their habitats would not be impacted by the proposed development.

Threatened raptor species may be attracted to the subject site if there are high densities of potential prey species, e.g. rabbits, rodents and insectivorous birds that are attracted to aggregations of insects. Therefore, there is a risk of individuals of threatened raptor species being burnt if they fly through High Flux Zones while attempting to land on the subject site while chasing insect-feeding birds. Heat stress, burns and mortality of raptors may also occur if individuals attempt to land in high temperature zones around the receivers.

There is currently no habitat for threatened waterbirds, shorebirds or other wading birds within the proposed development area of the subject site. However, they may occur on or fly over the subject site or nearby wetlands (e.g. Thurumbidgee Lagoon) and along the Lachlan River and its tributaries after widespread local flooding. Individuals of these species have the potential to collide with heliostats if flying over the subject site and mistaking the array of heliostats as a body of water. There is also a risk of individuals being burnt if they fly through High Flux Zones while attempting to land on the subject site or on bodies of water on neighbouring lands.

However, High Flux Zones are negligible proportions of the total air-space above the subject site and the numbers of threatened raptors, open-country species, waterbirds, shorebirds and other wading birds occurring on or over the site are likely to be low. Collisions with heliostats would be minimised or avoided if the recommendations in Sections 5.1 and 5.2 of the present report are implemented.

3.3 Nationally-threatened Species

3.3.1 Endangered Species

Under the EPBC Act, a nationally endangered species is significantly impacted on if a proposal is likely to:

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

Four nationally endangered bird species have the potential of occurring on the subject site or flying low over or through the site while moving between habitats. These species are the Australasian Bittern, Australian Painted Snipe, Swift Parrot and Regent Honeyeater.

Swift Parrots that occur in the locality are part of the population that over-winters in mainland Australia from late March to early September. Most over-winter in Victoria and central and eastern NSW, but each year a few are recorded from south-eastern Qld and occasionally from as far west in Tasmania. Swift Parrots have the potential to occur in woodland areas on the subject site while over-wintering on the mainland. The species flies fast and very low

over open areas between woodland remnants, preferred food trees occur in woodland that will be retained on the subject site. Swift Parrots usually fly in small to medium-sized flocks and collision with barriers (e.g. windows, cyclone fences) is a listed threatening process.

The Swift Parrot does not breed in mainland Australia, therefore the proposed solar farm will not impact on the breeding cycle of this species. Although Swift Parrots have the ability to fly across open paddocks, they are more likely to move through woodland corridors around the proposed development area rather than through it.

The subject site is only marginal habitat for the other three endangered species which, at most, are only likely to occur on the site or in neighbouring areas as occasional vagrants. Like the Swift Parrot, these species are likely to move through the woodland areas around the proposed solar farm rather than through it.

Therefore, the status of threatened woodland bird species and their habitats would not be impacted by the proposed operation of the solar farm. Consequently, the life-cycles of these species are unlikely to be significantly impacted to the extent that viable local populations would be placed at risk of extinction.

3.3.2 Vulnerable Species

Under the EPBC Act, a nationally vulnerable species is significantly impacted on if a proposal is likely to:

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

One nationally vulnerable bird species, the Superb Parrot, was recorded on the subject site in November 2014. The Superb Parrot flies low over open areas between woodland (mostly riparian woodland) remnants. This species has the potential to nest in tree hollows within remnant woodland that will be retained on the subject site or in River Red Gum woodland along the banks of Thurumbidgee Lagoon and other woodland remnants close to the subject site. The site is located in a region that is particularly important for Superb Parrots, probably comprising winter migrants from Riverina (NSW & Vic) & South-west Slopes region, summer migrants from northern Central NSW and part of the local population likely to be resident in the region throughout the year.

However, the proposed development area is likely to be too large an open area of space for Superb Parrots to fly across. They are more likely to move through woodland corridors around the proposed development area rather than through it. There are no hollow-bearing trees within the development footprint that could potentially be used by Superb Parrots and would be impacted by the positioning of the heliostats and the power towers, or reflections of

the sun's energy. Therefore, the life-cycle of the Superb Parrot and the national status of its habitats are unlikely to be significantly impacted to the extent that viable local populations would be placed at risk of extinction.

3.3.3 Conclusion

The construction and operation of the proposed solar is unlikely to significantly impact on the status of nationally threatened bird species. Therefore, there is no need to refer the proposed development to the Commonwealth Minister for the Environment under the EPBC Act.

4. Migratory Species

Threatened bird species that have been recorded within the locality (10 km radius around the subject site), their habitat requirements and their likelihood of occurrence on the site, and the nature and magnitude of potential impacts from the proposed development are shown in Table 3.

Individuals of 17 species (73.9% of migratory species recorded in the locality) have no or a low risk of injury or mortality as a result of the operation of the Jemalong Solar Farm (CRFS = 0 to 3). These species are either occasional vagrants to the locality and/or unlikely to fly through potential impact zones on the subject site.

There is a medium risk (CRFS = 4 to 6) of injury or mortality to individuals of six migratory species that have been recorded in the locality. These are the Eastern Great Egret, Cattle Egret, Glossy Ibis, Rainbow Bee-eater, Fork-tailed Swift and White-throated Needletail. Individuals of the former three species have the potential of sustaining burns from solar flux or colliding with heliostats when landing or taking off from the ground or pools of water. Individuals of the latter three species have the potential of flying through High Flux Zones or high temperature zones, colliding with heliostats and preyed upon by raptors, if attracted to the subject site to feed on insect aggregations.

However, the subject site is a negligible proportion of potential habitat available for migratory species. All migratory species that could potentially occur on the site have widespread distributions in eastern Australia and are abundant in NSW. Therefore, the operation of the Jemalong Solar Station is most unlikely to significantly impact on the national status of migratory species and their habitats.

5. Recommendations

5.1 Bird Hazard Management

Develop a Bird Hazard Management Plan which should include the following essential components:

- ❑ Bird-proofing the tower railings, receivers and associated external piping to prevent birds from landing on them.

- ❑ Placing bird-proof netting over water bodies on the subject site (e.g. farm dams, water-logged soils and other pooled water) and ensure adequate and rapid drainage of pooled water from the subject site after flooding. This would reduce the risk of waterbirds, wading birds and terrestrial birds being attracted to water bodies on the subject site.
- ❑ If necessary, use standard and appropriate bird-scaring devices (e.g. propane gas-filled cannons) to deter aggregations of birds (e.g. ground-feeding cockatoos and parrots) occurring on the subject site.
- ❑ Tilting heliostat mirrors downwards at an angle from the vertical at night and when washing or maintaining them. Klem *et al.* (2004) showed that glass and other reflective surfaces angled 20 and 40 degrees downward from the vertical had significantly fewer strikes than vertically-placed surfaces; the more the angle increased, the more the number of bird strikes and fatalities decreased. They concluded that the angling protects the birds by reflecting the ground instead of the surrounding habitat and sky. The mirrors should not be angled horizontally or near-horizontally when they are not being used to generate power, especially at night, to avoid waterbirds and other bird species mistaking the array of mirrors as a water body.
- ❑ If possible, incorporating UV-reflective bands, spaced between 10 and 28 cm apart, into the design of the heliostats. Ultraviolet light is visible to birds and if UV-reflective bands do not significantly reduce the efficiency of the heliostats in capturing and directing solar energy to the receivers, then they could be used reduce the risk of bird collisions.
- ❑ Placing flashing red lights, as opposed to continuously burning white lights, at regular intervals on the receiving towers and receivers, so that they are visible to birds flying at night and during inclement weather (e.g. heavy fog conditions).
- ❑ Suspending receiving tower operation during peak bird and Bogong Moth migration times and during peak periods of movement of waterbirds into neighbouring wetlands after major local flood events.
- ❑ If possible, placing the power line underground. If this is not practicable, then efforts should be made to locate the lines parallel to important flight paths over the subject site. The power line should be made more visible (e.g. use of reflective power line marking balls), especially to birds that fly over the subject site at night.
- ❑ When necessary, implementing a feral species control program on the subject site (e.g. rabbit, rodent and starling eradication) to reduce the risk of these species attracting large numbers of raptors to the site.
- ❑ Regular monitoring and evaluation of the effectiveness of the implemented Bird Hazard Management Plan and, where necessary, modifying it to more effectively reduce risks to birds. Regular monitoring should:
 - (a) document use of the subject site and its air space by birds during the solar facility's operational phase, using the same methodology employed in the EIA [Bird Utilisation (Vantage Point) Surveys];

- (b) involve scientifically-robust surveys of bird mortalities and injuries resulting from the operation of the solar facility (see Section 5.2); and
- (c) identify significant ongoing hazards resulting from the operation of the solar facility (e.g. attraction of birds to insect aggregations on the subject site) and appropriately managing them.

5.2 Survey and Assessment of Bird Impacts

5.2.1 Introduction

Jemalong Solar Farm will be the first large-scale solar thermal facility in Australia. Predicted impacts on bird populations are based on limited studies conducted in North America, coupled with knowledge of known distributions, ecologies and habitat requirements of Australian bird species that have been recorded in the locality around the subject site. Therefore, it is essential to monitor and record the nature and magnitude of impacts that Jemalong Solar Farm has on bird populations to assist:

- ❑ the development of an appropriate Bird Hazard Management Plan for the site; and
- ❑ avian impact assessments of future solar thermal farm proposals in Australia.

5.2.2 Surveys and Analyses of Bird Mortality

Systematic searches for dead and injured birds at the Jemalong Solar Farm should be conducted at regular intervals. These surveys should be conducted daily in the first 12 months of the solar farm's operation to gather baseline information on the extent and temporal variation in bird mortality that may arise from the operation and maintenance of the solar farm. This information should then be analysed by a suitably qualified and experienced ornithologist who, in consultation with OEH and the owner of the Jemalong Solar Station, is to recommend suitable future search efforts for bird carcasses.

Searches for bird carcasses should be conducted within the first few hours of daylight to reduce the risk of dead or injured birds being scavenged by ground-dwelling carnivores (mammals and reptiles) and aerial carnivores (e.g. raptors and corvids). In turn, this would reduce the risk of estimates of bird mortality being under-estimated and scavenging birds being killed or injured on site.

The surveys should record the:

- ❑ name of the observer;
- ❑ precise location, date and time of the discovery of each bird carcass; and
- ❑ if possible, the hazard that led to the mortality of the bird.

Each carcass should be collected, placed in a plastic bag along with the collection records and frozen for subsequent post-mortem examination by an appropriately qualified and experienced forensic ornithologist. Forensic examinations would:

- ❑ confirm the identification of the species (rather than relying on an inexperienced; and
- ❑ determine cause of death including:

- (a) solar flux (extent of feather and flesh burns);
- (b) impact trauma (bone fractures/dislocations, internal bleeding);
- (c) predation trauma (external and internal injuries caused by potential predators);
- (d) electrocution;
- (e) emaciation/dehydration; and
- (f) undetermined causes of death.

Species identification, accurate reporting of where a dead bird was found, and a forensic analysis of the cause of death would identify the probable causes of bird mortality at the solar station and would lead to measures that mitigate or avoid bird mortality.

6. Conclusion

Overall, the benefits gained by installing a 30 MW solar power facility are likely to outweigh the risks posed to bird species, especially if the recommendations in Sections 5.1 & 5.2 are implemented. For instance, the Jemalong Solar Facility would counteract human-induced climate change, which Foden *et al.* (2013) and Garnett & Franklin (2014) conclude to be one of the most significant global threats to birds today. Erikson *et al.* (2014) state that 1 MW of solar energy offsets between 680 to 1,700 tonnes of CO₂ emissions per year that result from the burning of fossil fuels. Therefore, a 30 MW facility would potentially offset between 20,400 and 51,000 tonnes of CO₂ emitted per year.

However, studies at similar solar facilities in the United States suggest that birds from a broad range of ecological niches may be susceptible to solar flux injury, impact trauma and increased predation risk at the Jemalong Solar Station.

Specific hazards include High Flux Zones between heliostats and the receiving towers, high temperature zones around the receivers, vertically- and horizontally-orientated heliostats, aggregations of insects that attract insectivorous birds and resident predators that are attracted to aggregations of insectivores and water bodies on and adjacent to the subject site. The site is also located within a number of migratory flyways, as well as providing potential habitat and air-space for nomadic species. Therefore, migratory, nomadic and resident birds are likely to fly low through or over the subject site while moving between habitats (woodland, wetlands and grassland) within or outside the site.

However, the limited studies that have been conducted in the U.S. also suggest that the numbers of bird mortalities and injuries at facilities using solar flux technology is relatively small compared with other anthropomorphic impacts. Based on these findings, it is unlikely that the Jemalong Solar Station would significantly impact on the status of local populations of bird species, including threatened species and listed migratory species.

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Table 1 Bird species recorded on the subject site, their habitat, feeding, nesting, social and residency guilds, and predicted risks of the proposed solar farm.

Habitat Guilds. **WO:** Woodland bird species; **O:** Open-country species; **WE:** species normally found in or near water.

Feeding Guilds. **A:** Aerial foragers; **B:** Bark-foraging insectivores; **C:** Canopy-foraging insectivores; **DG:** Insectivores foraging from damp ground below cover; **F:** Frugivores (taking fruit as a major source, among others); **G:** Generalist insectivores, feeding at many levels in the woodland; **N:** Nectarivores (taking nectar, honeydew & invertebrates); **OG:** Insectivores foraging on open ground (may be far from cover); **OT:** Insectivores foraging on open ground among trees; **TS:** Insectivores foraging from tall shrubs; **SG:** Seed eaters, taking seeds close to the ground; **ST:** Seed eaters, taking seeds and insects (e.g. galls) at all levels; **U:** Insectivores foraging from dense understorey or on the ground below; **V:** Carnivores/omnivores, taking vertebrates as an important component of their diet; **OM:** Omnivores; seeds, fruits, flowers, grasses & invertebrates are important components of diet; **W:** Wetlands (various food sources, not categorised here).

Nesting or Shelter Guilds: **B:** Burrow in ground; **BP:** Brood parasite, laying eggs in nests of other bird species; **F:** Fork in a branch or shrub or tree; **G:** Ground surface (typically below cover of grasses and shrubs); **L:** Ledge or crevice in tree or rock-face (some species also use buildings or other man-made structures); **LH:** Large hollow in tree (some species also use buildings); **SH:** Small hollow in tree (some species also use buildings); **W:** Wetlands (including small ponds, farm dams and water-logged soils); **X:** Migrant not nesting in mainland Australia.

Social Guilds: **SI:** Non-communal : species occur as individuals, paired birds or small family groups (normally < 6 individuals); **SC:** Communal: species live in social groups of six or more individuals).

Residency Guilds: **NM:** Majority of population nomadic; **ND:** Non-migratory: species present year round, but part of the population is dispersive; **NS:** Non-migratory; territorial, sedentary or resident in locality throughout the year; **M:** Migratory: summer visitor (rare or absent April - August) or winter visitor (rare or absent September – March).

Cumulative Flight Risk Score: Potential for mortality or injury to individuals as a result of flying through High Flux Zones, high temperature zones, impact trauma and increased predation risk.

0. Bird species recorded in locality, but no potential habitat on or adjacent to the subject site (**no risk** of harm to individual birds).
1. Bird species recorded above or adjacent to subject site, but range of flight heights likely to be higher than solar flux receiving towers (**no risk** of harm to individual birds).
2. Bird species resident on subject site, but are restricted to habitat areas that would not be impacted by solar flux from heliostats, or there are very low dispersal rates from these habitat areas (**low risk** of harm to individual birds).
3. Bird species has the potential to occur on subject site as a vagrant or infrequent visitor, or may be resident in the locality year round but the subject site is a minor part of the bird's normal home range. Individual birds have the potential of flying between heliostats and solar flux receiving towers (**low risk** of harm to individual birds).
4. Bird species resident in or a regular visitor to the locality, there is no potential habitat on the subject site or, if habitat available, it is only temporary (e.g. flooding, ephemeral wetlands, abundance of seed or nectar). Birds may fly between heliostats and solar flux receiving towers on site when moving between or visiting suitable habitat areas (**medium risk** of harm to individual birds).
5. Bird species is a seasonal migrant or common nomad to locality, has a high potential to occur on or above the subject site, and may fly between heliostats and solar flux receiving towers while on site (**medium risk** of harm to individual birds).
6. Bird species is likely to be resident in the locality all year round, the subject site is likely to be within the regular home range of individuals of that species even though it was not detected on the site during field surveys, and may fly between heliostats and solar flux receiving towers while on site (**medium risk** of harm to individual birds).
7. Bird species is resident on subject site all year round and the air-space between the heliostats and solar flux receiving towers are within the species' home range (**high risk** of harm to individuals).

Risk Status: Risk of the construction and operation of the proposed solar farm impacting significantly on the distribution and abundance of local populations of bird species: None; Low; Medium or High.

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
Habitat Guild: Wetland Birds (WE)									
Pelecanidae	Australian Pelican	<i>Pelecanus conspicillatus</i>	41	W	W	SC	ND	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken by birds as water surface or terrestrial surface to loaf on). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Phalacrocoracidae	Great Cormorant	<i>Phalacrocorax carbo</i>	33	W	W	SC	NM	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken by birds as water surface or terrestrial substrate to loaf on). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Phalacrocoracidae	Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	20	W	F	SC	ND	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken by birds as water surface or terrestrial substrate to loaf on). Injury or mortality to birds colliding with heliostats or receiving towers in poor light or fog conditions.
Anatidae	Australian Wood Duck	<i>Chenonetta jubata</i>	64	W	LH	SC	ND	4 (Medium)	Loss of negligible amount of potential foraging habitat during flood events. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields, or attempting to land on heliostats (mistaken as water surface or terrestrial substrate to loaf on) or in grassed areas

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									surrounding infrastructure. Injury or mortality to birds colliding with heliostats or receiving towers or their guys on poor light or fog conditions.
Anatidae	Grey Teal	<i>Anas gracilis</i>	83	W	LH	SC	NM	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken by birds as water surface or terrestrial substrate to loaf on). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions
Anatidae	Pacific Black Duck	<i>Anas superciliosa</i>	90	W	LH	SC	NM	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken by birds as water surface or terrestrial substrate to loaf on). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Ardeidae	White-faced Heron	<i>Egretta novaehollandiae</i>	42	W	W	SI	ND	4 (Medium)	Loss of negligible amount of potential foraging habitat during flood events. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface or terrestrial substrate to loaf on). Injury or mortality to birds colliding with heliostats or receiving towers in poor light or fog conditions.
Ardeidae	White-necked Heron	<i>Ardea pacifica</i>	39	W	F	SI	ND	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									(mistaken by birds as water surface or terrestrial substrate to loaf on). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Ardeidae	Intermediate Egret	<i>Ardea intermedia</i>	14	W	F	SC	ND	3 (Low)	Loss of negligible amount of potential foraging habitat during flood events. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface or terrestrial substrate to loaf on). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Plataleidae	Royal Spoonbill	<i>Platalea regia</i>	18	W	F	SC	ND	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken by birds as water surface or terrestrial substrate to loaf on). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Plataleidae	Yellow-billed Spoonbill	<i>Platalea flavipes</i>	38	W	F	SI	M/ND	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken by birds as water surface or terrestrial substrate to loaf on). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Sylviidae	Australian Reed-Warbler	<i>Acrocephalus australis</i>	19	W	W	SC	M	3	Solar flux-related burns, injuries or mortality as a

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
								(Low)	result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken by birds as water surface or terrestrial substrate to loaf on). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Habitat Guild: Open-country Birds (O)									
Casuariidae	Emu	<i>Dromaius novaehollandiae</i>	4	OM	G	SI	ND	0 (None)	Subject site is likely to be fenced and Emu-proof.
Accipitridae	Black Kite	<i>Milvus migrans</i>	8	V	F	SI	ND	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats or receiving towers (mistaken as suitable vantage, feeding or resting points). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Accipitridae	Wedge-tailed Eagle	<i>Aquila audax</i>	16	V	F	SI	ND	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats or receiving towers (mistaken as suitable vantage, feeding or resting points). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Accipitridae	Spotted Harrier	<i>Circus assimilis</i>	10	V	F	SI	M/ND	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats or receiving towers (mistaken as suitable vantage, feeding or resting points).

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Falconidae	Australian Hobby	<i>Falco longipennis</i>	20	V	F	SI	ND	5 (Medium)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats or receiving towers (mistaken as suitable vantage, feeding or resting points). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Falconidae	Australian Kestrel	<i>Falco cenchroides</i>	43	V	LH	SI	ND	5 (Medium)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats or receiving towers (mistaken as suitable vantage, feeding or resting points). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Columbidae	Crested Pigeon	<i>Ocyphaps lophotes</i>	41	SG	F	SC	NS	7 (High)	Loss of negligible amount of potential ground foraging habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).
Cacatuidae	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	21	SG	LH	SC	ND	7 (High)	Loss of negligible amount of potential ground foraging habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).
Cacatuidae	Little Corella	<i>Cacatua sanguinea</i>	3	SG	LH	SC	ND	7 (High)	Loss of negligible amount of potential ground foraging habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
Cacatuidae	Galah	<i>Eolophus roseicapillus</i>	67	SG	LH	SC	ND	7 (High)	aerial predators (raptors). Loss of negligible amount of potential ground foraging habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).
Psittacidae	Cockatiel	<i>Nymphicus hollandicus</i>	31	SG	LH	SC	NM/ND	5 (Medium)	Loss of negligible amount of potential ground foraging habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).
Psittacidae	Red-rumped Parrot	<i>Psephotus haematonotus</i>	79	SG	LH	SC	NS	7 (High)	Loss of negligible amount of potential ground foraging habitat.

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).
Strigidae	Southern Boobook	<i>Ninox novaeseelandiae</i>	9	V	LH	SI	ND	6 (Medium)	Loss of negligible amount of potential foraging habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as suitable vantage point to search for prey). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Acanthizidae	Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	55	OG	F	SC	NS	3 (Low)	Loss of negligible amount of potential foraging or dispersal habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators).
Monarchidae	Magpie-lark	<i>Grallina cyanoleuca</i>	59	OG	F	SC	ND	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									dispersing) or attempting to land on heliostats or receiving towers (mistaken as suitable vantage, feeding or resting points). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Rhipiduridae	Willie Wagtail	<i>Rhipidura leucophrys</i>	99	OG	F	SC	M/ND	7 (High)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats or receiving towers (mistaken as suitable vantage, feeding or resting points). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Artamidae	Australian Magpie	<i>Cracticus tibicen</i>	59	OG	F	SC	NS	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats or receiving towers (mistaken as suitable vantage, feeding or resting points). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Corvidae	Little Raven	<i>Corvus mellori</i>	6	V	F	SC	ND	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats or receiving towers (mistaken as suitable vantage, feeding or resting points). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
Corvidae	Australian Raven	<i>Corvus coronoides</i>	41	V	F	SC	NS	3 (Low)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats or receiving towers (mistaken as suitable vantage, feeding or resting points). Injury or mortality to birds colliding with heliostats or receiving towers or their guys in poor light or fog conditions.
Hirundinidae	Welcome Swallow	<i>Hirundo neoxena</i>	42	A	L	SC	ND	7 (High)	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields while foraging for aerial insects or attempting to land on heliostats or receiving towers (mistaken as suitable vantage, feeding or resting points). Injury or mortality to birds colliding with heliostats or receiving towers at night
Megaluridae	Brown Songlark	<i>Cincloramphus crularis</i>	16	OG	G	SC	M	4 (Medium)	Loss of negligible amount of potential foraging or dispersal habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators).
Megaluridae	Rufous Songlark	<i>Megalurus mathewsi</i>	60	OG	G	SC	M	4 (Medium)	Loss of negligible amount of potential foraging or dispersal habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators).

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
Estrildidae	Zebra Finch	<i>Taeniopygia guttata</i>	10	SG	F	SC	NS	3 (Low)	Loss of negligible amount of potential foraging or dispersal habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators).
Sturnidae	Common Starling	<i>Sturnus vulgaris</i>	14	OG	SH	SC	ND	7 (High)	Loss of negligible amount of potential foraging or dispersal habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators).
Habitat Guild: Woodland Birds (WO)									
Psittacidae	Eastern Rosella	<i>Platycercus eximius</i>	52	SG	LH	SC	NS	3 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of woodland, but more likely to move around the footprint rather than through it. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers or guys in poor light conditions or fog. Increased aerial predation risk as a result of the

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									bird's inability to seek refuge on subject site from aerial predators (raptors).
Psittacidae	Blue Bonnett	<i>Northiella haematogaster</i>	21	SG	LH	SC	ND	3 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland, but more likely to move around the footprint rather than through it. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers or guys in poor light conditions or fog. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).
Psittacidae	Turquoise Parrot	<i>Neophema pulchella</i>	32	SG	LH	SC	NS	3 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland, but more likely to move around the footprint rather than through it. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers or guys in poor light

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									conditions or fog.. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).
Psittacidae	Superb Parrot	<i>Polytelis swainsonii</i>	25	ST	LH	SC	M	3 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland, but more likely to move around the footprint rather than through it. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers or guys in poor light conditions or fog.. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).
Cuculidae	Horsfield's Bronze-cuckoo	<i>Chrysococcyx basalus</i>	11	C	BP	SI	M	3 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland.
Podargidae	Tawny Frogmouth	<i>Podargus strigoides</i>	9	G	F	SI	NS	2 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Alcedinidae	Laughing Kookaburra	<i>Dacelo novaeguineae</i>	57	V	LH	SI	NS	3 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Alcedinidae	Sacred Kingfisher	<i>Todiramphus haematonotus</i>	34	V	LH	SI	M	2 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Climacteridae	Brown Treecreeper	<i>Climacteris picumnus picumnus</i>	224	B	SH	SI	NS	2 (Low)	Loss of negligible amount of potential foraging or dispersal habitat.

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
Pardalotidae	Spotted Pardalote	<i>Pardalotus punctatus</i>	14	C	B	SI	NS	2 (Low)	Loss of negligible amount of potential foraging or dispersal habitat.
Pardalotidae	Striated Pardalote	<i>Pardalotus striatus</i>	54	C	SH	SI	NS	2 (Low)	Loss of negligible amount of potential foraging or dispersal habitat.
Meliphagidae	Noisy Friarbird	<i>Philemon corniculatus</i>	25	N	F	SC	ND	3 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Meliphagidae	Blue-faced Honeyeater	<i>Entomyzon cyanotus</i>	22	G	F	SC	ND	2 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Meliphagidae	Noisy Miner	<i>Manorina melanocephala</i>	44	N	F	SC	NS	3 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland.

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Meliphagidae	White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>	419	N	F	SC	NS	2 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Pomatostomidae	Grey-crowned Babbler	<i>Pomatostomus temporalis temporalis</i>	52	OT	F	SC	NS	2 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									or receiving towers at night.
Pachycephalidae	Rufous Whistler	<i>Pachycephala rufiventris</i>	375	C	F	SI	M	2 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Rhipiduridae	Grey Fantail	<i>Rhipidura albiscapa</i>	76	C	F	SC	ND	2 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Campephagidae	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	43	G	F	SC	ND	3 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									(mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. .
Corcoracidae	White-winged Chough	<i>Corcorax melanorhamphos</i>	47	G	F	SC	NS	3 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Corcoracidae	Apostlebird	<i>Struthidea cinerea</i>	32	OT	F	SC	NS	3 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Artamidae	Grey Butcherbird	<i>Cracticus torquatus</i>	43	V	F	SI	NS	2	Potential to move over or through development

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
								(Low)	footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Artamidae	Pied Butcherbird	<i>Cracticus nigrogularis</i>	32	V	F	SI	NS	2 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.
Hirundinidae	Tree Martin	<i>Petrochelidon nigricans</i>	39	A	SH	SC	M	2 (Low)	Potential to move over or through development footprint on the subject site while moving between stands of remnant woodland. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators).

Family	Common Name	Scientific Name	No. Local Records	Feeding Guild	Nesting Guild	Social Guild	Residency Guild	Flight Risk Score	Nature of Risk
									Injury or mortality to birds colliding with heliostats or receiving towers at night.

Table 2 Threatened bird species that have been recorded in the locality (10 km radius of subject site) within the last 25 years, their habitat requirements, likelihood of occurrence on subject site and an assessment of the risk of the proposed development impacting on their status.

Threatened Species Codes:

- E* Endangered under the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).
 E Endangered under Schedule 1 of the NSW Threatened Species Conservation Act 1995 (TSC Act).
 CE Critically Endangered under Schedule 1 of the TSC Act.
 EP Endangered Population under Schedule 1 of the TSC Act.
 V Vulnerable under Schedule 2 of the TSC Act.
 V* Vulnerable under the EPBC Act.

Flight Risk Score: Potential for injury or harm to individual birds as a result of flying through concentrated solar energy fields on the subject site.

0. Bird species recorded in locality, but no potential habitat on or adjacent to the subject site (**no risk** of harm to individual birds).
1. Bird species recorded above or adjacent to subject site, but range of flight heights likely to be higher than solar flux receiving towers (**no risk** of harm to individual birds).
2. Bird species resident on subject site, but are restricted to habitat areas that would not be impacted by solar flux from heliostats, or there are very low dispersal rates from these habitat areas (**low risk** of harm to individual birds).
3. Bird species has the potential to occur on subject site as a vagrant or infrequent visitor and has the potential of flying between heliostats and solar flux receiving towers (**low risk** of harm to individual birds).
4. Bird species resident in or a regular visitor to the locality, there is no potential habitat on the subject site or, if habitat available, it is only temporary (e.g. flooding, ephemeral wetlands, abundance of seed or nectar). Birds may fly between heliostats and solar flux receiving towers on site when moving between or visiting suitable habitat areas (**medium risk** of harm to individual birds).
5. Bird species is a seasonal migrant or common nomad to locality, has a high potential to occur on or above the subject site, and may fly between heliostats and solar flux receiving towers while on site (**medium risk** of harm to individual birds).
6. Bird species is likely to be resident in the locality all year round, the subject site is likely to be within the regular home range of individuals of that species even though it was not detected on the site during field surveys, and may fly between heliostats and solar flux receiving towers while on site (**medium risk** of harm to individual birds).
7. Bird species is resident on subject site all year round and the air-space between the heliostats and solar flux receiving towers are within the species' home range (**high risk** of harm to individual birds).

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
Megapodiidae								
Malleefowl	<i>Leipoa ocellata</i>	E	V*	1	Predominantly inhabits mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300 - 450 mm mean annual rainfall) areas. Utilises mallee with a spinifex understorey, but usually at lower densities than in areas with a shrub understorey. Found less frequently in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands with	None. No suitable habitat on subject site.	0 (None)	No

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					thick understorey, or in other woodlands such dominated by Mulga or native Cypress Pine species. Prefers areas of light sandy to sandy loam soils and habitats with a dense but discontinuous canopy and dense and diverse shrub and herb layers. Bimblebox Woodland occurs on the subject site. However, unlikely to be suitable as habitat for Malleefowl because woodland does not have a thick understorey and remnants surrounded by paddocks.			
Anseranatidae								
Magpie Goose	<i>Anseranus semipalmata</i>	V		7	Found mainly in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Often seen in trios or flocks on shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains; roosts in tall vegetation. Potential to occur on subject site during flood periods. Individuals may fly low over subject site when approaching or departing nearby wetlands.	Loss of negligible amount of potential foraging habitat during flood events. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface). Injury or mortality to birds colliding with heliostats or receiving towers at night.	4 (Med.)	Yes
Anatidae								
Blue-billed Duck	<i>Oxyura australis</i>	V		12	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes. No potential habitat on subject site. Individuals may fly low over subject site when approaching or departing nearby wetlands.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken by birds as water surface). Injury or mortality to birds colliding with heliostats or receiving towers at night.	3 (Low)	Yes
Freckled Duck	<i>Stictonetta naevosa</i>	V		13	Prefers permanent freshwater swamps and creeks with	Solar flux-related burns, injuries or mortality as	4	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Generally rest in dense cover during the day, usually in deep water. No potential habitat on subject site. Individuals may fly low over subject site when approaching or departing nearby wetlands.	a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface). Injury or mortality to birds colliding with heliostats or receiving towers at night.	(Low)	
Ardeidae								
Australasian Bittern	<i>Botaurus poiciloptilus</i>	E	E*	3	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bulrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. No potential habitat on subject site. Individuals may fly low over subject site when approaching or departing nearby wetlands.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Accipitridae								
Spotted Harrier	<i>Circus assimilis</i>	V		9	Occurs in grassy open woodland including <i>Acacia</i> and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tall tree. Recorded on subject site during field surveys. Most likely uses the subject site and surrounding areas for foraging, but may also use tall trees within the Bimble Box on site for nesting.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats (mistaken as suitable vantage or resting points). Injury or mortality to birds colliding with heliostats or receiving towers at night.	3 (Low)	Yes
Black-breasted Buzzard	<i>Hamirostra melanosternum</i>	V		3	Inhabits a range of inland habitats, especially along timbered watercourses which is the preferred breeding	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar	3 (Low)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					habitat. Also hunts over grasslands and sparsely timbered woodlands. Breeds from August to October near water in a tall tree. Subject site is potential foraging habitat for this species. Breeding habitat more likely to occur in larger woodland remnants in the locality that along the banks of watercourses.	energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats (mistaken as suitable vantage or resting points). Injury or mortality to birds colliding with heliostats or receiving towers at night.		
Little Eagle	<i>Hieraaetus morphnoides</i>	V		7	Occupies open eucalypt forest, woodland or open woodland. She-oak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Potential use of the subject site and surrounding areas for foraging (esp. when rabbits are present), but may also use tall trees within the Bimble Box on site for nesting.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats (mistaken as suitable vantage or resting points). Injury or mortality to birds colliding with heliostats or receiving towers at night.	6 (Med.)	Yes
Square-tailed Kite	<i>Lophoictinia isura</i>	V		1	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs. Subject site is potential foraging habitat for this species. Breeding habitat more likely to occur in larger woodland remnants in the locality that along the banks of watercourses.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats (mistaken as suitable vantage or resting points). Injury or mortality to birds colliding with heliostats or receiving towers at night.	3 (Low)	Yes
Eastern Osprey	<i>Pandion cristatus</i>	V		3	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. Feeds on fish over clear, open water. Nests are located high up in dead trees or in dead crowns of live trees, usually within one kilometre of the	None. Unlikely to occur on subject site.	0 (None)	No

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					sea. Only likely to be in the locality as a vagrant because mainly a coastal species. Vagrants usually occur west of the Great Dividing Range in summer and autumn when juveniles disperse. Extremely low probably of occurring on subject site or flying over it.			
Falconidae								
Grey Falcon	<i>Falco hypoleucos</i>	E		12	Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey. Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring. Potential use of the subject site and surrounding areas for foraging, but may also use tall trees within the Bimble Box on site for nesting.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats (mistaken as suitable vantage or resting points). Injury or mortality to birds colliding with heliostats or receiving towers at night.	3 (Low)	Yes
Black Falcon	<i>Falco subniger</i>	V		10	Widely, but sparsely, distributed in NSW, mostly occurring in inland regions. Single NSW population that is considered to be continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres. Occurs as solitary individuals, in pairs, or in family groups of parents and offspring. Regularly seen hunting in open box woodlands and riverine forests, saltbush and bluebush plains, grasslands, large wetlands and crops (including rice paddies and irrigated pastures). Potential use of the subject site and surrounding areas for foraging, but may also use tall trees within the Bimble Box on site for nesting.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields (while chasing or searching for prey or dispersing) or attempting to land on heliostats (mistaken as suitable vantage or resting points). Injury or mortality to birds colliding with heliostats or receiving towers at night.	3 (Low)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
Gruidae								
Brolga	<i>Grus rubicunda</i>	V		5	In NSW, most often seen close to major river systems and wetlands in the western half of the state and near the northern coastline. Although Brolgas often feed in dry grassland, ploughed paddocks and desert claypans, they are dependent on wetlands too, especially shallow swamps, where they will forage with their head entirely submerged. The nest comprises a platform of grasses and sticks, augmented with mud, on an island or in the water. Records within the locality are from within the catchment area of the Lachlan River. Subject site located at the eastern edge of the inland NSW distribution of species. Potential to occur on subject site during flood periods. Individuals may fly low over subject site when approaching or departing nearby wetlands.	Loss of negligible amount of potential foraging habitat during flood events. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface). Injury or mortality to birds colliding with heliostats or receiving towers at night.	3 (Low)	Yes
Otididae								
Australian Bustard	<i>Ardeotis australis</i>	E		1	Mainly inhabits tussock and hummock grasslands, though prefers tussock grasses to hummock grasses; also occurs in low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams. Breeds on bare ground on low sandy ridges or stony rises in ecotones between grassland and protective shrubland cover; roosts on ground among shrubs and long grasses or under trees. Dispersive, with irregular widespread movements over long distances; movements are thought to be in response to habitat and climatic conditions; known to converge on areas with high mice numbers and in recently burnt areas. Subject site near eastern edge of the species' range. At most, subject site potential marginal habitat with individuals visiting infrequently, sheltering and foraging in paddocks when crops or pastures grasses growing, or foraging in open grassland within woodland remnants of	Loss of negligible amount of potential marginal foraging habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields. Injury or mortality to birds colliding with heliostats or receiving towers at night.	3 (Low)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					the subject site.			
Burhinidae								
Bush Stone-curlew	<i>Burhinus grallarius</i>	E		7	Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Feeds on the ground on insects and small vertebrates, such as frogs, lizards and snakes. Nests on the ground in a scrape or small bare patch. Potential marginal habitat in woodland areas of the subject site and adjacent areas.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Rostratulidae								
Australian Painted Snipe	<i>Rostratula australis</i>	E	E*	3	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter. No potential habitat on subject site. Individuals may fly low over subject site when approaching or departing nearby wetlands.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Scolapacidae								
Curlew Sandpiper	<i>Calidris ferruginea</i>	E		1	Generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. Also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. Roosts on shingle, shell or sand beaches; spits or islets on the coast or in wetlands; or sometimes in salt marsh, among beach-cast seaweed, or on rocky shores.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with	3 (Low)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					No potential habitat on subject site. Individuals may fly low over subject site when approaching or departing nearby wetlands. However, mainly a coastal species and only small numbers are likely to occur on wetlands within locality.	heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).		
Black-tailed Godwit	<i>Limosa limosa</i>	V		1	Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps. Individuals have been recorded in wet fields and sewerage treatment works. Forages for insects, crustaceans, molluscs, worms, larvae, spiders, fish eggs, frog eggs and tadpoles in soft mud or shallow water. Roosts and loafs on low banks of mud, sand and shell bars. No potential habitat on subject site. Only likely to occur in the locality as a vagrant, probably on passage to the Riverina area of the Murray-Darling Basin. Status of species unlikely to be significantly impacted by proposed solar farm.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	No
Cacatuidae								
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>	V		2	Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines. Normally found in pairs or small groups, though flocks of hundreds may be found where food is abundant. Nesting, in tree hollows, occurs throughout the second half of the year; nests are at least 1 km apart, with no more than one pair every 30 square kilometres. Potential foraging habitat occurs in woodland and in paddocks on subject site, particularly during sowing and	Loss of negligible amount of potential ground foraging habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.	6 (Med.)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					reaping of crops. Likely to fly low over the subject site.	Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).		
Psittacidae								
Little Lorikeet	<i>Glossopsitta pusilla</i>	V		3	Widespread in coastal areas of NSW, along the Great Dividing Range and on the Western Slopes. Forages primarily in the canopy of open <i>Eucalyptus</i> forest and woodland, yet also finds food in <i>Angophora</i>, <i>Melaleuca</i> and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like <i>Allocasuarina</i>. Subject site located near the western edge of the species' NSW range. Potential foraging, nesting and roosting habitat in woodland areas of the subject site and in adjacent areas. Potential for small numbers of individuals to fly low over the subject site.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Swift Parrot	<i>Lathamus discolor</i>	E	E*	8	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>Eucalyptus robusta</i>, Spotted Gum <i>Corymbia maculata</i>, Red Bloodwood <i>C. gummifera</i>, Mugga Ironbark <i>E. sideroxylon</i>, and White Box <i>E. albens</i>.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with	3 (Low)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					Commonly used lerp infested trees include Inland Grey Box <i>E. microcarpa</i>, Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i>. Subject site located near the western edge of the species' NSW range. Potential foraging and roosting habitat in woodland areas of the subject site and in adjacent areas. Potential for small numbers of individuals to fly low over the subject site.	heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).		
Turquoise Parrot	<i>Neophema pulchella</i>	V		32	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Nests in tree hollows, logs or posts, from August to December. Potential foraging, nesting and roosting habitat within woodland areas and along the edges of the paddocks on subject site. Small numbers are likely to occasionally fly low over the subject site.	Loss of negligible amount of potential ground foraging habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Superb Parrot	<i>Polytelis swainsonii</i>	V	V*	23	Inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. May forage up to 10 km from nesting sites, primarily in grassy box woodland. Feeds in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants. Also eaten are fruits, berries, nectar, buds, flowers, insects and grain. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of	3 (Low)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Two flocks of Superb Parrots recorded in woodland on subject site during field surveys. Potential foraging and roosting habitat in woodland areas of the subject site and in adjacent areas. Potential for small numbers of individuals to fly low over the subject site.	the bird's inability to seek refuge on subject site from aerial predators (raptors).		
Strigidae								
Barking Owl	<i>Ninox connivens</i>	V		2	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Roosts in shaded portions of tree canopies, including tall mid-storey trees with dense foliage such as <i>Acacia</i> and <i>Casuarina</i> species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Nests in hollows of large, old trees; living eucalypts are preferred although dead trees are also used. Potential foraging habitat occurs in woodland and paddocks on subject site.	Loss of negligible amount of potential foraging habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as suitable vantage point to search for prey). Injury or mortality to birds colliding with heliostats or receiving towers at night.	6 (Med.)	Yes
Climacteridae								
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	V		129	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (<i>Eucalyptus camaldulensis</i>) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense	Loss of negligible amount of potential foraging or dispersal habitat.	2 (Low)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Forages in trees and on the ground. Nests in hollows in standing dead or live trees and tree stumps. Adults and juveniles recorded in woodland areas of the subject site during field surveys. One juvenile recorded in tree hollow in woodland area of subject site. Therefore, these woodland areas are likely to be foraging, roosting and nesting habitats for this species. Brown Treecreepers are capable of dispersing through sparsely-treed areas (e.g. in paddocks) provided that the distances between trees are not more than 100 m. Therefore, there is potential for Brown Treecreepers to disperse across sparsely-treed paddock areas in the western quarter of the subject site.			
Acanthizidae								
Speckled Warbler	<i>Chthonicola sagittata</i>	V		136	Inhabits a wide range of <i>Eucalyptus</i> dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat includes scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Nests in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. Potential marginal habitat in woodland areas of the subject site. Individuals may occasionally fly low over cleared areas of the subject site while dispersing from locality during severe droughts.	Loss of negligible amount of potential foraging or dispersal habitat.	2 (Low)	Yes
Shy Heathwren	<i>Hylacola cautus</i>	V		1	Inhabits mallee woodlands with a relatively dense	None. No suitable habitat on subject site.	0	No

