1. Threatened flora species

1.1. EPBC Act protected matters report

Table 1-1 lists threatened flora species returned in an EPBC Act protected matters search tool (PMST).

Table 1-1. Flora species returned in EPBC Act PMST

Species name	Common Name	Status	PMST category for a 10km search radius:[1]
Trees / shrubs			
Acacia bynoeana	Bynoe's Wattle	Vulnerable	May occur
Acacia pubescens	Downy Wattle	Vulnerable	Known to occur
Allocasuarina glareicola		Endangered	Likely to occur
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Vulnerable	Known to occur
Melaleuca deanei	Deane's Melaleuca	Vulnerable	May occur
Micromyrtus minutiflora		Vulnerable	Likely to occur
Persoonia hirsuta	Hairy Geebung	Endangered	Likely to occur
Persoonia nutans	Nodding Geebung	Endangered	Known to occur
Pimelea spicata	Spiked Rice-flower	Endangered	Known to occur
Pimelea curviflora var. curviflora		Vulnerable	May occur
Pomaderris brunnea	Rufous Pomaderris	Vulnerable	Likely to occur
Pultenaea parviflora		Vulnerable	Is known to occur
Rhodamnia rubescens	Scrub Turpentine	Critically Endangered	May occur
Syzygium paniculatum	Magenta Lilly Pilly	Vulnerable	May occur
Herbs/Forbs			
Haloragis exalata subsp. exalata	Wingless Raspwort, Square Raspwort	Vulnerable	May occur
Persicaria elatior	Knotweed, Tall Knotweed	Vulnerable	May occur
Thesium australe	Austral Toadflax	Vulnerable	May occur
Orchids			
Cryptostylis hunteriana	Leafless Tongue-orchid	Vulnerable	Known to occur
Genoplesium baueri	Yellow Gnat-orchid	Endangered	May occur
Pterostylis gibbosa	Illawarra Greenhood	Endangered	May occur
Pterostylis saxicola	Sydney Plains Greenhood	Endangered	Likely to occur
Rhizanthella slateri	Eastern Underground Orchid	Endangered	May occur
Vines			
Cynanchum elegans	White-flowered Wax Plant	Endangered	Known to occur

[1] The Protected Matters Search Tool (PMST) generates reports that help to determine whether MNES or other matters protected by the EPBC Act are likely to occur in the area of a proposed action. The PMST uses three terms to indicate the likelihood of occurrence of a species, or species' habitat:

1. known to occur

2. likely to occur

3. may occur.

The likelihood rating assigned to various listed species in the action footprint is one source of information to assess whether targeted ecological surveys are required.

1.2. Significant impact criteria

An action is likely to have a significant impact on a **critically endangered or endangered species** if there is a real chance or possibility that it will:

1. Lead to a long-term decrease in the size of a population[#2]
2. Reduce the area of occupancy of the species.
3. Fragment an existing population into two or more populations.
4. Adversely affect habitat critical to the survival of a species.
5. Disrupt the breeding cycle of a population.
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.
8. Introduce disease that may cause the species to decline. or
9. Interfere with the recovery of the species.

The significant impact criteria for a **vulnerable species** are the same for the above criteria 3 to 9, but differing in criteria 1 and 2 as follows:

1. Lead to a long-term decrease in the size of an important population of a species[3]
2. Reduce the area of occupancy of an important population

Investigations relevant to this referral have concluded that the project land does not contain, or provide habitat for, any populations of threatened flora species. This due to the following:

- Fourteen of the listed species are tree, shrub or subshrub in habitat, varying in height from 0.5m to 8m. Patches of native vegetation in the project area range from 0.2 to 0.45 ha and were able to be comprehensively assessed for the presence of native trees, shrubs and subshrubs. A shrub/subshrub layer is absent from the project area.
- Habitat for the three listed herbaceous species is absent from the project area and these species are also not known from the region and /or the 10km radius search area.
- Habitat for the three of the five listed orchids is absent from the project area, the remaining two listed orchids are not known from the region and all five species have not been recorded from the search area.
- The one listed vine species is a conspicuous vine which was not found during surveys and also not recorded from the search area.