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					understorey of shrubs and heath plants. The central NSW population also occurs at low densities in rocky hilltop vegetation with a thick shrub layer such as Broombush or Tea-tree. Appears to occur in all age classes of vegetation, though believed to prefer either one to five years following fire when the resprouting eucalypts provide dense vegetation cover or in long unburnt (greater than 40 years) areas which have a well developed shrub layer. Feeds on the ground, almost entirely on insects (cockroaches, grasshoppers, bugs, lerps, beetles, caterpillars, moths, ants, spiders and insect eggs) and rarely on seeds, including those of saltbush. reeds late winter to early summer and builds a dome-shaped nest in a concealed location on the ground, using a variety of plant materials. No potential habitat on subject site or adjacent lands.		(None)	
Meliphagidae								
Regent Honeyeater	<i>Anthochaera phrygia</i>	CE	E*	1	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak. Occurs mostly in woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast. A generalist forager, it feeds mainly on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: <i>Eucalyptus microcarpa</i>, <i>E. punctata</i>, <i>E. polyanthemos</i>, <i>E. moluccana</i>, <i>Corymbia robusta</i>, <i>E. crebra</i>, <i>E. caleyi</i>, <i>C.</i>	Loss of negligible amount of potential foraging or dispersal habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.	3 (Low)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					<i>maculata</i>, <i>E.mckieana</i>, <i>E. macrorhyncha</i>, <i>E. laevopinea</i>, and <i>Angophora floribunda</i>. Nectar and fruit from the mistletoes <i>Amyema miquelii</i>, <i>A. pendula</i> and <i>A. cambagei</i> are also eaten during the breeding season. When nectar is scarce lerp and honeydew comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings. A shrubby understorey is an important source of insects and nesting material. There are three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River She-oak. Subject site located near the western edge of the species' NSW range. Potential habitat occurs in woodland area of the subject site. However, preferred food tree species are absent .			
Pied Honeyeater	<i>Certhionyx variegatus</i>	V		1	Inhabits wattle shrub, primarily Mulga (<i>Acacia aneura</i>), mallee, spinifex and eucalypt woodlands, usually when shrubs are flowering; feeds on nectar, predominantly from various species of emu-bushes (<i>Eremophila</i> spp.); also from mistletoes and various other shrubs (e.g. <i>Grevillea</i> spp.); also eats saltbush fruit, berries, seed, flowers and insects. Nests in the fork of a shrub or tree up to 5 m above the ground. Subject site near the eastern edge of the species' NSW range. Potential marginal habitat in woodland areas of the subject site. At most, likely to be an infrequent visitor or vagrant to the subject site, occurring only when there is abundant mistletoe flowering.	Loss of negligible amount of potential foraging or dispersal habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.	3 (Low)	Yes
Painted Honeyeater	<i>Grantiella picta</i>	V		5	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of	Loss of negligible amount of potential foraging or dispersal habitat.	3 (Low)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i>. Nests from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches. Potential marginal habitat in woodland areas of the subject site. At most, likely to be an infrequent visitor or vagrant to the subject site, occurring only when there is abundant mistletoe flowering.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.		
White-fronted Chat	<i>Epthianura albifrons</i>	V		6	In NSW, occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. In inland areas, occurs around freshwater wetlands, either permanent or ephemeral, especially in surrounding grassland, including pasture, and sometimes among reeds and rushes. Potential marginal habitat in woodland and pasture areas of the subject site and in neighbouring areas, especially when parts of the site are flooded. Likely to be, at most, an infrequent visitor to the subject site, but may potentially cross the site when dispersing to more suitable wetland habitat in nearby areas.	Loss of negligible amount of potential foraging or dispersal habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.	3 (Low)	Yes
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	V		11	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>) and Forest Red Gum (<i>E. tereticornis</i>). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river she-oaks (nesting habitat) and tea-trees. Prefers the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares. Nests high	Loss of negligible amount of potential foraging or dispersal habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators).	3 (Low)	

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					in the crown of a tree, in the uppermost lateral branches, hidden by foliage. Potential foraging, nesting and roosting habitat in woodland areas of the subject site. Individuals are capable of flying long distances over open spaces to reach woodland remnants, though prefer disperse along woodland corridors and along creeks. Therefore, they have the potential to disperse across open paddocks on the subject site.	Injury or mortality to birds colliding with heliostats or receiving towers at night.		
Pomatostomidae								
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	V		40	Inhabits open Box-Gum Woodlands on the western slopes of the Great Dividing Range, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Feeds on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Nests are maintained year round, and old nests are often dismantled to build new ones. Recorded on the subject site during field surveys. Likely foraging, nesting and roosting habitat in woodland areas of the subject site. Grey-crowned are capable of dispersing through sparsely-treed areas (e.g. in paddocks) provided that the distances between trees are not more than 200 m. Therefore, there is potential for Grey-crowned Babblers to disperse across sparsely-treed paddock areas in the western quarter of the subject site.	Loss of negligible amount of potential foraging or dispersal habitat.	2 (Low)	Yes
Psophodidae								
Chestnut Quail-thrush	<i>Cinclosoma castanotum</i>	V		1	Occurs in a wide range of arid and semi-arid habitats; mainly in the low shrubs and undergrowth of mallee scrub, but also in <i>Acacia</i> scrubs, dry sclerophyll woodland, heath,	None. No suitable habitat on subject site.	0 (None)	No

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					and native pine. However, in NSW it seems to occur almost exclusively in mallee habitats, with understorey dominated by spinifex, chenopods or other shrubs including <i>Acacia</i> species. Only rarely is it recorded in other types of woodland, and in these areas a dense understorey may be a prerequisite. Occupies vegetation with a wide range of fire histories, though appears to occur at highest densities in areas two to fifteen years post fire. There is some evidence from the Victorian mallee that if the interval between fires is too short (less than fifteen years) local declines may occur. Forages on the ground, often among spinifex clumps. Nests in a depression in the ground lined with strips of bark, fine grass or sticks, placed near a mallee trunk, against a fallen branch, under a low bush or in a sparse tuft of grass. No potential habitat on subject site or in adjacent areas.			
Neosittidae								
Varied Sittella	<i>Daphoenositta chrysoptera</i>	V		5	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and <i>Acacia</i> woodland. Feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. Potential foraging, nesting and roosting habitat in woodland areas of the subject site.	Loss of negligible amount of potential foraging or dispersal habitat.	2 (Low)	Yes
Pachycephalidae								
Gilbert's Whistler	<i>Pachycephala inornata</i>	V		10	Occurs in a range of habitats within NSW, though the shared feature appears to be a dense shrub layer. It is widely recorded in mallee shrublands, but also occurs in box-ironbark woodlands, Cypress Pine and Belah	None. No suitable habitat on subject site.	0 (None)	No

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					woodlands and River Red Gum forests, though at this stage it is only known to use this habitat along the Murray, Edwards and Wakool Rivers. Within the mallee the species is often found in association with an understorey of spinifex and low shrubs including wattles, hakeas, sennas and hop-bushes. In woodland habitats, the understorey comprises dense patches of shrubs, particularly thickets of regrowth <i>Callitris</i> pine. Parasitic 'cherries' (<i>Exocarpus</i> species) appear to be an important habitat component in Belah and Red Gum communities, though in the latter case other dense shrubs, such as Lignum and wattles, are also utilised. Forages on or near the ground in shrub thickets and in tops of small trees. Nests are usually built below about two and a half metres (but up to six metres) above the ground in the fork of dense foliage of plants such as wattles or cypress pines. No potential habitat areas on the subject site or adjacent lands.			
Petroicidae								
Southern Scrub-robin	<i>Drymodes brunneopygia</i>	V		1	Inhabits mallee and acacia scrub, particularly with dense sub-shrubs in the understorey, including Broombush and other dry shrubs. Occupies vegetation with a post fire age of 4-80 years, but is most abundant in areas with a post fire age of 26-40 years as dependent on a well-developed shrub layer. Forages around the base of mallee trees and on the ground beneath shrubs for ground- and litter-dwelling invertebrates, with certain ant species dominating. Constructs a shallow cup-shaped nest of twigs, bark and grass, which is normally located on the ground and usually concealed in the shelter of a tree, shrub or fallen branch. No potential habitat areas on the subject site or adjacent lands.	None. No suitable habitat on subject site.	0 (None)	No
Hooded Robin (south-eastern)	<i>Melanodryas cucullata cucullata</i>	V		11	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near	Loss of negligible amount of potential foraging or dispersal habitat.	2 (Low)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
form)					clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground. Potential foraging, nesting and roosting habitat in woodland areas of the subject site.			
Scarlet Robin	<i>Petroica boodang</i>	V		3	Primarily a resident in dry eucalypt forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. The understorey is usually open and grassy with few scattered shrubs. Lives in both mature and regrowth vegetation. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Habitat usually contains abundant logs and fallen timber. Breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. Potential foraging, nesting and roosting habitat in woodland areas of the subject site.	Loss of negligible amount of potential foraging or dispersal habitat.	2 (Low)	Yes
Flame Robin	<i>Petroica phoenicea</i>	V		4	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgeland at high altitudes. In winter, birds migrate to drier more open habitats in the	Loss of negligible amount of potential foraging or dispersal habitat.	2 (Low)	Yes

Common Name	Scientific Name	TSC Status	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Nature of Risk	Flight Risk Score	Seven-part Test Required ?
					lowlands (i.e. valleys below the ranges, and to the western slopes and plains). Winter habitats are dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees; occasionally seen in heathland or other shrublands in coastal areas. Forage from low perches, from which they sally or pounce onto small invertebrates which they take from the ground or off tree trunks, logs and other coarse woody debris. Potential winter foraging and roosting habitat in woodland areas of the subject site.			
Estrildidae								
Diamond Firetail	<i>Stagonopleura guttata</i>	V		28	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum <i>Eucalyptus pauciflora</i> Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Potential foraging, nesting and roosting habitat in woodland areas of the subject site.	Loss of negligible amount of potential foraging or dispersal habitat.	2 (Low)	Yes

Table 3 **Listed migratory bird species that have been recorded in the locality (10 km radius of subject site) within the last 25 years, their habitat requirements, likelihood of occurrence on subject site and an assessment of the risk of the proposed development impacting on their status.**

B: Protected under IUCN Biodiversity Conservation Agreement.
J: Listed on the Japanese and Australian Migratory Bird Agreement (JAMBA).
C: Listed on the Chinese and Australian Migratory Bird Agreement (CAMBA).
R: Listed on the Republic of Korea and Australian Migratory Bird Agreement (ROKAMBA).

Cumulative Flight Risk Score: see legend for Table 1.

Common Name	Scientific Name	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Potential Risk	Flight Risk Score	Assess. of Sig. Required ?
Ardeidae							
Eastern Great Egret	<i>Ardea modesta</i>	B	17	Occurs in shallows of rivers and estuaries; tidal mudflats, freshwater wetlands; sewage ponds, irrigation areas, larger dams, etc. Nests in the canopy of trees over water in swamp woodland and in mangroves. Potential to occur on subject site during flood periods, water-logged soil areas and in permanent irrigation channels that surround the paddocks. Individuals may fly low over subject site when approaching or departing nearby wetlands.	Loss of negligible amount of potential foraging habitat during flood events. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface). Injury or mortality to birds colliding with heliostats or receiving towers at night.	6 (Med)	Yes
Cattle Egret	<i>Ardea ibis</i>	C, J	2	Occurs in fields, marshes, freshwater wetlands, pastures, livestock pens, swamps, garbage tips and along air strips. Often associated with the presence of cattle because the livestock stir up insects that are eaten by the birds. Nests in colonies in swamp woodland. Potential foraging habitat for species across most of the subject site, especially when livestock present. Individuals may fly low over subject site when approaching or departing nearby wetlands or pasture areas.	Loss of negligible amount of potential foraging habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface). Injury or mortality to birds colliding with heliostats or receiving towers at night.	6 (Med)	Yes
Threskiornithidae							
Glossy Ibis	<i>Plegadis falcinellus</i>	C	6	The largest contiguous area of prime habitat is inland and northern floodplains. Preferred habitats for foraging and breeding are freshwater marshes at the edges of lakes	Loss of negligible amount of potential foraging habitat during flood events.	4 (Med.)	Yes

Common Name	Scientific Name	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Potential Risk	Flight Risk Score	Assess. of Sig. Required ?
				and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. Occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons. In largest numbers in drying grass/sedge swamps and grass/forb meadows. Sometimes recorded in wooded swamps, artificial wetlands (such as irrigated fields), and in mangroves for breeding. May retreat to permanent wetlands and/or coastal areas (including tidal wetlands) during drought. Potential to occur on subject site during flood periods or when there are water-logged soil areas. Individuals may fly low over subject site when approaching or departing nearby wetlands.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface). Injury or mortality to birds colliding with heliostats or receiving towers at night.		
Laridae							
White-winged Black Tern	<i>Chlidonias leucopterus</i>	C, J, K	1	Occurs on large coastal and inland wetlands, saltfields, sewage ponds, and in estuaries and coastal waters. No potential habitat on subject site or adjacent areas.	None. No potential habitat on subject site.	0 (None)	No
Caspian Tern	<i>Hydroprogne caspia</i>	C, J	2	Usually found near the coast, in extensive wetlands, on coastal and interior beaches and sheltered estuaries. The Caspian Tern lives equally well in fresh water and saline environments. No potential habitat on subject site or adjacent areas.	None. No potential habitat on subject site.	0 (None)	No
Accipitridae							
Eastern Osprey	<i>Pandion cristatus</i>	B	3	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. Feeds on fish over clear, open water. Nests are located high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. Only likely to be in the locality as a vagrant because mainly a coastal species. Vagrants usually occur west of the Great Dividing Range in summer and autumn when juveniles disperse. Extremely low probably of occurring on subject site or flying over it.	None. No potential habitat on subject site.	0 (None)	No
White-bellied Sea-	<i>Haliaeetus leucogaster</i>	C	5	Forages along coasts, estuaries, inlets, large rivers and on	None. No potential habitat on subject site.	0	No

Common Name	Scientific Name	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Potential Risk	Flight Risk Score	Assess. of Sig. Required ?
eagle				inland lakes and reservoirs. Nests in tall, live trees (usually eucalypts) near water. No potential habitat on subject site. Local sea-eagles likely to be strongly associated with the large river systems and their riparian vegetation. Potential for sea-eagles to fly over the subject site when dispersing between wetlands or river systems, but this is likely to occur infrequently.		(None)	
Rostratulidae							
Australian Painted Snipe	<i>Rostratula australis</i>	B	3	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter. No potential habitat on subject site. Individuals may fly low over subject site when approaching or departing nearby wetlands.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Charadriidae							
Pacific Golden Plover	<i>Pluvialis fulva</i>	C, J, K	1	Found on muddy, rocky and sandy wetlands, shores, paddocks, saltmarsh, coastal golf courses, estuaries and lagoons. Normally a coastal species and subject site outside usual range. Only sporadic records west of the Great Dividing Range. May occur on subject site during flood periods, but only as a vagrant.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	No
Scolopacidae							
Common Sandpiper	<i>Actitis hypoleucos</i>	C, J, K	2	Occurs along shallow, pebbly, muddy or sandy edges of rivers and streams, coastal to far inland; dams, lakes,	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy	3 (Low)	Yes

Common Name	Scientific Name	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Potential Risk	Flight Risk Score	Assess. of Sig. Required ?
				sewage ponds; margins of tidal rivers; waterways in mangroves or saltmarsh; mudflats; rocky or sandy beaches; and on man-made structures such as causeways, street gutters, drains and riverside lawns. Widespread east of the Great Dividing Range; sparsely scattered in Western and Plains regions of NSW. May occur on subject site during flood periods, but only as a vagrant or as an infrequent visitor. May fly low over the subject site when dispersing between wetlands in the locality.	fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).		
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	C, J, K	2	Prefers the grassy edges of shallow inland freshwater wetlands. It is also found around sewage farms, flooded fields, mudflats, mangroves, rocky shores and beaches. Its breeding habitat in Siberia is the peat-hummock and lichen tundra of the high Arctic. Potential to occur at the edges of water bodies on the subject site and neighbouring lands during flood periods. May fly low over the subject site when dispersing between wetlands in the locality.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Curlew Sandpiper	<i>Calidris ferruginea</i>	C, J, K	1	Found on intertidal mudflats of estuaries, lagoons, mangroves, as well as beaches, rocky shores and around lakes, dams and floodwaters. Its breeding habitat is the lowland tundra of Siberia. No potential habitat on subject site. Individuals may fly low over subject site when approaching or departing nearby wetlands. However, mainly a coastal species and only small numbers are likely to occur on wetlands within locality.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Pectoral Sandpiper	<i>Calidris melanotos</i>	J, K	2	In Australasia, prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats	3 (Low)	Yes

Common Name	Scientific Name	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Potential Risk	Flight Risk Score	Assess. of Sig. Required ?
				pools, creeks, floodplains and artificial wetlands. Also occasionally found further inland, preferring wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. May occur on subject site during flood periods, but only as a vagrant or as an infrequent visitor. May fly low over the subject site when dispersing between wetlands in the locality.	(mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).		
Red-necked Stint	<i>Calidris ruficollis</i>	C, J, K	2	In Australia, Red-necked Stints are found on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. They may also be seen in saltworks, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats, flooded paddocks or damp grasslands. They are often in dense flocks, feeding or roosting. May occur on subject site during flood periods, but only as an infrequent visitor. May fly low over the subject site when dispersing between wetlands in the locality.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Latham's Snipe	<i>Gallinago hardwickii</i>	C, J, K	2	Usually found on soft wet ground or in shallow water that contains grass tussocks or other green or dead vegetation. Also occurs in wet paddocks, seepage areas below dams, irrigated areas, in scrub or open woodland areas, saltmarshes and along the fringes of mangroves. May occur on subject site during flood periods or in water-logged soil areas where there are grass tussocks and/or shrubby weeds. May fly low over the subject site when dispersing between wetlands in the locality.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Bar-tailed Godwit	<i>Limosa laponica</i>	C, J, K	1	Inhabits estuarine mudflats, beaches and mangroves. They are common in coastal areas around Australia. They are social birds and are often seen in large flocks and in the company of other waders.	None. No potential habitat on subject site.	0 (None)	No

Common Name	Scientific Name	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Potential Risk	Flight Risk Score	Assess. of Sig. Required ?
				Mainly a coastal species, occurring in the locality as a vagrant. No potential habitat on subject site.			
Black-tailed Godwit	<i>Limosa limosa</i>	C, J, K	1	Occurs on tidal mudflats, estuaries, sewage ponds, shallow river margins, brackish or saline inland lakes, flooded pastures and airfields. May occur on subject site during flood periods, but only as an infrequent visitor. May fly low over the subject site when dispersing between wetlands in the locality.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Common Greenshank	<i>Tringa nebularia</i>	C, J, K	2	Found both on the coast and inland, in estuaries and mudflats, mangrove swamps and lagoons, and in billabongs, swamps, sewage farms and flooded crops. Potential to occur at the edges of water bodies on the subject site and neighbouring lands during flood periods. May fly low over the subject site when dispersing between wetlands in the locality.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the bird's inability to seek refuge on subject site from aerial predators (raptors).	3 (Low)	Yes
Marsh Sandpiper	<i>Tringa stagnatilis</i>	C, J, K	2	Occurs in salty, brackish or freshwater wetlands; sewage ponds; commercial saltfields; bore drains, mangroves, tidal mudflats and estuaries. Potential to occur at the edges of water bodies on the subject site and neighbouring lands during flood periods. May fly low over the subject site when dispersing between wetlands in the locality.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on or near heliostats (mistaken as water surface or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night. Increased aerial predation risk as a result of the	3 (Low)	Yes

Common Name	Scientific Name	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Potential Risk	Flight Risk Score	Assess. of Sig. Required ?
					bird's inability to seek refuge on subject site from aerial predators (raptors).		
Meropidae							
Rainbow Bee-eater	<i>Merops ornatus</i>	J	12	Occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches. Also occurs in grasslands and, especially in arid or semi-arid areas, in riparian, floodplain or wetland vegetation assemblages. Potential habitat occurs in woodland areas of the subject site and along edges of paddocks. Potential nesting habitat in soils along the banks of permanent irrigation channels at edges of paddocks. Also likely to fly low over the subject site in spring/summer when moving between sites in locality.	Loss of negligible amount of potential foraging or dispersal habitat. Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields or attempting to land on heliostats (mistaken as water surface from which to bathe and drink or potential refuge areas from predators). Injury or mortality to birds colliding with heliostats or receiving towers at night.	5 (Med.)	Yes
Apodidae							
Fork-tailed Swift	<i>Apus pacificus</i>	C, J, K	3	Aerial flier over most habitats across Australia. Usually flies high in sky in association with cold- or storm-fronts. Potential for species to forage for aerial insects over the subject site at altitudes < 1 m to several hundred metres above ground. Also likely to soar over the subject site at high altitudes ahead of cold- or storm-fronts.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields while foraging for aerial insects. Injury or mortality to birds colliding with heliostats or receiving towers at night.	5 (Med.)	Yes
White-throated Needletail	<i>Hirundapus caudacutus</i>	C, J, K	3	Aerial flier over most habitats across Australia. Usually flies high in sky in association with cold- or storm-fronts. Potential for species to forage for aerial insects over the subject site at altitudes of < 1 m up to > 1000 m above ground. Also likely to soar over the subject site at high altitudes ahead of cold- or storm-fronts.	Solar flux-related burns, injuries or mortality as a result of flying through concentrated solar energy fields while foraging for aerial insects. Injury or mortality to birds colliding with heliostats or receiving towers at night	5 (Med.)	Yes
Dicruridae							

Common Name	Scientific Name	EPBC Status	No. Local Records	Habitat Requirements & Likelihood of Occurrence on Subject Site	Potential Risk	Flight Risk Score	Assess. of Sig. Required ?
Satin Flycatcher	<i>Myiagra cyanoaleuca</i>	B	1	Occurs in heavily vegetated gullies in forests and taller woodlands, usually above the shrub layer. During migration it may occur in coastal forests, woodlands, mangroves, trees in open country and in gardens. No potential habitat on subject site or in neighbouring lands.	None. No potential habitat on subject site.	0 (None)	No

Species Profiles and Seven-part Tests of Significance

APPENDIX A

SEVEN-PART TESTS OF SIGNIFICANCE

INTRODUCTION

The Seven-Part Test is a standard set of questions devised by the Scientific Committee established under the *Threatened Species Conservation Amendment Act 2002*. The Test should be applied individually to all threatened species, populations and ecological communities and their habitats that are to be, or likely to be, on the site to be developed.

The results of a Seven-Part Test help determine the nature and significance of impacts of the proposed operation of the solar farm on threatened species, populations or ecological communities, or their habitats, and whether the preparation of *Species Impact Statement* (SIS) is required.

An SIS provides a more detailed assessment of threatened biota issues and proposes measures to avoid or reduce adverse impacts on the threatened species, populations or ecological communities, or their habitats, resulting from the proposal.

Appendix A provides Seven-part tests for the following threatened bird species in relation to the proposed development:

Aquatic Birds

- ❑ Magpie Goose (*Anseranus semipalmata*);
- ❑ Blue-billed Duck (*Oxyura australis*); and
- ❑ Freckled Duck (*Stictonetta naevosa*).

Shorebirds and Other Wading Species

- ❑ Australasian Bittern (*Botaurus poiciloptilus*);
- ❑ Australian Painted Snipe (*Rostratula australis*); and
- ❑ Curlew Sandpiper (*Calidris ferruginea*).

Raptors

- ❑ Spotted Harrier (*Circus assimilis*);
- ❑ Black-breasted Buzzard (*Hamirostra melanosternum*);
- ❑ Little Eagle (*Hieraaetus morphnoides*);
- ❑ Square-tailed Kite (*Lophoictinia isura*);
- ❑ Grey Falcon (*Falco hypoleucos*);
- ❑ Black Falcon (*Falco subniger*); and
- ❑ Barking Owl (*Ninox connivens*).

Parrots and Cockatoos

- ❑ Major Mitchell's Cockatoo (*Lophochroa leadbeateri*);
- ❑ Little Lorikeet (*Glossopsitta pusilla*);
- ❑ Swift Parrot (*Lathamus discolor*);
- ❑ Turquoise Parrot (*Neophema pulchella*); and

- ❑ Superb Parrot (*Polytelis swainsonii*).

Other Woodland Birds

- ❑ Bush Stone-curlew (*Burhinus grallarius*);
- ❑ Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- ❑ Speckled Warbler (*Chthonicola sagittata*);
- ❑ Regent Honeyeater (*Anthochaera phrygia*);
- ❑ Pied Honeyeater (*Certhionyx variegatus*);
- ❑ Painted Honeyeater (*Grantiella picta*);
- ❑ Black-chinned Honeyeater (*Melithreptus gularis gularis*);
- ❑ Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- ❑ Varied Sittella (*Daphoenositta chrysoptera*);
- ❑ Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*);
- ❑ Scarlet Robin (*Petroica boodang*);
- ❑ Flame Robin (*Petroica phoenicea*); and
- ❑ Diamond Firetail (*Stagonopleura guttata*).

Grassland & Shrubland Birds

- ❑ Brolga (*Grus rubicunda*);
- ❑ Australian Bustard (*Ardeotis australis*); and
- ❑ White-fronted Chat (*Epthianura albifrons*).

AQUATIC BIRDS

1. SPECIES PROFILES

Magpie Goose (*Aneranus semipalmata*)

The Magpie Goose has a black neck and head, with a characteristic knob on the crown (larger in males), which increases in size with age. The underparts are white, with contrasting black edges on the underwing. The bill, legs and feet are orange. The Magpie Goose differs from most waterfowl in having strongly clawed toes that are webbed only on their basal halves (i.e. only partly webbed). Females are slightly smaller than males.

The Magpie Goose is widespread throughout coastal northern and eastern Australia. The species is still relatively common in the Australian northern tropics, but had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. It can be seen from Fitzroy River, Western Australia, through northern Australia to Rockhampton, Queensland, and has been extending its range into coastal New South Wales to the Clarence River and further south. Since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW.

Large, noisy flocks of up to a few thousand birds congregate to feed on aquatic vegetation. The Magpie Goose is a specialized feeder with wild rice, *Oryza*, *Paspalum*, *Panicum* and spike-rush, *Eleocharis*, forming the bulk of its diet.

During the breeding season, Magpie Geese build nests in secluded places, usually close to wetlands. The nest is almost single-handedly constructed by the male. It usually consists of a simple unlined cup placed either in a floating platform of trampled reeds or built in tree-tops. Pairs of geese mate for life, but a male may have two females. Two females may occasionally use the same nest to lay the large, oval, off-white coloured eggs. All adults share incubation and care of the young.

Threats to the status of the Magpie Goose in NSW include:

- ❑ Inappropriate hydrological regimes of wetland habitats through drainage of swamps, ponds, dams and other wetlands for agricultural and other human purposes.
- ❑ Degradation of habitat through water pollution (e.g. salinity, chemicals, eutrophication).
- ❑ Modification of habitat and nest loss from trampling and overgrazing.
- ❑ Predation on eggs and goslings.
- ❑ Too-frequent burning of wetlands.

Blue-billed Duck (*Oxyura australis*)

The Blue-billed Duck is endemic to Australia, occurring within temperate wetlands of south-eastern and south-western Australia (Marchant & Higgins 1990). Breeding occurs in the Murray-Darling Basin and has been recorded from Willandra Creek, other tributary creeks of the Lachlan River, Narran Lake and in the lignum swamps of the Paroo (Pizzey & Doyle 1996). Within the species' range, new areas of suitable habitat are readily colonised by floods (Frith 1982).

The Blue-billed Duck is almost wholly aquatic and seldom seen on land (Kingsford 1991). Non-breeding flocks, often totalling several hundred individuals, congregate on large, deep, open freshwater dams and lakes during autumn and winter. It has also been observed in sewage ponds, large rivers and saline water bodies during non-breeding periods (Marchant & Higgins 1990). It favours deep, permanent, well vegetated freshwater swamps, especially those with beds of cumbungi (*Typha* spp.) (Frith 1982). Daylight hours are spent alone in small, concealed bays within vegetation or communally in large exposed rafts far from shore (Smith *et al.* 1995).

The Blue-billed Duck feeds on the surface of the water or by diving. Aquatic invertebrates constitute the bulk of the species' diet, but it may also eat seeds, buds, stems, leaves and fruit of aquatic vegetation (Marchant & Higgins 1990).

The main threat to the Blue-billed Duck comes from the destruction or modification of habitat, particularly by drainage works, clearing, cropping or burning and salinisation of wetlands (Marchant & Higgins 1990; Smith *et al.* 1995).

Freckled Duck (*Stictonetta naevosa*)

The Freckled Duck is recorded across southern and central Australia with the largest concentrations recorded in the Paroo-Warrego catchment (Currawinya Lakes, Qld), Eyre-Georgina-Mulligan catchment (Lake Torquinie, Qld) and possibly at Lake Galilee, Qld (Garnett & Crowley 2000). Other inland sites where substantial numbers have been recorded include the Cooper Creek and Bulloo River catchments, Barkley Tablelands, Qld and Lake Gregory, WA. Outside this area, breeding has also been recorded throughout the Murray-Darling catchment, notably along Lachlan River, and within Milcent Basin of South Australia and Victoria. During extensive inland droughts, Freckled Ducks apparently seek refuge in the Murray River Basin, south-eastern Qld, eastern NSW and southern SA, but usually some inland refuges remain (Jaensch & Vervest 1990; Marchant & Higgins 1990; Jaensch & Bellchambers 1997). A separate sub-population breeds in south-west WA (Jaensch & Vervest 1988). The maximum estimate of the eastern sub-population is 19,000 birds (Martindale 1986).

In inland eastern Australia, the largest numbers of Freckled Ducks occur in brackish to hypersaline wetlands that are densely vegetated with Lignum (*Muehlenbeckia cunninghamii*), within which the birds build their nests (Braithwaite 1976). They may breed prolifically after exceptionally wet years, then disperse widely, largely toward the coast, but in most years they appear to be nomadic between ephemeral wetlands (R. Jaensch in Garnett & Crowley 2000). In the driest years, they congregate on permanent wetlands.

In the past much of the wetland habitat in the south-east and south-west has been drained. The biggest potential threat is the currently shelved proposal to use water from the Paroo River and Cooper Creek for irrigation, which would affect flooding of critical habitat swamps (Kingsford 1999, 2000; Kingsford *et al.* 1998, 1999b). Also, during times of inland drought, when Freckled Ducks are found near the coast, they are at risk of being misidentified as game species and shot during duck hunting seasons (Martindale 1986; Loyn 1991), although no correlation between Freckled Duck abundance and hunting effort has been identified (Kingsford *et al.* 1999a).

2. SEVEN-PART TEST

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

There are seven records of the Magpie Goose occurring in the locality (10 km radius around the subject site), 12 Blue-billed Duck records and 13 Freckled Duck records.

Magpie Geese that occur in the locality are likely to be part the population that occurs across central and northern NSW. However, Magpie Geese move over long distances and there is likely to be movement of individuals between south-eastern and northern Australia.

Blue-billed Ducks that occur in the locality are likely to be part of the breeding population that occurs within the Murray-Darling Basin.

Freckled Ducks that occur in the locality are likely to be part of the population that occurs in inland eastern Australia and which disperse more widely after breeding prolifically after floods or when inland wetlands dry up during droughts.

Therefore, individuals of all three species within the locality are likely to be negligible proportions of local viable populations.

There is currently no habitat for Magpie Geese, Blue-billed Ducks or Freckled Ducks on the subject site. However, they may occur on or fly over the subject site or nearby wetlands and along the Lachlan River and its tributaries after widespread local flooding. Individuals of all three species have the potential to collide with heliostats if flying over the subject site and mistaking the array of heliostats as a body of water. There is also a risk of individuals being burnt if they fly through High Flux Zones while attempting to land on the subject site or on bodies of water on neighbouring lands.

However, High Flux Zones are negligible proportions of the total air-space above the subject site and the numbers of Magpie Geese, Blue-billed Ducks and Freckled Ducks occurring on or over the site are likely to be small. Collisions with heliostats would be minimised or avoided if the recommendations in Section 5.1 and 5.2 of the present report are implemented.

Therefore, the life-cycles of the Magpie Goose, Blue-billed Duck and Freckled Duck are unlikely to be significantly impacted to the extent that viable local populations would be placed at risk of extinction.

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

Not applicable. Each aquatic species is identified as a threatened species rather than as an endangered population.

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

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

Not applicable. Each aquatic species is identified as a threatened species rather than as an endangered or critically endangered ecological community.

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

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

- (i) The proposed development is a 30 MW concentrated solar thermal (SCT) plant with thermal energy storage, made up of 89 modules, with each module consisting of a heliostat field and a 27 metre high receiving tower. The heliostats would be 2.2 metres high, located 30 to 100 metres from the receiving tower. A solar tracking system would drive the heliostats to beam solar energy to the receiving towers during daylight hours. The receiving towers would be lattice structures approximately 25 metres high with a 2 metre high receiving device mounted at the top. The proposed development footprint is at least 100 ha in area.

Solar flux levels above 50kW/m² (approximately 50 times the brightness of the sun) and temperatures above 450°C poses an elevated risk to avifauna. Flux Modelling for Jemalong predicts that the distance from the receiver at which the maximum flux drops below 50kW/m² occurs between the 14 m and 16 m flux planes. However, over the vast majority of the area at the 12 and 14 m flux planes falls below the threshold. The peak flux at 14m occurs in a very small area circled in the corner of the flux plane. Overall, the High Flux Zone for a receiving tower occupies a relatively small area, ranging from 11.2 m² (0.4% of bounding area) when looking east to 52.8 m² (2.8% of bounding box area) when looking north. The High Flux Zone is predicted to be 66.4 m² when viewed from above (i.e. aerially), representing 0.9% of the bounding box area. There would be 89 receiving towers and receivers at the facility.

The receiver at the top of the tower and the pipes external to the receiver will have elevated temperatures that are likely to be fatal to birds. The front of the receiver tubes and the upper supporting structure are expected to reach temperatures in excess of 450°C, but these high temperatures would dissipate before they reach the tower structure.

- (ii) No Magpie Goose, Blue-billed Duck or Freckled Duck habitat would become fragmented or isolated as a result of the proposed development.
- (iii) There is currently no habitat for Magpie Geese, Blue-billed Ducks or Freckled Ducks on the subject site. However, they may occur on or fly over the subject site or nearby wetlands and along the Lachlan River and its tributaries after widespread local flooding.

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

No critical habitats for threatened aquatic bird species have been listed for the locality under the schedules of the TSC Act.

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

Magpie Goose

Priority actions proposed by OEH for the recovery of the Magpie Goose in NSW are:

- ☐ Undertake predator control in known wetland breeding sites.
- ☐ Protect habitat from fire.
- ☐ Protect wetlands from water pollution by reducing the use of chemicals, monitoring of salinity levels and nutrient loading near wetlands.
- ☐ Maintain or restore natural flow regimes in wetlands.
- ☐ Protect known or potential wetland habitats from grazing.

The proposed operation of the solar farm is consistent with these priority actions.

Blue-billed Duck

Priority actions proposed by OEH for the recovery of the Blue-billed Duck in NSW are:

- ☐ Retain or reintroduce ecologically sustainable water flows to wetland and swamp habitat. Allow swamps to be flooded periodically and floodwaters to recede naturally.
- ☐ Develop salinity management plans for affected catchments.
- ☐ Avoid heavy, prolonged heavy grazing on Cumbungi and Lignum sites. This could be done through a whole farm plan which identifies areas to be fenced and destocked.
- ☐ Makes sure pesticides and herbicides are kept well away from wetlands.
- ☐ Assist in determining distribution and population size by recording sightings and submitting them to the NPWS Wildlife Atlas.
- ☐ Report illegal hunting to NPWS.

The proposed operation of the solar farm is consistent with these priority actions.

Freckled Duck

Priority actions proposed by OEH for the recovery of the Freckled Duck in NSW are:

- ❑ Retain and protect wetlands and maintain a natural density of riparian and wetland vegetation.
- ❑ Retain or reintroduce ecologically sustainable water flows to swamp, wetland and creek habitat.
- ❑ Provide stock watering points away from wetlands.
- ❑ Fence swamps and wetlands to protect from domestic stock.
- ❑ Report illegal shooting of Freckled Ducks to the OEH.

The proposed operation of the solar farm is consistent with these priority actions.

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

Magpie Goose

Threats to the status of the Magpie Goose in NSW include:

- ❑ Inappropriate hydrological regimes of wetland habitats through drainage of swamps, ponds, dams and other wetlands for agricultural and other human purposes.
- ❑ Degradation of habitat through water pollution (e.g. salinity, chemicals, eutrophication).
- ❑ Modification of habitat and nest loss from trampling and overgrazing.
- ❑ Predation on eggs and goslings.
- ❑ Too-frequent burning of wetlands.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Blue-billed Duck

The main threat to the Blue-billed Duck comes from the destruction or modification of habitat, particularly by drainage works, clearing, cropping or burning and salinisation of wetlands. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Freckled Duck

In the past much of the wetland habitat in south-eastern and south-western Australia available for the Freckled Duck has been drained. The biggest potential threat is the currently shelved proposal to use water from the Paroo River and Cooper Creek for irrigation, which would affect flooding of critical habitat swamps. Also, during times of inland drought, when Freckled Ducks are found near the coast, they are at risk of being misidentified as game species and shot during duck hunting seasons, although no correlation between Freckled Duck abundance and hunting effort has been identified. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

3. CONCLUSION

The proposed operation of the solar farm would not significantly impact on the status of the Magpie Goose, Blue-billed Duck or Freckled Duck or their habitats in NSW. Therefore, a Species Impact Statement is NOT required for these species.

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SHOREBIRDS AND OTHER WADING SPECIES

1. SPECIES PROFILES

Australasian Bittern (*Botaurus poiciloptilus*)

This species occurs as two sub-populations, one in south-eastern Australia from south-east Qld to south-eastern SA, including Tasmania, the other in south-western Australia between Moora and Cape Arid (Marchant & Higgins 1990). In recent decades, numbers in previous strongholds in the Murray-Darling Basin have declined, the Western Australian subpopulation has become more restricted with few records away from the south coast and Lake Muir wetlands, breeding in South Australia is confined to the coast from Adelaide to the Victorian border, and there are a few recent Qld records (Barrett *et al.* 2003).

In 2009-2010, Birds Australia estimated the number of adult Australasian Bitterns in wetlands where they were previously known to occur to be 3-16 in Qld, 82-162 in NSW, 86-248 in Vic., 26-116 in SA and 38-154 in WA (Garnett *et al.* 2011).

Australasian Bitterns have fairly narrow habitat preferences, preferring shallow, vegetated freshwater or brackish swamps. They are seen most frequently in exceptionally wet years, possibly because the population size increases and they occupy isolated ephemeral wetlands. Pairs occupy territories containing a mixture of tall and short sedges for breeding (R. Jaensch in Garnett & Crowley 2000), although they will feed in more open swamp vegetation. Nests are well constructed cups in which the birds lay 4-5 eggs (Hobbs 1961; Marchant & Higgins 1990).

The main threats are diversion of water for irrigation (Kingsford & Thomas 1995; Kingsford 2000), and salinisation or drainage of permanent swamps (Garnett & Crowley 2000). Overgrazing by livestock, and inappropriate fire regimes can also reduce habitat suitability (Marchant & Higgins 1990). Bitterns are able to move between wetlands as suitability changes. However, they have comparatively specialised habitat requirements, so are more sensitive to overall habitat loss than are many wetland species.

Australian Painted Snipe (*Rostratula australis*)

The Australian Painted Snipe is irregularly recorded at wetlands in eastern and central Australia. Most records are from the Murray-Darling drainage system (Lowe 1963; Vestjens 1977; Blakers *et al.* 1984).

Since 1900, there have been fewer than 100 records throughout Australia and only a handful from the core of the subspecies' original eastern Australian range (Lane & Rogers 2000). The population is estimated to be between 1000 and 1500, and is highly unlikely to exceed 2500 mature individuals, based on counts of 805 birds, including duplicate sightings and juveniles, recorded over c. 160 sites between 2001 and 2009 (SEWPAC 2011). A population decline of greater than 30% is estimated for the past 26 years, a trend that is likely to continue into the future, based on ongoing habitat loss (SEWPAC 2011).

Typical habitat includes shallow, vegetated, temporary or infrequently filled wetlands, sometimes where there are trees such as River Red Gum (*Eucalyptus camaldulensis*) or Poplar Box (*E. populnea*) or shrubs such as Lignum (*Muehlenbeckia florulenta*) or samphire

(Vestjens 1977; Leach *et al.* 1987). Feeding at the water's edge and on mudflats, Painted Snipe take seeds and invertebrates, including insects, worms, molluscs and crustaceans. The polyandrous female lays 3-6 eggs, which are incubated by the male, in a shallow scrape nest (Lowe 1963; Marchant & Higgins 1993).

Although sufficiently opportunistic to take advantage of floods, the species has probably suffered primarily from either wetland drainage, or the diversion of water from rivers, which means that shallow wetlands never form (Garnett & Crowley 2000). Major water resource developments in the Murray-Darling Basin from the 1960s-1990s coincided with a significant decline in the number of observations (Lane & Rogers 2000). Such developments are continuing as river flows are reduced for irrigation with little regard for the ecological consequences (Kingsford & Thomas 1998; Kingsford 2000).

Curlew Sandpiper (*Calidris ferruginea*)

The Curlew Sandpiper breeds in north Siberia, wintering from western Africa to Australia (Bamford *et al.* 2008, Lappo *et al.* 2011). Non-breeding birds occur around coastal Australia, with large numbers at sites in both the north and south of the continent (SEWPPAC 2011).

The global population is estimated at 1,850,000 individuals and the flyway population at 180,000 (Wetlands International 2006), including 115,000 in Australia (Bamford *et al.* 2008).

The species breeds in open tundra in the lowlands of the high Arctic. Non-breeding birds migrate to coastal brackish lagoons, tidal mud and sand flats, estuaries, saltmarshes and less often inland, where they feed on polychaete worms, molluscs and crustaceans (Higgins & Davies 1996).

The status of Curlew Sandpipers is threatened by wetland degradation at migration staging points in East Asia (Bamford *et al.* 2008). The species is threatened specifically at Bohai Bay where up to 30% of the population stages its migration along 20 km of mudflats which is being reclaimed and developed (Rogers *et al.* 2010). General threats at migratory staging sites include environmental pollution, reduced river flows, human disturbance and reclamation for tidal power plants and barrages, industrial use, urban expansion and climate change (Barter 2002, Kelin & Qiang 2006, Moores 2006). Threats in Australia, especially eastern and southern Australia, include ongoing human disturbance, habitat loss and degradation from pollution, changes to the water regime and invasive plants (Rogers *et al.* 2006, Australian Government 2009).

2. SEVEN-PART TEST

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

Australasian Bitterns that have been recorded in the locality are part of the south-eastern Australian population that extends from south-east Qld to south-eastern SA, including Tasmania. There are only three BioNet records of the Australasian Bittern occurring in the locality over the last 25 years.

Australian Painted Snipes that have been recorded in the locality are part of the population that extends across the Murray-Darling Basin. There are only three BioNet records of the Australian Painted Snipe occurring in the locality over the last 25 years.

The Curlew Sandpiper occurs mainly in coastal Australia. There is only one BioNet record of this species occurring in the locality over the last 25 years, and is likely to visit only as a vagrant.

Therefore, individuals of all three species within the locality are likely to be negligible proportions of local viable populations.

There is currently no habitat for Australasian Bitterns, Australian Painted Snipes or Curlew Sandpipers on the subject site. However, they may occur on or fly over the subject site or nearby wetlands and along the Lachlan River and its tributaries after widespread local flooding. Individuals of all three species have the potential to collide with heliostats if flying over the subject site and mistaking the array of heliostats as a body of water. There is also a risk of individuals being burnt if they fly through High Flux Zones while attempting to land on the subject site or on bodies of water on neighbouring lands.

However, High Flux Zones are negligible proportions of the total air-space above the subject site and the numbers of Australasian Bitterns, Australian Painted Snipes and Curlew Sandpipers occurring on or over the site are likely to be small. Collisions with heliostats would be minimised or avoided if the recommendations in Section 5.1 and 5.2 of the present report are implemented.

Therefore, the life-cycles of the Australasian Bitterns, Australian Painted Snipes and Curlew Sandpipers are unlikely to be significantly impacted to the extent that viable local populations would be placed at risk of extinction.

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

Not applicable. Each shorebird and other wading bird species is identified as a threatened species rather than as an endangered population.

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

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

Not applicable. Each shorebird and other wading bird species is identified as a threatened species rather than as an endangered or critically endangered ecological community.

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

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

- (i) The proposed development is a 30 MW concentrated solar thermal (SCT) plant with thermal energy storage, made up of 89 modules, with each module consisting of a heliostat field and a 27 metre high receiving tower. The heliostats would be 2.2 metres high, located 30 to 100 metres from the receiving tower. A solar tracking system would drive the heliostats to beam solar energy to the receiving towers during daylight hours. The receiving towers would be lattice structures approximately 25 metres high with a 2 metre high receiving device mounted at the top. The proposed development footprint is at least 100 ha in area.

Solar flux levels above 50kW/m² (approximately 50 times the brightness of the sun) and temperatures above 450°C poses an elevated risk to avifauna. Flux Modelling for Jemalong predicts that the distance from the receiver at which the maximum flux drops below 50kW/m² occurs between the 14 m and 16 m flux planes. However, over the vast majority of the area at the 12 and 14 m flux planes falls below the threshold. The peak flux at 14m occurs in a very small area circled in the corner of the flux plane. Overall, the High Flux Zone for a receiving tower occupies a relatively small area, ranging from 11.2 m² (0.4% of bounding area) when looking east to 52.8 m² (2.8% of bounding box area) when looking north. The High Flux Zone is predicted to be 66.4 m² when viewed from above (i.e. aerially), representing 0.9% of the bounding box area. There would be 89 receiving towers and receivers at the facility.

The receiver at the top of the tower and the pipes external to the receiver will have elevated temperatures that are likely to be fatal to birds. The front of the receiver tubes and the upper supporting structure are expected to reach temperatures in excess of 450°C, but these high temperatures would dissipate before they reach the tower structure.