Table 1-2 provides a summary of known distribution and habitat requirements for each of the species returned in the PMST along with justification of the likelihood of each species occurrence.

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[2] A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered and endangered threatened species, occurrences include but are not limited to:

- A geographically distinct regional population, or collection of local populations, or
- A population, or collection of local populations, that occurs within a particular bioregion.

[3] An 'important population' is a population that is necessary for a species' long-term survival and recovery. In relation to vulnerable species, 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.

Table 1-2. Likelihood of PSMT listed threatened species to occur in subject lands

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
Trees / shrubs		
Acacia bynoeana		
Found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. Currently known from about 30 locations, wit the size of the populations at most locations being very small (1-5 plants) (TSProfile). The species has been recorded in the Blue Mountains, Royal, Marramarra and Tarlo River NPs and also conserved in Castlereagh, Dharawal and Agnes Banks NRs and Lake Macquarie SRA (SPRAT).	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple (SPRAT).	Unlikely • Habitat absent and species not known from search area. • A semi-prostrate shrub to 1m high, not found during surveys and not recorded from search area.
Acacia pubescens		
This species is confined to the Sydney district with most occurrences on the Cumberland Plain. The species is conserved in Scheyville NP, Windsor Downs NR, 4 other environmental conservation zones sites at Mountain Lagoon, Pleasure Point, Campbell Hill Pioneer Park and Duck River Reserve and 2 sites owned by WaterNSW. Also occurs in a range of Council reserves. Areas of particular conservation significance are located in Rookwood Cemetery (Auburn LGA), Saltpan Ck, Riverwood, Padstow Bankstown/Hurstville LGA), Horsley Park Corridor (Fairfield LGA), Longneck Lagoon (Hawkesbury LGA), Castlereagh SF (Penrith LGA), Agnes Banks NR (Penrith LGA), and remnant bushland at Kemps Ck (Penrith LGA) (SPRAT).	Grows in dry open sclerophyll forest, usually in gravelly clay or sandy soils on alluviums, shales and at the interface between shales and sandstones that contain ironstone, are usually low in nutrients and are well drained. Associated species include *Eucalyptus gummifera, E. sieberi, E. punctata, E. fibrosa, E. moluccana, Acacia suaveolens, A. ulicifolia, A. brownii, A. parramattensis, A. falcata, Bursaria spinosa, Corymbia maculata, M. nodosa, M. stypheliodes, M. decora* and *Angophora bakeri* in a number of ecological communities (SPRAT).	Unlikely • Habitat degraded and species not known from search area. • A conspicuous spreading shrub, 1-5 m high, not found during surveys in the project area.
Allocasuarina glareicola		
This species is restricted to a few small populations in and around Castlereagh NR, north-east of Penrith, NSW. First collected in 1983 in Castlereagh SF (now Castlereagh NR). Ten other populations have been discovered since then. This species is known to occur on Commonwealth land at the Holsworthy Military Area (SPRAT)	Grows on tertiary alluvial gravels, with yellow clayey subsoil and lateritic soil, which are low in fertility and strongly to very strongly acidic. Found in the Castlereagh open woodland community, with *Eucalyptus parramattensis, E. fibrosa, E. sclerophylla, Angophora bakeri* and *Melaleuca decora*. Common associated understorey species include *Melaleuca nodosa, Hakea dactyloides,*	Unlikely • Habitat absent and species not known from search area. • An erect, often depauperate she-oak shrub 1-2 m high, not found during surveys.