- (ii) No Australasian Bittern, Australian Painted Snipe or Curlew Sandpiper habitat would become fragmented or isolated as a result of the proposed development.
- (iii) There is currently no habitat for Australasian Bittern, Australian Painted Snipe or Curlew Sandpiper on the subject site. However, they may occur on or fly over the subject site or nearby wetlands and along the Lachlan River and its tributaries after widespread local flooding.

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

No critical habitats for shorebirds or other wading birds have been listed for the locality under the schedules of the TSC Act.

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

Australasian Bittern

Priority actions proposed by OEH for the recovery of the Australasian Bittern in NSW are:

- ❑ Undertake fox and feral cat control in and nearby wetlands.
- ❑ Protect swamps from fire during hazard reduction activities.
- ❑ Fence wetlands to exclude grazing and trampling by stock.
- ❑ Protect wetlands and water-courses from pollution.
- ❑ Protect wetlands, ponds and associated marshy areas from clearing or disturbance.

The proposed operation of the solar farm is consistent with these priority actions.

Australian Painted Snipe

Priority actions proposed by OEH for the recovery of the Australian Painted Snipe in NSW are:

- ❑ Control foxes, feral dogs and cats.
- ❑ Protect swamps from fire during burning-off or hazard reduction activities.
- ❑ Protect wetlands and watercourses from pollution.
- ❑ Limit the use of pesticides and other chemicals near wetlands and consider alternatives where available.
- ❑ Protect wetlands and associated marshy areas from clearing or disturbance.

The proposed operation of the solar farm is consistent with these priority actions.

Curlew Sandpiper

Priority actions proposed by OEH for the recovery of the Curlew Sandpiper in NSW are:

- ❑ Control dogs on beaches and in estuaries.
- ❑ Raise visitor awareness of the presence of this and other threatened shorebird species; provide information on how visitors' actions will affect the species' survival.
- ❑ Conduct searches for the species in suitable habitat in proposed development areas.
- ❑ Manage estuaries, inland water bodies and the surrounding landscape to maintain the natural hydrological regimes.
- ❑ Protect coastal areas from pollution.
- ❑ Protect and maintain known or potential habitat; implement protection zones around recent records.
- ❑ Protect foraging and roosting areas from disturbance or inappropriate development.
- ❑ Assess the importance of sites to the species' survival, including linkages provided between ecological resources across the broader landscape.

The proposed operation of the solar farm is consistent with these priority actions.

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

Australasian Bittern

The main threats to the Australasian Bittern are diversion of water for irrigation, and salinisation or drainage of permanent swamps. Overgrazing by livestock, and inappropriate fire regimes can also reduce habitat suitability. Bitterns are able to move between wetlands as suitability changes. However, they have comparatively specialised habitat requirements, so are more sensitive to overall habitat loss than are many wetland species. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Australian Painted Snipe

Although sufficiently opportunistic to take advantage of floods, the Australian Painted Snipe has suffered primarily from either wetland drainage, or the diversion of water from rivers, which means that shallow wetlands never form. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Curlew Sandpiper

Threats to the Curlew Sandpiper in Australia, especially eastern and southern Australia, include ongoing human disturbance, habitat loss and degradation from pollution, changes to the water regime and invasive plants. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

3. CONCLUSION

The proposed operation of the solar farm would not significantly impact on the status of the Australasian Bittern, Australian Painted Snipe or Curlew Sandpiper, or their habitats, in NSW. Therefore, a Species Impact Statement is NOT required for these species.

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RAPTORS

1. SPECIES PROFILES

Spotted Harrier (*Circus assimilis*)

The Spotted Harrier is a large, slim-bodied raptor with a striking white-spotted chestnut breast and mainly blue-grey upper parts. It has an owl-like chestnut coloured facial disc with a narrow light grey ruff around it and yellow eyes. It has long slender yellow legs and a long tail, with a wedge-shaped tip. Its long, broad wings have dark, well rounded, 'fingered' tips. The female Spotted Harrier is larger than the male. The Spotted Harrier glides slowly, with up-swept wings. It is also called the Allied or Jardine's Harrier or the Spotted Swamp-hawk.

The species occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population.

It inhabits grassy open woodland, including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.

Paired Spotted Harriers build a stick nest in a tree and usually breed in spring (sometimes autumn), with young remaining in the nest for several months.

Individuals prey on terrestrial mammals (e.g. bandicoots, bettongs, and rodents), birds and reptiles, occasionally insects and rarely carrion.

Threats to the status of Spotted Harriers in NSW include:

- ❑ secondary poisoning from rodenticides and rabbit baits; and
- ❑ clearing and degradation of foraging and breeding habitat, particularly that which affects prey densities.

Black-breasted Buzzard (*Hamirostra melanosternum*)

The Black-breasted Buzzard is one of the larger Australian birds of prey, with a wingspan of up to 1.5 metres. The wings are noticeably long, relative to its body and its short square tail. In flight this species is also recognised by its black breast and the conspicuous white patches at the base of the black 'fingered' primaries. At rest, it has a reddish nape against the black face and back.

The species is found sparsely in areas of less than 500 mm rainfall, from north-western NSW and north-eastern South Australia to the east coast at about Rockhampton, then across northern Australia south almost to Perth, avoiding only the Western Australian deserts.

It lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. It also hunts over grasslands and sparsely timbered woodlands.

The Black-breasted Buzzard is not a powerful hunter, despite its size, taking mostly reptiles, small mammals, birds, including nestlings, and carrion. It also specialises in feeding on large eggs, including those of emus, which it cracks on a rock.

Paired individuals breed from August to October near water in a tall tree. The stick nest is large and flat and lined with green leaves. Normally two eggs are laid.

Threats to the status of the Black-breasted Buzzard in NSW include:

- ❑ degradation of foraging habitat through overgrazing and tree clearing;
- ❑ illegal egg collection and shooting; and
- ❑ clearing of trees along inland watercourses.

Little Eagle (*Hieraaetus morphnoides*)

The Little Eagle is a medium-sized bird of prey that occurs in two colour forms: either pale brown with an obscure underwing pattern, or dark brown on the upperparts and pale underneath, with a rusty head and a distinctive underwing pattern of rufous leading edge, pale 'M' marking and black-barred wingtips. Both forms have a black-streaked head with a slight crest, a pale shoulder band on the upperwings, a rather short and square-tipped barred tail, and feathered legs.

This species is found throughout the Australian mainland except the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW.

It inhabits open eucalypt forest, woodland or open woodland. She-oak or acacia woodlands and riparian woodlands of interior NSW are also used. Breeding pairs nest in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Females lay two or three eggs during spring, and young fledge in early summer.

Little Eagles prey on birds, reptiles and mammals, occasionally adding large insects and carrion.

Threats to the status of Little Eagle in NSW include:

- ❑ rural-residential subdivision and associated land uses (e.g. horse and goat grazing);
- ❑ secondary poisoning from rabbit baiting;
- ❑ urban expansion; and
- ❑ clearing and degradation of foraging and breeding habitat.

Square-tailed Kite (*Lophoictinia isura*)

The Square-tailed Kite is found throughout the Australian mainland, primarily within 250 km of the coast and rarely inland along wooded watercourses and in central Australia (Blakers *et al.* 1984; Debus & Czechura 1989). Breeding occurs in south-western Australia and in wetter parts of southern and eastern Australia with birds from southern Australia probably overwintering in the tropics (Debus 1983; Blakers *et al.* 1984; Debus & Silveira 1981; Marchant & Higgins 1993).

The population size in SA is estimated at fewer than 10 individuals (Debus 1991) and that in Vic at 2-50 pairs (Debus & Silveira 1989), although it has been seen more frequently in western Vic in recent years (G. Pizzey in Garnett & Crowley 2000). Numbers in southern Qld are possibly increasing, particularly since the mid-1970s (G. Czechura in Garnett & Crowley 2000).

The Square-tailed Kite is a specialised predator of the canopy, taking small birds and their eggs and nestlings, as well as insects (Barnes *et al.* 1999). It hunts primarily over open forest, woodlands and mallee communities that are rich in passerines, as well over adjacent heaths and other low scrubby habitats and in wooded towns (Storr 1980, Debus & Czechura 1989). It appears to prefer a landscape that is structurally diverse (Garnett & Crowley 2000).

Much of the native vegetation in the south and east of the species' range has been cleared for agriculture (Debus & Czechura 1989; Olsen 1998). While this is still considered to be the major threat, in places, the species may have benefited from partial clearance (G. Czechura in Garnett & Crowley 2000). Illegal egg collecting and shooting constitute threats at the margins of the species' range (Jolly 1989). An apparently low recruitment rate means that recovery from any losses is likely to be slow (Debus & Czechura 1989; Jolly 1989).

Grey Falcon (*Falco hypoleucos*)

The Grey Falcon occurs in arid and semi-arid Australia, including the Murray-Darling Basin, Eyre Basin, central Australia and Western Australia (Blakers *et al.* 1984; Olsen & Olsen 1986; Marchant & Higgins 1993). It is found mainly where annual rainfall is less than 500 mm, except during inland drought, when it seemingly more widespread. There is some evidence of regular movements between the arid zone and northern Australia, and possibly New Guinea (Olsen & Olsen 1986), and from west to east in Qld (G. Czechura in Garnett & Crowley 2000). In the east, most breeding records are from the Murray-Darling and Eyre Basins, but the species is likely to breed throughout the arid zone under suitable conditions (Blakers *et al.* 1984; Marchant & Higgins 1993). The total population is estimated to be fewer than 5,000 individuals and 1,000 pairs (P. Olsen in Garnett & Crowley 2000).

Grey Falcons frequent timbered lowlands, particularly acacia shrublands that are crossed by tree-lined watercourses. It also hunts far out into treeless areas and frequents tussock grassland and open woodland, especially in winter (Olsen & Olsen 1986). It preys on birds, mostly granivorous parrots and pigeons, and mammals (Marchant & Higgins 1993). It also occasionally feeds on carrion, including dead lambs (Olsen & Olsen 1986). It nests in old nests of other bird species, particularly those of other raptors, laying 2-3 eggs. The nests that are chosen are usually in the tallest trees along watercourses, particularly River Red Gum (*Eucalyptus camaldulensis*) (Marchant & Higgins 1993).

Clearance of the semi-arid zone for marginal farming has destroyed some habitat. Continued overgrazing of arid zone rangelands may also affect prey abundance. The provision of water in these areas may favour the more mesic Peregrine Falcon (*Falco peregrinus macropus*) over the more arid-adapted Grey Falcon (Hollands 1984).

Black Falcon (*Falco subniger*)

The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South

Wales are likely to be Brown Falcons. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres (Marchant & Higgins 1993). The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring. Individuals may congregate at food sources (e.g. after fires which expose prey, when there are irruptions of quail or button-quail, or during locust plagues).

The species inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. The Black Falcon is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes the Black Falcon tends to nest in healthy, riparian woodland remnants with a diverse avifauna (Debus *et al.* 2005). Much of the best habitat of the Black Falcon in New South Wales is likely to occur on private land (i.e. agricultural or pastoral land), rather than in reserves (e.g. Debus *et al.* 2005; Debus & Olsen 2011; Debus & Tsang 2011).

The Black Falcon feeds mostly on other birds, especially flocking, ground-feeding granivores such as pigeons and parrots, but also some small mammals, large insects and occasionally carrion (e.g. road kill) (Marchant & Higgins 1993; Debus *et al.* 2005; Debus & Olsen 2011; Debus & Tsang 2011). Some of its key avian prey are strongly affected by farming practices, with the abundance of terrestrial grassland birds including quail, button-quail, pipits, larks and songlarks being sensitive to the intensity of livestock grazing pressure (Marchant & Higgins 1993). In agricultural areas the Black Falcon sometimes consumes introduced Common Starlings *Sturnus vulgaris* and Rock Doves *Columba livia*, which may lead to the bioaccumulation of pesticide residues in the Black Falcon (Olsen 1990; Olsen *et al.* 1993). Rock Doves may also be a vector for disease (e.g. trichomoniasis, which infects raptors via their prey) (Olsen 1990). In inland New South Wales, most of the former native mammalian prey species of the Black Falcon are now extinct ('critical weight range' terrestrial mammals of rabbit size or smaller, e.g. large rodents: Van Dyck & Strahan 2008). The European Rabbit *Oryctolagus cuniculus*, has historically formed a high proportion of the Black Falcon's diet by biomass, but following the spread of rabbit calicivirus after its release in 1996, and the consequent decline in rabbit numbers by 65-85% in the arid and semi-arid zones, the Black Falcon is now likely to be increasingly dependent on native prey, especially other birds (Marchant & Higgins 1993; Falkenberg *et al.* 2000; Sharp *et al.* 2002; Debus *et al.* 2005; Debus & Olsen 2011; Debus & Tsang 2011).

Breeding pairs of Black Falcons defend their nesting territories against other predators and competitors, and use the same breeding territories in successive years. The Black Falcon's home range is undetermined, but is likely to be larger than that of the comparable Peregrine Falcon *Falco peregrinus* in the temperate zone (i.e. more than 100 km²) (Marchant & Higgins 1993). Nesting densities are variously one pair per 15 km² (four pairs in 60 km², with 4-5 km between nests) in arid-zone floodplain woodland during good seasons, and one pair in 134 km² during average to dry years in the sheep-wheat belt (Marchant & Higgins 1993). Black Falcons nest in old stick nests, typically built by corvids or sometimes other raptor species, in the top of emergent trees in woodland, particularly riparian woodland. A clutch of three or four eggs is laid between winter and late spring. The incubation period is five weeks, the nestling period six to seven weeks, and the post-fledging dependence period lasts at least three weeks. Generation length is unknown for Black Falcons but is estimated as six years

for the similar Grey Falcon *Falco hypoleucos* (Garnett *et al.* 2011) and seven years for the Peregrine Falcon (Garnett *et al.* unpublished data).

The national population size of the Black Falcon was estimated in the 1990s to be in the upper thousands to possibly 10,000 or more birds (Ferguson-Lees & Christie 2001). This estimate was made before the reduction in rabbit prey associated with the release of rabbit calicivirus, and more recent surveys suggest that the species has undergone decline. A population estimate of between 3,000 and 5,000 mature individuals in New South Wales was made by P. McDonald (*in litt.* 2008), based on the low encounter rate of the species, especially breeding birds, in the second national bird atlas (Barrett *et al.* 2003a). While there is considerable uncertainty associated with these population estimates, and no published estimates are available for New South Wales, it is likely that the population size of the Black Falcon in New South Wales is moderately low, numbering fewer than 10,000 individuals.

Five lines of evidence from broad-scale surveys are also indicative of a decline in the population size of the Black Falcon since 1980. Firstly, at a national scale, Barrett *et al.* (2003b) flagged the Black Falcon as among those grassland bird species showing a 30-50% national decline during the preceding 20 years (approximately three generations), with declines greatest in south-eastern Australia. Secondly, in the eastern sheep-wheat belt of Australia, a statistically significant between-atlas decline in reporting rate of 38% over three generations was identified (Debus 2009). Thirdly, the species was reported in 59 one-degree grids in New South Wales in the first national bird atlas in 1977-1981, at mostly moderate to high reporting rates (11-40%) (Blakers *et al.* 1984), and 55 one-degree grids in the second national bird atlas in 1998-2002, at low reporting rates (10-20%) (Barrett *et al.* 2003a). This represents an apparent decline of 19% in New South Wales in the 20 year period between the two atlases (Barrett *et al.* 2007). However, this decline was not statistically significant, at least partly because of low statistical power, and the model was flagged as unstable and possibly inaccurate (Barrett *et al.* 2007). Between-atlas comparisons for some species also need to be interpreted cautiously because of changes in methodology between atlases, although this may not be such an issue for the Black Falcon, given that an ecologically similar species with a larger sample size (Australian Hobby *Falco longipennis*, a bird-eating falcon of open habitats), was shown to have equal detectability in the two bird atlases (Barrett *et al.* 2003a). Fourthly, a separate data set collected by the New South Wales Bird Atlassers, is also indicative of a continuing decline in Black Falcon abundance in New South Wales. These data were collected using consistent methods over time and are based on continuous survey records which allow a more statistically powerful analysis of trends. A linear regression fitted through yearly reporting rates from 1977 to 2006 indicates a significant reduction of 43% in the reporting rate over the 29 year period (approximately four generations). Finally, recent data confirm that on the New South Wales Southern Tablelands, the decline in frequency of sightings has continued over the last two to three decades (Debus & Olsen 2011). While the magnitude of decline of a rare species determined from broad-scale reporting rates must be interpreted with caution, the available data strongly suggest a continuing decline in abundance of Black Falcons in New South Wales.

The main threats to Black Falcons are thought to be the clearing of habitat in the semi-arid zone, and the degradation of habitat by overgrazing, with likely effects on the Black Falcon's foraging habitat, nest sites and food supply (Marchant & Higgins 1993). Of particular concern is the loss of breeding populations after destruction of their riparian nest trees (Olsen 1990) as a result of clearing and degradation of riparian woodlands (Debus 2012).

The Black Falcon may also be threatened by human disturbance to nest sites, pesticide accumulation, and collisions with power lines and wind turbines. A potential threat to the falcon's breeding productivity in the agricultural zone is competition for, and interference at nests by overabundant ravens and cockatoos (Debus & Tsang 2011). A new potential threat is an outbreak of Newcastle disease (paramyxovirus) in domestic and feral pigeons, which is killing some bird-eating raptors in Victoria, and is likely to spread through the native pigeon and raptor population.

Barking Owl (*Ninox connivens*)

This species is a medium-sized robust owl, smoky-brown above with large white spots on the wings, whitish below with dark grey to rusty streaks, feathered legs and powerful feet. Males grow larger than females. It typically roosts by day in pairs in leafy trees, sometimes in exposed conditions (Pizzey and Doyle, 1996). They are usually found in pairs which occupy 30 - 2000 hectare territories all year round (Schodde and Tiedemann, 1993). This species is fairly widespread in NSW, except the far north-west of the state, and it is rare east of the divide (Pizzey and Doyle, 1996). It is distributed in well-forested hills and flats, eucalypt savannah and riverine woodland in coastal and sub-coastal eastern, northern and south-western mainland Australia.

The Barking Owl breeds from July to November and nests in an open hollow 10 - 250 centimetres deep in a trunk or spout of a tree at 3 - 30 m above ground. The chief prey are mammals and birds and it also feeds on insects and other invertebrates. It also takes young hares, rats, mice, occasional small bats and some marsupials, including possums. Birds up to the size of magpies and Tawny Frogmouths are also dietary items (Schodde and Tiedemann, 1993).

Much of the habitat of the southern subspecies of the Barking Owl has been cleared (Silveira *et al.* 1997; Higgins 1999; NPWS 1999). Forestry practices, particularly those that include the felling of old-growth forests or over-mature trees, further threaten the species by reducing the availability of nesting and roosting hollows and shelter for breeding season prey (Kavanagh *et al.* 1995; Taylor & Kirsten 2000). On private land, much of the remaining habitat is fragmented and subject to further clearing, firewood collection and grazing, and there has been little regeneration (Barrett *et al.* 1994; Robinson & Traill 1996; Debus 1997, NPWS 1999).

2. SEVEN-PART TEST

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

There are nine records of the Spotted Harrier occurring in the locality (10 km radius around the subject site), three Black-breasted Buzzard records, seven Little Eagle records, one Square-tailed Kite record, 12 Grey Falcon records, 10 Black Falcon records and two Barking Owl records. The Spotted Harrier was observed on the subject site during surveys conducted in November 2014.

All diurnal raptor species have widespread distributions in Australia and young disperse widely, particularly when there are irruptions after successful breeding following heavy rains.

Barking Owl individuals within the locality are likely to be part of the population that is distributed in well-forested hills and flats, eucalypt savannah and riverine woodland in coastal and sub-coastal eastern mainland Australia.

Potential nesting habitat for threatened raptor species occurs in woodland areas on the subject site and the River Red Gum Forest along the banks of the Thurumbidgee Lagoon.

During operation of the solar farm, threatened raptor species may be attracted to the subject site if there are high densities of potential prey species, e.g. rabbits, rodents and insectivorous birds that are attracted to aggregations of insects. Therefore, there is a risk of individuals of threatened raptor species being burnt if they fly through High Flux Zones while attempting to land on the subject site while chasing insect-feeding birds. Heat stress, burns and mortality of raptors may also occur if individuals attempt to land in high temperature zones around the receivers.

However, High Flux Zones and high temperature zones are negligible proportions of the total air-space above the subject site and the numbers of threatened raptors occurring on or over the site are likely to be small. Potential for mortality or injury to raptors on the subject site would be minimised or avoided if the recommendations in Section 5.1 and 5.2 of the present report, including feral animal (e.g. rabbits and rodents) control on the subject site and placement of perch-guards around the receivers and tower rails, are implemented.

Therefore, the life-cycles of threatened raptor species are unlikely to be significantly impacted to the extent that viable local populations would be placed at risk of extinction.

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

Not applicable. Each raptor species is identified as a threatened species rather than as an endangered population.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. Each raptor species is identified as a threatened species rather than as an endangered or critically endangered ecological community.

(d) In relation to a habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

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

- (i) The proposed development is a 30 MW concentrated solar thermal (SCT) plant with thermal energy storage, made up of 89 modules, with each module consisting of a heliostat field and a 27 metre high receiving tower. The heliostats would be 2.2 metres high, located 30 to 100 metres from the receiving tower. A solar tracking system would drive the heliostats to beam solar energy to the receiving towers during daylight hours. The receiving towers would be lattice structures approximately 25 metres high with a 2 metre high receiving device mounted at the top. The proposed development footprint is at least 100 ha in area.

Solar flux levels above 50kW/m² (approximately 50 times the brightness of the sun) and temperatures above 450°C poses an elevated risk to avifauna. Flux Modelling for Jemalong predicts that the distance from the receiver at which the maximum flux drops below 50kW/m² occurs between the 14 m and 16 m flux planes. However, over the vast majority of the area at the 12 and 14 m flux planes falls below the threshold. The peak flux at 14m occurs in a very small area circled in the corner of the flux plane. Overall, the High Flux Zone for a receiving tower occupies a relatively small area, ranging from 11.2 m² (0.4% of bounding area) when looking east to 52.8 m² (2.8% of bounding box area) when looking north. The High Flux Zone is predicted to be 66.4 m² when viewed from above (i.e. aerially), representing 0.9% of the bounding box area. There would be 89 receiving towers and receivers at the facility.

The receiver at the top of the tower and the pipes external to the receiver will have elevated temperatures that are likely to be fatal to birds. The front of the receiver tubes and the upper supporting structure are expected to reach temperatures in excess of 450°C, but these high temperatures would dissipate before they reach the tower structure.

- (ii) No threatened raptor habitat would become fragmented or isolated as a result of the proposed operation of the solar farm.
- (iii) Potential nesting habitat for threatened raptor species occurs in woodland areas on the subject site and the River Red Gum Forest along the banks of the Thurumbidgee Lagoon. These habitat areas would be retained and, as a consequence, the proposed operation of the solar farm would not impact on breeding habitat of threatened raptor species.

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

No critical habitats for threatened raptor species have been listed for the locality under the schedules of the TSC Act.

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

Spotted Harrier

Priority actions proposed by OEH for the recovery of the Spotted Harrier in NSW are:

- ❑ Protect areas of habitat from overgrazing.
- ❑ Protect areas of habitat from development.
- ❑ Retain and protect nesting and foraging habitat

The proposed operation of the solar farm would impact on 165 ha of known foraging habitat for this species, which is inconsistent with OEH's priority actions to assist species' in the recovery. However, the local population is likely to be migratory, dispersing over large distances within south-north migration routes in response to locally favourable conditions. Potential nesting habitat within woodland areas of the subject site would be retained. Nesting territories of Spotted Harriers are at least 5.5 km² (Baker-Gabb 1984) and, therefore, there is the potential for up to 30% of the home range of a single breeding pair being impacted by the operation of the solar farm. This is a negligible amount of potential habitat that is available for Spotted Harriers within the locality and broader geographical area. Spotted Harriers using the subject site are also likely to be a negligible proportion of the local population. Therefore, the potential operational impacts of the solar farm on part of a single Spotted Harrier territory is unlikely to significantly impact on the status of the species or the availability of suitable habitat.

Black-breasted Buzzard

Priority actions proposed by OEH for the recovery of the Black-breasted Buzzard in NSW are:

- ❑ Encourage less intense grazing regimes in areas of foraging habitat.
- ❑ Protect nesting habitat along watercourses.
- ❑ Report suspected egg collection or shooting of birds.

The proposed operation of the solar farm is consistent with these priority actions.

Little Eagle

Priority actions proposed by OEH for the recovery of the Little Eagle in NSW are:

- ❑ Buffer habitat areas from the impacts of other activities.
- ❑ Protect known populations and areas of potential habitat from clearing, fragmentation or disturbance.
- ❑ Rehabilitate known and potential habitat.
- ❑ Retain and protect nesting and foraging habitat.

The proposed operation of the solar farm is consistent with these priority actions.

Square-tailed Kite

Priority actions proposed by OEH for the recovery of the Square-tailed in NSW are:

- ❑ Protect known habitat from fires of a frequency greater than that recommended for the retention of biodiversity.
- ❑ Retain and protect nesting and foraging habitat, particularly along watercourses.
- ❑ Report suspected illegal bird shooting and egg-collecting to OEH.

The proposed operation of the solar farm is consistent with these priority actions.

Grey Falcon

Priority actions proposed by OEH for the recovery of the Grey Falcon in NSW are:

- ❑ Retain existing habitat and manage grazing to ensure habitat features are protected.
- ❑ Protect and rehabilitate habitat along watercourses.
- ❑ Monitor known nesting sites to deter poachers.
- ❑ Monitor secondary poisoning from mouse or locust control. Inform DEC if any unusual species mortality occurs.

The proposed operation of the solar farm is consistent with these priority actions.

Black Falcon

Priority actions proposed by OEH for the recovery of the Black Falcon in NSW are:

- ❑ Protect and monitor known nest sites.
- ❑ Protect old stick nests (e.g., those of corvids and raptors) that have the potential to be used as nest sites.
- ❑ Protect and facilitate the recruitment of large old trees, a resource that is critical for nesting and hunting.
- ❑ Protect and expand potential nesting habitat, especially riparian and floodplain woodlands.
- ❑ Identify Black Falcon nesting territories and engage landholders in the management of habitat in these areas.
- ❑ Promote the reporting of any signs of disease that are unusual or clusters of deaths in raptors or their prey to the NSW Environment Line on 131 555.
- ❑ Investigate the dietary importance of terrestrial ground birds and rabbits, and the potential for agricultural activities to benefit or negatively impact on falcon populations.
- ❑ Increase community awareness of the Black Falcon through the preparation and distribution of educational material, including an identification guide.

The proposed operation of the solar farm is consistent with these priority actions.

Barking Owl

- ❑ Apply a mosaic pattern during fire hazard reduction to ensure the same areas are not burned too frequently.
- ❑ Protect woodland and open forest remnants, especially those containing hollow-bearing trees.
- ❑ Retain and enhance vegetation along watercourses and surrounding areas to protect important habitat of the owls and their prey.

- ❑ Maintain a buffer of undisturbed native vegetation at least 200 metres radius around known nest sites.
- ❑ Retain standing dead trees and large fallen logs.
- ❑ Fence habitat remnants and protect from heavy grazing.

The proposed operation of the solar farm is consistent with these priority actions.

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

Spotted Harrier

Threats to the status of Spotted Harriers in NSW include:

- ❑ secondary poisoning from rodenticides and rabbit baits; and
- ❑ clearing and degradation of foraging and breeding habitat, particularly that which affects prey densities.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Black-breasted Buzzard

Threats to the status of the Black-breasted Buzzard in NSW include:

- ❑ degradation of foraging habitat through overgrazing and tree clearing;
- ❑ illegal egg collection and shooting; and
- ❑ clearing of trees along inland watercourses.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Little Eagle

Threats to the status of Little Eagle in NSW include:

- ❑ rural-residential subdivision and associated land uses (e.g. horse and goat grazing);
- ❑ secondary poisoning from rabbit baiting;
- ❑ urban expansion; and
- ❑ clearing and degradation of foraging and breeding habitat.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Square-tailed Kite

Much of the native vegetation in the south and east of the species' range has been cleared for agriculture. While this is still considered to be the major threat, in places, the species may have benefited from partial clearance. Illegal egg collecting and shooting constitute

threats at the margins of the species' range. An apparently low recruitment rate means that recovery from any losses is likely to be slow. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Grey Falcon

Clearance of the semi-arid zone for marginal farming has destroyed some habitat. Continued overgrazing of arid zone rangelands may also affect prey abundance. The provision of water in these areas may favour the more mesic Peregrine Falcon (*Falco peregrinus macropus*) over the more arid-adapted Grey Falcon. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Black Falcon

The main threats to Black Falcons are thought to be the clearing of habitat in the semi-arid zone, and the degradation of habitat by overgrazing, with likely effects on the Black Falcon's foraging habitat, nest sites and food supply. Of particular concern is the loss of breeding populations after destruction of their riparian nest trees as a result of clearing and degradation of riparian woodlands. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Barking Owl

Much of the habitat of the southern subspecies of the Barking Owl has been cleared. Forestry practices, particularly those that include the felling of old-growth forests or over-mature trees, further threaten the species by reducing the availability of nesting and roosting hollows and shelter for breeding season prey. On private land, much of the remaining habitat is fragmented and subject to further clearing, firewood collection and grazing, and there has been little regeneration. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

3. CONCLUSION

The proposed operation of the solar farm would not significantly impact on the status of the Spotted Harrier, Black-breasted Buzzard, Little Eagle, Square-tailed Kite, Grey Falcon, Black Falcon, or Barking Owl, or their habitats, in NSW. Therefore, a Species Impact Statement is NOT required for these species.

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PARROTS

1. SPECIES PROFILES

Major Mitchell's Cockatoo (*Lophochroa leadbeateri*)

Major Mitchell's Cockatoo inhabits the arid and semi-arid regions of Australia, except the northeast. Its morphology and distribution are described in detail in Higgins (1999). In south-eastern Australia it is restricted mainly to sparsely timbered grasslands, Pine–Buloke and Belah woodlands, tall old mallee with suitable nest hollows, and riverine woodlands of Black Box and Red Gum (Pizzey & Knight 1997, Emison *et al.* 1987, Higgins 1999). Remnant vegetation surrounding agricultural land has also been used for nesting.

Near permanent water, birds appear to be sedentary, but if food and water are limited they may become somewhat nomadic, and numbers fluctuate (Forshaw and Cooper 1981). During droughts in the interior, birds may move to less arid areas. Major Mitchell's Cockatoos feed on the seeds of a wide variety of native shrubs and trees, which might be supplemented with insect larvae and the seeds of some agricultural crops and weeds. They are monogamous and nest in tree hollows, often in old Cypress-pines. The species is long-lived, reproducing slowly and teaching the young over several years (Rowley and Chapman 1991).

Major Mitchell's Cockatoo depends on tree hollows because it cannot excavate a nest. The widespread fragmentation and loss of woodland and Big Mallee and Chenopod Mallee communities has led to a sharp decline in the number of suitable hollows. Competition with other hollow-dependent animals, including feral Honey Bees, could also limit the number of hollows available to Major Mitchell's Cockatoos (Paton 1996).

Because Belah and Pine–Buloke Woodlands are extremely sensitive to fire, they could be eliminated by a single fire if subsequent grazing pressure is high, reducing the area to a grassland with almost no tree regeneration.

The manipulation of the flood regimes has resulted in less frequent flooding of areas, which has in turn resulted in a lack of regeneration of the key riverine woodland species Black Box *Eucalyptus largiflorens* and River Red Gum *Eucalyptus camaldulensis* (Wouters 1993).

Major Mitchell's Cockatoos are very long lived (up to 80 years in captivity: D. Moy *pers. comm.*), so a decline in their abundance in the wild might not become apparent for some time. In the absence of significant recruitment, the risk of uncontrollable decline might thus be greater than is thought.

The attractive appearance of Major Mitchell's Cockatoos means that are sought after by specialist aviculturalists and command high prices overseas (P. Menkhorst *pers. comm.*; Higgins 1999). Although pairs rarely abandon robbed nests, they will not breed again in the same season (Rowley & Chapman 1991). Forshaw & Cooper (1981) considered illegal trapping and collection of nestlings to be a contributing factor in the species' decline in Western Australia, and this may also be true for Victoria and NSW.

Major Mitchell's Cockatoo probably needs a more varied diet than other cockatoos (Rowley & Chapman 1991). In south-eastern Australia this restricts the birds largely to native vegetation or the boundaries of cropped land. They are relatively poor fliers (Forshaw & Cooper 1981)

and appear to avoid taking long flights over open treeless areas. This might have contributed to their decline in agricultural areas. Because they can travel quite long distances when foraging, there could be an overestimation of numbers because of duplication of records. Because Major Mitchell's Cockatoos are not fast fliers and often feed on the ground, they can be killed by vehicle collision, particularly in summer when grain spills occur along roads (Rowley & Chapman 1991). There is also a risk of predation by Red Foxes *Canis vulpes* and Cats *Felis catus*.

Major Mitchell's Cockatoos have been responsible for occasional but sometimes considerable damage to crops such as wheat and almonds. The declaration of the Long-billed Corella *Cacatua tenuirostris*, Sulphur-crested Cockatoo *Cacatua galerita* and Galah *Cacatua roseicapilla* as unprotected wildlife enables landowners to take or destroy these species, subject to the conditions limitations and restrictions of the National Parks & Wildlife Act 1975. Incorrect identification could result in the killing of Major Mitchell's Cockatoos.

Little Lorikeet (*Glossopsitta pusilla*)

The Little Lorikeet is a small (16-19 cm; 40 g) bright green parrot, with a red face surrounding its black bill and extending to the eye. The undertail is olive-yellow with a partly concealed red base, and the underwing coverts are bright green. The mantle is imbued with light brown. The call in flight is diagnostically different from other lorikeets, being a shrill and rolling screech: 'zit-zit' or 'zzet'. Although difficult to observe while foraging high in treetops, a flock's constantly chattering contact calls give it away. Flight is fast, direct and through or above the canopy.

The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs.

Individuals forage primarily in the canopy of open eucalypt forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. They feed mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards

Little Lorikeets are gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries.

Individuals roost in treetops, often distant from feeding areas. But breeding pairs nest in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees are often chosen, including species like *Allocasuarina*.

The nesting season extends from May to September. In years when flowering is prolific, Little Lorikeet pairs can breed twice, producing 3-4 young per attempt. However, the survival rate of fledglings is unknown.

Given that large old *Eucalyptus* trees on fertile soils produce more nectar, the extensive clearing of woodlands for agriculture has significantly decreased food for the lorikeet, thus reducing survival and reproduction. Small scale clearing, such as during roadworks and fence construction, continues to destroy habitat and it is likely to be decades before revegetated areas provide adequate foraging sites.

The loss of old hollow bearing trees has reduced nest sites, and increased competition with other native and exotic species that need large hollows with small entrances to avoid predation. Felling of hollow trees for firewood collection or other human demands increases this competition.

Competition with the introduced Honeybee for both nectar and hollows exacerbates these resource limitations.

Swift Parrot (*Lathamus discolor*)

The Swift Parrot is a gregarious species that breeds in eucalypt forests in eastern and northern Tasmania and it over-winters in south-eastern mainland Australia. During the breeding season the species feeds on the nectar of the flowering Tasmanian Blue Gum (*Eucalyptus globulus*).

In late March almost the entire population moves to mainland Australia. Most over-winter in Victoria and central and eastern NSW, but each year a few are recorded from south-eastern Qld and occasionally from as far west in Tasmania (Blakers *et al.* 1984). Migrants return to Tasmania in September (Brown 1989).

Swift Parrots inhabit *Eucalyptus* forests, breeding in mature and senescent trees. They breed where Tasmanian Blue Gums are flowering well, and in poor flowering seasons the amount of breeding is reduced. On the mainland Swift Parrot movements are little understood. It congregates in areas where eucalypts are flowering profusely or where there are abundant lerp infestations, often returning regularly to the same places. It is consequently dependent on winter-flowering species, particularly Red Ironbark (*Eucalyptus sideroxylon*), Yellow Gum (*E. leucoxylon*), White Box (*E. albens*) and Swamp Gum (*E. ovata*) (Brown 1989). It also feeds in Manna Gum (*E. viminalis*) in autumn. It often occurs in remnant patches of mature eucalypts of agricultural land and is also common in some Melbourne suburbs (Emison *et al.* 1987).

Favoured food trees of the Swift Parrot in NSW when there is winter-flowering include Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*). Commonly used lerp-infested trees include Inland Grey Box (*E. macrocarpa*), Grey Box (*E. moluccana*) and Blackbutt (*E. pilularis*) (OEH Threatened Species Database <http://www.environment.nsw.gov.au/threatenedspecies>).

Population size and trends are poorly known as the species' habitat use within its broad range varies irregularly (Garnett *et al.* 2011). The breeding population was estimated at

1,320 breeding pairs in 1987-1988 and 940 pairs in 1995-96 (Brereton 1996). Annual surveys across the species' non-breeding range fluctuate depending on the distribution of birds across the landscape and flock sizes. A total of 2,158 birds, including immature, in 2010, was the highest count for many years (C. Tzaros & D. Ingwersen cited by Garnett *et al.* 2011). There is little evidence of decreased national abundance, but much anecdotal evidence of localised declines and demonstrable loss of breeding habitat. Garnett *et al.* (2011) estimates the total population consists of 2000 mature birds and is declining.

In Tasmania the abundance of Blue Gums has been greatly reduced by clearance of land for agriculture, saw log production and clear-felling for woodchips (Garnett 1993). Individual parkland trees are now often the most important food sources.

Similarly, on the mainland most of the best-quality stands of favoured food tree species have been cleared for agriculture and many of those remaining have been heavily cut-over to produce poles for firewood. The resulting immature stands may be poorer and less reliable sources of nectar (Brown 1989). In 1959 there were several reports of large concentrations of Swift Parrots from Victoria and NSW during winter (Hindwood and Sharland 1964). However, in NSW, there appear to be few records from the period 1988-90 (Garnett 1993) and, apart from 100+ birds being observed in Temora in May 1990, all observations were of fewer than four birds (A. Morris in Garnett 1993).

Some Swift Parrots are also taken illegally for the commercial bird trade and, in recent years, a number of trappers have been prosecuted in NSW (J. Hardy in Garnett 1993).

Other less well understood potential threats include competition for food with large, aggressive nectarivorous honeyeaters and the introduced Bumblebee (*Bombus terrestris*), and for nest hollows with the Common Starling (*Sturnus vulgaris*) which may be exacerbated by forest fragmentation (Hingston *et al.* 2004, Saunders & Tzaros 2010).

High mortality also occurs through collisions with windows, wire netting, fences and vehicles (Pfennigwerth 2008). Wind energy turbines in south-eastern Australia are probably not a serious threat (Smales 2005). Another potential threat is Psittacine Beak and Feather Disease (Garnett *et al.* 2011).

Turquoise Parrot (*Neophema pulchella*)

The Turquoise Parrot is endemic to eastern Australia. The species range extends from north-eastern Vic., through NSW to the granite belt of south-east Qld. In NSW, the Turquoise Parrot is typically recorded west of the escarpment in the tablelands and on the western slopes, extending to coastal districts through the dry forest corridor of the Hunter Valley (Crome & Shields 1992). Once common near Sydney, this population crashed early in the 1900s and at one stage the Sydney population was thought to be extinct (Garnett 1993). Recent records indicate that the species now occurs in scattered populations near Sydney and throughout eastern and central NSW (Blakers *et al.* 1984).

The species is an inhabitant of the steep, rocky ridges and gullies, rolling hills, valleys and river-flats and nearby plains of the Great Dividing Range. It occurs in eucalypt woodlands and open forests with a ground cover of grasses and low understorey of shrubs (Jarman 1973; Morris 1980). It feeds on seed of grasses, herbaceous plants and shrubs and

requires a reliable supply of drinking water (Higgins 1999). The species seldom forms large flocks and is commonly encountered as pairs or small parties of 6-8 birds (Higgins 1999).

Threats to this species include:

- ❑ Loss of habitat through clearing, intensive logging, burning and grazing;
- ❑ destruction of sites containing hollows which may be used for nesting; and
- ❑ inappropriate fire regimes which remove nesting and feeding resources.

Superb Parrot (*Polytelis swainsonii*)

The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. It is estimated that there are less than 5000 breeding pairs left in the wild.

This species inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species identified as nest trees include Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Superb Parrots nest in small colonies, often with more than one nest in a single tree.

Individuals may forage up to 10 km from nesting sites, primarily in grassy box woodland. They feed in trees, among understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants. Also eaten are fruits, berries, nectar, buds, flowers, insects and grain.

Threats to the status of Superb Parrots include:

- ❑ removal of hollow bearing trees;
- ❑ clearing of woodland remnants;
- ❑ poor regeneration of nesting trees and food resources;
- ❑ feeding on grain spills and subsequently being struck by vehicles;
- ❑ loss of hollows to feral bees and native and exotic hollow-nesting birds; and
- ❑ illegal trapping which can also result in the destruction of hollows.

2. SEVEN-PART TEST

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

Superb Parrot, Turquoise Parrot and Swift Parrot

There are 23 records of the Superb Parrot occurring in the locality (10 km radius around the subject site), 32 Turquoise Parrot records and eight Swift Parrot records. Several Superb Parrots were observed on the subject site during surveys conducted in November 2014.

The Superb Parrot flies low over open areas between woodland (mostly riparian woodland) remnants. This species has the potential to nest in tree hollows within remnant woodland that will be retained on the subject site or in River Red Gum woodland along the banks of Thurumbidgee Lagoon and other woodland remnants close to the subject site. The site is located in a region that is particularly important for Superb Parrots, probably comprising winter migrants from Riverina (NSW & Vic) & South-west Slopes region, summer migrants from northern Central NSW and part of the local population likely to be resident in the region throughout the year. Bionet and NSW Bird Atlas records indicate this species is present in the locality throughout the year.

Swift Parrots that occur in the locality are part of the population that over-winters in mainland Australia from late March to early September. Most over-winter in Victoria and central and eastern NSW, but each year a few are recorded from south-eastern Qld and occasionally from as far west in Tasmania. Swift Parrots have the potential to occur in woodland areas on the subject site while over-wintering on the mainland. The species flies fast and very low over open areas between woodland remnants, preferred food trees occur in woodland that will be retained on the subject site. Swift Parrots usually fly in small to medium-sized flocks and collision with barriers (e.g. windows, cyclone fences) is a listed threatening process.

Turquoise Parrots that occur in the locality are likely to be part of the population that is recorded west of the escarpment in the tablelands and on the western slopes of the Great Dividing Range in NSW, extending to coastal districts through the dry forest corridor of the Hunter Valley. The Turquoise Parrot feeds on seeds of grasses or shrubs in open areas near the edges of eucalypt woodland. There are more BioNet records of this species occurring within the locality than other threatened parrot species (32 records, compared with 23 Superb Parrot records, eight Swift Parrot records, three Little Lorikeet records and two Major Mitchell's Cockatoo records). Two Turquoise Parrots were observed along the northern edge of Thurumbidgee Lagoon in February 2015 and it is probable that this species feeds on the seeds of grasses and shrubs in open habitats within and close to the site's remnant woodland. This species also has the potential to nest in tree hollows within remnant woodland that will be retained on the subject site or in River Red Gum woodland along the banks of Thurumbidgee Lagoon.

Although Superb Parrots, Swift Parrots and Turquoise Parrots have the ability to fly across open paddocks, they are more likely to move through woodland corridors around the proposed development area rather than through it. Therefore, the status of threatened woodland bird species and their habitats would not be impacted by the proposed operation of the solar farm. Therefore, the life-cycles of these species are unlikely to be significantly impacted to the extent that viable local populations would be placed at risk of extinction.

Major Mitchell's Cockatoo and Little Lorikeet

There are two Major Mitchell's Cockatoo records and three Little Lorikeet records from within the locality. Both species are likely to be vagrants to the locality.

Major Mitchell's Cockatoo inhabits the arid and semi-arid regions of Australia, except the north-east. Major Mitchell's Cockatoos that have been recorded in the locality are likely to be part of a nomadic population that wanders widely throughout arid and semi-arid regions. In south-eastern Australia it is restricted mainly to sparsely timbered grasslands, Pine-Buloke

and Belah woodlands, tall old mallee with suitable nest hollows, and riverine woodlands of Black Box and Red Gum.

Local records of the Little Lorikeet are likely to be of members of a viable population that is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs.

Both species have the potential to nest in tree hollows within remnant woodland that will be retained on the subject site or in River Red Gum Forest along the banks of Thurumbidgee Lagoon and may move through or low over open areas of the subject site where the solar farm is planned to be located. There is a potential for individuals to collide with heliostats and receiver towers on the subject site, experience solar flux burns and predation from raptors that are attracted to the site by aggregations of other potential prey items (e.g. insect-feeding birds). However, Little Lorikeets and Major Mitchell's Cockatoos that may occur on the subject from time to time are likely to be a negligible proportion of the locally viable population and are only likely to occur on the site as occasional vagrants. Therefore, the life-cycles of these two species are unlikely to be significantly impacted to the extent that viable local populations would be placed at risk of extinction.

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

Not applicable. Each parrot species is identified as a threatened species rather than as an endangered population.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. Each parrot species is identified as a threatened species rather than as an endangered or critically endangered ecological community.

(d) In relation to a habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

- (i) The proposed development is a 30 MW concentrated solar thermal (SCT) plant with thermal energy storage, made up of 89 modules, with each module consisting of a heliostat field and a 27 metre high receiving tower. The heliostats would be 2.2 metres high, located 30 to 100 metres from the receiving tower. A solar tracking system would drive the heliostats to beam solar energy to the receiving towers during daylight hours. The receiving towers would be lattice structures approximately 25 metres high with a 2 metre high receiving device mounted at the top. The proposed development footprint is at least 100 ha in area.

Solar flux levels above 50kW/m² (approximately 50 times the brightness of the sun) and temperatures above 450°C poses an elevated risk to avifauna. Flux Modelling for Jemalong predicts that the distance from the receiver at which the maximum flux drops below 50kW/m² occurs between the 14 m and 16 m flux planes. However, over the vast majority of the area at the 12 and 14 m flux planes falls below the threshold. The peak flux at 14m occurs in a very small area circled in the corner of the flux plane. Overall, the High Flux Zone for a receiving tower occupies a relatively small area, ranging from 11.2 m² (0.4% of bounding area) when looking east to 52.8 m² (2.8% of bounding box area) when looking north. The High Flux Zone is predicted to be 66.4 m² when viewed from above (i.e. aerially), representing 0.9% of the bounding box area. There would be 89 receiving towers and receivers at the facility.

The receiver at the top of the tower and the pipes external to the receiver will have elevated temperatures that are likely to be fatal to birds. The front of the receiver tubes and the upper supporting structure are expected to reach temperatures in excess of 450°C, but these high temperatures would dissipate before they reach the tower structure.

- (ii) No threatened parrot habitat would become fragmented or isolated as a result of the proposed operation of the solar farm
- (iii) Although threatened parrot species have the ability to fly across open paddocks, they are more likely to move through woodland corridors around the proposed development area rather than through it.

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

No critical habitats for threatened parrot species have been listed for the locality under the schedules of the TSC Act.

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

Major Mitchell's Cockatoo

Priority actions proposed by OEH for the recovery of the Major Mitchell's Cockatoo in NSW are:

- ❑ Manage grazing in feeding areas to prevent loss of food resources.
- ❑ Fence areas of habitat, exclude stock and control rabbits to assist regeneration of trees, shrubs and native grasses.
- ❑ Protect existing and future hollow-bearing trees for nest sites.
- ❑ Monitor known nesting sites to deter poachers.

The proposed operation of the solar farm is consistent with these priority actions.

Little Lorikeet

Priority actions proposed by OEH for the recovery of the Little Lorikeet in NSW are:

- ❑ Retain large old trees, especially those that are hollow-bearing
- ❑ Ensure recruitment of trees into the mature age class so that there is not a lag period of decades between the death of old trees and hollow formation in younger trees.
- ❑ Protect large flowering *Eucalyptus* trees throughout the habitats frequented by this species. Manage remnant woodlands and forest for recovery of old-growth characteristics.
- ❑ Where natural tree recruitment is inadequate, replant local species to maintain foraging habitat and breeding sites.
- ❑ Reduce the abundance of feral Honeybees and limit the exploitation of nectar by domestic bees where resources are spatially or temporally sparse (e.g. in years of drought).
- ❑ Document nest sites and ensure their protection.

The proposed operation of the solar farm is consistent with these priority actions.

Swift Parrot

Priority actions proposed by OEH for the recovery of the Swift Parrot in NSW are:

- ❑ Reduce collisions in areas where Swift Parrots are foraging by closing window blinds or letting windows get dirty. Alternatively hang wind chimes, mobiles etc in front of windows. Hang strips of fabric across wire mesh fences.
- ❑ Retain stands of winter-flowering feed-trees, particularly large mature individuals.
- ❑ Revegetate with winter-flowering tree species where appropriate.
- ❑ Participate in biannual surveys to locate the winter foraging areas for this species.

The proposed operation of the solar farm is consistent with these priority actions.

Turquoise Parrot

Priority actions proposed by OEH for the recovery of the Turquoise Parrot in NSW are:

- ❑ Undertake fox and feral cat control programs in key habitat areas.
- ❑ Retain areas of open woodland with grassy under-storey and adjoining grassland.
- ❑ Protect hollow-bearing trees for nest sites. Younger mature trees should also be retained to provide replacements for the older trees when they eventually die and fall over.
- ❑ Protect sites where Turquoise Parrots forage and nest from heavy, prolonged grazing.
- ❑ Report suspected illegal bird trapping, egg collection or sales to NPWS.

The proposed operation of the solar farm is consistent with these priority actions.

Superb Parrot

Priority actions proposed by OEH for the recovery of the Superb Parrot in NSW are:

- ❑ Retain and protect hollow-bearing trees.
- ❑ Retain and protect woodland remnants.
- ❑ Cover grain trucks and check all openings are properly sealed.
- ❑ Report grain spills to local authorities so they can be removed.
- ❑ Report suspected illegal bird trapping, egg collection or sales to NPWS.
- ❑ Remove feral bee colonies from hollows in Superb Parrot habitat, or report them to NPWS officers.

The proposed operation of the solar farm is consistent with these priority actions.

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

Major Mitchell's Cockatoo

Major Mitchell's Cockatoo depends on tree hollows because it cannot excavate a nest. The widespread fragmentation and loss of woodland and Big Mallee and Chenopod Mallee communities has led to a sharp decline in the number of suitable hollows. Competition with other hollow-dependent animals, including feral Honey Bees, could also limit the number of hollows available to Major Mitchell's Cockatoos.

Because Belah and Pine–Buloke Woodlands are extremely sensitive to fire, they could be eliminated by a single fire if subsequent grazing pressure is high, reducing the area to a grassland with almost no tree regeneration.

The manipulation of the flood regimes has resulted in less frequent flooding of areas, which has in turn resulted in a lack of regeneration of the key riverine woodland species Black Box *Eucalyptus largiflorens* and River Red Gum *Eucalyptus camaldulensis*.

Major Mitchell's Cockatoos are very long lived (up to 80 years in captivity), so a decline in their abundance in the wild might not become apparent for some time. In the absence of significant recruitment, the risk of uncontrollable decline might thus be greater than is thought.

Illegal trapping and collection of nestlings is a contributing factor in the species' decline in Western Australia, and this may also be true for Victoria and NSW.

Major Mitchell's Cockatoo probably needs a more varied diet than other cockatoos. In south-eastern Australia this restricts the birds largely to native vegetation or the boundaries of cropped land. They are relatively poor fliers and appear to avoid taking long flights over open treeless areas. This might have contributed to their decline in agricultural areas. Because Major Mitchell's Cockatoos are not fast fliers and often feed on the ground, they can be killed

by vehicle collision, particularly in summer when grain spills occur along roads. There is also a risk of predation by Red Foxes *Canis vulpes* and Cats *Felis catus*.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Little Lorikeet

Given that large old *Eucalyptus* trees on fertile soils produce more nectar, the extensive clearing of woodlands for agriculture has significantly decreased food for the lorikeet, thus reducing survival and reproduction. Small scale clearing, such as during roadworks and fence construction, continues to destroy habitat and it is likely to be decades before revegetated areas provide adequate foraging sites.

The loss of old hollow bearing trees has reduced nest sites, and increased competition with other native and exotic species that need large hollows with small entrances to avoid predation. Felling of hollow trees for firewood collection or other human demands increases this competition.

Competition with the introduced Honeybee for both nectar and hollows exacerbates these resource limitations.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Swift Parrot

On the mainland, most of the best-quality stands of favoured food tree species have been cleared for agriculture and many of those remaining have been heavily cut-over to produce poles for firewood. The resulting immature stands may be poorer and less reliable sources of nectar.

Some Swift Parrots are also taken illegally for the commercial bird trade and, in recent years, a number of trappers have been prosecuted in NSW.

Other less well understood potential threats include competition for food with large, aggressive nectarivorous honeyeaters and the introduced Bumblebee (*Bombus terrestris*), and for nest hollows with the Common Starling (*Sturnus vulgaris*) which may be exacerbated by forest fragmentation.

High mortality also occurs through collisions with windows, wire netting, fences and vehicles. Wind energy turbines in south-eastern Australia are probably not a serious threat. Another potential threat is Psittacine Beak and Feather Disease.

There is a potential for Swift Parrot flocks to collide with perimeter fencing, heliostats and receiver towers on the subject site, experience solar flux burns and predation from raptors that are attracted to the site by aggregations of other potential prey items (e.g. insect-feeding birds). However, they are likely to avoid flying over the proposed development area in favour of moving through and foraging in woodland remnant corridors that would not be impacted on by the operation of the solar farm

Turquoise Parrot

Threats to the status of the Turquoise Parrot in NSW include:

- ❑ Loss of habitat through clearing, intensive logging, burning and grazing;
- ❑ destruction of sites containing hollows which may be used for nesting; and
- ❑ inappropriate fire regimes which remove nesting and feeding resources.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Superb Parrot

Threats to the status of Superb Parrots in NSW include:

- ❑ removal of hollow bearing trees;
- ❑ clearing of woodland remnants;
- ❑ poor regeneration of nesting trees and food resources;
- ❑ feeding on grain spills and subsequently being struck by vehicles;
- ❑ loss of hollows to feral bees and native and exotic hollow-nesting birds; and
- ❑ illegal trapping which can also result in the destruction of hollows.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

3. CONCLUSION

The proposed operation of the solar farm would not significantly impact on the status of the Major Mitchell's Cockatoo, Little Lorikeet, Superb Parrot, Swift Parrot, Turquoise Parrot or their habitats in NSW. Therefore, a Species Impact Statement is NOT required for these species.

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OTHER WOODLAND BIRDS

1. SPECIES PROFILES

Bush Stone-curlew (*Burhinus grallarius*)

The Bush Stone-curlew has been recorded throughout mainland Australia except for the most arid parts (Blakers *et al.* 1984; Marchant & Higgins 1993). The current Australian population is estimated to be 15,000 individuals (Watkins 1993).

Bush Stone-curlews require sparsely grassed, lightly timbered, open forest or woodland. In southern Australia, they persist most often where there is a well-structured litter layer and fallen timber debris (Blakers *et al.* 1984, Marchant & Higgins 1993; Johnson & Baker-Gabb 1994), but in parts of northern Australia, they seem to persist where the ground cover is more open (A. Appleman in Garnett & Crowley 2000). They are thought to be sedentary, but abundance in central Australia appears to vary with rainfall. They lay one or two eggs on the ground in open areas, usually well away from trees (Johnson & Baker-Gabb 1994), and feed on a range of invertebrates and small vertebrates, as well as seeds and shoots (Marchant & Higgins 1993).

The rarity and continuing decline of Bush Stone-curlews in the southern part of the species' range has been attributed to predation by foxes, habitat clearance for agriculture, habitat degradation by pastoralism, and removal of leaf litter and fallen timber debris from habitat remnants (Johnson & Baker-Gabb 1994). The species was formerly hunted legally, and continues to be so illegally (Marchant & Higgins 1993).

Brown Treecreeper (*Climacteris picumnus victoriae*)

The Brown Treecreeper is a medium-sized insectivorous bird that occupies eucalypt woodlands, particularly open woodland that lacks a dense understorey (Blakers *et al.* 1984). It is sedentary and nests in tree hollows within permanent territories, breeding in pairs or communally in small groups (Noske 1991). Birds forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae (Noske 1979). Maron & Lill (2005) concluded that Brown Treecreepers prefer foraging on fallen timber that is close to the base of standing trees. Antos *et al.* (2008) found that Brown Treecreepers were more abundant in grassy woodland habitat that had native grass cover and a low incidence of exotic grasses and weeds.

Doer *et al.* (2010 & 2011) indicate that Brown Treecreepers disperse through areas where there are scattered trees, possibly in preference to more densely vegetated corridors. However, Doerr *et al.* (2009, 2010 & 2011) indicate that narrow roadside woodland corridors are also important for dispersal.

The Brown Treecreeper is a co-operative breeder. Larger groups and territories with lower densities of shrub, moderate levels of ground cover, and greater amounts of foraging substrate produced more fledglings, whereas territories with greater invertebrate biomass produced more independent young (Doerr *et al.* 2006).

Bennett *et al.* (2013) found that Brown Treecreepers reintroduced into restored habitat areas chose sites with sparse ground cover because this allowed better access to food and better

vigilance for predators. The addition of coarse woody debris benefited Brown Treecreepers through increasing the probability of foraging on a log or on the ground. However, the introduction of nest boxes did not significantly influence the behaviour or substrate use of Brown Treecreepers.

The overall distribution of the Brown Treecreeper has not changed, but it is now extinct in parts of its range. Declines in populations have been recorded from the Cumberland Plain (Hoskin 1991, Keast 1995, Egan *et al.* 1997), the New England Tablelands (Barrett *et al.* 1994), the Inverell district (Baldwin 1975), from Munghorn Gap Nature Reserve near Mudgee (Scientific Committee 2001a), and from travelling stock routes in the Parkes district (N. Schrader in Scientific Committee 2001a). Reid (1999) identified the Brown Treecreeper as a 'decliner' in a review of bird species' status in the NSW sheep-wheatbelt.

Brown Treecreepers are threatened by clearance and the fragmentation of the woodland habitat. Increased isolation decreases treecreeper vagility and increases the vulnerability of populations to extinction as a result of stochastic events (Scientific Committee 2001e). This species appears unable to maintain viable populations in remnants less than 200 ha and its abundance decreases as remnant size decreases (Barrett *et al.* 1994). Fragmentation also leads to a skewed sex ratio in Brown Treecreeper populations because female birds are unable to disperse to isolated remnants, increasing the chance of local extinctions (Walters *et al.* 1999).

Habitat degradation, including loss of hollow-bearing trees, threatens Brown Treecreeper populations (Scientific Committee 2001a). Grazing by livestock in woodland areas leads to a decrease in the diversity of ground-dwelling invertebrates (Bronham *et al.* 1999), thus decreasing the availability of food for the birds. In addition, Brown Treecreepers are likely to be threatened by such factors as increased competition with aggressive honeyeater species and increased levels of nest predation that are a consequence of fragmentation of habitat (Major *et al.* 1998).

Speckled Warbler (*Chthonicola sagittata*)

The Speckled Warbler is distributed from south-eastern Queensland, through central and eastern NSW to Victoria. In NSW, Speckled Warblers occupy eucalypt and cypress woodlands on the slopes west of the Great Dividing Range, with an extension of range into the cypress woodlands of the northern Riverina. Populations also occur in drier coastal areas such as the Cumberland Plain, Western Sydney and the Hunter and Snowy River valleys (Blakers *et al.* 1984, Schodde & Mason 1999).

Speckled Warblers inhabit woodlands with a grassy understorey, often on ridges or gullies. The species is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. They forage on the ground and in the understorey for arthropods and seeds (Ford *et al.* 1986). Home ranges vary from 6-12 hectares.

The Speckled Warbler has declined in numbers from large parts of its range. Declines have been reported from the Cumberland Plain (Hoskin 1991; Keast 1995; Egan *et al.* 1997), the New England Tableland (Barrett *et al.* 1994), and from around Parkes (N. Schrader, unpubl.). Fisher (1997) predicted Speckled Warblers would become extinct in the Bathurst area if current land management practices were not reversed. Further, Reid (1999) identified the species as a 'decliner' in a review of bird status in the NSW sheep-wheatbelt.

The Speckled Warbler is threatened by clearance and fragmentation of habitat including removal of dead timber. Barrett *et al.* (1994) found that the species decreased in abundance as woodland area decreased, and it appears to be extinct in districts where no fragments larger than 100ha remain. Isolation of Speckled Warbler populations in small remnants increases their vulnerability to local extinction as a result of stochastic events and decreases their genetic viability in the long term. Low population densities and relatively large home range requirements also would exacerbate their vulnerability to habitat loss.

The preferred foraging habitat of Speckled Warbler is areas with a combination of open grassy patches, leaf litter and shrub cover. This habitat is susceptible to degradation by stock and weed invasion. Nesting on the ground also makes them vulnerable to predation from exotic mammalian predators such as foxes and cats.

Regent Honeyeater (*Anthochaera phrygia*)

The Regent Honeyeater previously occurred from south-east South Australia to south-east Queensland (Anon. 2003). The species is now absent from South Australia, its distribution in Victoria has contracted to the north-east (Chiltern) where it is considered almost extinct (Olsen *et al.* 2005), and it is now rare and sporadic in extreme south-east Queensland. Within NSW, breeding sub-populations are fragmented and now occur mainly around the Capertee Valley in central-eastern NSW and the Bundarra-Barraba region in northern inland NSW. Minor and sporadic breeding occurs in other areas such as Warrumbungle National Park, Pilliga forests, Mudgee-Wollar region, and the Hunter and Clarence Valleys.

The Regent Honeyeater inhabits eucalypt open forests and woodlands, predominantly box-ironbark types, but also Spotted Gum and Swamp Mahogany on the coast. The species also inhabits River She-oak gallery forest with *Amyema cambagei* (Needle-leaf Mistletoe).

The Regent Honeyeater builds a cup-shaped nest of fibres located in forks in live eucalypt (including *Angophora*) or she-oak canopy. A clutch of two or three eggs is laid from late winter to early summer, with multiple attempts per season. The incubation period is 14 days, nestling period 16 days and post-fledging dependence period is three to four weeks. The species experiences a high rate of breeding failure, which is typical of open-nesting passerines in woodland, mainly through nest predation (e.g. by the Pied Currawong, *Strepera graculina*). Individuals may breed in more than one location within a year, or the species may not breed at all in some locations in some years. Generation length (IUCN 2008) is estimated at five years (Garnett & Crowley 2000).

The Regent Honeyeater mostly feeds on nectar from flowering eucalypts, especially boxes and ironbarks, and from *Amyema cambagei*. They also feed on the sugary exudates of insects (e.g. lerps) which become an important part of their diet when breeding.

Over the last decade, the Regent Honeyeater has undergone a population reduction and continuing decline, with the apparent loss of some of its minor breeding populations (e.g. Warrumbungle National Park, Pilliga forests), as well as declines at its two major breeding sites; Capertee Valley and Bundarra-Barraba. In 1997 the global population of Regent Honeyeaters was estimated as 1 500 mature birds, with 1 000 shared between the Capertee Valley and Bundarra-Barraba breeding sites; however numbers have since declined (Garnett & Crowley 2000). The Capertee Valley population declined from around 140 birds in spring

2005 to 40 birds in spring 2006 (Regent Honeyeater Recovery Team data; NSW Field Ornithologists Club data) and in 2007, no breeding was detected (D. Geering unpubl data; C. Proberts pers. comm. June 2008; S. Debus pers. comm. 2009). In autumn 2008, about 40 birds reappeared in the Capertee Valley and persisted until August (D. Geering pers. comm.). The apparent decline in the Capertee Valley, from hundreds in the mid 1990s to tens in 2008, represents a decline in index of abundance of more than 80% in three generations (15 years) (S. Debus 2008), although the influence of greater dispersal due to failed eucalypt flowering combined with variable survey effort may have contributed to this apparent decline (D. Geering *in litt.* 2010). In the Bundarra-Barraba area, numbers have apparently declined from around 100 in the 1990s, to 50 birds in subsequent breeding seasons, and about 30 birds in recent years (Williams undated Bundarra-Barraba Ops Group data). In 2007 there was no eucalypt flowering and no Regent Honeyeaters could be found in the Bundarra-Barraba region and northwards to Inverell-Ashford (S. Debus pers. comm. 2009).

Since 2000, only very small numbers (fewer than 10 birds) of Regent Honeyeaters have been reported for each of the minor Regent Honeyeater sites in NSW, apart from the lower Hunter and Central Coast, where tens of birds are still sometimes reported. Some pairs bred in the lower Hunter Valley (Cessnock area). In spring-summer 2007 (NSW Field Ornithologists Club data; A. Morris pers. comm. July 2008) and in August 2008 there were five to 10 birds on the Central Coast (A. Morris pers. comm. August 2008).

Populations of Regent Honeyeaters at particular locations fluctuate greatly between years and sites, according to seasonal conditions (Garnett & Crowley 2000). In one part of the major Bundarra-Barraba breeding area, this fluctuation has been more than tenfold over the last few years, from around 50 birds breeding in good years to no birds found in poor years (Williams undated Barraba Ops Group data). Similar fluctuations occur in the other key breeding population (Capertee), from around 100 birds in good years to fewer than 10 found in poor years. It is estimated that the NSW population of Regent Honeyeaters may now be fewer than 250 mature individuals.

The Regent Honeyeater's habitat is severely fragmented. However, the species is capable of dispersing more than 530 km (based on sightings of colour-banded individuals at known breeding areas, Geering 2004; 2006) and can therefore move between remnants. A major current threat to the species is the loss or failure (e.g. non-flowering in particular years) of key sites, or 'stepping-stones' in the chain of productive habitat in the honeyeater's annual cycle of movement (Geering 2004; 2006). Different sites are used by the birds in different years, presumably depending on food availability at favoured sites. The location of these key sites is poorly known. 'Clearing of native vegetation' is listed as a Key Threatening Process under the *Threatened Species Conservation Act* 1995. Droughts, and consequent failure of the Regent Honeyeaters food resources (i.e. flowering eucalypts), are likely to become more frequent with climate change.

Pied Honeyeater (*Certhionyx variegatus*)

In the early 1900s the Pied Honeyeater was "widely distributed, principally over the southern half of the continent" (North, 1909), with occurrences primarily across central and western NSW, the arid interior and the eastern parts of South Australia.

The Pied Honeyeater is found principally in a band below approximately 18 °S which extends roughly from central Queensland, central NSW and central Victoria in the east and across to the Western Australian coastline.

The species is found in the arid and semi-arid zones, on the sand hills of inland plains, inland ranges, granite outcrops (Higgins *et al.* 2001) and also on the coastal sand hills of Western Australia (Carter 1902b; North 1909). It frequents shrublands and woodlands with the former dominated by emu bush *Eremophila* spp. and grevilleas, (predominantly mulga) (Higgins *et al.* 2001). Habitat may include a scattering of river red gum *Eucalyptus camaldulensis* along watercourses and *Casuarina Myoporum* along dry watercourses and dry salt lakes (Keast 1968).

Pied Honeyeaters also habituate spinifex-dominated grasslands within scattered areas of mulga, *Casuarina* and bloodwood (*Corymbia terminalis*) (Higgins *et al.* 2001, Keast 1968).

Widely considered as nomadic and categorized by Keast (1968) as a 'desert nomad', the Pied Honeyeater has more recently been found to be both sedentary–resident and irruptive (Higgins *et al.* 2001), turning up occasionally in numbers far outside its "normal" range in correlation with heavy rains following drought periods (Burbridge & Fuller 2007).

Movements are poorly understood with no apparent pattern to occurrence or numbers in an area and limited knowledge of actual movements. Occurrences may coincide with the flowering of the emu-bush *Eremophila* (Keast 1968; Shelly *et al.* 2008) and perhaps the need to secure minimal breeding requirements via an abundance of insects (Keast 1968). Migration and seasonal movements occur (Birds Australia 2005a, Higgins *et al.* 2001, Keast 1968), particularly in coastal north-western Australia (North 1909). "The Pied Honeyeater is one of the commonest winter visitors, occurring in great numbers immediately after the first heavy rain" (Carter 1902). There are some instances of residency (Birds Australia, 2005b, Higgins *et al.* 2001), while occurrence has been seen to be irregular at the periphery of its range (Keast 1968, North 1909).

It appears not to need free surface water; its distribution within the landscape, less consistent along gradients in relation to distance from water (Schneider & Griesser 2009).

The Pied Honeyeater feeds primarily on nectar, but also eats insects, fruit and seeds. It utilizes its long bill to explore flowers and foliage of trees and shrubs, especially Emu bush (e.g. *Eremophila longifolia*, *E. sturtii*) and a variety of eucalypts (e.g. *Eucalyptus largiflorens*, *E. ochrophloia*) and grevilleas (Higgins *et al.* 2001; MacGillivray 1910; Shelly *et al.* 2008). It has been observed feeding in lignum (*Muehlenbeckia cunninghamii*), flowering turpentine and tobacco-bush (*Nicotiana glauca*) (MacGillivray 1910). It also feeds on the seeds of harlequin fuchsia- bush (*Eremophila duttonii*) and turpentine (*Eremophila sturtii*) (Shelly *et al.* 2008). Stomach content analysis has revealed "grape-like" seeds, berries, grit and insects and larvae (e.g. *Coleoptera*, *Lepidoptera*) (Lea & Gray 1936).

Threats to the status of this species in NSW include:

- ❑ The clearing of nectar-producing shrubs (such as *Eremophila* and *Grevillea* spp.), which reduces food supplies and interrupts broadscale nomadic movements.
- ❑ Grazing which has a similar but less immediate impact compared to clearing, although many of the preferred food shrubs appear immune to grazing effects.

Painted Honeyeater (*Grantiella picta*)

The Painted Honeyeater is sparsely distributed from southern Victoria and south-eastern South Australia to far northern Queensland and eastern Northern Territory. The greatest concentrations, and almost all breeding, occur on the inland slopes of the Great Dividing Range in Victoria, New South Wales and Queensland, roughly south of 26°S (Blakers *et al.* 1984). Emison *et al.* (1987) reported Painted Honeyeaters in forest and woodlands of the northern foothills of the Great Dividing Range, in the Upper Murray Valley, and occasionally in Black Box *Eucalyptus largiflorens* woodlands along the Murray River. Cooper & McAllan (1995) stated that the Painted Honeyeater has a scattered distribution over most of the central sector of NSW. In winter, much of the southern population migrates northwards, mostly north of about 26°S (Blakers *et al.* 1984).

Cooper (1989) described the Painted Honeyeater as present in low numbers in NSW. Morris & Burton (1995) noted that there were fewer Painted Honeyeater records than normal in 1993.

The Painted Honeyeater is arboreal, foraging on mistletoes, particularly *Amyema* spp., mainly in upper canopies of trees. It feeds almost exclusively on mistletoe *Amyema* spp. berries (Blakers *et al.* 1984; Schodde & Tidemann 1986), but will also eat nectar from mistletoe flowers, as well as insects (Chisholm 1936; Frith 1969; Blakers *et al.* 1984; Longmore 1991). It is a disseminator of mistletoe seed (Reid 1986), although Liddy (1983) considered this not to be important due to its rarity.

The usual breeding period for the Painted Honeyeater in NSW is between November and February. The nest is a flimsy cup of plant material and spiders' webs in foliage, 3-20 m from the ground. Both male and female build the nest, and both incubate the eggs, changing over within hourly intervals (Whitmore and Eller 1983; Schodde and Tidemann 1986). Both parents feed the young, mostly on insects and mistletoe berries (Schodde and Tidemann 1986). The male bird defends the territory in a spectacular manner, flying high over the canopy and calling constantly (Eddy 1961).

Outside the breeding season, the species is usually seen in pairs, but sometimes in small flocks (Blakers *et al.* 1984). The ecology of the species in the non-breeding season is virtually unknown, but movement seems to be influenced by rainfall and fruiting of mistletoes (Pizzey and Knight 1997). The northward shift in the population begins after April and birds return by December to breed (Garnett 1993).

For the Painted Honeyeater, a mobile species that uses resources in different and widely distributed locations, the major causes of its decline are thought to be reduction in total area of habitat, selective loss of important habitats and isolation of fragmented remnant habitats (Bennett 1993). In central NSW, widespread clearing of habitat such as Boree is said to have reduced the numbers of the species (Cooper & McAllan 1995).

Black-chinned Honeyeater (*Melithreptus gularis gularis*)

Black-chinned Honeyeaters occupy the dry eucalypt woodland within an annual range of 400-700 mm, particularly associations containing ironbark and box (Blakers *et al.* 1984; Emison *et al.* 1987; Higgins *et al.* 2001). There they feed on insects, nectar and lerp (Blakers *et al.* 1984; Higgins *et al.* 2001) and build suspended nests in which two eggs are

laid (Beruldsen 2003; Higgins *et al.* 2001). While they do not occur in patches of less than 200 ha (NSW Scientific Committee 2001b), they avoid patches that are embedded in plantations (Loyn *et al.* 2010).

Most honeyeaters are highly mobile and it is assumed that the eastern birds form one subpopulation, but it is suspected that the birds in the Mt Lofty Ranges have long been isolated (Schodde & Mason 1999) and it is possible that birds in fragments elsewhere in the species' range are also now separated from larger populations in more continuous habitat (Scientific Committee 2001b).

The Black-chinned Honeyeater is regarded as a declining species in western NSW (Smith *et al.* 1995) and in the wheat-sheep belt where it is apparently absent from large areas that would once have contained suitable habitat (Reid 1999; Traill & Duncan 2000; Montague-Drake 2009). This is most likely due to the clearance and fragmentation of woodland habitat (Garnett & Crowley 2000; Ford 2011). Birds in fragments can suffer such high nest predation that they produce too few recruits to replace adult mortality (Ford *et al.* 2009) and are subject to competition with Noisy Miners (*Manorina melanocephala*) (Maron & Lill 2005). These pressures may be compounded by a reliance on what is becoming a depauperate food base (Watson 2011). Most threats are greater at habitat edges so are exacerbated by fragmentation. However, Black-chinned Honeyeaters also use isolated paddock trees, themselves a diminishing resource (Gibbons & Boak 2002).

Grey-crowned Babbler (*Pomatostomus temporalis temporalis*)

Grey-crowned Babblers inhabit woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. The species builds conspicuous dome-shaped nests and breeds co-operatively in sedentary family groups of 2-13 birds (Davidson & Robinson 1992). They are insectivorous and forage in leaf litter and on bark of trees.

The species is extinct in the Orange area (Heron 1973) and possibly also from around Bathurst. Recent surveys show a decline in the number of family groups that remain in the southern portion of its range, such that approximately five groups remain in the Boorowa Shire, less than 10 around Wagga Wagga, and less than 30 groups in the shires of Young, Junee and Harden. A survey of 96 woodland sites in the Holbrook Shire revealed only four groups. Furthermore, the species has disappeared from the Shires of Gundagai, Gunning, Yass and Yarrowlumla (Scientific Committee 2001c).

There are probably no Grey-crowned Babblers left on the New England Tableland (H. Ford in Scientific Committee 2001c) and they are now very uncommon in the Hunter Valley with most family groups reduced to two or four members (P. Cowper in Scientific Committee 2001c).

In southern NSW, the size of Grey-crowned Babbler family groups is also reduced. In a three year study of 15 family groups near West Wyalong, the mean number of birds in each group was four (A. Overs in Scientific Committee 2001c). Such groups are much smaller than those recorded further north near Peak Hill, where groups averaged 8-13 birds.

The Grey-crowned Babbler is threatened by clearance and fragmentation of habitat, including removal of dead timber. The species occupies woodlands on fertile soils of plains

and undulating terrain. Therefore, Grey-crowned Babbler habitat has been disproportionately cleared for agriculture. Isolation of populations in scattered remnants is exacerbated by the apparent reluctance of birds to traverse tracts of cleared land. As reduced family groups, these isolated small populations are vulnerable to extinction via stochastic events and to loss of genetic viability in the long-term (Scientific Committee 2001c).

Habitat degradation threatens Grey-crowned Babblers, particularly as a result of weed invasion and grazing by stock. In addition, it is likely that increased abundance of competitors, such as Noisy Miners, and nest predators, including the Pied Currawong and Australian Raven (Major *et al.* 1996) threaten Babbler foraging efficiency and breeding success.

Varied Sittella (*Daphoenositta chrysoptera*)

The Varied Sittella is a small (10 cm) songbird with a sharp, slightly upturned bill, short tail, barred undertail, and yellow eyes and feet. In flight the orange wing-bar and white rump are prominent. In NSW most individuals have a grey head and are streaked with dark brown, but in the extreme north-east they have a white head, and in the extreme south-west a black cap. Varied Sittellas are more active and acrobatic among branches than the larger treecreepers. They fly into the heads of trees, typically working their way down branches and trunk with constant motion.

The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades.

This species inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and acacia woodland.

It feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.

Breeding pairs build a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. Generation length is estimated to be 5 years.

Listed threats to the status of the Varied Sittella and its habitats in NSW include:

- ❑ An apparent decline in the abundance of species due to declining habitat. The sedentary nature of the Varied Sittella makes cleared land a potential barrier to movement.
- ❑ Increased competition for resources and exclusion from remnants as a result of the dominance of Noisy Miners in woodland patches.
- ❑ habitat degradation through small-scale clearing for fencelines and road verges, rural tree decline, loss of paddock trees and connectivity, 'tidying up' on farms, and firewood collection.

Hooded Robin (*Melanodryas cucullata cucullata*)

The Hooded Robin inhabits a wide range of eucalypt woodlands, acacia scrublands and open forests (Blakers *et al.* 1984). In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover (Fitri and Ford 1997). In semi-arid NSW, the species favours open woodlands of Belah, Rosewood, Mulga and Cypress.

Hooded Robins live in small family groups, pairs or trios, and build cup-shaped nests. Home ranges are relatively large, averaging 18 ha in the New England Tablelands (Fitri and Ford 1997). The species feeds on the ground by pouncing on insects, and forage in areas with a mix of bare ground, vegetation cover and ground debris (Blakers *et al.* 1984, H.F. Recher in NSW Scientific Committee 2001a).

The Hooded Robin has declined significantly in range and abundance. Declines have been reported from the following areas: (1) the Cumberland Plain, western Sydney (Hoskin 1991), with Keast (1995) reporting the species as extinct in the area, and Egan *et al.* (1997) recording a local extinction near Scheyville; (2) the New England Tableland (Barrett *et al.* 1994; Fitri and Ford 1997); (3) the Central West around the Orange area (Heron 1973); (4) the area around Parkes, Tottenham and Condoblin (N. Schrader in NSW Scientific Committee 2001d); and (5) from around Inverell (Baldwin 1975). Fisher (1997) predicted that Hooded Robins would decline from the Bathurst area if current land management practices continued. Reid (1999) identified the species as a 'decliner' in a review of bird status in the NSW sheep-wheatbelt.

The Hooded Robin is threatened by clearance and fragmentation of habitat. The species appears to be unable to survive in remnants smaller than 100-200 ha (Egan *et al.* 1997; N. Schrader in NSW Scientific Committee 2001d). Isolation of populations in small remnants increases vulnerability to local extinction as a result of stochastic events and can decrease their genetic viability in the long-term. Low population densities and relatively large home-ranges also exacerbate their vulnerability within highly fragmented and predominantly cleared landscape.

Habitat degradation by stock grazing and weed invasion may reduce food resources for the species (NSW Scientific Committee 2001d). Moreover, the breeding success of Hooded Robins may be reduced by increased populations of nest predators such as Pied Currawongs and Australian Ravens (Major *et al.* 1996).

Scarlet Robin (*Petroica boodang*)

The Scarlet Robin is found from SE Queensland to SE South Australia and also in Tasmania and SW Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter.

The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. The species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps.

Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. It is primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees.

Individuals forage from low perches, fence-posts or on the ground, from where they pounce on small insects and other invertebrates which are taken from the ground, or off tree trunks and logs; they sometimes forage in the shrub or canopy layer.

Scarlet Robin pairs defend a breeding territory and mainly breed between the months of July and January; they may raise two or three broods in each season. This species' nest is an open cup made of plant fibres and cobwebs and is built in the fork of tree usually more than two metres above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub. Eggs are pale greenish-, bluish- or brownish-white, spotted with brown; clutch size ranges from one to four.

Birds usually occur singly or in pairs, occasionally in small family parties; pairs stay together year round. In autumn and winter, the Scarlet Robin joins mixed flocks of other small insectivorous birds which forage through dry forests and woodlands.

Threats to the status of the Scarlet Robin in NSW include:

- ❑ Historical habitat clearing and degradation.
- ❑ Habitat modification due to overgrazing.
- ❑ Reduction of size of remnant patches.
- ❑ Reduction in the structural complexity of habitat, including reductions in canopy cover, shrub cover, ground cover, logs, fallen branches and leaf litter.
- ❑ Reduction of the native ground cover in favour of exotic grasses.
- ❑ Loss of nest sites, food sources and foraging sites, such as standing dead timber, logs and coarse woody debris from depletion by grazing, firewood collection and 'tidying up' of rough pasture.
- ❑ Predation by over-abundant populations of Pied Currawong (*Strepera graculina*) which are supported by planted exotic berry-producing shrubs; this pressure, in addition to that from other native and exotic predators, may be a potentially severe threat to the breeding success of Scarlet Robin populations.
- ❑ Predation by feral cats (*Felis catus*).
- ❑ Robbing of nests and predation of fledglings by rats.
- ❑ Isolation of patches of habitat, particularly where these patches are smaller than 30 ha, and in landscapes where clearing has been heavy or where remnants are surrounded by cropping or stock grazing.
- ❑ Habitat for the Scarlet Robin may become unsuitable if dense regeneration occurs after bushfires or other disturbances.

Flame Robin (*Petroica phoenicea*)

The Flame Robin *Petroica phoenicea* Gould 1837 is a small (14 cm) songbird with dark grey upperparts, orange-red underparts from chin to belly, a small white forehead spot, and white flashes in the wings and tail. The female is brown with white flashes in the wings and tail. The Scarlet Robin *Petroica boodang* is similar, but the male has black upperparts and throat, a red breast, white lower belly, and a large white forehead spot, while the female has a red-tinged breast.

The Flame Robin is found in south-eastern Australia (Queensland border to Tasmania, western Victoria and south-east South Australia). In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter 2002). There may be two disjunct breeding populations in NSW on the Northern Tablelands and the Central–Southern Tablelands (inferred from distributional data in Barrett *et al.* 2003 and the NSW Wildlife Atlas).

The Flame Robin forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank. Generation length has been estimated as 5 years (Garnett and Crowley 2000).

In recent decades the Flame Robin is believed to have undergone a moderate reduction in population size in NSW based on comparative evidence from broadscale surveys. It was reported in 42 one-degree grids in NSW during the first national bird atlas in 1977-81 at mostly moderate to high reporting rates (Blakers *et al.* 1984). During the second national bird atlas in 1998-2002 it was recorded in 39 one-degree grids at mostly low reporting rates (Barrett *et al.* 2003). The index of abundance (reporting rate) over the 20 years between the two atlases declined significantly by 56% in NSW and 57% nationally, with no variation between bioregions (Barrett *et al.* 2003, 2007). Assuming a linear decline this is equivalent to a state and national decline of 46% over three generations (15 years) the time frame recommended by IUCN (2008) for estimating population change. The robin was not less likely to be detected in Atlas 2 versus Atlas 1 due to the different survey methods (Barrett *et al.* 2003) and therefore comparison of the two atlases is unlikely to be significantly affected by survey bias.

The Flame Robin's index of abundance (reporting rate) is positively associated with native vegetation cover (Barrett *et al.* 2007). Clearing and degradation of breeding habitat, and degradation of wintering habitat are key threats to the species. For instance, habitat in the sheep-wheat belt is subject to degradation by overgrazing and simplification by the removal of standing dead timber, logs and coarse woody debris. Core breeding bioregions (New England Tableland and South Eastern Highlands) are 53-58% cleared and moderately to highly stressed (landscape stress factor 3-6 out of 6), and a core wintering bioregion (NSW South Western Slopes) is 84% cleared with a stress rating of 5 (Morgan 2000; Barrett *et al.* 2007). 'Clearing of native vegetation' and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes in NSW under the *Threatened Species Conservation Act* 1995. The species suffers a high rate of nest predation by native and exotic predators,

including artificially large populations of Pied Currawong *Strepera graculina* in some areas (Higgins & Peter 2002).

Diamond Firetail (*Stagonopleura guttata*)

The Diamond Firetail is a brightly coloured finch that occupies eucalypt woodlands, forests and mallee where there is a grassy understorey. The species is considered sedentary with some local movements recorded. Firetails build bottle-shaped nests in low trees and bushes, and forage on the ground, largely for grass seeds and other plant material, but also for insects (Blakers *et al.* 1984, Reid 1994).

The Diamond Firetail has disappeared from parts of its former range and has declined in numbers in many areas. Declines have been recorded in the Cumberland Plain, western Sydney (Hoskin 1991, Keast 1995) with a local extinction near Scheyville (Egan *et al.* 1997). On the New England Tableland, declines in populations are apparent (Barrett *et al.* 1994) and the species has become extinct within Imbota Nature Reserve and surrounds (H.A. Ford in NSW Scientific Committee 2001b). Reid (1999) identified the species as a 'decliner' in a review of bird status in the NSW sheep-wheatbelt. Fisher (1997) predicted that Diamond Firetails would significantly decline from the Bathurst District if current trends in land management persisted.

The Diamond Firetail is threatened by clearance and fragmentation of habitat. Isolation and reductions in remnant area inhibit dispersal and increase their vulnerability to local extinction via stochastic events (NSW Scientific Committee 2001f). Small, isolated populations also lose their long-term genetic viability (Barrett *et al.* 1994). Moreover, Diamond Firetail populations appear unable to persist in areas which lack remnants of native vegetation larger than 200 ha (N. Schrader in NSW Scientific Committee 2001f).

Habitat degradation, particularly overgrazing of the grass understorey, threatens the granivorous Diamond Firetail (NSW Scientific Committee 2001b). In addition, an increased abundance of predators such as the Pied Currawong and Australian Raven may increase nest predation in fragmented woodland remnants (Major *et al.* 1996).

2. SEVEN-PART TEST

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

The numbers of BioNet records for each threatened woodland bird species from within the locality (10 km radius of the subject site): seven Bush Stone-curlew records, 129 Brown Treecreeper records, 136 Speckled Warbler records, one Regent Honeyeater record, one Pied Honeyeater record, one Painted Honeyeater record, 11 Black-chinned Honeyeater records, 40 Grey-crowned Babbler records, five Varied Sittella records, 11 Hooded Robin records, three Scarlet Robin records, four Flame Robin records and 28 Diamond Firetail records.

Remnant woodland that would be retained near the northern boundary of the subject site and the River Red Gum Forest along the banks of Thurumbidgee Lagoon are potential habitat areas for threatened woodland birds in the locality. Most threatened woodland bird species

would be unable to disperse over open areas of the subject site to move between remnants and, therefore, would not be impacted by the proposed development.

In contrast, Regent Honeyeaters, Painted Honeyeaters and Pied Honeyeaters are known to move long distances and have the potential to move through the development footprint. Therefore, there is a potential for individuals to collide with perimeter fencing, heliostats and receiver towers on the subject site, experience solar flux burns and predation from raptors that are attracted to the site by aggregations of other potential prey items (e.g. insect-feeding birds). However, these species are likely to be very occasional vagrants to the locality and the woodland on the subject site and in neighbouring areas is marginal habitat. Individuals that may very occasionally be on the subject site would be very negligible proportions of locally viable populations.

Therefore, the life-cycles of threatened woodland bird species are unlikely to be significantly impacted on to the extent that viable local populations are likely to be placed at risk of extinction.

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

Not applicable. Each woodland bird species is identified as a threatened species rather than as an endangered population.

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

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

Not applicable. Each woodland bird species is identified as a threatened species rather than as an endangered or critically endangered ecological community.

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

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

- (i) The proposed development is a 30 MW concentrated solar thermal (SCT) plant with thermal energy storage, made up of 89 modules, with each module consisting of a heliostat field and a 27 metre high receiving tower. The heliostats would be 2.2 metres high, located 30 to 100 metres from the receiving tower. A solar tracking system would**

drive the heliostats to beam solar energy to the receiving towers during daylight hours. The receiving towers would be lattice structures approximately 25 metres high with a 2 metre high receiving device mounted at the top. The proposed development footprint is at least 100 ha in area.

Solar flux levels above 50kW/m² (approximately 50 times the brightness of the sun) and temperatures above 450°C poses an elevated risk to avifauna. Flux Modelling for Jemalong predicts that the distance from the receiver at which the maximum flux drops below 50kW/m² occurs between the 14 m and 16 m flux planes. However, over the vast majority of the area at the 12 and 14 m flux planes falls below the threshold. The peak flux at 14m occurs in a very small area circled in the corner of the flux plane. Overall, the High Flux Zone for a receiving tower occupies a relatively small area, ranging from 11.2 m² (0.4% of bounding area) when looking east to 52.8 m² (2.8% of bounding box area) when looking north. The High Flux Zone is predicted to be 66.4 m² when viewed from above (i.e. aerially), representing 0.9% of the bounding box area. There would be 89 receiving towers and receivers at the facility.