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
	H.sericea, Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, A. brownei, Themeda australis and *Xanthorrhoea minor* (SPRAT)	
Grevillea parviflora subsp. parviflora		
Endemic to NSW and occurs sporadically throughout the Sydney Basin. Known from sizeable populations around Picton, Wedderburn; Appin and Bargo (and possibly further south to the Moss Vale area); the Hunter Valley; Putty to Wyong on the Central Coast; the western shores of Lake Macquarie at Dooralong; Cooranbong and Awaba near Liverpool, where small populations occur at Kemps Creek and Voyager Point; west of Prospect to Woronora Plateau (this population is now extinct).	Occurs in a range of vegetation types from heath and scrubby woodland to open forest. Canopy species vary between communities but are species that generally favour soils with a strong lateritic influence. Associated within the following EPBC Act and BC Act TECs: Shale/Sandstone Transition Forest; White Box-Yellow Box-Blakely's Red Gum Grassy Woodland; and Turpentine-Ironbark Forest (SPRAT)	Unlikely • Habitat absent. • Not recorded from the Mamre Road Precinct • Low open to erect shrub 0.3–1 m tall. A native shrub and subshrub layer absent from the project land.
Melaleuca deanei		
Occurs in NSW between St Albans and Nowra. Known from two distinct areas approximately 28 km apart, in the Ku-ring-gai/Berowra area north of Sydney and Holsworthy/Wedderburn area south of Sydney. The species is absent from unsuitable habitat on the Cumberland Plain in Western Sydney and areas cleared for urban development (SPRAT). There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal and Central Coast areas (TSProfile).	This species grows in wet heath on sandstone, sandy soils and woodlands (SPRAT).	Unlikely • Habitat absent and not recorded from the locality. • A conspicuous shrub to 3m tall with fibrous flaky bark (TSProfile) and not found during surveys with Melaleuca species noticeably absent from the project area.
Micromyrtus minutiflora		
Restricted to the general area between Richmond and Penrith, Western Sydney (SPRAT).	Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments (SPRAT).	Unlikely • Habitat absent and not recorded from the locality. • A slender spreading shrub to 2 m high, which was not found during surveys of the project area.
Persoonia hirsuta		
Scattered distribution around Sydney from Singleton in the north, along the east coast to Bargo in the south and the	Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	Unlikely • Habitat absent, not recorded from the

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
Blue Mountains to the west.		locality and no Persoonia species detected during surveys of the project area.
Persoonia nutans		
Restricted to the Cumberland Plains, known from an area between Richmond and Macquarie Fields, particularly near the Nepean and Georges Rivers. The range of the species is fragmented, with approximately 99% of the known populations occurring in the north of the distribution at Agnes Banks, Londonderry, Castlereagh, Berkshire Park and Windsor Downs. Local Government Areas where the species occurs include Penrith, Hawkesbury, Liverpool, Campbelltown, Bankstown and Blacktown (SPRAT).	Confined to aeolian and alluvial sediments, below 60 m above sea level. Drainage may also influence the distribution of the species as it is more common on the deeper sands at Agnes Banks than at the edge of the deposit next to the Londonderry clay. At other locations on the Cumberland Plain it occurs on gently undulating low rises as opposed to swales or other low-lying areas. Associated vegetation communities include Agnes Banks Woodland, Castlereagh Scribbly Gum Woodland, Cooks River/Castlereagh Ironbark Forest and Shale Sandstone Transition Forest (SPRAT).	Unlikely • Habitat absent. • Not recorded from the Mamre Road Precinct. • No Persoonia species detected during surveys of the project area.
Pimelea curviflora var. curviflora		
Confined to the coastal area of the Sydney and Illawarra regions of NSW, known from approximately 20 locations from the coastal area of northern Sydney to Maroota in the north-west. Found in the Baulkham Hills, Blacktown, Hornsby, Parramatta and Warringah Local LGAs. Also recorded from Croom Reserve near Albion Park in the Shellharbour LGA and formerly around the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly (SPRAT.	Occurs on ridge tops and upper slopes in open forest and woodland on sandy soil derived from sandstone, on shaley/lateritic soils and shale/sandstone transition soils. The population at Albion Park on the Illawarra coastal plain occurs in Lowland Grassy Woodland habitat. It often grows among dense grasses and sedges (SPRAT). The species is reported to have an inconspicuous cryptic habit and can survive from some time without any foliage after fire or grazing relying on energy reserves in its tuberous roots (TSProfile).	Unlikely • Habitat degraded, not recorded from the locality and no Persoonia species detected during surveys of the project area. • Due to the consistent historical land use within the project area, it is considered unlikely that the species could have subsisted. • Project area and broader surrounding landscape not indicated as an area in which the species has been located.
Pimelea spicata		
The species has a relatively scattered distribution occurring in two disjunct areas, the Cumberland Plain (western Sydney) and coastal Illawarra. In western Sydney, the	In western Sydney, occurs on an undulating topography of well structured clay soils, derived from Wianamatta shale and is restricted to areas	Unlikely • Not recorded from the Mamre Road Precinct.

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
species' current known distribution extends from Mount Annan and Narellan Vale in the south to Freemans Reach in the north and from Penrith in the west to Georges Hall in the east (DEC 2006 Recovery Plan).	supporting, or that previously supported CPW (DEC 2006 Recovery Plan). Co-occurring species in the Cumberland Plain sites are *Eucalyptus moluccana, E. tereticornis and E. crebra*). Bursaria spinosa is often present at sites (and may be important in protection from grazing) and Themeda australis is usually present in the groundcover (also indicative of a less intense grazing history).	• Shrub to 50 cm high. The project area lacks a native shrub and subshrub layer.
Pomaderris brunnea		
In the Sydney region found in very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden (TSProfile).	Grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines (TSProfile).	Unlikely • Habitat absent. • Shrub 2–3 m high, not found during surveys of the project area. • Not recorded from the search area.
Pultenaea parviflora		
Endemic to the Cumberland Plain from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce (TSProfile). Within the Cumberland Plain, the species is mainly found between Penrith and Windsor in the Blacktown, Hawkesbury, Liverpool and Penrith LGAs. Most records are from roadsides, vacant crown land or private property. Populations occur in Windsor Downs NR and near Long Neck Lagoon (Hawkesbury); at five locations in Penrith; Castlereagh NR, in or adjoining Agnes Banks NR, on Australian Defence Industries land at St Marys, at Shanes Park and on remnant bushland at Kemps Creek; at Marsden Park (Blacktown) and Badgerys Creek (Liverpool). (SPRAT).	Found in dry sclerophyll woodlands, forest or in grasslands on Wianamatta Shale, laterite or Tertiary alluvium. At Badgerys Creek it occurs in shrubby woodland of *Eucalyptus fibrosa, Melaleuca decora* and *M.nodosa* on red brown clay soil. At other sites it is associated with *Acacia decurrens, A. elongata, Allocasuarina littoralis, Angophora bakeri, Bursaria spinosa, Daviesia genistifolia, Eucalyptus sclerophylla, E.sideroxylon, Hakea sericea, Kunzea ambigua* and *Olearia microphylla*. Positively identified in the Castlereagh Ironbark Forest (SPRAT).	Unlikely • Not recorded from the Mamre Road Precinct. • Usually a small erect branching shrub to 1m, but up to 1.8 m (when in competition with other shrubs) The project area lacks a native shrub and subshrub layer.
Rhodamnia rubescens		
Occurs in coastal districts north from Batemans Bay in NSW to areas inland of Bundaberg in Queensland. Populations typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m ASL (SPRAT).	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils (SPRAT).	Unlikely • Habitat absent, and not recorded from the search area. • A conspicuous shrub 2–3 m high, not found during surveys of the project