The receiver at the top of the tower and the pipes external to the receiver will have elevated temperatures that are likely to be fatal to birds. The front of the receiver tubes and the upper supporting structure are expected to reach temperatures in excess of 450°C, but these high temperatures would dissipate before they reach the tower structure.

- (ii) No threatened woodland bird habitat would become fragmented or isolated as a result of the proposed operation of the solar farm.
- (iii) Potential nesting habitat for threatened woodland species occurs in woodland areas on the subject site and the River Red Gum Forest along the banks of the Thurumbidgee Lagoon. These habitat areas would be retained and, as a consequence, the proposed operation of the solar farm would not impact on breeding habitat of threatened woodland birds.

The subject site, including the proposed development footprint, is potential dispersal habitat at least three woodland bird species: Regent Honeyeater, Painted Honeyeater and Pied Honeyeater. However, each of these species is likely to be a vagrant to the locality.

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

No critical habitats for threatened woodland bird species have been listed for the locality under the schedules of the TSC Act.

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

Bush Stone-curlew

Priority actions proposed by OEH for the recovery of the Bush Stone-curlew in NSW are:

- ❑ Keep domestic dogs and cats indoors at night. Desex domestic dogs and cats.
- ❑ Undertake fox and feral cat control programs.
- ❑ Assess the appropriateness of dog and cat ownership in new subdivisions.
- ❑ Remove cattle from paddocks containing nesting areas at least during breeding season or while eggs and chicks are in nest.
- ❑ Retain existing vegetation along roadsides, in paddocks and remnant stands of native trees.
- ❑ Retain dead timber on the ground in open woodland areas.
- ❑ Fence off nesting sites.
- ❑ Fence off suitable woodland habitats, particularly those with unimproved pasture and an intact native ground plant layer.
- ❑ Increase the size of existing remnants, planting trees and establishing buffer zones of unimproved uncultivated pasture around woodland remnants.
- ❑ Assess the importance of the site to the species' survival. Include the linkages the site provides for the species between ecological resources across the broader landscape.

The proposed operation of the solar farm is consistent with these priority actions.

Brown Treecreeper

Priority actions proposed by OEH for the recovery of the Brown Treecreeper in NSW are:

- ❑ Modify grazing management practices that will maintain or improve habitat values and still allow some grazing to occur at strategic times of the year.
- ❑ Do not allow further loss of dead standing or fallen timber from firewood collection or on-farm practices such as 'tidying up'; do not allow removal of hollow-bearing dead or living trees and stumps on private and public lands.
- ❑ Fencing of known habitat to protect natural features and to allow natural regeneration.
- ❑ Increase remnant size and connectivity through incentives and OEH threatened species extension services.

The proposed operation of the solar farm is consistent with these priority actions.

Speckled Warbler

Priority actions proposed by OEH for the recovery of the Speckled Warbler in NSW are:

- ❑ Keep domestic dogs and cats indoors at night. Desex domestic dogs and cats. Assess the appropriateness of dog and cat ownership in new subdivisions.
- ❑ Undertake fox and feral cat control programs.
- ❑ OEH should be consulted when planning development to minimise impact on populations.
- ❑ Retain existing vegetation along roadsides, in paddocks and remnant stands of native trees.
- ❑ Retain dead timber on the ground in open woodland areas.
- ❑ Limit firewood collection.
- ❑ Encourage regeneration of habitat by fencing remnant stands.
- ❑ Fence suitable woodland habitats, particularly those with unimproved pasture and an intact native ground plant layer.

- ❑ Increase the size of existing remnants, planting trees and establishing buffer zones of unimproved uncultivated pasture around woodland remnants.
- ❑ Assess the importance of the site to the species' survival. Include the linkages the site provides for the species between ecological resources across the broader landscape.
- ❑ Report any new sightings of the Speckled Warbler to the Office of Environment and Heritage.

The proposed operation of the solar farm is consistent with these priority actions.

Regent Honeyeater

Priority actions proposed by OEH for the recovery of the Regent Honeyeater in NSW are:

- ❑ Maintain a captive population of Regent Honeyeaters.
- ❑ Provide landholders and other community members with information on the ecology and conservation requirements of the Regent Honeyeater. Use incentives on private land to encourage landholders to manage key areas.
- ❑ No loss of mature key nectar tree species. Minimise the removal of mistletoes at key sites.
- ❑ Encourage landholders/agistees to remove stock from sensitive riparian breeding sites.
- ❑ Protect and enhance key breeding and foraging habitats.
- ❑ Encourage natural regeneration and increase the remnant size of known and potential Regent Honeyeater habitats.
- ❑ Continue treeplanting programs at key breeding and foraging locations.
- ❑ No further loss of known woodland and forest habitat throughout the range of the Regent Honeyeater from developments.
- ❑ Conduct research into habitat selection in non-breeding season and long-distance movements.
- ❑ Investigate impacts of interspecific competition for resources and nest predation by native birds.

The proposed operation of the solar farm is consistent with these priority actions.

Pied Honeyeater

Priority actions proposed by OEH for the recovery of the Pied Honeyeater in NSW are:

- ❑ Reduce stock intensity of, or exclude grazing in, some areas to allow regeneration of vegetation for habitat.
- ❑ Retain understorey shrubs and allow them to complete their life cycle (i.e. seed set, germination, establishment, growth to maturity).
- ❑ Prevent clearing of habitat.

The proposed operation of the solar farm is consistent with these priority actions.

Painted Honeyeater

Priority actions proposed by OEH for the recovery of the Painted Honeyeater in NSW are:

- ❑ Manage grazing on sites where Painted Honeyeater habitat occurs.

- ❑ Encourage regeneration of habitat by fencing remnant stands and undertaking new plantings.
- ❑ Protect remnant woodland and open forest throughout the range of the species.
- ❑ Regenerate and replant local flora species to maintain breeding and foraging habitat.
- ❑ Conduct further research to increase understanding of habitat selection and nomadic movements of the Painted Honeyeater.

The proposed operation of the solar farm is consistent with these priority actions.

Black-chinned Honeyeater

Priority actions proposed by OEH for the recovery of the Black-chinned Honeyeater in NSW are:

- ❑ Retain suitable woodland habitats, particularly those with unimproved pasture and an intact native ground plant layer.
- ❑ Increase the size and connectivity of existing remnants, planting trees and establishing buffer zones of unimproved uncultivated pasture around woodland remnants.

The proposed operation of the solar farm is consistent with these priority actions.

Grey-crowned Babbler

Priority actions proposed by OEH for the recovery of the Grey-crowned Babbler in NSW are:

- ❑ Retain existing woodland vegetation.
- ❑ Retain dead timber on the ground in open woodland areas.
- ❑ Encourage regeneration of habitat by fencing remnant stands.
- ❑ Increase the size of existing remnants, planting trees and establishing buffer zones of unimproved uncultivated pasture around woodland remnants.

The proposed operation of the solar farm is consistent with these priority actions.

Varied Sittella, Hooded Robin

Priority actions proposed by OEH for the recovery of the Varied Sittella and Scarlet Robin in NSW are:

- ❑ Retain existing vegetation and remnant stands along roadsides and in paddocks.
- ❑ Increase the size of existing remnants by planting trees and establishing buffer zones.
- ❑ Where remnants have lost connective links, re-establish links by revegetating corridors or stepping stones.
- ❑ Limit firewood collection and retain dead timber in open forest and woodland areas.
- ❑ Encourage regeneration of habitat by fencing remnant stands and managing the intensity and duration of grazing.
- ❑ Control weeds in areas of known habitat.

The proposed operation of the solar farm is consistent with these priority actions.

Scarlet Robin and Flame Robin

Priority actions proposed by OEH for the recovery of the Scarlet Robin and Flame Robin in NSW are:

- ❑ Retain existing forest, woodland and remnant grassland vegetation, including paddock trees.
- ❑ Retain dead timber on the ground in open forest and woodland areas.
- ❑ Enhance potential habitat through regeneration by reducing the intensity and duration of grazing.
- ❑ Fence remnants to protect from long-term, intense grazing.
- ❑ Increase the size of existing remnants, by planting trees and establishing buffer zones of un-modified, uncultivated pasture around woodland remnants.
- ❑ Keep domestic cats indoors at night; desex domestic cats; assess the appropriateness of cat ownership in new subdivisions adjacent to Scarlet Robin habitat.
- ❑ Avoid the use of exotic berry-producing shrubs in landscape and garden plantings in areas adjacent to Scarlet Robin habitats.

The proposed operation of the solar farm is consistent with these priority actions.

Diamond Firetail

Priority actions proposed by OEH for the recovery of the Diamond Firetail in NSW are:

- ❑ Retain dead timber on the ground in open woodland areas.
- ❑ Reduce heavy grazing by domestic stock in areas of known or potential habitat, to enable flowering and subsequent seeding of grasses and forbs that this species requires.
- ❑ Control weeds in areas of known habitat, especially the exotic, winter-fruiting shrubs such as cotoneasters, hawthorns, firethorns and privets that support Pied Currawongs.
- ❑ Retain and protect woodland, open forest, grassland and mallee habitat from clearing, fragmentation and disturbance; areas of 200 hectares or greater within woody vegetation are particularly significant, though this species also uses treeless grasslands in the Southern Tablelands.
- ❑ Expand and reconnect smaller fragments of habitat, by fencing and encouraging natural regeneration or applying revegetation techniques where regeneration fails.
- ❑ Ensure remnant populations remain connected or linked to each other; in cases where remnants have lost connective links, re-establish links by revegetating sites to act as stepping stones for dispersal.

The proposed operation of the solar farm is consistent with these priority actions.

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

Bush Stone-curlew

The rarity and continuing decline of Bush Stone-curlews in the southern part of the species' range has been attributed to predation by foxes, habitat clearance for agriculture, habitat degradation by pastoralism, and removal of leaf litter and fallen timber debris from habitat remnants. The species was formerly hunted legally, and continues to be so illegally. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Brown Treecreeper

Brown Treecreepers are threatened by clearance and the fragmentation of the woodland habitat. Increased isolation decreases treecreeper vagility and increases the vulnerability of populations to extinction as a result of stochastic events. This species appears unable to maintain viable populations in remnants less than 200 ha and its abundance decreases as remnant size decreases. Fragmentation also leads to a skewed sex ratio in Brown Treecreeper populations because female birds are unable to disperse to isolated remnants, increasing the chance of local extinctions.

Habitat degradation, including loss of hollow-bearing trees, threatens Brown Treecreeper populations. Grazing by livestock in woodland areas leads to a decrease in the diversity of ground-dwelling invertebrates, thus decreasing the availability of food for the birds. In addition, Brown Treecreepers are likely to be threatened by such factors as increased competition with aggressive honeyeater species and increased levels of nest predation that are a consequence of fragmentation of habitat.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Speckled Warbler

The Speckled Warbler is threatened by clearance and fragmentation of habitat including removal of dead timber. The species decreases in abundance as woodland area decreases, and it appears to be extinct in districts where no fragments larger than 100ha remain. Isolation of Speckled Warbler populations in small remnants increases their vulnerability to local extinction as a result of stochastic events and decreases their genetic viability in the long term. Low population densities and relatively large home range requirements also would exacerbate their vulnerability to habitat loss.

The preferred foraging habitat of the Speckled Warbler is areas with a combination of open grassy patches, leaf litter and shrub cover. This habitat is susceptible to degradation by stock and weed invasion. Nesting on the ground also makes them vulnerable to predation from exotic mammalian predators such as foxes and cats.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Regent Honeyeater

A major current threat to the Regent Honeyeater is the loss or failure (e.g. non-flowering in particular years) of key sites, or 'stepping-stones' in the chain of productive habitat in the honeyeater's annual cycle of movement. Different sites are used by the birds in different years, presumably depending on food availability at favoured sites. The location of these key sites is poorly known. 'Clearing of native vegetation' is listed as a Key Threatening Process under the *Threatened Species Conservation Act 1995*. Droughts, and consequent failure of the Regent Honeyeaters' food resources (i.e. flowering eucalypts), are likely to become more frequent with climate change. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Pied Honeyeater

Threats to the status of the Pied Honeyeater in NSW include:

- ❑ The clearing of nectar-producing shrubs (such as *Eremophila* and *Grevillea* spp.), which reduces food supplies and interrupts broadscale nomadic movements.
- ❑ Grazing which has a similar but less immediate impact compared to clearing, although many of the preferred food shrubs appear immune to grazing effects.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Painted Honeyeater

The major causes of the decline in the abundance of the Painted Honeyeater are thought to be reduction in total area of habitat, selective loss of important habitats and isolation of fragmented remnant habitats. In central NSW, widespread clearing of habitat such as Boree is said to have reduced the numbers of the species. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Black-chinned Honeyeater

The Black-chinned Honeyeater is regarded as a declining species in western NSW and in the wheat-sheep belt where it is apparently absent from large areas that would once have contained suitable habitat. This is most likely due to the clearance and fragmentation of woodland habitat. Birds in fragments can suffer such high nest predation that they produce too few recruits to replace adult mortality and are subject to competition with Noisy Miners (*Manorina melanocephala*). These pressures may be compounded by a reliance on what is becoming a depauperate food base. Most threats are greater at habitat edges so are exacerbated by fragmentation. However, Black-chinned Honeyeaters also use isolated paddock trees, themselves a diminishing resource. The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Grey-crowned Babbler

The Grey-crowned Babbler is threatened by clearance and fragmentation of habitat, including removal of dead timber. The species occupies woodlands on fertile soils of plains

and undulating terrain. Therefore, Grey-crowned Babbler habitat has been disproportionately cleared for agriculture. Isolation of populations in scattered remnants is exacerbated by the apparent reluctance of birds to traverse tracts of cleared land. As reduced family groups, these isolated small populations are vulnerable to extinction via stochastic events and to loss of genetic viability in the long-term.

Habitat degradation threatens Grey-crowned Babblers, particularly as a result of weed invasion and grazing by stock. In addition, it is likely that increased abundance of competitors, such as Noisy Miners, and nest predators, including the Pied Currawong and Australian Raven threaten Babbler foraging efficiency and breeding success.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Varied Sittella

Listed threats to the Varied Sittella in NSW include:

- ❑ An apparent decline in the abundance of species due to declining habitat. The sedentary nature of the Varied Sittella makes cleared land a potential barrier to movement.
- ❑ Increased competition for resources and exclusion from remnants as a result of the dominance of Noisy Miners in woodland patches.
- ❑ habitat degradation through small-scale clearing for fencelines and road verges, rural tree decline, loss of paddock trees and connectivity, 'tidying up' on farms, and firewood collection.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Hooded Robin

The Hooded Robin is threatened by clearance and fragmentation of habitat. The species appears to be unable to survive in remnants smaller than 100-200 ha. Isolation of populations in small remnants increases vulnerability to local extinction as a result of stochastic events and can decrease their genetic viability in the long-term. Low population densities and relatively large home-ranges also exacerbate their vulnerability within highly fragmented and predominantly cleared landscape.

Habitat degradation by stock grazing and weed invasion may reduce food resources for the species. Moreover, the breeding success of Hooded Robins may be reduced by increased populations of nest predators such as Pied Currawongs and Australian Ravens.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Scarlet Robin

Threats to the status of the Scarlet Robin in NSW include:

- ❑ Historical habitat clearing and degradation.
- ❑ Habitat modification due to overgrazing.
- ❑ Reduction of size of remnant patches.
- ❑ Reduction in the structural complexity of habitat, including reductions in canopy cover, shrub cover, ground cover, logs, fallen branches and leaf litter.
- ❑ Reduction of the native ground cover in favour of exotic grasses.
- ❑ Loss of nest sites, food sources and foraging sites, such as standing dead timber, logs and coarse woody debris from depletion by grazing, firewood collection and 'tidying up' of rough pasture.
- ❑ Predation by over-abundant populations of Pied Currawong (*Strepera graculina*) which are supported by planted exotic berry-producing shrubs; this pressure, in addition to that from other native and exotic predators, may be a potentially severe threat to the breeding success of Scarlet Robin populations.
- ❑ Predation by feral cats (*Felis catus*).
- ❑ Robbing of nests and predation of fledglings by rats.
- ❑ Isolation of patches of habitat, particularly where these patches are smaller than 30 ha, and in landscapes where clearing has been heavy or where remnants are surrounded by cropping or stock grazing.
- ❑ Habitat for the Scarlet Robin may become unsuitable if dense regeneration occurs after bushfires or other disturbances.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Flame Robin

Clearing and degradation of breeding habitat, and degradation of wintering habitat are key threats to the Flame Robin. 'Clearing of native vegetation' and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes in NSW under the *Threatened Species Conservation Act 1995*. The species suffers a high rate of nest predation by native and exotic predators, including artificially large populations of Pied Currawong *Strepera graculina* in some areas (Higgins & Peter 2002). The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

Diamond Firetail

The Diamond Firetail is threatened by clearance and fragmentation of habitat. Isolation and reductions in remnant area inhibit dispersal and increase their vulnerability to local extinction via stochastic events. Small, isolated populations also lose their long-term genetic viability. Moreover, Diamond Firetail populations appear unable to persist in areas which lack remnants of native vegetation larger than 200 ha.

Habitat degradation, particularly overgrazing of the grass understorey, threatens the granivorous Diamond Firetail (NSW Scientific Committee 2001b). In addition, an increased abundance of predators such as the Pied Currawong and Australian Raven may increase nest predation in fragmented woodland remnants.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

3. CONCLUSION

The proposed operation of the solar farm would not significantly impact on the status of the Bush Stone-curlew, Brown Treecreeper (eastern subspecies), Speckled Warbler, Regent Honeyeater, Pied Honeyeater, Painted Honeyeater, Black-chinned Honeyeater (eastern subspecies), Grey-crowned Babbler (eastern subspecies), Varied Sittella, Hooded Robin (south-eastern form), Scarlet Robin, Flame Robin or Diamond Firetail, or their habitats, in NSW. Therefore, a Species Impact Statement is NOT required for these species.

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GRASSLAND AND SHRUBLAND BIRDS

1. SPECIES PROFILES

Brolga (*Grus rubicunda*)

The Brolga is distributed across New Guinea, northern and south-eastern Australia (Blakers *et al.* 1984, Marchant & Higgins 1993). The populations in Victoria and South Australia may now be isolated from the northern populations as there appear to be only scattered birds in the western regions of New South Wales.

The Brolga is omnivorous and utilises a diverse range of food items on a seasonal basis. The main food items taken are vegetable materials, particularly the fleshy tubers of wetland plants, which it obtains by digging and foraging. The residues of grain and potato crops are also taken. Amphibians, sometimes small fish and a wide range of invertebrates are also taken including freshwater molluscs, crustaceans and insects (Marchant & Higgins 1993, White 1983).

During summer and autumn, many birds flock to deep freshwater marshes and permanent open water and adjacent dryland areas. Most of these areas are on private land. These sites provide for the birds' drinking, feeding and roosting requirements. It is possible that young adults form their initial pair bonds at these sites (Arnol *et al.* 1984). Not all Brolgas go to the flocking areas. Some breeding pairs with young remain close to their breeding areas (White 1983).

In late autumn and winter the flocks disperse back to the breeding areas where bonded pairs re-establish substantial territories. Most recorded nest sites are on private land. Pairs are capable of occupying these territories for many breeding seasons as they are long-lived birds (White 1983).

Nests are generally constructed on a slight rise or island in shallow herb-dominated or sedge-dominated freshwater marshes. Nests usually consist of a platform of coarse vegetation. Occasionally eggs are laid on the ground with a few pieces of coarse vegetation placed around them (Campbell 1900, Beruldsen 1980, Marchant & Higgins 1993). Usually two eggs are laid and the parents share in nest building, incubation of the eggs and rearing of the young. The chicks fledge 90-100 days after hatching and remain with the parents until the onset of the next breeding season or for another year if the parents do not re-nest (White 1983, Marchant & Higgins 1993).

Little is known about breeding success. However, Hill (1992) estimates it to be about one chick per nesting attempt. White (1983) suggests that if hatching is successful it is more common for one young to be reared than two. This varies from season to season. Fledging success is unknown; however, losses of immature birds are attributed to predation by the Red Fox *Vulpes vulpes* and entanglement in wire fencing (Arnol *et al.* 1984).

There are no estimates of the size of the Brolga population in NSW, but studies of Victorian birds suggest no recent declines in the adult population. However, while the adult population may appear to be unchanged, it may be ageing as the Brolga is a long-lived bird. With increasing age, the fecundity may be reduced and with no recruitment to the population the numbers may crash when older birds die. Fertility was not considered a limiting factor in the

early 1980s when 82% of eggs collected were fertile (White 1983). In 1980 immature and juvenile birds made up 10% of a flock at Willaura in western Victoria (White 1983): however, few were located during the 1992 survey.

Another impact on recruitment is the modification and disappearance of breeding wetlands. In recent years some wetlands have been restored by landowners and Brolgas have bred on them; however drainage of freshwater wetlands still continues particularly where raised-bed cropping activities are occurring. Grazing of wetlands by stock also reduces vegetation leaving insufficient for nest construction when the wetlands fill (White 1983).

In recent years concern has also been expressed about the subtle influence of salinity on freshwater wetlands (Codd 1992, Kevin 1992) which may contribute to the loss of suitable habitat through secondary salinisation.

In addition there has recently been extensive planting of pine trees and blue gums in some rural areas, including the basalt plains. These plantations may impact on shallow freshwater wetlands in the vicinity by intercepting water that normally would flow into them.

Predation by the Red Fox on eggs and chicks is probably a major cause of nest failure at the present time (D. White *pers. comm.*).

Human activities have also had a direct adverse impact on Brolga populations. In the past, egg losses were due to egg collecting and trampling by cattle, but they do not appear to be a major cause at present. Young birds have become entangled in fencing and may collide with vehicles and farm machinery (White 1983, Arnol *et al.* 1984). Netting fences present barriers to unfledged chicks, which must remain close to their parents. As breeding sites dry out, adults and young must find other sources of food and water, and if young cannot get through fences, they are more susceptible to predation or starvation.

There have been a number of reports of fledged Brolgas colliding with transmission lines (White 1983, Goldstraw & Du Guesclin 1991). If nest sites are in the vicinity of these power lines there is a possibility that these sites will be unsuccessful because of mortality of adults or newly fledged young.

In the past, Brolgas were shot and poisoned to protect grain crops, but reports of these occurrences are now infrequent. Brolgas may also have been indirectly poisoned as a result of baiting programs for other pests, for example cricket baiting programs and use of other agricultural pesticides. Brolgas have also died as a result of illegal bird-poisoning activities when the target species was the Long-billed Corella *Cacatua tenuirostris* (D. Venn *pers. comm.*).

Brolgas were also shot for food last century. Campbell (1900) stated 'its flesh is good for the table' and commented that they were frequently offered for sale in the Melbourne market.

Australian Bustard (*Ardeotis australis*)

The Australian Bustard mainly occurs in inland Australia and is now scarce or absent from southern and south-eastern Australia. In NSW, they are mainly found in the north-west corner and less often recorded in the lower western and central west plains regions.

Occasional vagrants are still seen as far east as the western slopes and Riverine plain. Breeding now only occurs in the north-west region of NSW.

A wide range of open vegetation communities can support populations of the Australian Bustard. These range from tropical to semi-arid and temperate tussock grasslands, open-shrublands and grassy woodlands. In settled areas they visit pasture and crops. Bustards may roost in clumps of trees or on the ground, usually in an elevated position, presumably for protection from predators. Over large areas of inland rural NSW, the original habitat of extensive tussock grasslands with a suite of herbs between the tussocks has been almost entirely converted to dense swards of introduced pasture grasses or crops. Australian Bustards apparently cannot persist in such environments.

The remnant population in Victoria and western NSW is apparently unusual in that it utilises semi-arid heath for much of the year, a relatively dense vegetation formation for bustards. However, they often congregate in recently-burnt heath. In winter, bustards can be found in sheep paddocks, lucerne crops and grain stubble. Lekking takes place in these more open habitats but females probably return to the mallee heath to nest.

Australian Bustards are opportunistic feeders and consume a range of invertebrates, small vertebrates, leaf material, flowers, fruits and seeds. Crickets, grasshoppers, small reptiles and House Mice are common food items (Marchant & Higgins 1993).

Nesting can probably occur at any time when conditions are suitable. Breeding records in the wild in NSW and Victoria are few and cover the period October to April with most in January. No nest is constructed; instead the eggs are laid on bare ground amongst tussocks, often near a bush, but with a clear view all round. Clutch size is one or two and incubation takes 24 days. Males do not breed until 5-7 years old, females can breed at three years of age (Marchant & Higgins 1993) but most may not breed successfully until older. Only females participate in incubation and chick rearing.

Threats to the status of the Australian Bustard in NSW include:

- ❑ Deterioration in the quality of habitat as a result of intensive grazing of livestock, intensive agriculture such as pasture improvement, and clearing of scrub.
- ❑ Increased mortality due to use of firearms for hunting. Although hunted by aborigines (Smyth 1878, Presland 1977, Dawson 1881), the arrival of Europeans with more sophisticated weapons resulted in an increase in hunting pressure on the Australian Bustard which rapidly became a favoured game bird (D'Ewes 1858, Wheelwright 1861, Campbell 1900).
- ❑ An increased mortality rate due to predation by the introduced Red Fox, Cat and domestic and wild Dogs.
- ❑ Widespread use of poisons for rabbit control. From 1880 there were poison carts in every district, sometimes one per grazing property (Kiddle 1961, Stead 1935). Rolls (1969) recounts how bustards died in hundreds in 1882 when phosphorised oats were scattered in the Riverina. The baits may have been eaten directly, or the poison obtained secondarily through mice or insects.

- ❑ Susceptibility to disturbance or predation, particularly during the mating display when birds aggregate and evasive tactics may be less effective. Females guarding chicks are also highly susceptible to predators.

White-fronted Chat (*Epthianura albifrons*)

The White-fronted Chat is an endemic Australian passerine bird, 12 cm in length and weighing approximately 13 g. It has a short slender bill, long spindly legs, a short square-tipped tail and rounded wings. Classified as a honeyeater it is most similar in form to its close relatives, the Orange Chat, Yellow Chat and Crimson Chat from which it is easily distinguished by its black and white colouration. The male's plumage is more striking than the females; juvenile plumage is most similar to the female. A distinctive 'tang, tang' is used as a contact call.

The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas.

It is a gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. It is insectivorous, feeding mainly on flies and beetles caught from or close to the ground.

The White-fronted Chat has been observed breeding from late July through to early March, with 'open-cup' nests built in low vegetation. Nests in the Sydney region have also been seen in low isolated mangroves. Nests are usually built about 23 cm above the ground (but have been found up to 2.5 m above the ground). Two to three eggs are laid in each clutch, and the complete nesting cycle from nest-building to independent young is approximately 50 day. Birds can breed at one year of age and are estimated to live for five years.

Threats to the status of the White-fronted Chat in NSW include:

- ❑ Reduction in habitat size and quality.
- ❑ Human disturbance (particularly in urban areas) and elevated nest-predation levels.
- ❑ Much of their natural habitat is prone to alteration due to modification of river flows and floodplains.
- ❑ Prone to predation from snakes and mammals, particularly Feral Cats, European Red Foxes and rodents, as well as birds, particularly ravens.
- ❑ In coastal areas mangrove encroachment and sea-level rise associated with global warming present an additional future threat to their preferred habitat.

2. SEVEN-PART TEST

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

There is one record of the Australian Bustard occurring in the locality (10 km radius of the subject site), five Brolga records and six White-fronted Chat records.

The subject site is, at most, very marginal habitat for these three species. The Australian Bustard is likely to be a vagrant to the locality and the occasional individual may land or fly over the subject site to forage in cleared areas. The Brolga is only likely to use the subject site and neighbouring areas if they are flooded after heavy rains. The White-fronted Chat may move through grassed areas of the subject site when dispersing to suitable habitat areas on the edges of wetlands.

Therefore, there is a negligible risk of individuals of each of these species being burnt if they fly through High Flux Zones while attempting to land or fly low over the subject site.

However, High Flux Zones and high temperature zones are negligible proportions of the total air-space above the subject site and the numbers of Australian Bustards, Brolgas and White-fronted Chats occurring on or over the site are likely to be small. Potential for mortality or injury to these species on the subject site would be minimised or avoided if the recommendations in Section 5.1 and 5.2 of the present report are implemented.

Therefore, the life-cycles of threatened grassland and shrubland species are unlikely to be significantly impacted to the extent that viable local populations would be placed at risk of extinction.

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

Not applicable. Each grassland and shrubland bird species is identified as a threatened species rather than as an endangered population.

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

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

Not applicable. Each grassland and shrubland bird species is identified as a threatened species rather than as an endangered or critically endangered ecological community.

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

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**

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

- (i) The proposed development is a 30 MW concentrated solar thermal (SCT) plant with thermal energy storage, made up of 89 modules, with each module consisting of a heliostat field and a 27 metre high receiving tower. The heliostats would be 2.2 metres high, located 30 to 100 metres from the receiving tower. A solar tracking system would drive the heliostats to beam solar energy to the receiving towers during daylight hours. The receiving towers would be lattice structures approximately 25 metres high with a 2 metre high receiving device mounted at the top. The proposed development footprint is at least 100 ha in area.

Solar flux levels above 50kW/m² (approximately 50 times the brightness of the sun) and temperatures above 450°C poses an elevated risk to avifauna. Flux Modelling for Jemalong predicts that the distance from the receiver at which the maximum flux drops below 50kW/m² occurs between the 14 m and 16 m flux planes. However, over the vast majority of the area at the 12 and 14 m flux planes falls below the threshold. The peak flux at 14m occurs in a very small area circled in the corner of the flux plane. Overall, the High Flux Zone for a receiving tower occupies a relatively small area, ranging from 11.2 m² (0.4% of bounding area) when looking east to 52.8 m² (2.8% of bounding box area) when looking north. The High Flux Zone is predicted to be 66.4 m² when viewed from above (i.e. aerially), representing 0.9% of the bounding box area. There would be 89 receiving towers and receivers at the facility.

The receiver at the top of the tower and the pipes external to the receiver will have elevated temperatures that are likely to be fatal to birds. The front of the receiver tubes and the upper supporting structure are expected to reach temperatures in excess of 450°C, but these high temperatures would dissipate before they reach the tower structure.

- (ii) No Australian Bustard, Brolga or White-fronted Chat habitat would become fragmented or isolated as a result of the proposed operation of the solar farm.

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

No critical habitats for the Australian Bustard, Brolga or White-fronted Chat have been listed for the locality under the schedules of the TSC Act.

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

Brolga

Priority actions proposed by OEH for the recovery of the Brolga in NSW are:

- ☐ Retain or reintroduce ecologically sustainable water flows to wetland habitat.
- ☐ Monitor Brolga populations to identify any sign of illegal persecution.

- ❑ Report persecution of Brolgas (and other native wildlife) to National Parks and Wildlife Service.

The proposed operation of the solar farm is consistent with these priority actions.

Australian Bustard

Priority actions proposed by OEH for the recovery of the Australian Bustard in NSW are:

- ❑ Undertake fox and feral cat and goat control; ensure feral animal control measures do not impact on native species.
- ❑ Minimise the risk of secondary poisoning from rabbit baiting.
- ❑ Reduce or remove heavy stocking regimes from semi-arid grassland and shrubland habitats.
- ❑ Report suspected illegal hunting to the OEH.

The proposed operation of the solar farm is consistent with these priority actions.

White-fronted Chat

Priority actions proposed by OEH for the recovery of the White-fronted Chat in NSW are:

- ❑ Survey to identify the key populations around the state
- ❑ Protect saltmarsh habitats in coastal areas
- ❑ Implement appropriate flow regimes in wetland habitats
- ❑ Implement feral predator control programs
- ❑ Consider impacts of urbanisation on coastal habitats in planning instruments

The proposed operation of the solar farm is consistent with these priority actions.

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

Australian Bustard

Threats to the status of the Australian Bustard in NSW include:

- ❑ Deterioration in the quality of habitat as a result of intensive grazing of livestock, intensive agriculture such as pasture improvement, and clearing of scrub.
- ❑ Increased mortality due to use of firearms for hunting. Although hunted by aborigines, the arrival of Europeans with more sophisticated weapons resulted in an increase in hunting pressure on the Australian Bustard which rapidly became a favoured game bird.
- ❑ An increased mortality rate due to predation by the introduced Red Fox, Cat and domestic and wild Dogs.
- ❑ Widespread use of poisons for rabbit control. The baits may be eaten directly, or the poison obtained secondarily through mice or insects.

- ❑ Susceptibility to disturbance or predation, particularly during the mating display when birds aggregate and evasive tactics may be less effective. Females guarding chicks are also highly susceptible to predators.

The proposed operation of the solar farm would potentially contribute to the poisoning of Australian Bustards if a rabbit control program is introduced. However, Australian Bustards are, at most, only occasional vagrants to the subject site. Therefore, it is unlikely that significant numbers would be poisoned if feral animal control was implemented as part of a Bird Hazard Management Plan.

Brolga

In recent years some wetlands have been restored by landowners and Brolgas have bred on them; however drainage of freshwater wetlands still continues particularly where raised-bed cropping activities are occurring. Grazing of wetlands by stock also reduces vegetation leaving insufficient for nest construction when the wetlands fill.

In recent years concern has also been expressed about the subtle influence of salinity on freshwater wetlands which may contribute to the loss of suitable habitat through secondary salinisation.

In addition there has recently been extensive planting of pine trees and blue gums in some rural areas, including the basalt plains. These plantations may impact on shallow freshwater wetlands in the vicinity by intercepting water that normally would flow into them.

Predation by the Red Fox on eggs and chicks is probably a major cause of nest failure.

Human activities have also had a direct adverse impact on Brolga populations. In the past, egg losses were due to egg collecting and trampling by cattle, but they do not appear to be a major cause at present. Young birds have become entangled in fencing and may collide with vehicles and farm machinery. Netting fences present barriers to unfledged chicks, which must remain close to their parents. As breeding sites dry out, adults and young must find other sources of food and water, and if young cannot get through fences, they are more susceptible to predation or starvation.

There have been a number of reports of fledged Brolgas colliding with transmission lines. If nest sites are in the vicinity of these power lines there is a possibility that these sites will be unsuccessful because of mortality of adults or newly fledged young.

In the past, Brolgas were shot and poisoned to protect grain crops, but reports of these occurrences are now infrequent. Brolgas may also have been indirectly poisoned as a result of baiting programs for other pests, for example cricket baiting programs and use of other agricultural pesticides. Brolgas have also died as a result of illegal bird-poisoning activities when the target species was the Long-billed Corella *Cacatua tenuirostris*.

The proposed operation of the solar farm would potentially contribute to the poisoning of Brolgas if a rabbit or rodent control program is introduced. However, Brolgas are, at most, only occasional vagrants to the subject site. Therefore, it is unlikely that significant numbers

would be poisoned is feral animal control was implemented as part of a Bird Hazard Management Plan.

White-fronted Chat

Threats to the status of the White-fronted Chat in NSW include:

- ❑ Reduction in habitat size and quality.
- ❑ Human disturbance (particularly in urban areas) and elevated nest-predation levels.
- ❑ Much of their natural habitat is prone to alteration due to modification of river flows and floodplains.
- ❑ Prone to predation from snakes and mammals, particularly Feral Cats, European Red Foxes and rodents, as well as birds, particularly ravens.
- ❑ In coastal areas mangrove encroachment and sea-level rise associated with global warming present an additional future threat to their preferred habitat.

The proposed operation of the solar farm is unlikely to significantly increase the levels of these threats.

3. CONCLUSION

The proposed operation of the solar farm would not significantly impact on the status of the Brolga, Australian Bustard or White-fronted Chat, or their habitats, in NSW. Therefore, a Species Impact Statement is NOT required for these species.

4. REFERENCES

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APPENDIX B FLORA SPECIES RECORDED

All native and introduced vascular plant species encountered within the study area, and their relative abundances, were recorded (where identifiable). Cover/abundance assessments are based on visual estimates of foliage cover (after Carnahan 1997), scored using a modified Braun-Blanquet 6-point scale:

- | | |
|---|--|
| 1 | 1 to a few individuals present, less than 5% cover |
| 2 | many individuals present, but still less than 5% cover |
| 3 | 5 - <20% cover |
| 4 | 20 - <50% cover |
| 5 | 50 - <75% cover |
| 6 | 75 - 100% cover |

Cover/abundance scores relate to general abundance over the site, not to representative quadrats. Single-figure values are generalised over the study area. Where the abundance of a particular species varies markedly over the survey sector, a range of cover values is provided. Where a range of values is given, abundance is based on a standard 20 metre x 20 metre quadrat scale. Cover abundance is provided for each vegetation type, with abbreviations as follows:

- | | |
|-----|--|
| GBW | Western Grey Box – Poplar Box – White Cypress Pine woodland |
| PBW | Poplar Box Grassy Woodland |
| EX | Exotic-dominated or planted non-local vegetation (includes areas where sparse native overstorey is present but shrub and ground layers are exotic) |
| RRG | River Red Gum swampy woodland |

Where uncertainty exists due to the unavailability of reproductive material, the taxon is preceded by a question mark, or plants are identified to genus level only. Scientific nomenclature follows Harden (1990-2002), with recent name changes as per the Australian Plant Name Index of the Australian National Herbarium.

Species not indigenous to the area are preceded by an asterisk (*), and weeds declared as noxious within the Parkes Shire Council are denoted by a triangle (△).

Scientific name	Common name	Family	Abundance			
			GBW	PBW	EX	RRG
TREES						
<i>Allocasuarina luehmannii</i>	Buloke	Casuarinaceae	1			
<i>Callitris glaucophylla</i>	White Cypress Pine	Curpressaceae	1			
<i>Eucalyptus camaldulensis</i> subsp. <i>camaldulensis</i>	River Red Gum	Myrtaceae		1		4
<i>Eucalyptus microcarpa</i>	Inland Grey Box	Myrtaceae	3			
<i>Eucalyptus populnea</i> ssp. <i>bimble</i>	Bimble Box	Myrtaceae	1	3-4	1	
SHRUBS, SUB-SHRUBS						
<i>Acacia hakeoides</i>	Hakea Wattle	Fabaceae		1		
<i>Acacia spectabilis</i>	Mudgee Wattle	Fabaceae		1		
<i>Acacia</i> sp.	Wattle	Fabaceae		1		1
<i>Callistemon</i> sp.	Bottlebrush	Myrtaceae			1	
* <i>Datura</i> sp.	Thornapple	Solanaceae		1	1	
<i>Dodonaea viscosa</i> ssp. <i>angustissima</i>	Narrow-leaved Hopbush	Sapindaceae	1	1		
<i>Einadia</i> sp.	Saltbush		1	1		1
<i>Geijera parviflora</i>	Wilga	Rutaceae		2		
△* <i>Lycium ferocissimum</i>	African Boxthorn	Solanaceae	2	2	1	1
<i>Maireana microphylla</i>	Small-leaf Bluebush	Chenopodiaceae				1
* <i>Marrubium vulgare</i>	White Horehound	Lamiaceae		1		
* <i>Olea europaea</i>	African Olive	Oleaceae			2	
* <i>Schinus</i> sp.	Pepper Tree	Anacardiaceae			1	
<i>Sclerolaena birchii</i>	Galvanized Burr	Chenopodiaceae		1		
<i>Senna</i> (=Cassia) <i>artemisioides</i> ssp. <i>Zygophylla</i>	Silver Cassia	Fabaceae		1		
* <i>Senna</i> sp.	Senna	Fabaceae		1		
* <i>Sida ?rhombifolia</i>	Paddy’s Lucerne	Malvaceae	1	1	1	
FORBS						
* <i>Anagallis</i> (=Lysimachia) <i>arvensis</i>	Scarlet Pimpernel	Myrsinaceae		1		
* <i>Arctotheca calendula</i>	Capeweed	Asteraceae		1	1	
<i>Atriplex</i> sp.	Atriplex	Chenopodiaceae		1		

Scientific name	Common name	Family	Abundance			
			GBW	PBW	EX	RRG
<i>Centipeda cunninghamii</i>	Common Sneezeweed	Asteraceae	1			
* <i>Cirsium vulgare</i>	Spear Thistle	Asteraceae	1	1		
<i>Einadia nutans</i>	Climbing Saltbush	Chenopodiaceae		1		
<i>Geranium</i> sp.	Geranium	Geraniaceae	1	1		
<i>Goodenia pinnatifida</i>	Goodenia	Goodeniaceae	1	1		1
* <i>Lepidium africanum</i>	Lepidium	Brassicaceae	1	1		
<i>Maireana</i> sp.	Maireana	Amaranthaceae		1		
* <i>Malva parviflora</i>	Mallow	Malvaceae	1	1		
<i>Opercularia</i> sp.	Stinkweed	Rubiaceae				1
<i>Oxalis</i> sp.	Oxalis	Oxalidaceae	1	1		
<i>Ptilotus</i> sp.	Ptilotus	Amaranthaceae		1		
<i>Sclerolaena</i> sp.	Sclerolaena	Chenopodiaceae	1	1		
<i>Senna artemisioides</i> subsp. <i>zygophylla</i> (Benth.) Randell	Senna	Fabaceae		1		
<i>Sida corrugata</i>	Corrugated Sida	Malvaceae	1	1	1	1
* <i>Sonchus oleraceus</i>	Smooth Sowthistle	Asteraceae		1		
<i>Trifolium</i> sp.	Clover	Fabaceae			2	
<i>Vittadinia cuneata</i>	Fuzzweed	Fabaceae		1		
<i>Wahlenbergia</i> sp.	Bluebell	Campanulaceae		1		1
GRASSES						
<i>Aristida ramosa</i>	Wire-grass	Poaceae		1		
<i>Austrostipa scabra</i> ssp. <i>scabra</i>	Speargrass	Poaceae	1	2		
<i>Austrostipa verticillata</i>	Slender Bamboo Grass	Poaceae		1		
* <i>Avena</i> sp.	Wild Oats	Poaceae		1	5	
<i>Chloris truncata</i>	Native Windmill Grass	Poaceae		1		
<i>Elymus scaber</i>	Common Wheat Grass	Poaceae		1		
<i>Enteropogon acicularis</i>	Windmill Grass	Poaceae		1		
* <i>Hordeum</i> sp.	Barley Grass	Poaceae	3	1	2	1
* <i>Lolium perenne</i>	Ryegrass	Poaceae	2	1	2	3
<i>Microlaena stipoides</i>	Weeping Grass	Poaceae		1		1
<i>Rytidosperma</i> sp.	Wallaby Grass	Poaceae	1	1		
* <i>Triticum</i> sp.	Wheat	Poaceae		1	1	

APPENDIX C FAUNA SPECIES RECORDED

Common Name	Scientific Name	Survey	Observation Type
Amphibians & Reptiles			
Boulenger's Snake-eyed Skink	<i>Morethia boulengeri</i>	Active search	Observed
Common Dwarf Skink	<i>Menetia greyii</i>	Opportunistic/Active Search	Observed
Ragged Snake-eyed Skink	<i>Cryptoblepharus pannosus</i>	Opportunistic/Active search	Observed
Birds			
Apostlebird	<i>Struthidea cinerea</i>	Opportunistic	Observed
Australian Hobby	<i>Falco longipennis</i>	Targeted Search	Observed
Australian Magpie	<i>Cracticus tibicen</i>	Targeted Search	Observed
Australian Pelican	<i>Pelecanus conspicillatus</i>	Opportunistic	Observed
Australian Raven	<i>Corvus coronoides</i>	Targeted Search	Observed
Australian Reed-warbler	<i>Acrocephalus australis</i>	Targeted Search	Observed
Australian Wood Duck	<i>Chenonetta jubata</i>	Opportunistic	Observed
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	Targeted Search	Observed
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>	Opportunistic	Observed
Black Kite	<i>Milvus migrans</i>	Opportunistic	Observed
Blue Bonnet	<i>Northiella haematogaster</i>	Targeted Search	Observed
Brown Songlark	<i>Cincloramphus cruralis</i>	Targeted Search	Observed
Brown Treecreeper*	<i>Climacteris picumnus</i>	Targeted Search	Observed
Cockatiel	<i>Nymphicus hollandicus</i>	Targeted Search	Observed
Common Starling	<i>Sturnus vulgaris</i>	Targeted Search	Observed
Crested Pigeon	<i>Ocyphaps lophotes</i>	Targeted Search	Observed
Eastern Rosella	<i>Platycercus eximius</i>	Targeted Search	Observed
Emu	<i>Dromaius novaehollandiae</i>	Opportunistic	Observed
Galah	<i>Eolophus roseicapillus</i>	Targeted Search	Observed
Great Cormorant	<i>Phalacrocorax carbo</i>	Opportunistic	Observed
Grey-crowned Babbler*	<i>Pomatostomus temporalis temporalis</i>	Targeted Search	Observed
Grey Butcherbird	<i>Cracticus torquatus</i>	Opportunistic	Observed
Grey Fantail	<i>Rhipidura albiscapa</i>	Opportunistic	Observed
Grey Teal	<i>Anas gracilis</i>	Targeted Search	Observed
Horsefield's Bronze-cuckoo	<i>Chrysococcyx basalis</i>	Targeted Search	Heard
Intermediate Egret	<i>Ardea intermedia</i>	Opportunistic	Observed
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	Targeted Search	Observed

Common Name	Scientific Name	Survey	Observation Type
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	Targeted Search	Observed
Little Raven	<i>Corvus mellori</i>	Targeted Search	Observed
Magpie-lark	<i>Grallina cyanoleuca</i>	Targeted Search	Observed
Nankeen Kestrel	<i>Falco cenchroides</i>	Targeted Search	Observed
Noisy Friarbird	<i>Philemon corniculatus</i>	Targeted Search	Observed
Noisy Miner	<i>Manorina melanocephala</i>	Targeted Search	Observed
Pacific Black Duck	<i>Anas superciliosa</i>	Targeted Search	Observed
Pied Butcherbird	<i>Cracticus nigrogularis</i>	Targeted Search	Observed
Red-rumped Parrot	<i>Psephotus haematonotus</i>	Targeted Search	Observed
Royal Spoonbill	<i>Platalea regia</i>	Targeted Search	Observed
Rufous Songlark	<i>Megalurus mathewsi</i>	Targeted Search	Observed
Rufous Whistler	<i>Pachycephala rufiventris</i>	Targeted Search	Heard
Sacred Kingfisher	<i>Todiramphus sanctus</i>	Targeted Search	Observed
Short-billed Corella	<i>Cacatua sanguinea</i>	Targeted Search	Observed
Southern Boobook	<i>Ninox novaeseelandiae</i>	Opportunistic	Heard
Spotted Harrier*	<i>Circus assimilis</i>	Targeted Search	Observed
Spotted Pardalote	<i>Pardalotus punctatus</i>	Targeted Search	Observed
Striated Pardalote	<i>Pardalotus striatus</i>	Targeted Search	Observed
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	Opportunistic	Observed
Superb Parrot*#	<i>Polytelis swainsonii</i>	Targeted Search	Observed
Tawny Frogmouth	<i>Podargus strigoides</i>	Opportunistic	Observed
Tree Martin	<i>Petrochelidon nigricans</i>	Targeted Search	Observed
Wedge-tailed Eagle	<i>Aquila audax</i>	Targeted Search	Observed
Welcome Swallow	<i>Hirundo neoxena</i>	Targeted Search	Observed
White-faced Heron	<i>Egretta novaehollandiae</i>	Targeted Search	Observed
White-necked Heron	<i>Ardea pacifica</i>	Targeted Search	Observed
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>	Targeted Search	Observed
White-winged Chough	<i>Corcorax melanorhamphos</i>	Targeted Search	Observed
Willie Wagtail	<i>Rhipidura leucophrys</i>	Targeted Search	Observed
Yellow-billed Spoonbill	<i>Platalea flavipes</i>	Targeted Search	Observed
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	Targeted Search	Observed
Zebra Finch	<i>Taeniopygia guttata</i>	Targeted Search	Observed
Non-volant mammals			
Cat^	<i>Felis catus</i>	Spotlight	Observed

Common Name	Scientific Name	Survey	Observation Type
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	Spotlight	Observed
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	Spotlight, opportunistic	Observed
European Fox [^]	<i>Vulpes vulpes</i>	Spotlight, opportunistic	Observed
European Rabbit [^]	<i>Oryctolagus cuniculus</i>	Spotlight, opportunistic	Observed
Swamp Wallaby	<i>Wallabia bicolor</i>	Spotlight	Observed
Bats			
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	Definite – 3 locations	Anabat~
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	Definite – 2 locations	Anabat~
Little Pied Bat*	<i>Chalinolobus picatus</i>	Possible – 2 locations	Anabat~
Eastern Freetail-bat	<i>Mormopterus</i> sp. 2 (=ridei)	Possible (2 poor calls) both in and outside proposal site	Anabat~
Inland Freetail-bat	<i>Mormopterus</i> sp. 3 (=petersi)	Definite – 3 sites	Anabat''
Southern Freetail-bat	<i>Mormopterus</i> sp. 4	Definite – 2 sites	Anabat~
Long-eared Bat*	<i>Nyctophilus</i> sp. (<i>N. geoffroi</i> , <i>N. gouldii</i> , or <i>N. corbeni</i>)	Definite – 3 sites	Anabat~
Yellow-bellied Sheath-tail-bat*	<i>Saccolaimus flaviventris</i>	Probable – 1 site	Anabat~
Western Broad-nosed Bat	<i>Scotorepens balstoni</i>	Definite and Probable – 2 sites	Anabat~
Little Broad-nosed Bat	<i>Scotorepens greyii</i>	Definite and Probable – 2 sites	Anabat~
White-striped Freetail-bat	<i>Tadarida australis</i> (=Nyctinomus=Austronomus) <i>australis</i>	Definite and Probable – 2 sites	Anabat~
Inland Forest Bat*	<i>Vespadelus baverstocki</i>	Probable – 2 sites	Anabat~
Large Forest Bat	<i>Vespadelus darlingtoni</i>	Possible – 2 sites	Anabat~
Southern Forest Bat	<i>Vespadelus regulus</i>	Possible and Probable – 2 sites	Anabat~
Little Forest Bat	<i>Vespadelus vulturnus</i>	Probable – 2 sites	Anabat~
Forest Bat	<i>Vespadelus</i> sp. (either <i>V. regulus</i> or <i>V. vulturnus</i>)	Definite – 3 sites	Anabat~

* Listed as vulnerable on Schedule 2 of the TSC Act

Listed as vulnerable under the EPBC Act

[^] Exotic

~Anabat Likelihood Key: Definite (100%), Probable (over 60%), Possible (20-60%)

Note: Quite a few microbat species overlap in frequency range and call shape so hence the reason for possible and probable rankings. Also call quality can be poor making it difficult for good identification.

APPENDIX D DATABASE SEARCH RESULTS

Numbers in parentheses indicate number of species records within search area from relevant database.

OEH Bionet Wildlife Atlas: Lists records and predictions of threatened species on the schedule of the TSC Act within 10 km of the study area and within the Lower Slopes

EPBC Protected Matters Search tool: Lists items/species on the Schedules of the EPBC Act with the potential to occur within 10 km of the study area

ACRONYMS

EPBC: Environment Protection and Biodiversity Conservation Act

FM: Fisheries Management Act

TSC: Threatened Species Conservation Act

E: Endangered

V: Vulnerable

CE: Critically Endangered

EEC: Endangered Ecological Community

CEEC: Critically Endangered Ecological Community

EP: Endangered Population

Species	Common Name	OEH Wildlife Atlas 10 km and Forbes LGA search (08/07/2013)	EPBC Protected Matters 10 km search (9/07/2013)
FAUNA			
Amphibians			
<i>Crinia sloanei</i>	Sloane's Froglet	TSC-V	
<i>Litoria booroolongensis</i>	Booroolong Frog	TSC-E	EPBC-E
Birds			
<i>Anseranas semipalmata</i>	Magpie Goose	TSC-V	
<i>Anthochaera Phrygia</i>	Regent Honeyeater	TSC-CE	EPBC-E, Migratory
<i>Apus pacificus</i>	Fork-tailed Swift		EPBC-Migratory
<i>Ardea alba</i>	Great Egret		EPBC-Marine, Migratory
<i>Ardea ibis</i>	Cattle Egret		EPBC-Marine, Migratory
<i>Ardeotis australis</i>	Australian Bustard	TSC-E	
<i>Botaurus poiciloptilus</i>	Australasian Bittern	TSC-E	EPBC-E
<i>Burhinus grallarius</i>	Bush Stone-curlew	TSC-E	

Species	Common Name	OEH Wildlife Atlas 10 km and Forbes LGA search (08/07/2013)	EPBC Protected Matters 10 km search (9/07/2013)
<i>Callidris ferruginea</i>	Curlew Sandpiper	TSC-E	EPBC-Marine, Migratory
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	TSC-V	
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	TSC-V	
<i>Certhionyx variegatus</i>	Pied Honeyeater	TSC-V	
<i>Chthonicola sagittata</i>	Speckled Warbler	TSC-V (2)	
<i>Cinclosoma castanotum</i>	Chestnut Quail-thrush	TSC-V	
<i>Circus assimilis</i>	Spotted Harrier	TSC-V	
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	TSC-V (5)	
<i>Daphoenositta chrysoptera</i>	Varied Sittella	TSC-V (2)	
<i>Drymodes brunneopygia</i>	Southern Scrub-robin	TSC-V	
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	TSC-E	
<i>Epthianura albifrons</i>	White-fronted Chat	TSC-V	
<i>Falco hypoleucos</i>	Grey Falcon	TSC-E	
<i>Falco subniger</i>	Black Falcom	TSC-V	
<i>Gallinago hardwickii</i>	Latham's Snipe		EPBC-Marine, Migratory
<i>Glossopsitta pusilla</i>	Little Lorikeet	TSC-V	
<i>Grantiella picta</i>	Painted Honeyeater	TSC-V (1)	
<i>Grus rubicunda</i>	Brolga	TSC-V	
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle		EPBC-Migratory
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard	TSC-V	
<i>Hieraaetus morphnoides</i>	Little Eagle	TSC-V (1)	
<i>Hylacola cautus</i>	Shy Heathwren	TSC-V	
<i>Lathamus discolor</i>	Swift Parrot	TSC-E	EPBC-E, Marine
<i>Leipoa ocellata</i>	Malleefowl	TSC-E (1)	EPBC-V
<i>Limosa limosa</i>	Black-tailed Godwit	TSC-V	
<i>Lophochroa leadbeateri</i>	Major Mitchell's Cockatoo	TSC-V	
<i>Lophoictinia isura</i>	Square-tailed Kite	TSC-V	
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	TSC-V	
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	TSC-V	

Species	Common Name	OEH Wildlife Atlas 10 km and Forbes LGA search (08/07/2013)	EPBC Protected Matters 10 km search (9/07/2013)
<i>Neophema pulchella</i>	Turquoise Parrot	TSC-V	
<i>Ninox connivens</i>	Barking Owl	TSC-V	
<i>Ninox strenua</i>	Powerful Owl	TSC-V	
<i>Oxyura australis</i>	Blue-billed Duck	TSC-V	
<i>Pachycephala inornata</i>	Gilbert's Whistler	TSC-V	
<i>Pachycephala rufogularis</i>	Red-lored Whistler	TSC-E	EPBC-V
<i>Pandion cristatus</i>	Eastern Osprey	TSC-V	EPBC – Marine, Migratory
<i>Petroica boodang</i>	Scarlet Robin	TSC-V	
<i>Petroica phoenicea</i>	Flame Robin	TSC-V	
<i>Polytelis swainsonii</i>	Superb Parrot	TSC-V (3)	EPBC-V
<i>Pomatostomus temporalis</i> <i>temporalis</i>	Grey-crowned Babbler (eastern subspecies)	TSC-V (2)	
<i>Rostratula australis</i>	Australian Painted Snipe	TSC-E	EPBC-E, Marine, Migratory
<i>Stagonopleura guttata</i>	Diamond Firetail	TSC-V (1)	
<i>Stictonetta naevosa</i>	Freckled Duck	TSC-V	
Fish			
<i>Bidyanus bidyanus</i>	Silver Perch		EPBC-CE
<i>Maccullochella peelii</i>	Murray Cod		EPBC-V
<i>Macquaria australasica</i>	Macquarie Perch		EPBC-E
Mammals			
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	TSC-V	
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	TSC-V	EPBC-V
<i>Chalinolobus picatus</i>	Little Pied Bat	TSC-V	
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	TSC-V	EPBC-E
<i>Miniopterus schreibersii</i> <i>oceanensis</i>	Eastern Bentwing-bat	TSC-V	
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	TSC-V	EPBC-V
<i>Petaurus norfolcensis</i>	Squirrel Glider	TSC-V	
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	TSC-E	EPBC-V
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	TSC-V	
<i>Phascolarctos cinereus</i>	Koala	TSC-V (1)	EPBC-V

Species	Common Name	OEH Wildlife Atlas 10 km and Forbes LGA search (08/07/2013)	EPBC Protected Matters 10 km search (9/07/2013)
<i>Pseudomys novaehollandiae</i>	New Holland Mouse		EPBC-V
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	TSC-V	EPBC-V
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	TSC-V	
<i>Vespadelus baverstocki</i>	Inland Forest Bat	TSC-V	
Reptiles			
<i>Aprasia parapulchella</i>	Pink-tailed Worm-lizard		EPBC-V
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	TSC-V	
<i>Suta flagellum</i>	Little Whip Snake	TSC-V	
INSECTA			
<i>Synemon plana</i>	Golden Sun Moth	TSC-E	EPBC-CE
FLORA			
<i>Acacia ausfeldii</i>	Ausfield's Wattle	TSC-V	
<i>Austrostipa metatoris</i>	A pear-grass	TSC-V	EPBC-V
<i>Austrostipa wakoolica</i>	A spear-grass	TSC-E	EPBC-E
<i>Diuris tricolor</i>	Pine Donkey Orchid	TSC-V	
<i>Swainsona murrayana</i>	Slender Darling-pea	TSC-V	EPBC-V
<i>Swainsona sericea</i>	Silky Swainson-pea	TSC-V	
<i>Tylophora linearis</i>		TSC-V	EPBC-E
THREATENED ECOLOGICAL COMMUNITIES			
<i>Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions</i>		TSC-EEC	
<i>Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia</i>			EPBC-EEC
<i>Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions</i>		TSC-EEC	
<i>Mallee and Mallee-Broombush dominated woodland and shrubland, lacking Triodia, in NSW South Western Slopes Bioregion</i>		TSC-CEEC	
<i>Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions</i>		TSC-EEC	
<i>Weeping Myall Woodlands</i>			EPBC-EEC

Species	Common Name	OEH Wildlife Atlas 10 km and Forbes LGA search (08/07/2013)	EPBC Protected Matters 10 km search (9/07/2013)
<i>White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland</i>			EPBC-CEEC
<i>White Box Yellow Box Blakely's Red Gum Woodland</i>		TSC-EEC	
MIGRATORY SPECIES			
<i>Apus pacificus</i>	Fork-tailed Swift		Species or species habitat likely to occur within area
<i>Ardea alba</i>	Great Egret		Species or species habitat known to occur within area
<i>Ardea ibis</i>	Cattle Egret		Species or species habitat may occur within area
<i>Gallinago hardwickii</i>	Latham's Snipe		Species or species habitat may occur within area
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		Species or species habitat likely to occur within area
<i>Hirundapus caudacutus</i>	White-throated Needletail		Species or species habitat may occur within area
<i>Merops ornatus</i>	Rainbow Bee-eater		Species or species habitat may occur within area
<i>Myiagra cyanoleuca</i>	Satin Flycatcher		Species or species habitat may occur within area
<i>Rostratula benghalensis</i>	Painted Snipe		Species or species habitat may occur within area

APPENDIX E THREATENED SPECIES EVALUATIONS

An evaluation of presence of habitat and likelihood of occurrence of threatened flora and fauna recorded within a 10 kilometre radius of the subject site. Records are from a search of the OEH Wildlife Atlas and the EPBC Environmental Reporting Tool for the Department of the Environment (DoE). Ecology information has been obtained from the Threatened Species Profiles on the NSW OEH website (www.threatenedspecies.environment.nsw.gov.au).

Codes:

Presence of Habitat

- Present:** Potential or known suitable abiotic factors such as soil type, geology, moisture content, topography, aspect and/or altitude are present within the Proposal Site. Associated species/vegetation type is present within the proposal site.
- Marginal:** Some suitable habitat is present within the proposal site.
- Absent:** No suitable resources/landscape/vegetation type is present within the proposal site

Likelihood of Occurrence

- None:** Species / EEC does not occur at the site.
- Unlikely:** Species is not likely to occur.
- Possible:** Species could occur and proposal site may provide suitable conditions.
- Present:** Species was recorded during the field investigations.

Possible to be impacted

- No:** The proposal would not impact this species or its habitats. The proposal would not result in an impact to this species. No Assessment of Significance (AoS) is necessary for this species.
- Yes:** The proposal could impact this species or its habitats. An AoS has been applied to these entities.

- TSC-V** Listed as Vulnerable under the Threatened Species Conservation Act
- TSC-E** Listed as Endangered under the Threatened Species Conservation Act
- TSC-EEC** Listed as an Endangered Ecological Community under the Threatened Species Conservation Act
- TSC-EP** Listed as an Endangered Population under the Threatened Species Conservation Act
- EPBC-V** Listed as Vulnerable under the Environment Protection and Biodiversity Conservation Act
- EPBC-E** Listed as Endangered under the Environment Protection and Biodiversity Conservation Act
- EPBC-EEC** Listed as an Endangered Ecological Community under the Environment Protection and Biodiversity Conservation Act
- EPBC-CEEC** Listed as a Critically Endangered Ecological Community under the Environment Protection and Biodiversity Conservation Act
- EPBC – Ma** Listed as Marine Species under the Environment Protection and Biodiversity Conservation Act
- EPBC – Mi** Listed as Migratory Species under the Environment Protection and Biodiversity Conservation Act

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
FAUNA							
Amphibians							
<i>Crinia sloanei</i> Sloane's Froglet		V	A small ground-dwelling frog. Sloane's Froglet has been recorded from widely scattered sites in the floodplains of the Murray-Darling Basin, with the majority of records in the Darling Riverine Plains, NSW South Western Slopes and Riverina bioregions in New South Wales. It has not been recorded recently in the northern part of its range and has only been recorded infrequently in the southern part of its range in NSW. The closest record to the proposal site is from Goobang National Park in 1998. At a number of sites where records are verified by museum specimens, the species has not been subsequently detected during more recent frog surveys in the vicinity (e.g. Holbrook, Nyngan, Wagga Wagga and Tocumwal). The low number of sites, low number of recorded individuals per site, and the low proportion of records of this species in regional surveys all indicate that a moderately low number of mature individuals exist. This indicates that this is not just a rare or uncommonly encountered species, but that there has been a reduction in population size and range. It is typically associated with periodically inundated areas in grassland, woodland and disturbed habitats. Typically breeds in ephemeral wetlands, or periodically inundated areas of permanent wetlands, in grasslands, woodlands, and disturbed environments. Shelters in any vegetation, ground debris, or cracks in the soil that would provide suitable refuge. Best detected in winter after 60mm of rain.	0	Yes – irregularly inundated floodplains present in the study area.	Unlikely – no records within 10 km and floodplain area will not be impacted.	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>Litoria booroolongensis</i> Booroolong Frog	E	E	The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. It has disappeared from much of the Northern Tablelands, however several populations have recently been recorded in the Namoi catchment. The species is rare throughout most of the remainder of its range. The frogs live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins. Shelter under rocks or amongst vegetation near the ground on the stream edge. Sometimes bask in the sun on exposed rocks near flowing water during summer. Breeding occurs in spring and early summer and tadpoles metamorphose in late summer to early autumn. Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools. Forage on stream banks or vegetation and timber within 100 m of streams. May shelter on stream banks or vegetation and fallen timber within 100 m of streams. Best detected from December to February.	0	Absent	None	No
Birds							
<i>Anseranas semipalmata</i> Magpie Goose	V		The Magpie Goose is still relatively common in the Australian northern tropics, but had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. Since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW. Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking	7	Yes	Possible – particularly during flood events	Construction, No – Negligible habitat loss.

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			and grazing on land; feeds on grasses, bulbs and rhizomes. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW. Often seen in trios or flocks on shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains; roosts in tall vegetation.				Operational, Yes – See Appendix A
<i>Anthochaera phrygia</i> Regent Honeyeater	CE	E, Mi	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years non-breeding flocks converge on flowering coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Mugga	1	Yes	Possible	Construction , No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises <i>E. microcarpa</i> , <i>E. punctata</i> , <i>E. polyanthemos</i> , <i>E. mollucana</i> , <i>Corymbia robusta</i> , <i>E. crebra</i> , <i>E. caleyi</i> , <i>Corymbia maculata</i> , <i>E. mckieana</i> , <i>E. macrorhyncha</i> , <i>E. laevopinea</i> , and <i>Angophora floribunda</i> . Nectar and fruit from the mistletoes <i>A. miquelii</i> , <i>A. pendula</i> and <i>A. cambagei</i> are also eaten during the breeding season. When nectar is scarce lerp and honeydew comprise a large proportion of the diet. A shrubby understorey is an important source of insects and nesting material. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks. Also nest in mistletoe haustoria.				
<i>Ardeotis australis</i> Australian Bustard	E		Mainly occurs in inland Australia and is now scarce or absent from southern and south-eastern Australia. In NSW, they are mainly found in the north-west corner and less often recorded in the lower western and central west plains regions. Occasional vagrants are still seen as far east as the western slopes and Riverine plain. Breeding now only occurs in the north-west region of NSW. Mainly inhabits tussock and hummock grasslands, though prefers tussock grasses to hummock grasses; also occurs in low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams. Breeds on bare ground on low sandy ridges or stony rises in ecotones between grassland and protective shrubland cover; roosts on ground among shrubs and long grasses or under trees. Forages on insects, young birds, lizards, mice, leaves, seeds and fruit. Dispersive, with irregular widespread movements over long distances; movements are	1	Yes	Possible	Construction , No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			thought to be in response to habitat and climatic conditions; known to converge on areas with high mice numbers and in recently burnt areas.				
<i>Botaurus poiciloptilus</i> Australasian Bittern	E	E	In NSW, this species occurs along the coast and is frequently recorded in the Murray-Darling Basin, notably in floodplain wetlands of the Murrumbidgee, Lachlan, Macquarie and Gwydir Rivers. Occurs in permanent freshwater wetlands with tall, dense vegetation. Favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. <i>Phragmites</i> , <i>Cyperus</i> , <i>Eleocharis</i> , <i>Juncus</i> , <i>Typha</i> , <i>Baumea</i> , , <i>Bolboschoenus</i>) or cutting grass (<i>Gahnia</i>) growing over muddy or peaty substrate. Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds. In Australia, the Bittern occurs with the Australian Painted Snipe <i>Rostratula benghalensis australis</i> .	3	Yes	Possible - particularly during flood events	Construction , No Operational, Yes – See Appendix A
<i>Burhinus grallarius</i> Bush Stone-curlew	E		The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. Two eggs are laid in spring and early summer.	7	Yes	Possible	Construction , No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>Calidris ferruginea</i> Curlew Sandpiper	E	Mi	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. This species does not breed in Australia. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds.	1	Yes	Possible - particularly during flood events	Construction, No Operational, Yes – See Appendix A
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo	V		The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. May also occur in sub-alpine Snow Gum <i>Eucalyptus pauciflora</i> woodland and occasionally in temperate rainforests. Favours old growth attributes for nesting and roosting. Feed mainly on seeds of native and introduced trees and shrubs, with a preference for eucalypts, wattles and introduced hawthorns. They will also eat berries,	0	Marginal – proposal site is located west of known distribution.	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			fruits, nuts and insects and their larvae. They are mainly arboreal (found in trees), coming to the ground only to drink and to forage among fallen fruits or pine cones.				
<i>Calyptrorhynchus lathamii</i> Glossy Black-Cockatoo	V		The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August. Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (<i>Allocasuarina littoralis</i>), Forest She-oak (<i>A. torulosa</i>) or Drooping She-oak (<i>A. verticillata</i>) occur. In the Riverina area, inhabits open woodlands dominated by Belah (<i>Casuarina cristata</i>). Feeds almost exclusively on the seeds of several species of she-oak (<i>Casuarina</i> and <i>Allocasuarina</i> species), shredding the cones with the massive bill.	1	Marginal – Proposal site is on edge of known distribution. No She-oaks present.	Unlikely	No
<i>Certhionyx variegatus</i> Pied Honeyeater	V		Widespread throughout acacia, mallee and spinifex scrubs of arid and semi-arid Australia. Occasionally occurs further east, on the slopes and plains and the Hunter Valley, typically during periods of drought. Inhabits wattle shrub (primarily Mulga, <i>Acacia aneura</i>), mallee, spinifex and eucalypt woodlands, usually when shrubs are flowering; feeds on nectar, predominantly from various species of emu-bushes (<i>Eremophila</i> spp.); also from mistletoes and various other shrubs (e.g. <i>Brachysema</i> spp. and <i>Grevillea</i> spp.); also eats saltbush fruit, berries, seed, flowers and insects. Highly nomadic, following the erratic flowering of shrubs; can be locally common at times. Constructs a	1	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			relatively large cup-shaped nest, usually robust, although occasionally loose, constructed of grasses and fine twigs, bound with spider webs, in the fork of a shrub or tree up to 5 m above the ground.				
<i>Chthonicola sagittata</i> Speckled Warbler	V		Has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100 ha survive. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. A side entrance allows the bird to walk directly inside. Some cooperative breeding occurs. The species may act as host to the Black-eared Cuckoo. Speckled Warblers often join mixed species feeding flocks in winter, with other species such as Yellow-rumped, Buff-rumped, Brown and Striated Thornbills.	136	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>Cinclosoma castanotum</i> Chestnut Quail-thrush	V		In NSW it seems to occur almost exclusively in mallee habitats, with understorey dominated by spinifex, chenopods or other shrubs including Acacia species. Only rarely, such as in Cocoparra NP, is it recorded in other types of woodland, and in these areas a dense understorey may be a prerequisite. Occupies vegetation with a wide range of fire histories, though appears to occur at highest densities in areas two to fifteen years post fire. These birds forage on the ground, often among spinifex clumps, on a wide range of invertebrates (including grasshoppers, bugs, beetles, flies, caterpillars and ants), seeds of both native and introduced species and, more rarely, fruits. Its nest is a depression in the ground lined with strips of bark, fine grass or sticks, placed near a mallee trunk, against a fallen branch, under a low bush or in a sparse tuft of grass.	1	Absent	None	No
<i>Circus assimilis</i> Spotted Harrier	V		The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Preys on terrestrial mammals (eg bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion.	10	Present – wide-ranging species	Occurs – identified in proposal site	Construction , No – Negligible habitat loss. Operational, Yes – See Appendix A
<i>Climacteris picumnus victoriae</i>	V		Endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly	129	Present	Occurs – identified	Construction , potential

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
Brown Treecreeper (eastern subspecies)			found on coastal plains and ranges. The western boundary of the range of <i>Climacteris picumnus victoriae</i> runs approximately through Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell and along this line the subspecies intergrades with the arid zone subspecies of Brown Treecreeper <i>Climacteris picumnus picumnus</i> which then occupies the remaining parts of the state. The eastern subspecies lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with drier open woodlands such as the Snowy River Valley, Cumberland Plains, Hunter Valley and parts of the Richmond and Clarence Valleys. The population density of this subspecies has been greatly reduced over much of its range, with major declines recorded in central NSW and the northern and southern tablelands. Declines have occurred in remnant vegetation fragments smaller than 300 hectares that have been isolated or fragmented for more than 50 years. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (<i>Eucalyptus camaldulensis</i>) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.			in proposal site	breeding habitat could be removed as a result of transmission line development. Operational, Yes – See Appendix A
<i>Daphoenositta chrysoptera</i>	V		The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west. It inhabits eucalypt forests	5	Present – rough-	Possible	Construction, No –

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
Varied Sittella			and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and <i>Acacia</i> woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.		barked trees relatively common within the proposal site.		Negligible habitat loss. Operational, Yes – See Appendix A
<i>Drymodes brunneopygia</i> Southern Scrub-robin	V		This species is restricted to mallees and shrublands across southern Australia and in NSW is confined to two main areas. The first is in central NSW (the proposal site) and is centred on Round Hill and Nombinnie Nature Reserves, though suitable habitat probably exists on adjoining leasehold lands. This population once extended south and east to near Griffith and West Wyalong, but clearing appears to have led to its local extinction in most of this region. Inhabits mallee and acacia scrub, particularly with dense sub-shrubs in the understorey, including Broombush and other dry shrubs. Occupies vegetation with a post fire age of 4-80 years, but is most abundant in areas with a post fire age of 26-40 years as dependent on a well-developed shrub layer. Forages around the base of mallee trees and on the ground beneath shrubs for ground- and litter-dwelling invertebrates, with certain ant species dominating. Constructs a shallow cup-shaped nest of twigs, bark and grass, which is normally located on the ground and usually concealed in the shelter of a tree, shrub or fallen branch. This species usually has a clutch of only one egg.	1	Absent	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>Ephippiorhynchus asiaticus</i> Black-necked Stork	E		The species is widespread across coastal northern and eastern Australia, becoming increasingly uncommon further south into NSW, and rarely south of Sydney. Some birds may move long distances and can be recorded well outside their normal range. Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on intertidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water on a variety of prey including fish, frogs, eels, turtles, crabs and snakes. Breeds in late summer in the north, and early summer further south. A large nest, up to 2 m in diameter, is made in a live or dead tree, in or near a freshwater swamp. Two to four eggs are laid; incubation is by both parents.	0	Marginal – proposal site is located at edge of known distribution	Unlikely	No
<i>Epthianura albifrons</i> White-fronted Chat	V		The White-fronted Chat is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands. Along the coastline, White-fronted Chats are found in estuarine and marshy grounds with vegetation less than 1 m tall. The species is also observed in open grasslands and sometimes in low shrubs bordering wetland areas. Inland, the White-fronted Chat is often observed in open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways. The species is sensitive to human disturbance and is not found in built areas.	6	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A
<i>Falco hypoleuco</i> Grey Falcon	E		The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to	12	Yes	Possible	Construction, No – Negligible habitat loss.

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			be extinct in areas with more than 500mm rainfall in NSW. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey. Preys primarily on birds, especially parrots and pigeons, using high-speed chases and stoops; reptiles and mammals are also taken. Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring; two or three eggs are laid.				Operational, Yes – See Appendix A
<i>Falco subniger</i> Black Falcon	V		Widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres. Inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. Usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes the Black Falcon tends to nest in healthy, riparian woodland remnants with a diverse avifauna. Feeds mostly on other birds, especially flocking, ground-feeding granivores such as pigeons and parrots, but also some small mammals, large insects and occasionally carrion. Home range is likely to be more than 100 km ² .	10	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>Glossopsitta pusilla</i> Little Lorikeet	V		The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability. Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina. Nesting season extends from May to September.	3	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A
<i>Grantiella picta</i> Painted Honeyeater	V		Nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> . Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to	5	Yes	Possible	Construction, No – Negligible habitat loss.

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.				Operational, Yes – See Appendix A
<i>Grus rubicunda</i> Brolga	V		Formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. It is still abundant in the northern tropics, but very sparse across the southern part of its range. Though Brolgas often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially shallow swamps, where they will forage with their head entirely submerged. They feed using their heavy straight bill as a 'crowbar' to probe the ground or turn it over, primarily on sedge roots and tubers. They will also take large insects, crustaceans, molluscs and frogs. The nest comprises a platform of grasses and sticks, augmented with mud, on an island or in the water. Two eggs are laid from winter to autumn.	5	Yes	Possible - particularly during flood events	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A
<i>Hamirostra melanosternon</i> Black-breasted Buzzard	V		The Black-breasted Buzzard is found sparsely in areas of less than 500mm rainfall, from north-western NSW and north-eastern South Australia to the east coast at about Rockhampton, then across northern Australia south almost to Perth, avoiding only the Western Australian deserts. Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands. Not a powerful hunter, despite its size, mostly taking reptiles, small mammals, birds, including nestlings, and carrion. Also specialises in feeding on large eggs, including those of emus, which it cracks on a rock.	3	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			Breeds from August to October near water in a tall tree. The stick nest is large and flat and lined with green leaves. Normally two eggs are laid.				
<i>Hieraaetus morphnoides</i> Little Eagle	V		The Little Eagle is a medium-sized bird of prey that is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	7	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A
<i>Hylacola macrorhyncha</i> Shy Heathwren	V		Occurs across southern Australia extending from the wheatbelt in southern Western Australia east to central NSW, including Kangaroo Island. Two subspecies occur in NSW. The first (<i>macrorhyncha</i>) is confined to central NSW between Griffith, Roto, Nymagee and West Wyalong (including the proposal site), with most records within OEH managed reserves (including Yathong, Nombinnie, Round Hill and The Charcoal Tank Nature Reserves and Cocoparra National Park). Inhabits mallee woodlands with a relatively dense understorey of shrubs and heath plants. The central NSW population (for example in Cocoparra NP) also occurs at low densities in rocky hilltop vegetation with a thick shrub layer such as Broombush or Tea-tree. Appears to occur in all age classes of vegetation, though believed to prefer either one to five years following fire when the resprouting eucalypts provide dense vegetation cover or in long unburnt (greater than 40 years) areas which have a well developed shrub layer. Feeds on the ground, almost entirely on insects	1	No	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			(cockroaches, grasshoppers, bugs, lerps, beetles, caterpillars, moths, ants, spiders and insect eggs) and rarely on seeds, including those of saltbush. Breeds late winter to early summer and builds a dome-shaped nest in a concealed location on the ground, using a variety of plant materials. Generally occurs singly or in pairs, where it can be secretive, keeping within dense vegetation. In spring, males may sing from the top of low shrubs.				
<i>Lathamus discolor</i> Swift Parrot	E	E	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>Eucalyptus robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> , and White Box <i>E. albens</i> . Commonly used lerp infested trees include Grey Box <i>E. microcarpa</i> , Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i> . Return to home foraging sites on a cyclic basis depending on food availability.	8	Yes	Possible	Construction – No – Negligible habitat loss. Operational, Yes – See Appendix A
<i>Leipoa ocellata</i> Malleefowl	E	V	The stronghold for this species in NSW is the mallee in the south west centred on Mallee Cliffs NP and extending east to near Balranald and scattered records as far north as Mungo NP. The population in central NSW has been significantly reduced through land clearance and fox predation and now occurs chiefly in Yathong, Nombinnie and Round Hill NRs and surrounding areas, though birds continue to survive in Loughnan NR. To the south of this area the species is probably locally extinct in such reserves as Pulletop NR	1	Marginal – less frequently found in woodland	Unlikely – susceptible to fox predation and unlikely to	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			(last recorded 1989), Ingalba NR (1982) and Buddigower NR (1990) and the intensely studied population at Yalgogrin was, in 2003, predicted to be locally extinct by 2008 (although this has not been confirmed). Further east, a population continues to persist in the Goonoo forest near Dubbo. Outside these areas, occasional records have been made in the Pilliga forests (most recently 1999), around Cobar (1991) and Goulburn River NP (1989) though the extent and status of populations in these areas are unknown. Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300 - 450 mm mean annual rainfall) areas. Utilises mallee with a spinifex understorey, but usually at lower densities than in areas with a shrub understorey. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands with thick understorey, or in other woodlands such dominated by Mulga or native Cypress Pine species. Prefers areas of light sandy to sandy loam soils and habitats with a dense but discontinuous canopy and dense and diverse shrub and herb layers. A pair may occupy a range of between 50 and 500 ha, overlapping with those of their neighbours. Mainly forage in open areas on seeds of acacias and other native shrubs (<i>Cassia</i> , <i>Beyeria</i> , <i>Bossiaea</i>), buds, flowers and fruits of herbs and various shrubs, insects (cockroaches, ants, soil invertebrates), and cereals if available. Incubate eggs in large mounds that contain considerable volumes of sandy soil.			occur in fragmented landscape	
<i>Limosa limosa</i> Black-tailed Godwit	V		Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps. Individuals have been recorded in wet fields and sewerage treatment works. Forages for insects, crustaceans, molluscs, worms, larvae,	1	Marginal – primarily a coastal species	Unlikely - possibly during	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			spiders, fish eggs, frog eggs and tadpoles in soft mud or shallow water. Roosts and loafs on low banks of mud, sand and shell bars. Frequently recorded in mixed flocks with Bar-tailed Godwits.			flood events	
<i>Lophochroa leadbeateri</i> Major Mitchell's Cockatoo	V		Found across the arid and semi-arid inland, from south-western Queensland south to north-west Victoria, through most of South Australia, north into the south-west Northern Territory and across to the west coast between Shark Bay and about Jurien. In NSW it is found regularly as far east as about Bourke and Griffith, and sporadically further east than that. Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines. Normally found in pairs or small groups, though flocks of hundreds may be found where food is abundant. Nesting, in tree hollows, occurs throughout the second half of the year; nests are at least 1 km apart, with no more than one pair every 30 square kilometres.	2	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A
<i>Lophoictinia isura</i> Square-tailed Kite	V		The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open	1	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Appears to occupy large hunting ranges of more than 100km ² . Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.				
<i>Melanodryas cucullata cucullata</i> Hooded Robin (south-eastern form)	V		Common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season. May breed any time between July and November, often rearing several broods. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground.	11	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A
<i>Melithreptus gularis gularis</i>	V		The subspecies is widespread, from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although	11	Yes	Possible	Construction, No –

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
Black-chinned Honeyeater (eastern subspecies)			regularly observed from the Richmond River district. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>Eucalyptus albens</i>), Grey Box (<i>Eucalyptus microcarpa</i>), Yellow Box (<i>Eucalyptus melliodora</i>) and Forest Red Gum (<i>Eucalyptus tereticornis</i>). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. A gregarious species usually seen in pairs and small groups of up to 12 birds. Feeding territories are large making the species locally nomadic. Recent studies have found that the Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares. Moves quickly from tree to tree, foraging rapidly along outer twigs, underside of branches and trunks, probing for insects. Breeds solitarily or co-operatively, with up to five or six adults, from June to December. The nest is placed high in the crown of a tree, in the uppermost lateral branches, hidden by foliage. It is a compact, suspended, cup-shaped nest. Two or three eggs are laid and both parents and occasionally helpers feed the young.				Negligible habitat loss. Operational, Yes – See Appendix A
<i>Neophema pulchella</i> Turquoise Parrot	V		The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Forages quietly and may be quite tolerant of	32	Yes	Possible	Construction , No – Negligible habitat loss.