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
		area.
Syzygium paniculatum		
Found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest (TSProfile).	On the central coast occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities (TSProfile).	Unlikely • Habitat absent, and not recorded from the search area. A conspicuous small to medium sized rainforest tree that grows to 8 m tall, not found during surveys of the project area.
Herbs / forbs		
Haloragis exalata subsp. exalata		
Occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW (TSProfile).	Appears to require protected and shaded damp situations in riparian habitats. PlantNet (RBG) also indicates damp places near watercourses (TSProfile).	Unlikely • Habitat absent. Not known from the region and not recorded from search area. • A shrub to 1.5m tall with distinguishing four ribbed stems (TSProfile), which was not found during surveys of farm dams and associated damp areas
Persicaria elatior		
Known from the North Coast, Central Coast and South Coast Botanical Subdivisions in NSW. Has been collected from eight sites in NSW including: South-east NSW Mt Dromedary (an old record); Moruya State Forest (SF), near Turlinjah; the Upper Avon River catchment, north of Robertson; Bermagui; Picton Lakes; North-east NSW Richmond Range SF, near Casino; Raymond Terrace, near Newcastle; Cherry Tree SF and Gibberagee SF, near Grafton (SPRAT).	Normally grows in damp places, including coastal with swampy areas, along watercourses, streams and lakes, swamp forest, and disturbed areas. Associated species include *Melaleuca linearifolia, M. quinquenervia, Lophostemon suaveolens, Casuarina glauca, Corymbia maculata, Pseudognaphalium luteoalbum* and *Polygonum hydropiper* (SPRAT)	Unlikely • Habitat absent and not recorded from the locality. • An erect herb to 90cm high, which was not found during surveys of farm dams and associated damp areas. • The subject land and surrounding landscape is not proximal to any of the identified collection sites.
Thesium australe		
Occurs in NSW, the ACT, Qld and Vic. In NSW occurs on the coast, tablelands and western slopes. The Atlas of Living	A semi-parasitic on roots of a range of grass species, notably *Themeda triandra,* occurring in	Unlikely • Habitat absent.

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
Australia (2013) indicates that there were 255 herbarium collections between 1990 and 2013 in NSW and the ACT, with over 200 in the Nandewar, New England Tablelands and North Coast Bioregions. Has also been recorded from a number of conservation reserves, including Kosciuszko, Namadgi, Crowdy Bay, Hat Head, Kwiambal NPs (SPRAT)	shrubland, grassland or woodland, often on damp sites. Vegetation types include open grassy heath and Kangaroo Grass grassland surrounded by Eucalyptus woodland; and grassland dominated by *Cymbopogon refractus* (SPRAT).	• Not recorded from the search area and not known from the region.
Orchids		
Cryptostylis hunteriana		
The distribution of the species extends from Orbost in East Gippsland, Victoria through coastal NSW and up in to the Tin Can Bay area of southern Qld. In NSW, occurs between Batemans Bay and Nowra with additional records in Nelson Bay, Wyee, Washpool NP, Nowendoc SF, Ku-Ring-Gai Chase NP, Ben Boyd NP, the Catherine Hill Bay area, Dolphin Point (nd Bulahdelah (SPRAT).	Reported to occur in a wide variety of habitats including heathlands, heathy woodlands, sedgelands, *Xanthorrheoa* spp. plains, dry sclerophyll forests, forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests and wet sclerophyll forests. Soils are generally considered to be moist and sandy, however, this species is also known to grow in dry or peaty soils (SPRAT).	Unlikely • Habitat including soil types absent from the subject land and surrounding landscape. • Not found during surveys and not recorded from search area.
Genoplesium baueri		
The species occurs within coastal areas, although it has been recorded from as far west as Woodford in the Blue Mountains, Bargo in Southern Sydney and Penrose State Forest in the southern highlands. Across its range, this species has a patchy distribution and is currently known from a small number of sites (TSProfile).	Habitat broadly described as including open or heathy forests and woodland with well drained sandy and gravelly soils and in moss beds on sandstone. Within this broad habitat description, observations suggest that the species prefers microhabitats where there is increased soil moisture (EcoPlanning, 2017).	Unlikely • Habitat absent. • Not known from or recorded from search area.
Pterostylis gibbosa		
Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). It is apparently extinct in western Sydney which is the area where it was first collected (SPRAT).	All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage (TSProfile).	Unlikely • Not known from the region, assumed extinct in Western Sydney.
Pterostylis saxicola		
Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few	Grows in heathy forest, sclerophyll forest or woodland in shallow sandy soil over flat sheets of	Unlikely • Habitat absent

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
known populations and they are all very small and isolated. Two populations occur within a conservation reserve (Georges River National Park; Scheyville NP) (TSProfile).	sandstone rock shelves above cliff lines and also in crevices between sandstone boulders; often in close proximity to streams (SPRAT)	• Not recorded from the search area or known from the locality
Rhizanthella slateri		
The Eastern Underground Orchid is known from less than ten isolated populations along the NSW south to mid-north coast. These populations occur at the Blue Mountains, Nowra, Watagan Mountains, Wiseman's Ferry, Agnes Banks and Alum Mountain. Anecdotal evidence suggests that some of these known populations may already be extinct due to development activities (TS Committee advice to DEHA).	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore, usually located only when the soil is disturbed (TS Committee advice to DEHA).	Unlikely • Not recorded from the locality and not known from the region. • Given the long history of disturbance, if the species was once present it is considered unlikely it would subsist in the project area.
Vines		
Cynanchum elegans		
Restricted to Wollongong, NSW, north to southeast Queensland and west to Mt Danger. Locations include Cumberland Plain, the Forster area, Manning Valley, Hunter Valley, Yabbra State Forest, Brunswick Heads, Gerroa, Merriwa and northeast of Tenterfield. It has been recorded from 86 locations with the most common in the Kempsey region (SPRAT).	Occurs mainly at the ecotone between dry subtropical rainforest and sclerophyll forest/woodland communities. In the Illawarra region and Cumberland Plain, the majority of the populations are found in small, isolated remnant patches of dry rainforest. Reported to overlay with various EPBC Act-listed TECs including CPW (SPRAT).	Unlikely • A conspicuous vine, with a fissured corky bark up to 10 metres long and 3.5 cm thick (TSProfile). • Not found during surveys and not recorded from search area.

2. Threatened fauna species

2.1. EPBC Act protected matters report

Table 2-1 lists threatened fauna species returned in an EPBC Act protected matters search tool (PMST).

Table 2-1. Fauna species returned in EPBC Act PMST

Species name	Common Name	Status	PMST category for a 10km search radius:
Amphibia			
Heleioporus australiacus	Giant Burrowing Frog	Vulnerable	Likely to occur
Litoria aurea	Green and Golden Bell Frog	Vulnerable	Likely to occur
Litoria raniformis	Growling Grass Frog	Vulnerable	May occur
Aves			
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Likely to occur
Botaurus poiciloptilus	Australasian Bittern	Endangered	May occur
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	May occur
Grantiella picta	Painted Honeyeater	Vulnerable	Likely to occur
Hirundapus caudacutus	White-throated Needletail	Vulnerable	May occur
Lathamus discolor	Swift Parrot	Critically Endangered	Likely to occur
Neophema chrysogaster	Orange-bellied Parrot	Critically Endangered	May occur
Numenius madagascariensis	Eastern Curlew	Critically Endangered	Likely to occur
Rostratula australis	Australian Painted Snipe	Endangered	May occur
Mammals			
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	May occur
Dasyurus maculatus maculatus	Spotted-tail Quoll (south eastern mainland population)	Endangered	Likely to occur
Petauroides volans	Greater Glider	Vulnerable	Likely to occur
Phascolarctos cinereus	Koala (combined populations of Qld, NSW and the ACT)	Vulnerable	May occur
Pseudomys novaehollandiae	New Holland Mouse	Vulnerable	Likely to occur
Pteropus poliocephalus	Grey-headed flying fox	Vulnerable	May occur

2.2. Significance of impact assessment

Two of the species listed in Table 2-1 are indicated as occuring within the project land, these being .

- *Chalinolobus dwyeri* (large-eared pied bat); and
- *Pteropus poliocephalus* (grey-headed flying fox).

Litoria aurea (green and golden bell frog), while considered unlikely to occur within the project land, has not been surveyed in accordance with the Significant Impact Guidelines (DEWHA 2009) and is therefore a significance of impact assessment is provided.