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			disturbance. However, if flushed it will fly to a nearby tree and then return to the ground to browse as soon as the danger has passed. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.				Operational, Yes – See Appendix A
<i>Ninox connivens</i> Barking Owl	V		Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as <i>Acacia</i> and <i>Casuarina</i> species, or the dense clumps of canopy leaves in large <i>Eucalypts</i> . Feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. Live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year. Three eggs are laid in nests in hollows of large, old eucalypts including River Red Gum (<i>Eucalyptus camaldulensis</i>), White Box (<i>Eucalyptus albens</i>), (Red Box) <i>Eucalyptus polyanthemos</i> and Blakely's Red Gum (<i>Eucalyptus blakelyi</i>). Breeding occurs during late winter and early spring.	2	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A
<i>Ninox strenua</i> Powerful Owl	V		Endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW the Powerful Owl lives in forests and woodlands occurring in the coastal, escarpment, tablelands and western slopes environments. Specific habitat requirements include eucalypt forests and woodlands on productive sites on gentle terrain; a mosaic of moist and dry types, with mesic gullies and permanent streams; presence of leafy sub-canopy trees or tall shrubs for roosting; presence of large old trees to provide nest hollows. Optimal habitat	0	Marginal – proposal site is west of its known distribution	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			includes a tall shrub layer and abundant hollows supporting high densities of arboreal marsupials. Roosts in groves of dense mid-canopy trees or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines, but also adjacent to cliff faces and below dry waterfalls. Species commonly used for roosting include the She-oaks <i>Allocasuarina</i> spp., rainforest species such as Coachwood <i>Ceratopetalum apetalum</i> , Lilly Pilly <i>Acmena smithii</i> and Sassafras <i>Doryphora sassafras</i> , Black Wattle <i>Acacia melanoxylon</i> , Turpentine <i>Syncarpia glomulifera</i> and eucalypts. Roosting sites are commonly among small groves of up to 2 ha of similar-sized trees with dense foliage in the height range 3-15 m.				
<i>Oxyura australis</i> Blue-billed Duck	V		The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal areas. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached. Blue-billed Ducks will feed by day far from the shore, particularly if dense cover is available in the central parts of the wetland. They feed on the bottom of swamps eating seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer. Blue-billed Ducks usually nest solitarily in Cumbungi over deep water between September and February.	12	Yes	Possible - particularl y during flood events	Construction , No Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			They will also nest in trampled vegetation in Lignum, sedges or Spike-rushes, where a bowl-shaped nest is constructed. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes.				
<i>Pachycephala inornata</i> Gilbert's Whistler	V		Sparsely distributed over much of the arid and semi-arid zone of inland southern Australia, from the western slopes of NSW to the Western Australian wheatbelt. The eastern population extends from the central NSW mallee (Yathong, Nombinnie and Round Hill NRs), south and east through the Cocoparra Range to Pomingalama Reserve (near Wagga Wagga) then north through the South West Slopes east as far as Cowra and Burrendong Dam, to the Goonoo reserves (with scattered records as far north as Pilliga). The north western limits of this population are poorly known, with records from as far west as Cobar and recent records from Quanda NR, though records further west may be due to confusion with the Golden Whistler. In a number of reserves in this area there have been no recent records (last records from Pulletop NR 1982, Pomingalama Reserve 1995 and Ingalba NR 1999) and this species may be locally extinct. Occasional records are also made of this species in the Capertee Valley. The species is also recorded in River Red Gum forests along the Murray River valley between Mathoura and Wentworth, with the eastern populations (between Mathoura and Barham) apparently isolated from other NSW populations. The Gilbert's Whistler occurs in a range of habitats within NSW, though the shared feature appears to be a dense shrub layer. It is widely recorded in mallee shrublands, but also occurs in box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum forests, though at this stage it is only known to use this habitat along the Murray, Edwards and Wakool Rivers. Within the mallee the species is often	10	Absent – prefers mallee shrublands	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			found in association with an understorey of spinifex and low shrubs including wattles, hakeas, sennas and hop-bushes. In woodland habitats, the understorey comprises dense patches of shrubs, particularly thickets of regrowth <i>Callitris</i> pine. Parasitic 'cherries' (<i>Exocarpus</i> species) appear to be an important habitat component in Belah and Red Gum communities, though in the latter case other dense shrubs, such as Lignum and wattles, are also utilised. The Gilbert's Whistler forages on or near the ground in shrub thickets and in tops of small trees. Breeding takes place between August and November. Nests are usually built below about two and a half metres (but up to six metres) above the ground in the fork of dense foliage of plants such as wattles or cypress pines. At Cowra three pairs nested in a 25 ha area. The nest is either a lined cup or sometimes birds use the old nests of other species, particularly disused babblers' nests.				
<i>Petroica boodang</i> Scarlet Robin	V		Found from SE Queensland to SE South Australia and also in Tasmania and SW Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter. Lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. Breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. Primarily a resident in forests and woodlands, but some adults	3	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			and young birds disperse to more open habitats after breeding. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees.				
<i>Petroica phoenicea</i> Flame Robin	V		Endemic to SE Australia, and ranges from near the Queensland border to SE South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgeland at high altitudes. In winter, birds migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains). Often occurs in recently burnt areas; however, habitat becomes unsuitable as vegetation closes up following regeneration. In winter lives in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. In winter, occasionally seen in heathland or other shrublands in coastal areas. Birds forage from low perches, from which they sally or pounce onto small invertebrates which they take from the ground or off tree trunks, logs and other coarse woody debris. Flying insects are often taken in the air and sometimes gleans for invertebrates from foliage and bark. In their autumn and winter habitats, birds often sally from fence-posts or thistles and other prominent perches in open habitats.	4	Yes	Possible	Construction , No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>Polytelis swainsonii</i> Superb Parrot	V	V	Found throughout eastern inland NSW. On the South-western Slopes their core breeding area is to the south of the site, roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. It is estimated that there are less than 5000 breeding pairs left in the wild. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. Breeding pairs, no sign of breeding was not observed at the site, only foraging behavior. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Because the Superb Parrots often use different habitats for different activities, the timing of their occurrence in each habitat may vary with the time of year. Between mid-January and early April, Superb Parrots do not use the River Red Gum breeding habitats on the Edward and Murrumbidgee Rivers, and their whereabouts at this time is unknown. Between April and August, they inhabit forests and woodlands dominated by River Red Gum, box-gum, White Cypress Pine (<i>Callitris glaucophylla</i>) and Boree. Nest in small colonies, often with more than one nest in a single tree. Breed between September and January. May forage up to 10 km from nesting sites, primarily in grassy box woodland. When foraging on the ground, Superb Parrots often eat the seeds of plants such as the native	23	Yes	Present – observed within the proposal site.	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			Ringed Wallaby-grass (<i>Danthonia caespitosa</i>), barley-grasses (<i>Critesion</i>), as well as cereal crops including wheat, oats and canola (<i>Brassica napus</i>); and spilt grain. They also eat the seed-pods of many understorey species of wattles such as Gold-dust Wattle (<i>Acacia acinacea</i>), Silver Wattle (<i>A. dealbata</i>) and Deane's Wattle (<i>A. deanei</i>) and cultivated Cootamundra Wattle (<i>A. baileyana</i>). When foraging in the forest canopy, Superb Parrots eat the flowers and fruits of eucalypts, especially in spring and summer, the berries of mistletoe, such as Box Mistletoe (<i>Amyema miquelii</i>) and Grey Mistletoe (<i>A. quandang</i>), and, in winter, lerps from the foliage of eucalypts.				
<i>Pomatostomus temporalis temporalis</i> Grey-crowned Babbler (eastern subspecies)	V		Occurs from Cape York south through Queensland, NSW and Victoria and formerly to the south east of South Australia. In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Birds are generally unable to cross large open areas. Live in family groups that consist of a breeding pair and young from previous breeding seasons. Feed on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Breed between July and February. Territories range from one to fifty hectares (usually around ten hectares) and are defended all year.	40	Yes	Present – observed within and outside proposal site.	Construction – No – Negligible habitat loss. Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>Rostratula australis</i> Australian Painted Snipe	E	V, Mi	Little is known of the ecology, habitat requirements and reproductive biology of Australian Painted Snipe. They feed in shallow water or at the waters' edge and on mudflats, taking seeds and invertebrates such as insects, worms, molluscs and crustaceans. Females, which are larger and more brightly coloured than males, are thought to sometimes be polyandrous, mating with several males and leaving each one to incubate and raise chicks. They lay 3-4 eggs per clutch and incubation lasts about 15-16 days. Most records of Australian Painted Snipe are from temporary or infrequently filled freshwater wetlands and although they have occurred at many sites, no site can be identified in which they are resident or regular in occurrence. This may suggest the species is nomadic but the extent to which its cryptic behaviour may contribute to this belief is uncertain. The birds are able to remain hidden in rank vegetation, but many reports are of birds not being secretive, but rather still and unobtrusive. Primarily occurs along the east coast from north Queensland (excluding Cape York) to the Eyre Peninsula in South Australia, including the majority of Victoria and NSW. In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Inhabits inland and coastal shallow freshwater wetlands. The species occurs in both ephemeral and permanent wetlands, particularly where there is a cover of vegetation, including grasses, Lignum and Samphire. Individuals have also been known to use artificial habitats, such as sewage ponds, dams and waterlogged grassland. Nests on the ground amongst tall vegetation, such as grass tussocks or reeds. Forages nocturnally on mud flats and in shallow water. Breeding is often in response to local conditions; generally occurs from September to December.	3	Yes	Possible - particularl y during flood events	Construction , No Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>Stagonopleura guttata</i> Diamond Firetail	V		The Diamond Firetail is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW. Also found in the Australian Capital Territory, Queensland, Victoria and South Australia. Groups separate into small colonies to breed, between August and January. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum <i>Eucalyptus pauciflora</i> Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Usually encountered in flocks of between five to 40 birds, occasionally more. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting. Appears to be sedentary, though some populations move locally, especially those in the south. Has been recorded in some towns and near farm houses.	28	Yes	Possible	Construction, No – Negligible habitat loss. Operational, Yes – See Appendix A
<i>Stictonetta naevosa</i> Freckled Duck	V		The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive	13	Yes	Possible - particularly during	Construction, No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. The largest numbers of Freckled Ducks occur in brackish to hyposaline wetlands that are densely vegetated with Lignum. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Generally rest in dense cover during the day, usually in deep water. Feed at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates. Nesting usually occurs between October and December but can take place at other times when conditions are favourable. Nests are usually located in dense vegetation at or near water level.			flood events	Operational, Yes – See Appendix A
Tyto novaehollandiae Masked Owl	V		Extends from the coast where it is most abundant to the western plains. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. Habitat for this species is also widespread throughout the dry eucalypt forests of the tablelands, western slopes and the undulating wet-dry forests of the coast. Optimal habitat includes an open understorey and a mosaic of sparse (grassy) and dense (shrubby) ground cover on gentle terrain. Roosts in hollows in live or occasionally dead eucalypts; dense foliage in gullies; and caves. Nest in old hollow eucalypts, live or dead, in a variety of topographic positions, with hollows greater than 40 cm wide and greater than 100 cm deep. Hollow entrances are at least 3 m above ground, in trees of at least 90 cm diameter at breast height. A specialist predator of terrestrial mammals, particularly native rodents. Home range has been estimated as 400-1000 ha according to habitat productivity.	0	Marginal – proposal site is on the edge of its known distribution	Unlikely – very few records in region	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
Fish							
<i>Maccullochella peelii peelii</i> Murray Cod		V	Grow up to a maximum size of 1200mm. Found extensively throughout the Murray Darling Basin in the south-eastern region of Australia. Murray cod are able to live in a wide range of habitats from clear, rocky streams in the upper western slopes regions of New South Wales to the slow flowing, turbid rivers and billabongs of the western plains. Generally, they are found in waters up to 5m deep and in sheltered areas with cover from rocks, timber or overhanging banks. The most common components of adult cod's diet include crustaceans such as yabbies, shrimp and crayfish, and fish such as the introduced common carp, goldfish and redfin perch, and the native fishes bony herring, catfish, golden perch, western carp gudgeon and even other cod. It appears that Murray cod prefer protected spawning sites, and typically spawn large (3.0-3.5mm diameter) adhesive eggs onto firm substrates such as hollow logs, rocks, pipes and clay banks, from spring to early summer.	0	Absent	Unlikely	No
<i>Bidyanus budyanus</i> Silver Perch		V	Silver perch grows to a maximum size of 500mm. Were once widespread and abundant throughout most of the Murray-Darling river system. The most abundant remaining natural population occurs in the central Murray River downstream of Yarrawonga Weir as well as several of its anabranches and tributaries (including the Edward River, an anabranch of the Murray which flows through Deniliquin, and the Murrumbidgee River). The central Murray population is considered secure and self-sustaining. There have also been reports of self-sustaining populations in other rivers, including the MacIntyre and Macquarie Rivers in northern NSW and the Warrego River in Queensland,	0	Absent	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			mostly from recreational anglers. Little is currently known about the status of these populations. Silver perch seem to prefer fast-flowing, open waters, especially where there are rapids and races, however they will also inhabit warm, sluggish water with cover provided by large woody debris and reeds. They are omnivorous, feeding on small aquatic insects, molluscs, earthworms and green algae. Adults migrate upstream in spring and summer to spawn. Juveniles also sometimes move upstream in response to rising water temperatures and levels.				
<i>Macquaria australasica</i> Macquarie Perch	E	E	Macquarie perch grow to a maximum size of 400mm. They are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. The conservation status of the different populations is not well known, but there have been long-term declines in their abundance. Macquarie perch are found in both river and lake habitats, especially the upper reaches of rivers and their tributaries. They are quiet, furtive fish that feed on aquatic insects, crustaceans and molluscs. Sexual maturity occurs at two years for males and three years for females. Macquarie perch spawn in spring or summer in shallow upland streams or flowing parts of rivers. Females produce around 50,000-100,000 eggs which settle among stones and gravel of the stream or river bed.	0	Absent	Unlikely	No
Insecta							
<i>Synemon plana</i> Golden Sun Moth	E	CE	The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut. The species' historical distribution	0	Absent – proposal	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			extended from Bathurst (central NSW) through the NSW Southern Tablelands, through to central and western Victoria, to Bordertown in eastern South Australia. It is now known from only 40 sites in NSW, about 12 sites in the Australian Capital Territory and eight sites in Victoria. Occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which groundlayer is dominated by wallaby grasses <i>Austrodanthonia</i> spp. Grasslands dominated by wallaby grasses are typically low and open - the bare ground between the tussocks is thought to be an important microhabitat feature for the Golden Sun Moth, as it is typically these areas on which the females are observed displaying to attract males. Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly spear-grasses <i>Austrostipa</i> spp. or Kangaroo Grass <i>Themeda australis</i>. Adults are short-lived (one to four days) and do not feed - having no functional mouthparts; the larvae are thought to feed exclusively on the roots of wallaby grasses. Males spend their entire adult life patrolling the grassland in search of females; once mated, the females spend their time laying eggs at the bases of wallaby grass tussocks. Females have reduced hind wings and are reluctant to fly, even when disturbed, though males are capable of active and prolonged flight. However, males will not fly long distances (no greater than 100 m) away from areas of suitable habitat. Thus populations separated by distances of greater than 200 m can be considered effectively isolated and populations which have gone extinct, or vacant patches of suitable habitat, are highly unlikely to be recolonised. The flight period is relatively short, typically lasting from six to eight weeks (during November and December in the ACT region, possibly earlier or alter in other regions). Males fly only in bright sunshine during the warmest part of the day		site is north of known distribution.		

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			(1000 - 1400 hrs). Adults emerge continuously throughout the flying season. Larvae feed on the roots of the wallaby grass plant.				
Mammals							
<i>Cercartetus nanus</i> Eastern Pygmy-possum	V		Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Also feeds on insects throughout the year; this feed source may be more important in habitats where flowers are less abundant such as wet forests. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (<i>Pseudocheirus peregrinus</i>) dreys or thickets of vegetation, (eg. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Appear to be mainly solitary, each individual using several nests, with males having non-exclusive home-ranges of about 0.68 hectares and females about 0.35 hectares. Young can be born whenever food sources are available, however most births occur between late spring and early autumn. Agile climbers, but can be caught on the ground in traps, pitfalls or postholes; generally nocturnal. Frequently spends time in torpor especially in winter, with body curled, ears folded and internal temperature close to the surroundings.	0	Absent – proposal site is west of known distribution	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	V	V	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Hirundo ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. Found in well-timbered areas containing gullies. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.	0	Absent – proposal site is west of known distribution	Unlikely	No
<i>Chalinolobus picatus</i> Little Pied Bat	V		The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria. Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, Bimbil box. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. Can tolerate high temperatures and dryness but need access to nearby open water. Feeds on moths and possibly other flying invertebrates.	1	Yes	Yes – 2 possible recordings	Yes
<i>Dasyurus maculatus</i> Spotted-tailed Quoll	V	E	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day;	0	Marginal – proposal site is west of its known	Unlikely – low likelihood of occurrence	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			spends most of the time on the ground. The home-range of this species is unknown, but estimates are between 800ha and 20km ² . Usually traverse their ranges along densely vegetated creeklines. They need suitable den sites and abundant food, requiring large areas of intact vegetation for foraging. Use 'latrine sites', often on flat rocks among boulder fields and rocky cliff-faces; latrine sites can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects; also eats carrion and takes domestic fowl.		distribution. No caves or rocky crevices.	e along roadside reserve in fragmented landscape	
<i>Miniopterus schreibersii oceanensis</i> Eastern Bentwing-bat	V		Eastern Bent-wing Bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops.	0	Marginal – proposal site is west of known distribution. Foraging habitat / no roosting habitat available	Unlikely – possible calls recorded although most likely to be <i>Vaspedelus</i> , 'highly unlikely range of <i>Miniopterus</i> ' (pers. comm. N.	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
						Williams, 2015).	
<i>Nyctophilus corbeni</i> Corben's Long-eared Bat	V	V	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. It is distributed throughout inland NSW except in the north-west area which is dominated by treeless plains. It can be found in the Hunter Valley, extending from central NSW to the eastern Hunter Valley coast. Records also indicate populations in River Red Gum, <i>Eucalyptus camaldulensis</i> , forests along the Murray River. In the Hunter Valley, NSW, the species is found in areas such as the Monobalai Nature Reserve and Goulburn River and Wollemi National Parks. It has primarily been recorded in moister woodland of various eucalypt species with a distinct shrub layer frequently adjacent to watercourses. There are a small number of records from closed forest adjacent to dry sclerophyll woodlands; in Araucarian notophyll vine forest in the Bunya Mountains and in semi evergreen vine thickets on the banks of the Dawson River and in the Brigalow Belt Bioregion. Inhabits a variety of vegetation types, including mallee, bullocke <i>Allocasuarina leuhmanni</i> and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. Schulz and Lumdsden (2010) DoE SPRAT Profile) found that roost sites were on average 1.89 ± 1.61 km (range 0.34–7.06 km) from the capture point. Slow flying agile bat, utilising the understorey to hunt non-flying prey - especially	0	Present	Possible – Definite recordings of <i>Nyctophilus</i> sp.	Yes

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			caterpillars and beetles - and will even hunt on the ground. Mating takes place in autumn with one or two young born in late spring to early summer.				
<i>Petaurus norfolcensis</i> Squirrel Glider	V		The Squirrel Glider is sparsely distributed along the east coast and immediate inland districts from western Victoria to north Queensland. The species is found inland as far as the Grampians in Victoria and the Pilliga and the Coonabarabran areas of NSW. Inhabits dry sclerophyll forest and woodland and is generally absent from rainforest and closed forest. In NSW, potential habitat includes Box-Ironbark forests and woodlands in the west, the River Red Gum forests of the Murray Valley and the eucalypt forests of the northeast. Requires abundant hollow-bearing trees and a mix of eucalypts, acacias and banksias. Nightly movements are estimated at between 300 and 500 m. Home-ranges have been estimated at between 0.65 and 8.55ha. Smooth-barked eucalypts are preferred as these eucalypts form hollows more readily than rough-barked and support a greater diversity of invertebrates. Squirrel Glider's forage in the upper and lower forest canopies and in the shrub understorey.	1	Marginal – proposal site west of known distribution.	Unlikely – not detected during spotlight surveys and no records from within 10 km.	No
<i>Petrogale penicillata</i> Brush-tailed Rock-wallaby	E	V	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. The species' range is now fragmented, particularly in the south where they are now mostly found as small isolated populations dotted across their former range. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Throughout their	0	Absent	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			range, Brush-tailed Rock-wallabies feed on a wide variety of grasses and shrubs, and have flexible dietary requirements. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. Highly territorial and have strong site fidelity with an average home range size of about 15 ha. Live in family groups of 2 – 5 adults and usually one or two juvenile and sub-adult individuals. Dominant males associate and breed with up to four females. Breeding is likely to be continuous, at least in the southern populations, with no apparent seasonal trends in births.				
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	V		Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Occurs primarily where the annual rainfall exceeds 500mm. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20 - 60 ha, while males have overlapping territories of up to 100 ha. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span. Also shelter in globular nests or possum drays. Mating occurs May - July; males die soon after the mating season whereas females can live for up to three years but generally only produce one litter.	0	Marginal – outside species known distribution.	Unlikely – no nearby records	No
<i>Phascolarctos cinereus</i> Koala	V	V	Occurs in eastern Australia, from north-eastern Queensland to south-eastern South Australia and to the west of the Great Dividing Range. In NSW it mainly occurs on the central and north coasts with some populations in the western region. It was historically abundant on the south coast of NSW, but now occurs in sparse and possibly disjunct populations. The koala inhabits a range	0	Present – secondary feed trees common	Unlikely – no recordings within	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			of eucalypt forest and woodland communities, including coastal forests, the woodlands of the tablelands and western slopes, and the riparian communities of the western plains. Examples of important shelter trees are cypress pine and brush box. The quality of forest and woodland communities as habitat for koalas is influenced by a range of factors, such as; species and size of trees present; structural diversity of the vegetation; soil nutrients; climate and rainfall; size and disturbance history of the habitat patch. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Breeding season for the koala peaks between September and February.		within proposal site.	50km of proposal site.	
<i>Pseudomys novaehollandiae</i> New Holland Mouse		V	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. Lives predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha. Breeding typically occurs between August and January, but can extend into autumn. The species peaks in abundance during early to mid stages of vegetation succession typically induced by fire. Nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal.	0	Absent – proposal site is west of known distribution.	Unlikely	No
<i>Pteropus poliocephalus</i>	V	V	Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. Occur in subtropical and temperate rainforests, tall sclerophyll forests and	0	Marginal	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
Grey-headed Flying-fox			woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source, often in stands of riparian rainforest, Paperbark or Casuarina forest, and are commonly found in gullies, close to water, or in vegetation with a dense canopy. Forage on the nectar and pollen of native trees, in particular <i>Eucalyptus</i> , <i>Melaleuca</i> and <i>Banksia</i> , and fruits of rainforest trees and vines. Travel up to 50 km to forage. Annual mating commences in January and a single young is born each October or November. Site fidelity to camps is high with some camps being used for over a century.				
<i>Saccolaimus flaviventris</i> Yellow-bellied Sheathtail-bat	V		The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.	0	Present – wide ranging species.	Possible – 1 possible recorded call.	Yes
<i>Sminthopsis macroura</i>	V		Occurs throughout much of inland central and northern Australia, extending into central and northern NSW, western Queensland, Northern Territory, South Australia and Western Australia. They are rare on the NSW Central	0	Absent	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
Stripe-faced Dunnart			West Slopes and North West Slopes with the most easterly records of recent times located around Dubbo, Coonabarabran, Wyalda and Ashford. Inhabit native dry grasslands and low dry shrublands, often along drainage lines. During periods of hot weather they shelter in cracks in the soil, in grass tussocks or under rocks and logs.				
<i>Vespadelus baverstocki</i> Inland Forest Bat	V		Because of the difficulty of identification, the distribution of this species, particularly in NSW, is very poorly known. Believed to occur widely in all the mainland states, generally in areas with annual rainfall less than 400 millimetres. In Victoria it is confined to the extreme north west. In NSW it has been most regularly captured in the far south west, north from the Murray River to Menindee, and at least as far east as the Balranald-Ivanhoe Road. There is some evidence to suggest that this species also occurs in the central NSW mallee, centred on Nombinnie Nature Reserve, although there has been very little recent survey in this part of the state. There are also records just south of the Queensland border around the Culgoa River, though whether this connect with the other NSW populations, or is the southern extent of a northern population is unknown. There are records further east in NSW but the identification of these records have not been confirmed. There are relatively few records any <i>Vespadelus</i> species in the north west of NSW and so whether this species does occur here is unknown. Some of the gaps in knowledge on the distribution on this and other bat species in western NSW probably reflects the lack of survey effort in most of this region. Roosts in hollows, fissures or cracks in live or dead trees, and roosts in abandoned buildings. Known to roost in very small hollows in stunted trees only a few metres high. The habitat requirements of this species are poorly known but it has been recorded from a variety of woodland formations, including	0	Present	Present – 21 probable recorded calls	Yes

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			mallee, mulga and River Red Gum. Most records are from drier woodland habitats with riparian areas inhabited by the Little Forest Bat. However, other habitats may be used for foraging and/or drinking. Colony size ranges from a few individuals to more than sixty. Females congregate to raise young in November and December, with young carried for the first week following birth. Young are independent by January. These bats fly rapidly and cover an extensive foraging area and are presumed to feed on flying insects.				
Reptiles							
<i>Aprasia parapulchella</i> Pink-tailed Worm-lizard	V	V	Only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong. This species is also found in the Australian Capital Territory. Inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (<i>Themeda australis</i>). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black ants and termites. Feeds on the larvae and eggs of the ants with which it shares its burrows. It is thought that this species lays 2 eggs inside the ant nests during summer; the young first appear in March. Best detected from September to February.	0	Absent – outside species known and predicted distribution. No Kangaroo Grass at site	Unlikely	No
<i>Hoplocephalus bitorquatus</i>	V		A patchy distribution from north-east Queensland to north-east NSW. In NSW it occurs from the coast to the western side of the Great Divide as far	0	Absent – outside	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
Pale-headed Snake			south as Tuggerah. Found mainly in dry eucalypt forests and woodlands, cypress woodland and occasionally in rainforest or moist eucalypt forest. Favours streamside areas, particularly in drier habitats. Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees. The main prey is tree frogs although lizards and small mammals are also taken.		known and predicted distribution. No streams on site.		
<i>Suta flagellum</i> Little Whip Snake	V		The Little Whip Snake is found within an area bounded by Crookwell in the north, Bombala in the south, Tumbarumba to the west and Braidwood to the east. Occurs in Natural Temperate Grasslands and grassy woodlands, including those dominated by Snow Gum <i>Eucalyptus pauciflora</i> or Yellow Box <i>E. melliodora</i> . Also occurs in secondary grasslands derived from clearing of woodlands. Found on well drained hillsides, mostly associated with scattered loose rocks. Most specimens have been found under rocks or logs lying on, or partially embedded in the soil. Little is known about the habits of this small snake as it is primarily nocturnal. Feeds on lizards and frogs. Up to seven live young are born between September and February.	0	Absent	Unlikely	No
FLORA							
<i>Acacia ausfeldii</i> Ausfeld's Wattle	V		An erect or spreading shrub 2 - 4 m high. Found to the east of Dubbo in the Mudgee, Ulan - Gulgong area of the NSW South Western Slopes bioregion, with some records in the adjoining Brigalow Belt South, South Eastern Highlands and the Sydney Basin bioregions. Populations are recorded from Yarrobil National Park, Goodiman State Conservation Area and there is a	0	Marginal – associated species present in	Unlikely. No records within 10 km; was	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			1963 record from Munghorn Gap Nature Reserve. A large population is also known from Tuckland State Forest to the northwest of Gulgong. Established plants are likely to be killed by fire, as mature and juvenile plants have a single-stemmed growth form. Associated species include <i>Eucalyptus albens</i> , <i>E. blakelyi</i> and <i>Callitris</i> spp., with an understorey dominated by <i>Cassinia</i> spp. and grasses. <i>Acacia ausfeldii</i> is likely to have a dormant soil seedbank from which germination is stimulated by fire; a small number of seeds have been observed to germinate in the absence of fire. When stimulated by fire, germination appears to be reduced at depth, and by low fire temperature. Laboratory experiments show strong germination only at the highest temperature treatment of 100°C. Flowers from August to October.		some areas.	not observed during surveys; and study area likely too degraded.	
<i>Austrostipa wakoolica</i> A spear-grass	E	E	A densely-tufted, perennial spear-grass, growing to 1 m tall. Confined to the floodplains of the Murray River tributaries of central-western and south-western NSW, with localities including Manna State Forest, Matong, Lake Tooim, Merran Creek, Tulla, Cunninyeuk and Mairjimmy State Forest. Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils; habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise. Associated species include <i>Callitris glaucophylla</i> , <i>Eucalyptus microcarpa</i> , <i>E. populnea</i> , <i>Austrostipa eremophila</i> , <i>A. drummondii</i> , <i>Austrodanthonia eriantha</i> and <i>Einadia nutans</i> . Flowers from October to December, mainly in response to rain. Seed dispersal is mainly by wind, rain and flood events; the awn and sharp point of the floret appear to be an adaptation for burying the seed into the soil; grass seed is traditionally believed to be viable for three to five years,	0	Marginal. No likely habitat types in study area, but some associated species present.	Unlikely. No records within 10 km of study area and the area is likely too degraded.	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			so a long-lived seed bank is considered unlikely for this species. Recorded as common in the Mairjimmy State Forest population.				
<i>Diuris tricolor</i> Pine Donkey Orchid	V		The Pine Donkey Orchid (formerly known as <i>Diuris sheaffiana</i>) is a terrestrial species that has a flower stalk 20-40 cm high. It is sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the far north of NSW. Localities include the Condobolin-Nymagee road, Wattamondara towards Cowra, Cooyal, Adelong, Red Hill north of Narrandera, Coolamon, near Darlington Point, Eugowra, Girilambone, Dubbo, Muswellbrook, and several sites west of Wagga Wagga. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Associated species include <i>Callitris glaucophylla</i> , <i>Eucalyptus populnea</i> , <i>Eucalyptus intertexta</i> , Ironbark and <i>Acacia</i> shrubland. The understorey is often grassy with herbaceous plants such as <i>Bulbine</i> species. Flowers from September to November or generally spring. The species is a tuberous, deciduous terrestrial orchid and the flowers have a pleasant, light sweet scent. It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. Usually recorded as common and locally frequent in populations, however only one or two plants have also been observed at sites. The species has been noted as growing in large colonies.	0	Marginal. Some associated species present.	Unlikely. No records from the region and not observed despite surveys undertaken during flowering period.	No
<i>Swainsona murrayana</i> Slender Darling-pea	V	V	An ascending to erect perennial forb growing to 25 cm high. Occurs from South Australia through south-west Victoria and central NSW to south-east Queensland. Found throughout NSW, it has been recorded in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park, near Broken Hill and in various localities between	0	Marginal. Some associated	Unlikely. Not recorded within 10	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			Dubbo and Moree. Found in grassland, herbland, and open Black-box woodland, often in depressions. Has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with Maireana species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated. Plants produce winter-spring growth, flower in spring to early summer and then die back after flowering. They re-shoot readily and often carpet the landscape after good cool-season rains. The species may require some disturbance and has been known to occur in paddocks that have been moderately grazed or occasionally cultivated. It is often associated with low chenopod shrubs (<i>Maireana</i> spp.), wallaby-grass (<i>Austrodanthonia</i> spp), and spear grass (<i>Austrostipa</i> spp.).		species present.	km of study area, and abiotic factors likely not appropriate.	
<i>Swainsona sericea</i> Sily Swainson-pea	V		A slender, erect perennial plant with few stems 20 - 30 cm high. The range of <i>S. recta</i> has contracted to two disjunct clusters in NSW, one between Wellington and Mudgee, and the other from Canberra and Queanbeyan south to Williamsdale. The largest known population has about 3,400 plants, scattered along 22 km of narrow railway easement in NSW from Tralee (south of Queanbeyan) to south of Williamsdale. Occurs in grassland and open woodland, often on stony hillsides, dominated by one or more of the following: <i>Callitris endichleri</i> , <i>C. glaucophylla</i> , <i>Eucalyptus blakelyi</i> , <i>E. bridgesiana</i> , <i>E. dives</i> , <i>E. melliodora</i> , <i>E. microcarpa</i> , <i>E. nortonii</i> and <i>E. polyanthemos</i> . Requires a forb-rich grassy groundlayer dominated by <i>Themeda triandra</i> , <i>Poa sieberiana</i> var. <i>sieberiana</i> or <i>Austrostipa</i> spp.	0	Absent	None	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			Resprouts in autumn and winter from a woody root. It flowers in spring, peaking over two to three weeks in October.				
<i>Tylophora linearis</i>	V	E	An herbaceous climber with clear latex that grows to about 2 m long. Known from eight localities in the Dubbo area and Mt Crow near Barraba in NSW, and "Myall Park" near Glenmorgan in Queensland. This species is conserved within Goobang National Park, Eura State Forest, Goonoo SF, Pilliga West SF and Coolbaggie Nature Reserve. Grows in dry scrub, open forest and woodlands associated with <i>Melaleuca uncinata</i> , <i>Eucalyptus fibrosa</i> , <i>E. sideroxylon</i> , <i>E. albens</i> , <i>Callitris endlicheri</i> , <i>C. glaucophylla</i> , <i>Allocasuarina luehmannii</i> , <i>Acacia hakeoides</i> , <i>A. lineata</i> , <i>Myoporum</i> spp., and <i>Casuarina</i> spp. The distribution of this species overlaps with the following EPBC Act-listed threatened ecological communities: Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant), and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. Flowers in spring, with flowers recorded in November or May with fruiting probably 2 to 3 months later.	1	Marginal. Some associated species present, and recorded within 10 km of study area.	Unlikely	No
<i>Zieria obcordata</i>	E	E	A densely rounded shrub 40-50 cm high and 50 cm wide. Known only from near Bathurst on the Central Tablelands of NSW and from near Wellington on the Central Western Slopes of NSW. All known sites are on private property: Bulbudgere Station near Wellington, comprising of a single population of 77 plants and Crackerjack Rock/Rock Forests area NW of Bathurst, comprising of 5 populations across 3 sites, totaling 259 plants. Grows in eucalypt woodland or shrubland dominated by species of <i>Acacia</i> on rocky hillsides. Also occurs in <i>Eucalyptus</i> and <i>Callitris</i> dominated woodland with an open, low shrub understorey, on moderately steep, west to north-facing slopes in sandy loam amongst granite boulders. The altitude range of	0	Absent	None	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			sites is 500 to 830 metres. Associated vegetation includes <i>Eucalyptus blakelyi</i>, <i>Brachychiton populneus</i> and <i>Acacia implexa</i> woodland with pockets of low shrub understorey. Also in <i>Eucalyptus goniocalyx</i>, <i>Eucalyptus dwyeri</i>, <i>Acacia doratoxylon</i> and <i>Callitris glaucophylla</i> woodland with a shrubby understorey. Understorey species include <i>Pandorea pandorana</i>, <i>Isotoma axillaris</i>, <i>Westringia eremicola</i>, <i>Leucopogon attenuatus</i>, <i>Dillwynia sericea</i>, <i>Olearia ramulosa</i>, <i>Stypandra glauca</i>, <i>Stellaria pungens</i>, <i>Acacia vestita</i>, <i>Melichrus urceolatus</i>, <i>Cryptandra amara</i>, <i>Lepidosperma</i>, <i>Styphelia</i>, <i>Kunzea</i>, <i>Haloragis</i> and <i>Cheilanthes</i> species. In wild populations, plants tend to grow in crevices between granite boulders. <i>Zieria obcordata</i> is extremely sensitive to grazing and browsing disturbances by domestic stock and native herbivores. Heavily browsed plants and vigorous regrowth (following severe browsing by wallabies) have been recorded at sites. Flowering time is in spring (September-October) with fruiting specimens observed in summer.				
THREATENED ECOLOGICAL COMMUNITIES							
Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	EEC		Tall woodland or open forest dominated by Fuzzy Box <i>Eucalyptus conica</i>, often with Grey Box <i>Eucalyptus microcarpa</i>, Yellow Box <i>Eucalyptus melliodora</i>, or Kurrajong <i>Brachychiton populneus</i>. Buloke <i>Allocasuarina luehmannii</i> is common in places. Shrubs are generally sparse, and the groundcover moderately dense, although this will vary with season. Found on alluvial soils of the South West Slopes, Brigalow Belt South and Darling Riverine Plains Bioregions. Mainly found in the Dubbo-Narromine-Parkes-Forbes area. Community occurs on brown loam or clay, alluvial or colluvial soils on prior streams and abandoned channels or slight depressions on undulating plains or flats of the western slopes. Community often occurs		Absent	None	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			upslope from River Red Gum communities above frequently inundated areas of the floodplain. It also occurs on colluvium soils on lower slopes and valley flats. Less than 5% of the original extent is estimated to remain. Shrubs include Wilga, Deane's Wattle, Hop Bush, Cassia, Water Bush and Sifton Bush.				
<i>Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia</i>		EEC	Predominantly occurs on the drier edge of the temperate grassy eucalypt woodland belt and ranges from central New South Wales through northern and central Victoria into South Australia. Relatively less well studied and understood in comparison with other grassy woodland systems in south-eastern Australia. The ecological community also occupies a complex position in the landscape. For example, in NSW it can be transitional between the temperate lower slopes and tablelands occupied by, e.g. the EPBC Act-listed <i>White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland</i> ecological community, and the semi-arid floodplain communities. Generally occurs in landscapes of low-relief such as flat to undulating plains, low slopes and rises and, to a lesser extent, drainage depressions and flats. The ecological community may extend to more elevated hillslopes on the fringes of its range where it intergrades with other woodland or dry sclerophyll forest communities. often occurs on productive soils derived from alluvial or colluvial materials but may occur on a range of substrates. Soils include: duplex soils; red-brown earths; gradational soils; non-calceric and calceric browns with variable textures including sandy clay loam, clay loam, sandy loam, loam, heavy clay; and loams with quartzite surface stones and rocky outcroppings in the Mount Lofty Ranges. Gilgai topography may be present. The ecological community tends to occupy drier sites within the belt of grassy woodlands in south-eastern Australia (Prober and Thiele, 1993). The mean annual rainfall associated with the distribution		Absent -	None	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
of the ecological community lies in the range 375-700 mm/year. The typical structure of ecological community is a woodland to open forest with a canopy dominated by eucalypts and an understorey with a moderately dense to sparse shrub layer and a ground layer of perennial and annual native forbs and graminoids. Tussock grasses dominate the ground layer vegetation, though other graminoids or forbs may be common. Chenopods also may be present in the ground layer. The tree canopy is dominated ($\geq 50\%$ canopy crown cover) by <i>Eucalyptus microcarpa</i> (Grey Box). Widespread associated tree species that may be present include: <i>Allocasuarina luehmannii</i> (Buloke), <i>Brachychiton populneus</i> (Kurrajong), <i>Callitris glaucophylla</i> (White Cypress Pine), <i>Eucalyptus albens</i> (White Box), <i>E. camaldulensis</i> (River Red Gum), <i>E. conica</i> (Fuzzy Box), <i>E. leucoxylon</i> (Yellow Gum, SA Blue Gum), <i>E. melliodora</i> (Yellow Box) and <i>E. populnea</i> (Bimble Box, Poplar Box). The ground layer also is highly variable in development and composition, ranging from almost absent to mostly grassy to forb-rich. Ground layer flora commonly present include one or more of the graminoid genera: <i>Austrodanthonia</i>, <i>Austrostipa</i>, <i>Elymus</i>, <i>Enteropogon</i>, <i>Dianella</i> and <i>Lomandra</i>; and one or more of the chenopod genera: <i>Atriplex</i>, <i>Chenopodium</i>, <i>Einadia</i>, <i>Enchylaena</i>, <i>Maireana</i>, <i>Salsola</i> and <i>Sclerolaena</i>. Derived grasslands are a special state of the ecological community, whereby the canopy and mid layers have been mostly removed to $<10\%$ crown cover but the native ground layer remains largely intact, with 50% or more of the total vegetation cover being native.							
Inland Grey Box Woodland in the Riverina, NSW South Western	EEC		Includes those woodlands in which the most characteristic tree species, <i>Eucalyptus microcarpa</i> (Inland Grey Box), is often found in association with <i>E. populnea</i> subsp. <i>bimbil</i> (Bimble or Poplar Box), <i>Callitris glaucophylla</i> (White Cypress Pine), <i>Brachychiton populneus</i> (Kurrajong), <i>Allocasuarina luehmannii</i>		Present	Present	No – the proposed transmission

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions			(Bullock) or <i>E. melliodora</i> (Yellow Box), and sometimes with <i>E. albens</i> (White Box). Shrubs are typically sparse or absent, although this component can be diverse and may be locally common, especially in drier western portions of the community. A variable ground layer of grass and herbaceous species is present at most sites. At severely disturbed sites the ground layer may be absent. The community generally occurs as an open woodland 15–25 m tall but in some locations the overstorey may be absent as a result of past clearing or thinning, leaving only an understorey. Generally occurs in landscapes of low-relief such as flat to undulating plains, low slopes and rises and, to a lesser extent, drainage depressions and flats. Tends to occupy drier sites within the belt of grassy woodlands in south-eastern Australia. Inland Grey Box Woodland occurs predominately within the Riverina and South West Slopes regions of NSW down to the Victorian border. It includes Albury to the east and may extend out west towards Hay. This community also extends across the slopes and plains in Central and Northern NSW up to the Queensland Border. This includes Yetman and Inverell in the North, Molong to the east of the Central Slopes and plains and out towards Nymagee to the west. Occurs on fertile soils of the western slopes and plains of NSW. The community generally occurs where average rainfall is 375- 800 mm pa and the mean maximum annual temperature is 22- 26°C. There is a correlation between the distribution of <i>Eucalyptus microcarpa</i> communities and soils of Tertiary and Quaternary alluvial origin, largely corresponding with the Red Brown Earths. The majority of remnant patches of Inland Grey Box Woodland survive with trees largely intact but with the shrub or ground layers degraded to varying degrees through grazing or pasture modification. Some species				line will avoid any clearing of this community in the north of the proposal site.

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			that are part of the community appear intolerant to heavy grazing by domestic stock and are confined to the least disturbed remnants.				
<i>Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions</i>	EEC		Scattered across the eastern parts of the alluvial plains of the Murray-Darling river system. Typically, it occurs on red-brown earths and heavy textured grey and brown alluvial soils within a climatic belt receiving between 375 and 500 mm mean annual rainfall. The structure of the community varies from low woodland and low open woodland to low sparse woodland or open shrubland, depending on site quality and disturbance history. The tree layer grows up to a height of about 10 metres and invariably includes <i>Acacia pendula</i> (Weeping Myall or Boree) as one of the dominant species or the only tree species present. The understorey includes an open layer of chenopod shrubs and other woody plant species and an open to continuous groundcover of grasses and herbs. The structure and composition of the community varies, particularly with latitude, as chenopod shrubs are more prominent south of the Lachlan River district, while other woody species and summer grasses are more common further north. In some areas the shrub and canopy stratum may have been reduced or eliminated by clearing or heavy grazing, leaving derived grassland that may still constitute this community. This EEC is known from parts of the Local Government Areas of Berrigan, Bland, Bogan, Carrathool, Conargo, Coolamon, Coonamble, Corowa, Forbes, Gilgandra, Griffith, Gwydir, Inverell, Jerilderee, Lachlan, Leeton, Lockhart, Moree Plains, Murray, Murrumbidgee, Narrabri, Narranderra, Narromine, Parkes, Urana, Wagga Wagga and Warren, and but may occur elsewhere in these bioregions.		Absent	None	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
Weeping Myall Woodlands		EEC	The Weeping Myall Woodlands occurs on the inland alluvial plains west of the Great Dividing Range in NSW and Queensland, with one small outlying patch in northern Victoria. It occurs in the Riverina, NSW South Western Slopes, Darling Riverine Plains, Brigalow Belt South, Brigalow Belt North, Murray-Darling Depression, Nandewar and Cobar Peneplain IBRA Bioregions. Occurs in a range from open woodlands to woodlands, generally 4-12 m high, in which Weeping Myall (<i>Acacia pendula</i>) trees are the sole or dominant overstorey species. Other common names for Weeping Myall include Myall, Boree, Balaar, Nilyah, Bastard Gidgee, and Silver Leaf Boree. Weeping Myall trees often occur in monotypic stands, however other vegetation may also occur in the ecological community, though not as dominant species. These include: Western Rosewood (<i>Alectryon oleifolius</i> subsp. <i>elongatus</i>); Poplar Box (<i>Eucalyptus populnea</i>); or Black Box (<i>Eucalyptus largiflorens</i>). Grey Mistletoe (<i>Amyema quandang</i>) commonly occurs on the branches of Weeping Myall trees throughout the ecological community's range. The understorey of Weeping Myall Woodlands often includes an open layer of shrubs above an open ground layer of grasses and herbs, though the ecological community can exist naturally either as a shrubby or a grassy woodland. Generally occur on flat areas, shallow depressions or gilgais on raised (relict) alluvial plains. These areas are not associated with active drainage channels and are rarely if ever flooded. The ecological community occurs on black, brown, red-brown or grey clay or clay loam soils. The Weeping Myall Woodlands provide important habitat for a range of animals such as the Superb Parrot (<i>Polytelis swainsonii</i>), Painted Honeyeater (<i>Grantiella picta</i>) and the Bush Stone-curlew (<i>Burhinus grallarius</i>).		Absent	None	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>White Box Yellow Box Blakely's Red Gum Woodland</i>	EEC		An open woodland community (sometimes occurring as a forest formation). Areas that are part of the Australian Government listed ecological community must have either: an intact tree layer and predominately native ground layer; or an intact native ground layer with a high diversity of native plant species but no remaining tree layer. Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW. The community occurs within the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and NSW South Western Slopes Bioregions. Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. The tree-cover is generally discontinuous and consists of widely-spaced trees of medium height in which the canopies are clearly separated. The understorey in intact sites is characterised by scattered shrubs, native tussock grasses, and a high diversity of herbs. Remnants generally occur on fertile lower parts of the landscape where resources such as water and nutrients are abundant. Sites with particular characteristics, including varying age classes in the trees, patches of regrowth, old trees with hollows and fallen timber on the ground are very important as wildlife habitat. Sites in the lowest parts of the landscape often support very large trees which have leafy crowns and reliable nectar flows - sites important for insectivorous and nectar feeding birds. Sites that retain only a grassy groundlayer and with few or no trees remaining are important for rehabilitation, and to rebuild connections between sites of better quality. Remnants support many species of threatened fauna and flora. This		Absent	None	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			ecological community occurs in areas where rainfall is between 400 and 1200 mm per annum, on moderate to highly fertile soils at altitudes of 170 metres to 1200 metres.				
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland		CEEC	An open woodland community (sometimes occurring as a forest formation). Areas that are part of the Australian Government listed ecological community must have either: an intact tree layer and predominately native ground layer; or an intact native ground layer with a high diversity of native plant species but no remaining tree layer. Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW. The community occurs within the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and NSW South Western Slopes Bioregions. Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. The tree-cover is generally discontinuous and consists of widely-spaced trees of medium height in which the canopies are clearly separated. The understorey in intact sites is characterised by scattered shrubs, native tussock grasses, and a high diversity of herbs. Remnants generally occur on fertile lower parts of the landscape where resources such as water and nutrients are abundant. Sites with particular characteristics, including varying age classes in the trees, patches of regrowth, old trees with hollows and fallen timber on the ground are very important as wildlife habitat. Sites in the lowest parts of the landscape often support very large trees which have leafy crowns and reliable nectar flows - sites important for insectivorous and nectar feeding birds. Sites that retain only a grassy		Absent	Absent	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			groundlayer and with few or no trees remaining are important for rehabilitation, and to rebuild connections between sites of better quality. Remnants support many species of threatened fauna and flora. This ecological community occurs in areas where rainfall is between 400 and 1200 mm per annum, on moderate to highly fertile soils at altitudes of 170 metres to 1200 metres.				
MIGRATORY SPECIES							
<i>Actitis hypoleucos</i> Common Sandpiper		Ma, Mi	Widespread east of the Great Dividing Range; sparsely scattered in Western and Plains regions of NSW. Occurs along shallow, pebbly, muddy or sandy edges of rivers and streams, coastal to far inland; dams, lakes, sewage ponds; margins of tidal rivers; waterways in mangroves or saltmarsh; mudflats; rocky or sandy beaches; and on man-made structures such as causeways, street gutters, drains and riverside lawns.	2	Marginal	Possible – low likelihood, rare visitor – particularly during flood events	Construction, No Operational, Yes – See Appendix A
<i>Apus pacificus</i> Fork-tailed Swift		Ma, Mi	This species breeds in the north-east and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, beginning to arrive in the Kimberley in late September, in the Pilbara and Eucla in November and in the south-west land division in mid-December, and leaving by late April. It is common in the Kimberley, uncommon to moderately common near north-west, west and southeast	3	Marginal – broad habitat preference	Possible – low likelihood, but may be	Construction, No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			coasts and rare to scarce elsewhere. They never settle voluntarily on the ground and spend most of their lives in the air, living on the insects they catch in their beaks.		, mostly aerial	a rare visitor	Operational, Yes – See Appendix A
<i>Ardea alba</i> Great Egret		Ma, Mi	The Eastern Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs. The species usually frequents shallow waters. Eastern Great Egrets usually nest in colonies and rarely as solitary pairs. In Australia, breeding sites are located in wooded and shrubby swamps including mangrove forests (the main habitat of the species in the Top End), <i>Melaleuca</i> swamps (on the eastern coast of Australia and south-western Western Australia) and mixed eucalypt/acacia/lignum swamps (in the Channel Country and Murray-Darling Basin). The Eastern Great Egret has a diverse diet that includes fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammal.		Marginal – dams on site. Non-breeding habitat only	Possible – low likelihood, rare visitor - particularly during flood events	Construction, No Operational, Yes – See Appendix A
<i>Ardea ibis</i> Cattle Egret		Ma, Mi	The Cattle Egret is found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. Will also forage at garbage dumps, and is often seen with cattle and other stock. The Cattle Egret is partially migratory, moving during winter. The Cattle Egret prefers grasshoppers, especially during breeding season, but eats many other invertebrates. It also eats frogs, cane toads,	0	Marginal – not common	Possible – low likelihood, rare visitor	Construction, No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			lizards and some small mammals. Its sharp bill is used in a lunging and stabbing manner. It often feeds by following large animals such as cattle, grabbing insects and worms that they disturb with their feet. They also will sit on cattle to look out for insects. Cattle Egret pairs are monogamous for the breeding season, and they breed in colonies, usually with other waterbirds. Their shallow platform nests are made in wetland areas in trees and bushes, usually as high up as possible. Both parents build the nest and incubate the eggs, with one brood per season being raised.		in inland areas		Operational, Yes – See Appendix A
<i>Calidris acuminata</i> Sharp-tailed Sandpiper		Ma, Mi	Prefers the grassy edges of shallow inland freshwater wetlands. It is also found around sewage farms, flooded fields, mudflats, mangroves, rocky shores and beaches. Its breeding habitat in Siberia is the peat-hummock and lichen tundra of the high Arctic.	2	Yes	Possible - particularly during flood events	Construction, No Operational, Yes – See Appendix A
<i>Calidris ferruginea</i> Curlew Sandpiper	E	Ma, Mi	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. This species does not breed in	1	Yes	Possible - particularly during flood events	Construction, No Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			Australia. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds.				
<i>Calidris melanotos</i> Pectoral Sandpiper		Ma, Mi	In Australasia, prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. Also occasionally found further inland, preferring wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire.	2	Yes	Possible - particularly during flood events	Construction, No Operational, Yes – See Appendix A
<i>Calidris ruficollis</i> Red-necked Stint		Ma, Mi	In Australia, Red-necked Stints are found on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. They may also be seen in saltworks, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats, flooded paddocks or damp grasslands. They are often in dense flocks, feeding or roosting.	2	Yes	Possible - particularly during flood events	Construction, No Operational, Yes – See Appendix A
<i>Chlidonias leucopterus</i> White-winged Black Tern		Ma, Mi	Occurs on large coastal and inland wetlands, saltfields, sewage ponds, and in estuaries and coastal waters.	1	Absent	Unlikely	No
<i>Gallinago hardwickii</i> Latham's Snipe		Ma, Mi	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in	2	Present	Possible - particularly during	Construction, No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity. Latham's Snipe does not breed within Australian jurisdiction. Latham's Snipe is an omnivorous species that feeds on seeds and other plant material (mainly from species in families such as Cyperaceae, Poaceae, Juncaceae, Polygonaceae, Ranunculaceae and Fabaceae), and on invertebrates including insects (mainly flies and beetles), earthworms and spiders and occasionally molluscs, isopods and centipedes.			flood events	Operational, Yes – See Appendix A
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle		Mi	White-bellied Sea-Eagles are a common sight in coastal and near coastal areas of Australia. Birds form permanent pairs that inhabit territories throughout the year. Their loud "goose-like" honking call is a familiar sound, particularly during the breeding season. Birds are normally seen, perched high in a tree, or soaring over waterways and adjacent land. In addition to Australia, the species is found in New Guinea, Indonesia, China, south-east Asia and India. The White-bellied Sea-Eagle feeds mainly off aquatic animals, such as fish, turtles and sea snakes, but it takes birds and mammals as well. It is a skilled hunter, and will attack prey up to the size of a swan. Sea-Eagles also feed on carrion (dead prey) such as sheep and fish along the waterline. They harass smaller birds, forcing them to drop any food that they are carrying. Sea-Eagles feed alone, in pairs or in family groups. White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession. The nest can be located in a tree up to 30m above the ground, but may be also be placed on the ground or on rocks, where there are no suitable trees. At the start of the breeding season (May to October), the nest is lined with fresh green leaves and twigs. The female carries out most of the	5	Marginal	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			incubation of the two white eggs, but the male performs this duty from time to time.				
<i>Hirundapus caudacutus</i> White-throated Needletail		Mi	White-throated Needletails often occur in large numbers over eastern and northern Australia. They arrive in Australia from their breeding grounds in the northern hemisphere in about October each year and leave somewhere between May and August. They are aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity. The White-throated Needletail feeds on flying insects, such as termites, ants, beetles and flies. They catch the insects in flight in their wide gaping beaks. Birds usually feed in rising thermal currents associated with storm fronts and bushfires and they are commonly seen moving with wind fronts. White-throated Needletails are non-breeding migrants in Australia.	3	Marginal – non-breeding habitat only. Broad habitat preference, mostly aerial	Possible – likely to be a rare visitor to site	Construction, No Operational, Yes – See Appendix A
<i>Hydroprogne caspia</i> Caspian Tern		Ma, Mi	Usually found near the coast, in extensive wetlands, on coastal and interior beaches and sheltered estuaries. The Caspian Tern lives equally well in fresh water and saline environments.	2	Absent	Unlikely	No
<i>Limosa lapponica</i> Bar-tailed Godwit		Mi	Inhabits estuarine mudflats, beaches and mangroves. They are common in coastal areas around Australia. They are social birds and are often seen in large flocks and in the company of other waders.	1	Absent	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>Limosa limosa</i> Black-tailed Godwit	V	Ma, Mi	Occurs on tidal mudflats, estuaries, sewage ponds, shallow river margins, brackish or saline inland lakes, flooded pastures and airfields.	1	Present	Possible - particularl y during flood events	Construction , No Operational, Yes – See Appendix A
<i>Merops ornatus</i> Rainbow Bee-eater		Mi	The Rainbow Bee-eater is found throughout mainland Australia, as well as eastern Indonesia, New Guinea and, rarely, the Solomon Islands. In Australia it is widespread, except in desert areas, and breeds throughout most of its range, although southern birds move north to breed. The Rainbow Bee-eater is most often found in open forests, woodlands and shrublands, and cleared areas, usually near water. It will be found on farmland with remnant vegetation and in orchards and vineyards. It will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels. Southern populations move north, often in huge flocks, during winter; northern populations are present year round. Rainbow Bee-eaters eat insects, mainly catching bees and wasps, as well as dragonflies, beetles, butterflies and moths. They catch flying insects on the wing and carry them back to a perch to beat them against it before swallowing them. Bees and wasps are rubbed against the perch to remove the stings and venom glands.	12	Marginal – foraging habitat only	Possible	Construction , No Operational, Yes – See Appendix A
<i>Myiagra cyanoleuca</i> Satin Flycatcher		Mi	The Satin Flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. It is also found in New Guinea. The Satin Flycatcher is not a commonly seen species, especially in the far south of its range, where it is a summer breeding	1	Absent	Unlikely	No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			migrant. The Satin Flycatcher is found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. The Satin Flycatcher is a migratory species, moving northwards in winter to northern Queensland and Papua New Guinea, returning south to breed in spring. The Satin Flycatcher takes insects on the wing, foraging actively from perches in the mid to upper canopy.				
<i>Pandion cristatus</i> Eastern Osprey	V	Ma, Mi	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. Feeds on fish over clear, open water. Nests are located high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	3	Absent	Unlikely	No
<i>Plagadis falcinellus</i> Glossy Ibis		Mi	The Glossy Ibis is found singularly, in pairs or in small flocks. Breeding is colonial and often with or near other ibis, herons and egrets (Marchant & Higgins 1990). Within Australia, the Glossy Ibis is generally located east of the Kimberley in Western Australia and Eyre Peninsula in South Australia. The Glossy Ibis' preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons (del Hoyo et al. 1992; Hancock et al. 1992; Marchant & Higgins 1990). Within Australia, the largest contiguous areas of prime habitat is inland and northern floodplains. The Glossy Ibis is commonly in largest numbers in drying Top End grass/sedge swamps and Channel Country grass/forb meadows. The species is sometimes recorded in wooded swamps, artificial wetlands (such as irrigated fields), and	6	Marginal – foraging habitat only	Possible - particularl y during flood events	Construction , No Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
			in mangroves for breeding (Chatto 2000; Marchant & Higgins 1990). The species may retreat to permanent wetlands and/or coastal areas (including tidal wetlands) during drought (Marchant & Higgins 1990). Glossy Ibis roost in trees or shrubs usually near, but sometimes far, from water bodies (Brown et al. 1982; Marchant & Higgins 1990).				
<i>Pluvialis fulva</i> Pacific Golden Plover		Ma, Mi	Found on muddy, rocky and sandy wetlands, shores, paddocks, saltmarsh, coastal golf courses, estuaries and lagoons.	1	Absent	Unlikely	No
<i>Rhipidura rufifrons</i> Rufous Fantail		Mi	The Rufous Fantail is found in northern and eastern coastal Australia, being more common in the north. It is also found in New Guinea, the Solomon Islands, Sulawesi and Guam. The Rufous Fantail is found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas. Strongly migratory in the south of its range, it moves northwards in winter, and virtually disappears from Victoria and New South Wales at this time. The Rufous Fantail feeds on insects, which it gleans from the middle and lower levels of the canopy. It is a very active feeder and constantly fans tail and flicks wings and body while foraging. The Rufous Fantail builds a small compact cup nest, of fine grasses bound with spider webs, that is suspended from a tree fork about 5 m from the ground. The bottom of the nest is drawn out into a long stem.	0	Absent	Unlikely	No
<i>Rostratula australis</i>	E	V	Little is known of the ecology, habitat requirements and reproductive biology of Australian Painted Snipe. They feed in shallow water or at the waters' edge and on mudflats, taking seeds and invertebrates such as insects, worms,	0	Absent	Unlikely – Possibly in	Construction , No