Significance of impact assessments are provided for each of these species in the following subsections. Table 2-2 provides a summary of known distribution and habitat requirements for each of the species returned in the PMST along with justification of the likelihood of each species occurrence.

2.2.1 *Chalinolobus dwyeri* (large-eared pied bat)

Status:

The large-eared pied bat is listed as a vulnerable species under the EBPC Act and the NSW BC Act.

Description:

The large-eared pied bat is a medium-sized insectivorous bat with relatively short, broad wings, suggesting it flies comparatively slowly and with considerable manoeuvrability (DERM, 2011). The species probably forages for small, flying insects below the forest canopy and is likely to hibernate through the coolest months (TSProfile).

Distribution of the large-eared pied bat is discontinuous and ranges from Shoalwater Bay in Queensland through to Ulladulla in NSW. Much of its known distribution occurs in NSW. In the north east of the state at Coolah Tops, Mt Kaputar and Warrumbungle National Park it is present in areas of volcanic strata. It is more widely distributed, but still uncommon and patchy within its distribution, in the sandstone areas of the Sydney Basin and the western slopes and plains including Pilliga Nature Reserve (DERM, 2011).

Over most of its range, the large-eared pied bat appears to roost predominantly in caves and overhangs in sandstone cliffs and forage in nearby high-fertility forest or woodland near watercourses. The presence of suitable caves or overhangs may be more important than the precise geology, as bats have also been captured near rhyolite cliffs in south-east Queensland (DERM, 2011).

This species has been recorded foraging in a range of vegetation types, including dry and wet sclerophyll forest, grassy woodland, Callitris dominated forest, tall open eucalypt forest with a rainforest sub-canopy, sub-alpine woodland and sandstone outcrop country. The occurrence of high-fertility forest or woodland near suitable roosting habitat is rare in the landscape, which implies that the species may always have been uncommon; however preferential clearing of fertile forests and woodlands has almost certainly reduced the amount of available habitat considerably (DERM, 2011).

The species has also been found roosting in abandoned mine tunnels and disused fairy martin nests. No evidence exists of the large-eared pied bat roosting in tree hollows (DERM, 2011).

Impact assessment

Calls of the large-eared pied bat were recorded from an Anabat deployed (over four nights) in vegetation within Area 1 of the project land. The vegetation comprises a 0.70h patch of Cumberland Swamp Oak riparian forest (SOFF) and an adjacent 0.33ha patch Cumberland riverflat forest RFEF)).

This vegetation is zoned Environmental Conservation (E2) under the WSEA SEPP and will not be directly impacted by the proposal. Existing development controls and those specified within the Draft Precinct DCP require demonstration that appropriate measures will be implemented to avoid, minimise and mitigate indirect impacts on biodiversity values.

Is there an important population?

Important populations for this species occur in the sandstone escarpments of the Hunter Valley, Sydney Basin and Southern Tablelands of NSW (DERM 2011).

The project land does not contain any sandstone escarpments. The relatively small, disjunct and degraded patches of vegetation are unlikely to provide an important foraging source for the species.

The project land does not occur at the limit of the species' range.

The occurrence of this foraging species within the project land is likely due to nearby larger and more intact patches of CPW and RFEF to the northeast, which provide a continuous corridor to the riparian zone of Ropes Creek and a patch sized greater than 30 ha within a 2km radius. This is supported by the species not being recorded on deployments in the south fo the project area over a further eight nights.

It is concluded that the project land does not contain or provide habitat for a population of the species 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.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:

1. **Lead to a long-term decrease in the size of an important population of a species**

Not applicable. The species in the project area is not part of an important population.

2. **Reduce the area of occupancy of an important population**

Not applicable. The species in the project area is not part of an important population.

3. **Fragment an existing population into two or more populations**.

Not applicable. The species in the project area is not part of an important population.

4. **Adversely affect habitat critical to the survival of a species.**

No critical habitat is listed for this species under the EPBC Act.