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
Australian Painted Snipe		Ma, Mi	molluscs and crustaceans. Females, which are larger and more brightly coloured than males, are thought to sometimes be polyandrous, mating with several males and leaving each one to incubate and raise chicks. They lay 3-4 eggs per clutch and incubation lasts about 15-16 days. Most records of Australian Painted Snipe are from temporary or infrequently filled freshwater wetlands and although they have occurred at many sites, no site can be identified in which they are resident or regular in occurrence. This may suggest the species is nomadic but the extent to which its cryptic behaviour may contribute to this belief is uncertain. The birds are able to remain hidden in rank vegetation, but many reports are of birds not being secretive, but rather still and unobtrusive. Primarily occurs along the east coast from north Queensland (excluding Cape York) to the Eyre Peninsula in South Australia, including the majority of Victoria and NSW. In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Inhabits inland and coastal shallow freshwater wetlands. The species occurs in both ephemeral and permanent wetlands, particularly where there is a cover of vegetation, including grasses, Lignum and Samphire. Individuals have also been known to use artificial habitats, such as sewage ponds, dams and waterlogged grassland. Nests on the ground amongst tall vegetation, such as grass tussocks or reeds. Forages nocturnally on mud flats and in shallow water. Breeding is often in response to local conditions; generally occurs from September to December.			flood events	Operational, Yes – See Appendix A

Species	TSC Act/ FM Act	EPB C Act	Habitat requirements	Number of records (NSW Wildlife Atlas 10km radius)	Presence of habitat	Likelihood of occurrence	Potential Impact
<i>Tringa nebularia</i> Common Greenshank		Ma, Mi	Found both on the coast and inland, in estuaries and mudflats, mangrove swamps and lagoons, and in billabongs, swamps, sewage farms and flooded crops.	3	Yes	Possible - particularly during flood events	Construction, No Operational, Yes – See Appendix A
<i>Tringa stagnatilis</i> Marsh Sandpiper		Ma, Mi	Occurs in salty, brackish or freshwater wetlands; sewage ponds; commercial saltfields; bore drains, mangroves, tidal mudflats and estuaries.	2	Yes	Possible - particularly during flood events	Construction, No Operational, Yes – See Appendix A

APPENDIX F NOXIOUS WEEDS

Noxious weed declarations for Forbes Shire Council

The following weeds are declared noxious in the control area of Forbes Shire Council:

Weed	Class	Legal requirements
<u>African boxthorn</u> <i>Lycium ferocissimum</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>African feather grass</u> <i>Pennisetum macrourum</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>African turnip weed - eastern</u> <i>Sisymbrium thellungii</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>African turnip weed - western</u> <i>Sisymbrium runcinatum</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Alligator weed</u> <i>Alternanthera philoxeroides</i>	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Anchored water hyacinth</u> <i>Eichhornia azurea</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Annual ragweed</u> <i>Ambrosia artemisiifolia</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Arrowhead</u> <i>Sagittaria montevidensis</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
<u>Artichoke thistle</u> <i>Cynara cardunculus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Asparagus - climbing asparagus fern</u> <i>Asparagus plumosus</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
<u>Asparagus - ground asparagus</u> <i>Asparagus aethiopicus</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
<u>Asparagus weeds</u> <i>Asparagus species</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>

Weed	Class	Legal requirements
<u>Athel pine</u> <i>Tamarix aphylla</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Bear-skin fescue</u> <i>Festuca gautieri</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Black knapweed</u> <i>Centaurea nigra</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Black willow</u> <i>Salix nigra</i>	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Blackberry</u> <i>Rubus fruticosus</i> species aggregate	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Boneseed</u> <i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Bridal creeper</u> <i>Asparagus asparagoides</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
<u>Bridal veil creeper</u> <i>Asparagus declinatus</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Broomrapes</u> <i>Orobanche</i> species	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Buffalo burr</u> <i>Solanum rostratum</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Burr - Bathurst burr</u> <i>Xanthium spinosum</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Burr - Californian burr</u> <i>Xanthium orientale</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Burr - Italian cocklebur</u> <i>Xanthium italicum</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Burr - Noogoora burr</u> <i>Xanthium occidentale</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>

Weed	Class	Legal requirements
<u>Burr - South American burr</u> <i>Xanthium cavanillesii</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Burr ragweed</u> <i>Ambrosia confertiflora</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Cabomba</u> <i>Cabomba</i> species	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Cape broom</u> <i>Genista monspessulana</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed</i>
<u>Cayenne snakeweed</u> <i>Stachytarpheta cayennensis</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Chilean needle grass</u> <i>Nassella neesiana</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Chinese violet</u> <i>Asystasia gangetica</i> subsp. <i>micrantha</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Clockweed</u> <i>Gaura parviflora</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Columbus grass</u> <i>Sorghum x alnum</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Coolatai grass</u> <i>Hyparrhenia hirta</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed</i>
<u>Corn sowthistle</u> <i>Sonchus arvensis</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Dodder</u> <i>Cuscuta</i> species	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Espartillo - broad kernel</u> <i>Amelichloa caudata</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Espartillo - narrow kernel</u> <i>Amelichloa brachychaeta</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>

Weed	Class	Legal requirements
<u>Eurasian water milfoil</u> <i>Myriophyllum spicatum</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Fine-bristled burr grass</u> <i>Cenchrus brownii</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Fireweed</u> <i>Senecio madagascariensis</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
<u>Flax-leaf broom</u> <i>Genista linifolia</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
<u>Fountain grass</u> <i>Cenchrus setaceus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Frogbit</u> <i>Limnobium laevigatum</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Gallon's curse</u> <i>Cenchrus biflorus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Galvanised burr</u> <i>Sclerolaena birchii</i>	4	Locally Controlled Weed <i>The plant must be controlled where it impacts on normal agricultural practices including cropping and pasture management.</i>
<u>Gamba grass</u> <i>Andropogon gayanus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Giant reed</u> <i>Arundo donax</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
<u>Glaucous starthistle</u> <i>Carthamus leucocaulos</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Golden dodder</u> <i>Cuscuta campestris</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Golden thistle</u> <i>Scolymus hispanicus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Green cestrum</u> <i>Cestrum parqui</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed</i>
<u>Grey sallow</u> <i>Salix cinerea</i>	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>

Weed	Class	Legal requirements
<u>Harrisia cactus</u> <i>Harrisia</i> species	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Hawkweeds</u> <i>Hieracium</i> species	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Horsetails</u> <i>Equisetum</i> species	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Hydrocotyl</u> <i>Hydrocotyl ranunculoides</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Hymenachne</u> <i>Hymenachne amplexicaulis</i> and hybrids	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Illyrian thistle</u> <i>Onopordum illyricum</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Johnson grass</u> <i>Sorghum halepense</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Karoo thorn</u> <i>Acacia karroo</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Kidney-leaf mud plantain</u> <i>Heteranthera reniformis</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Kochia</u> <i>Bassia scoparia</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Koster's curse</u> <i>Clidemia hirta</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Lagarosiphon</u> <i>Lagarosiphon major</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Leafy elodea</u> <i>Egeria densa</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
<u>Lippia</u> <i>Phyla canescens</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed except incidentally in hay or lucerne</i>

Weed	Class	Legal requirements
<u>Long-leaf willow primrose</u> <i>Ludwigia longifolia</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed</i>
<u>Mesquite</u> <i>Prosopis</i> species	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Mexican feather grass</u> <i>Nassella tenuissima</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Mexican poppy</u> <i>Argemone mexicana</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Miconia</u> <i>Miconia</i> species	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Mikania vine</u> <i>Mikania micrantha</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Mimosa</u> <i>Mimosa pigra</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Mossman River grass</u> <i>Cenchrus echinatus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Mother-of-millions</u> <i>Bryophyllum</i> species	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Parkinsonia</u> <i>Parkinsonia aculeata</i>	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Parthenium weed</u> <i>Parthenium hysterophorus</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Pond apple</u> <i>Annona glabra</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Prickly acacia</u> <i>Acacia nilotica</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Prickly pear - common pear</u> <i>Opuntia stricta</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>

Weed	Class	Legal requirements
<u>Prickly pear - Hudson pear</u> <i>Cylindropuntia rosea</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Prickly pear - smooth tree pear</u> <i>Opuntia monacantha</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Prickly pear - tiger pear</u> <i>Opuntia aurantiaca</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Prickly pear - velvety tree pear</u> <i>Opuntia tomentosa</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Red rice</u> <i>Oryza rufipogon</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Rhus tree</u> <i>Toxicodendron succedaneum</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Rubber vine</u> <i>Cryptostegia grandiflora</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Sagittaria</u> <i>Sagittaria platyphylla</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
<u>Salvinia</u> <i>Salvinia molesta</i>	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Scotch broom</u> <i>Cytisus scoparius</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
<u>Scotch thistle</u> <i>Onopordum acanthium</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Senegal tea plant</u> <i>Gymnocoronis spilanthoides</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>

Weed	Class	Legal requirements
<u>Serrated tussock</u> <i>Nassella trichotoma</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Siam weed</u> <i>Chromolaena odorata</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Silk forage sorghum</u> <i>Sorghum</i> species hybrid cultivar "Silk"	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Silverleaf nightshade</u> <i>Solanum elaeagnifolium</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Smooth-stemmed turnip</u> <i>Brassica barrelieri</i> subsp. <i>oxyrrhina</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Soldier thistle</u> <i>Picnemon acarna</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Spiny burrgrass - longispinus</u> <i>Cenchrus longispinus</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Spiny burrgrass - spinifex</u> <i>Cenchrus spinifex</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Spongeplant</u> <i>Limnobia spongia</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Spotted knapweed</u> <i>Centaurea stoebe</i> subsp. <i>micranthos</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>St. John's wort</u> <i>Hypericum perforatum</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
<u>Star thistle</u> <i>Centaurea calcitrapa</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>

Weed	Class	Legal requirements
<u>Stemless thistle</u> <i>Onopurdum acaulon</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Taurian thistle</u> <i>Onopurdum tauricum</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Texas blueweed</u> <i>Helianthus ciliaris</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
<u>Tropical soda apple</u> <i>Solanum viarum</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Water caltrop</u> <i>Trapa species</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Water hyacinth</u> <i>Eichhornia crassipes</i>	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Water lettuce</u> <i>Pistia stratiotes</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Water soldier</u> <i>Stratiotes aloides</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Wild radish</u> <i>Raphanus raphanistrum</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
<u>Willows</u> <i>Salix species</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
<u>Witchweeds</u> <i>Striga species</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Yellow burrhead</u> <i>Limncharis flava</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
<u>Yellow nutgrass</u> <i>Cyperus esculentus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>

APPENDIX G ASSESSMENTS OF SIGNIFICANCE

G.1 TSC ACT

The *Threatened Species Conservation Act 1995* (TSC Act) specifies a set of seven factors which must be considered by decision makers in assessing the effect of a proposed development or activity on threatened species, populations or ecological communities, or their habitats. These factors are collectively referred to as the 'seven part test'.

The seven factors are addressed below to determine whether there will be a significant impact on any of the TSC-listed threatened species and vegetation communities found in the study area. Appendix D that incorporates the Threatened Species Evaluations assessed that impact to threatened species, associated with construction of the Jemalong Solar Farm have potential to impact on a number of Microchiropteran Bats, including:

- Little Pied Bat (*Chalinolobus picatus*)
- South-eastern (Corben's)
- Long-eared Bat (*Nyctophilus corbeni*)
- Inland Forest Bat (*Vespadelus baverstocki*), and
- Yellow-bellied Sheath-tail Bat (*Saccolaimus flaviventris*)

Impacts relating to threatened birds primarily relate to operational impacts. The Seven Part Tests for bird species can be found in Appendix H.

For the purposes of these assessments, the following definitions apply:

The **study area** is the area surveyed for the purposes of this assessment. The study area included the proposal site and the surrounding landscape approximately one kilometre from the proposal site boundary around the solar farm proposal and all the vegetation within the proposed transmission line including adjacent patches of remnant bushland.

The **study locality** (in relation to database search area) is defined as the area within a 10 kilometre radius of the proposal site. Note that this is different to the definition of *locality* provided within the Threatened Species Assessment Guidelines: the assessment of significance (DECC 2007a) (see below).

The **locality** (as defined within DECC 2007a) is the same meaning as ascribed to local population of a species or local occurrence of an ecological community.

The **local occurrence** (as defined within DECC 2007a) is the ecological community that occurs within the study area. However the local occurrence may include adjacent areas if the ecological community on the study area forms part of a larger contiguous area of that ecological community and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated. This may include similar vegetation communities with similar species composition. For the current study area it is considered that a gap of up to 30 metres (30 metre threshold gap) is sufficient for all species within the ecological communities to move between communities and exchange genetic material.

The **local population** is the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions:

- The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.
- The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.

The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time.

Brown Treecreeper (eastern subspecies) (Climacteris picumnus victoriae)

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

Background searches for the Brown Treecreeper (eastern subspecies) returned 129 individuals records within 10 kilometres of the proposal site. This species was also recorded in the study area on four separate occasions during the current surveys, twice in the proposed transmission line easement, once in Thurrumbidgee Lagoon and once in the patch of Western Grey Box Woodland adjacent to the proposed transmission line easement (Appendix G.4).

The Brown Treecreeper is found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. This species is sedentary, considered to be resident in most locations throughout its range, although some birds may disperse locally after breeding. Foragers on invertebrates found on trunks and branches of trees, amongst fallen timber and spends much more time foraging on the ground and fallen logs than other treecreepers.

The Brown Treecreeper nests in small to medium – sized hollows in dead or live trees and stumps. It breeds in pairs or co-operatively in territories which range in size from 1.1 to 10.7 ha (mean = 4.4 ha). Male offspring are usually retained whilst female offspring usually disperse locally.

Approximately six medium and 13 small hollows will be removed due to the proposed transmission line easement, which are suitable nesting sites for the Brown Treecreeper. Additional trees with small hollows are likely along the proposal site, but are often difficult to detect. There are at least 197 hollow-bearing trees within or adjacent to the proposal site that will not be affected by the works, which represent alternative habitat for the Brown Treecreeper.

Other trees within the proposed transmission line easement with loose bark provide foraging habitat for the Brown Treecreeper, as does fallen timber. Overall, approximately 1.83 hectares of native vegetation would be removed as a result of the proposed works.

Due to the retention of a large number of hollows and hollow-bearing trees in the vicinity of the proposal site, the loss of the potential habitat as a result of the proposed transmission line easement is considered

unlikely to interfere with the life cycle of these species such that any local populations would be placed at risk of extinction.

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

N/A

- (c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

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

N/A

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

- i. **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
 - ii. **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
 - iii. **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**
- i. Approximately 1.83 hectares of native vegetation and up to eight hollow-bearing trees would be removed due to the proposed transmission line easement. These trees include approximately six medium and 13 small hollows which are suitable nesting sites for the Brown Treecreeper. There are also approximately 197 hollow-bearing trees within and adjacent to the proposal site that will be retained. Other trees with small hollows may also occur within the proposal site that were undetected due to the presence of obscure hollows. Trees with decorticated bark would also provide foraging habitat, as well as fallen timber.
 - ii. Habitat within the proposal site is only marginally likely to become more fragmented as a result of the proposed works, due to the loss of scattered trees and trees on the edge of remnant patches that currently provide connectivity. Despite this, connectivity will largely be retained for mobile species such as birds and bats, all of which will still be able to traverse the landscape using the vegetation to be retained within and around the proposal site. Due to this, the proposed works are unlikely to isolate the Brown Treecreeper from any areas of habitat along the proposed transmission line easement.
 - iii. The proposed transmission line easement provides suitable potential habitat for the Brown Treecreeper in an otherwise cleared landscape. The importance of this habitat to the long-term survival of this species is not considered to be high, due to the presence of equivalent and more well-connected vegetation patches in the surrounding landscape. The remnant patches and scattered trees to be retained within and adjacent to the proposal site do provide many mature hollow-bearing trees within a cleared agricultural landscape, with at least 510 hollows in approximately 197 hollow-bearing trees that will be retained within and adjacent to the proposal transmission line easement. Thus the importance of the habitat to be removed is not considered high, and is unlikely to impact upon the survival of this species within the locality.

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

No areas of critical habitat have been declared for this species.

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

An action or recovery plan has not been prepared for the Brown Treecreeper. However, a number of Activities to assist this species have been listed. Those relevant to the proposed transmission line easement include:

- Do not allow removal of hollow-bearing dead or living trees and stumps on private and public lands.

The proposed transmission line easement will remove approximately eight hollow-bearing trees containing a total of six medium and 13 small hollows. However, this loss of nesting habitat is considered negligible when considering the abundant tree hollows to be retained in the study area.

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

A number of key threatening processes are relevant to the proposed transmission easement including:

- Clearing of native vegetation;
- Removal of dead wood and dead trees; and
- Loss of hollow-bearing trees.

The clearing of native vegetation is considered a major contributor to the loss of biodiversity. In the determination, the NSW Scientific Committee found that 'clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity'. Clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts, habitat degradation and off-site impacts such as downstream sedimentation. Given that 1.83 hectares of native vegetation would be cleared as a result of the proposed transmission line easement, the proposal has only a small potential to increase the impact of this key threatening process.

Dead trees and dead wood that occurs within the proposal site are also likely to be removed due to the proposed transmission line easement. This has the potential to impact the Brown Treecreeper which utilises these features for foraging and nesting (hollows). As part of the mitigation measures, it has been recommended that fallen timber is retained and placed in adjacent areas. The removal of two to three dead standing trees within the proposed transmission line easement is unlikely to have a significant impact on the Brown Treecreeper, particularly if mitigation measures are followed.

The proposed transmission line easement would remove up to eight hollow-bearing trees, containing 22 hollows within the proposal site. All of these trees may potentially be used by the Brown Treecreeper for nesting, although the six medium and 13 small hollows are most likely to be used. The proposed transmission line easement would thus contribute to this key threatening process. However, this loss of nesting habitat is considered negligible when considering the abundant tree hollows to be retained in the study area.

Conclusion

The Assessment of Significance has concluded that the proposal is unlikely to have a significant impact on the Brown Treecreeper (eastern subspecies). The proposal is considered unlikely to:

- Reduce the long-term viability of this threatened species.
- Accelerate the extinction of this species or place it at risk of extinction; or
- Adversely affect breeding and foraging habitat.

Safeguards have been proposed that include the replacement of these hollows with nest boxes through the preparation of a Nest Box Management Strategy.

*Microchiropteran Bats, including the Little Pied Bat (*Chalinolobus picatus*) (hollow dependent and cave dwelling), Corben's Long Eared Bat (*Nyctophilus corbeni*) (hollow dependent), Inland Forest Bat (*Vespadelus baverstocki*) and Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) (hollow dependent)*

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

Background searches for threatened microbats returned no records within 10 kilometres of the proposal site, although some records from the locality are known (discussed below). This is not unexpected due to the paucity of bat surveys that have been undertaken across most of NSW. The habitat evaluation table considers four species likely to occur within 10 km of the proposal site, including the Little Pied Bat, Corben's Long-eared Bat, Inland Forest Bat and the Yellow-bellied Sheathtail Bat. All four of these species were recorded within the proposal site using Anabat.

The Little Pied Bat is known to roost in trees, caves abandoned mines and buildings. Roost sites within caves are usually warm and dry but this species can withstand temperatures of up to 40°C. Most colonies within caves contain less than ten individuals. There are no cave sites located within the study area. Favoured hollows for the Little Pied Bat include large mature trees with dead limbs and dead trees that have fallen over leaving a hollow stump. The species is known to roost alone and move roost location most days, although remain within the same general area (Churchill, 2008). This species was possibly recorded (5 poor quality calls, which were too difficult to accurately distinguish from other species) outside in patches of vegetation in the landscape surrounding the proposal site, but not within the proposal site itself. The Little Pied Bat has been recorded within the Strahorn State Forest, about 25 kilometres to the north-west of the proposal site. Although quite a distance away, this species is known to forage long distances from their roost sites (Penney, 2002). Six possible calls of this species in the proposal site

The Corben's Long-eared Bat is known to roost in a variety of tree species including Casuarinas, mallee, and box eucalypts. The species has been found to also roost in the fissures of tree branches and under dry sheets of bark that are still attached to the trunks of ring-barked trees. Tree hollows are usually used as maternity sites and range in opening size from 5-10cm. The species is more common in box/ironbark/cypress vegetation that occurs in a north-south belt along the western slopes and plains, consistent with the location of the study area. Calls of a Long-eared Bat (*Nyctophilus* sp.) were recorded both within and outside of the proposal site, but could not be accurately identified to species level, as there are two other Long-eared Bat species that may be found in the study area. It is more likely that one of the two common and widespread species was present within the study area. However, the Corben's Long-eared Bat has been recorded on the western edge of Goobang National Park, approximately 10 kilometres from the proposal site. In a recent roosting study, individuals were found to move large distances on a nightly basis. Roost sites were on average 1.89 ± 1.61 kilometres (range 0.34–7.06 km) from the capture point. Individuals used a number of different roost sites within the time they were tracked. Most roosts

were used for just a single day (1.3 ± 0.6 days) before the individual moved to a new roost site (Lumsden & Bennett 2006). A total of 57 definite calls for *Nyctophilus* were recorded within the proposal site.

The Inland Forest Bat roosts in hollows, fissures or cracks in live or dead trees, and roosts in abandoned buildings. Known to roost in very small hollows in stunted trees only a few metres high. The habitat requirements of this species are poorly known but it has been recorded from a variety of woodland formations, including mallee, mulga and River Red Gum. Most records are from drier woodland habitats with riparian areas inhabited by the Little Forest Bat. However, other habitats may be used for foraging and/or drinking. Colony size ranges from a few individuals to more than sixty. Females congregate to raise young in November and December, with young carried for the first week following birth. Young are independent by January. These bats fly rapidly and cover an extensive foraging area and are presumed to feed on flying insects. A total of 22 probable calls were recorded for this species within the proposal site.

The Yellow-bellied Sheathtail bat roosts in large tree hollows and in buildings. In treeless areas, the species has been known to utilise mammal burrows for roosting habitat. The Yellow-bellied Sheathtail Bat forages in most habitats across its range, however seasonal movements are unknown and there is speculation about the species migrating to southern Australia during colder months (Churchill, 2008). The study area thus supports suitable roosting habitat for this species. One definitively identified call of this species was recorded approximately 8 km from the study area, in a patch of high quality Inland Grey Box Woodland. There was also one unlikely but possible call recorded from within the study area. This species has also recently been recorded in 2013 along the Bogan River, about six kilometres west of the proposal site. One probable call of this species was recorded within the proposal site.

Approximately 13 small hollows will be removed by the proposal, which are suitable for tree-roosting microbats. Additional trees with small hollows are likely along the proposal site, but are often difficult to detect. There are at least 197 hollow-bearing trees within adjacent to the proposal site that will not be affected by the works, which represent alternative habitat for microbats.

Other trees within the proposal site with loose bark may provide roosting habitat for the Corben's Long-eared Bat. Overall, approximately 1.83 hectares of native vegetation would be removed as a result of the proposed works.

Due to the retention of a large number of hollows and hollow-bearing trees in the vicinity of the proposal site, the loss of the potential habitat as a result of the proposal is considered unlikely to interfere with the life cycle of these species such that any local populations would be placed at risk of extinction.

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

N/A

- (j) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- iii. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
 - iv. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

N/A

- (k) in relation to the habitat of a threatened species, population or ecological community:**

- iv. **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
 - v. **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
 - vi. **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**
- iv. Approximately 1.83 hectares of native vegetation and up to eight hollow-bearing trees would be removed as part of the proposed works. These trees include approximately 13 small hollows suitable for microbats proposed for removal. Microbats may also be present within larger hollows in hollow-bearing trees proposed for removal. There are also approximately 197 hollow-bearing trees within and adjacent to the proposal site that will be retained. Other trees with small hollows may also occur within the proposal site that were undetected due to the presence of obscure hollows. Trees with decorticated bark would also provide microbats with roosting habitat.
- v. Habitat within the proposal site is only slightly likely to become more fragmented as a result of the proposed works, due to the loss of scattered trees and trees on the edge of remnant patches that currently provide connectivity. Despite this, connectivity will largely be retained for the mobile species such as birds and bats, all of which will still be able to traverse the landscape using the vegetation to be retained within and around the proposal site. Due to this, the proposed works are unlikely to isolate any threatened microbat species from any areas of habitat along the proposal site.
- vi. The proposal site provides suitable potential habitat for these threatened microbats in an otherwise cleared landscape. The importance of this habitat to the long-term survival of these species is not considered to be high, due to the presence of equivalent and more well-connected vegetation patches in the surrounding landscape. The remnant patches and scattered trees to be retained within and adjacent to the proposal site do provide many mature hollow-bearing trees within a cleared agricultural landscape, with at least 510 hollows in about 197 hollow-bearing trees will be retained within and adjacent to the proposal boundary. Thus the importance of the habitat to be removed is not considered high, and is unlikely to impact upon the survival of these species within the locality.

(l) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No areas of critical habitat have been declared for these species.

(m) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The *Action Plan for Australian Bats* (Environment Australia 1999) lists the Little Pied Bat as near threatened. The recommended actions that are relevant to the proposed works include:

- protection of known roosts.

Although the proposal site does not contain known roosts, it does contain potential roost sites for this species.

The *Action Plan for Australian Bats* (Environment Australia 1999) lists the Corben's Long-eared Bat as vulnerable. There are two recovery objectives, however they are not relevant to the proposed works.

There are not currently any Recovery Plans or Threat Abatement Plans for the Inland Forest Bat or Yellow-bellied Sheath-tail-bat.

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

A number of key threatening processes are relevant to the proposal including:

- Clearing of native vegetation;
- Removal of dead wood and dead trees; and
- Loss of hollow-bearing trees.

The clearing of native vegetation is considered a major contributor to the loss of biodiversity. In the determination, the NSW Scientific Committee found that 'clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity'. Clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts, habitat degradation and off-site impacts such as downstream sedimentation. Given that 1.83 hectares of native vegetation would be cleared as a result of the proposal, the proposal has only a small potential to increase the impact of this key threatening process.

Dead trees and dead wood that occurs within the proposal site are also likely to be removed as part of the proposed works. This has the potential to impact any microbats that utilise these features to roost. As part of the mitigation measures, it has been recommended that fallen timber is retained and placed in adjacent areas. The removal of two to three dead standing trees within the proposal site is unlikely to have a significant impact on these threatened microbats, particularly if mitigation measures are followed.

The proposed works would remove up to eight hollow-bearing trees, containing 22 hollows within the proposal site. All of these trees may potentially harbour microbats (including threatened species), although the 13 small hollows that particularly suit some microbat species are most likely. The proposed works would thus contribute to this key threatening process.

Conclusion

The Assessment of Significance has concluded that the proposal is unlikely to have a significant impact on the Little Pied Bat, Corben's Long-eared Bat, Inland Forest Bat or the Yellow-bellied Sheath-tail Bat. The proposal is considered unlikely to:

- Reduce the long-term viability of these threatened species.
- Accelerate the extinction of these species or place them at risk of extinction; or
- Adversely affect breeding and foraging habitat.

Safeguards have been proposed that include the replacement of these hollows with nest boxes through the preparation of a Nest Box Management Strategy.

G.2 EPBC ACT

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects the environment, particularly Matters of National Environmental Significance (Protected matters). It streamlines the national environmental assessment and approvals process, protects Australian biodiversity and integrates management of important natural and cultural places. The Matters of National Environmental Significance are:

- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Ramsar wetlands of international importance;
- The Commonwealth marine environment;
- World Heritage properties;
- National Heritage places; and
- Nuclear actions.

An action will require approval if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

- Extinct in the wild;
- Critically endangered;
- Endangered; or
- Vulnerable.

An action will also require approval if the action has, will have, or is likely to have a significant impact on an ecological community listed in any of the following categories:

1. Critically endangered; or
2. Endangered.

All nationally threatened birds likely to be impacted by the proposal have been assessed in Appendix H.

Corben's Long-eared Bat (EPBC-V)

- **lead to a long-term decrease in the size of an important population of a species**

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are key source populations either for breeding or dispersal, populations that are necessary for maintaining genetic diversity, and/or populations that are near the limit of the species range. Recent studies have shown that this species will use a large number of different roost sites, usually for a single day before moving onto another roost site. The Corben's Long-eared Bat moves large distances 1.91 ± 1.86 km (range 25 m - 5.88 km) between consecutive roosts. A recent study found that not all individuals were located every day despite extensive searching, suggesting that they were using even larger home ranges, incorporating areas outside the area that could be regularly searched (Schulz & Lumsden 2010). The nearest record for this species is located over 10 km to the south-west of the proposal site. However the species is also known to travel long distances during foraging activities. A substantial food source for this species comes from the eucalypt

trees in which it dwells (Lumsden & Bennett 2000). The proposal site provides this resource. The species is also known to travel large distances on a nightly basis, using different roost sites. The proposal site does not contain an important population of the Corben's Long-eared Bat.

- **reduce the area of occupancy of an important population**

The proposal site does not contain an important population of the Corben's Long-eared Bat.

- **fragment an existing important population into two or more populations**

The proposal site does not contain an important population of the Corben's Long-eared Bat.

- **adversely affect habitat critical to the survival of the species**

No areas of critical habitat have been declared for these species.

- **disrupt the breeding cycle of an important population**

The proposal site does not contain an important population of the Corben's Long-eared Bat.

- **modify, destroy, remove, or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

Approximately eight hollow-bearing trees, containing 13 small hollows (< 10 cm), suitable for the Corben's Long-eared Bat, would be removed as part of the proposed works. Additional trees with small hollows are likely within the proposal site, but are often difficult to detect. A remaining 510 hollow-bearing trees occur within or adjacent to the proposal site which would not be impacted by the proposed works. Other trees within the proposal site with loose bark may also provide roosting habitat for the Corben's Long-eared Bat. Overall, approximately 1.83 hectares of native vegetation would be removed as a result of the proposed works. While this species was not definitively identified during field surveys it does have the potential to occur. The removal of approximately 13 small hollows and 1.83 hectares of the available habitat for this species is not considered likely to decrease the availability of habitat to the extent that the species could decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

Bats have been recorded being evicted from tree hollows by feral species, including the Common Starling (*Sturnus vulgaris*). The proposed works are unlikely to result in an increase in the abundance of species such as the Common Starling.

- **introduce disease that may cause the species to decline**

There is no record of diseases that may cause the Corben's Long-eared Bat to decline.

- **interfere with the recovery of the species**

The *Action Plan for Australian Bats* (Environment Australia 1999) lists the Corben's Long-eared Bat as Vulnerable. There are two recovery objectives, however they are not relevant to the proposed works.

Conclusion

The proposed vegetation removal (including approximately 1.83 hectares of native vegetation and eight hollow-bearing trees with small hollows) within the proposal site is unlikely to significantly impact a population of Corben's Long-eared Bat, due to the availability of alternative suitable (or higher quality) habitat within the surrounding landscape.

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APPENDIX H MAPS



FLORA SURVEY EFFORT

**Jemalong Solar Station
Biodiversity Assessment**

- Vegetation plot
- Substation
- Proposed transmission line
- Proposed connection route (preliminary)
- Proposal site
- Highway
- Major road
- Local road
- Proposed access
- Major drainage line
- Minor drainage line
- Waterbody
- State Forest

- GIS data may be restricted to (16km) background extent
- Infrastructure provided by Vast Solar and may be subject to change
- Topographic data from NSW LPI current from 25.09.2014
- State Forests are approximate only
- Base map © Esri and its data suppliers.

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FLORA RESULTS

**Jemalong Solar Station
Biodiversity Assessment**

- Plant Community Type
- Poplar Box Woodland
 - River Red Gum Swampy Woodland
 - Western Grey Box Woodland
 - Substation
 - Proposed transmission line
 - Proposed connection route (preliminary)
 - Proposal site
 - Highway
 - Major road
 - Local road
 - Proposed access
 - Major drainage line
 - Minor drainage line
 - Waterbody
 - State Forest

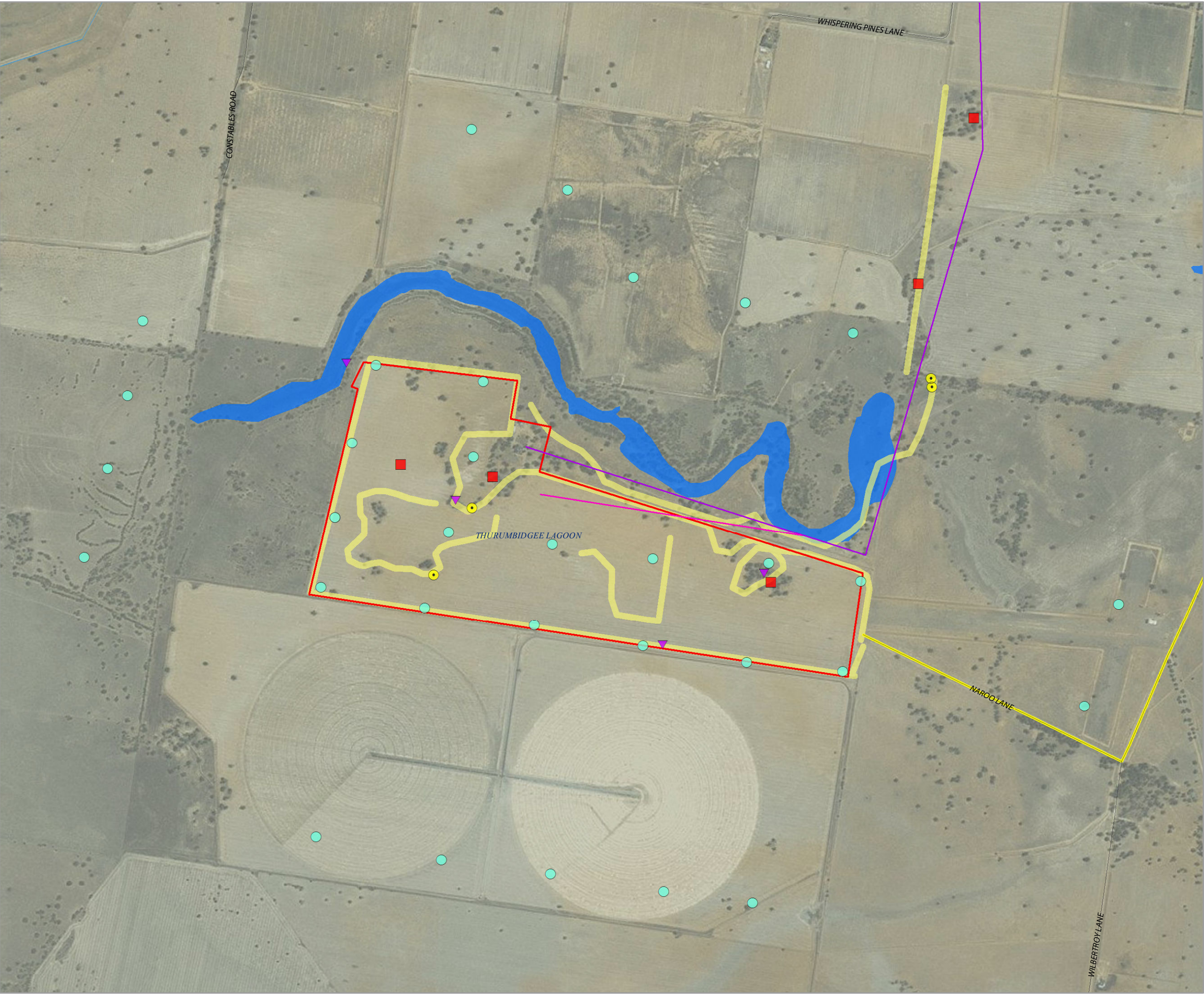
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FAUNA SURVEY EFFORT

**Jemalong Solar Station
Biodiversity Assessment**

- ▼ Anabat Location
- Bird Survey Location
- Habitat Assessment
- Hollow-bearing Tree Watch
- Substation
- Proposed transmission line
- Proposed connection route (preliminary)
- Proposal site
- Highway
- Major road
- Local road
- Proposed access
- Spotlight transect
- Major drainage line
- Minor drainage line
- Waterbody
- State Forest

- GIS data may be restricted to (16km) background extent
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FAUNA SURVEY RESULTS

**Jemalong Solar Station
Biodiversity Assessment**

- ★ Brown Treecreeper
- ★ Grey-crowned Babblers
- ★ Spotted Harrier
- ★ Superb Parrots

- Hollow-bearing Tree
- Substation
- Proposed transmission line
- Proposed connection route (preliminary)
- Proposal site
- Highway
- Major road
- Local road
- Proposed access
- Major drainage line
- Minor drainage line
- Waterbody
- State Forest

- GIS data may be restricted to (16km) background extent
- Infrastructure provided by Vast Solar and may be subject to change
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