Sandstone cliffs and fertile wooded valley habitat within close proximity of each other has been suggested as habitat critical to the survival of the large-eared pied bat (DECC 2007). The project area does not contain either habitat.

5. **Disrupt the breeding cycle of a population.**

Not applicable. The species in the project area is not part of an important population.

6. **Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**.

Habitat modelling based on surveys in the Southern Sydney region suggest that the species is largely restricted to the interface of sandstone escarpment (for roost habitat) and relatively fertile valleys (for foraging habitat) (DECC 2007). DECC (2007) also applied a data-based presence-only model, which found the following correlations (relevant to the project land):

- Occurrence in Grassy Box Woodlands and Red-Gum/Ironbark communities of the wider valleys and plains, as well as areas with moderately-tall to taller trees and along rivers and creeklines.
- Sensitivity to disturbance, probably reflecting a preference for vegetation on fertile soils, which is mostly disturbed to some degree.
- Many vegetation remnants of the Cumberland Plain are highlighted as moderate quality habitat, though may not be used if the distance from suitable roosting habitat is too far, or if remnants have been too isolated by clearing.
- Totally cleared land is not predicted as suitable habitat.

Native vegetation to be removed (excluding farm dam macrophytes) amounts to 1.45 ha from a total area of 63.3 hectares. The areas of vegetation to be removed comprise three isolated patches of CPW (0.33ha, 0.43ha, 0.46ha) and one isolated patch of RFEF (0.23). All patches are dominated by young regrowth with limited mature and larger trees.

It is considered unlikely that the removal of this vegetation would affect the availability or quality of habitat for this species to the extent that it is likely to decline.

7. **Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.**

The referred action is not likely to increase the likelihood of an invasive species becoming established in the habitat of the species.

8. **Introduce disease that may cause the species to decline.**

The referred action is unlikely to result in a disease becoming established or proliferating in a local population that would result in a decline of the species.

At the time of writing this report, information relating to diseases that may impact on microbat populations could not be found.

9. **Interfere with the recovery of the species.**

Due to the small amount of potential foraging habitat likely to be affected and the absence of roosting/breeding habitat, the referred action is not likely to interfere with the recovery of this species.

Conclusion

The proposal is unlikely to significantly impact upon the species due to the following:

- The project area does not contain any sandstone escarpments, fertile valleys, intact remnant vegetation or moderately-tall to taller trees along rivers and creek lines.
- The project area does not occur at the limit of the species' range.
- The project area is not considered to contain an important population of the species.
- The vegetation in which the species was recorded is being retained and protected.
- The vegetation to be removed comprise four disjunct and small patches of immature woodland with limited mature larger trees.
- 98% of the project area comprises pasture, market gardens, rural residences, agricultural dams and other cleared areas.
- More intact timbered areas are located to north east of the project land which will be retained as environmental conservation areas.

2.2.2 Pteropus poliocephalus (grey-headed flying fox)

Status:

The grey-headed flying-fox is listed as Vulnerable under the EPBC Act.

Description (sourced from the species recovery plan, DAWE, 2021)**:**

Endemic to Australia, the grey-headed flying-fox is one of the largest bats in the world. The species historically occupied forests and woodlands in the coastal lowlands, tablelands and slopes of eastern Australia, from Bundaberg in Queensland to Geelong in Victoria, with some isolated camps and rare sightings outside this range. More recently, camps have established in South Australia, the Australian Capital Territory and inland areas of central and southern New South Wales and Victoria and sightings have increased in Tasmania.

Breeding camps have been recorded as far north as Ingham in far north Queensland and more recently, the species has become established in South Australia, the Australian Capital Territory and Victoria and inland areas of New South Wales.

The species feeds primarily on blossoms and fruit in canopy vegetation, and supplements this diet with leaves. Major food plants include the fruit and blossom of rainforest species, especially Ficus spp., and blossoms of myrtaceous species such as Eucalyptus, Corymbia and Angophora, melaleucas, banksias and the fruit and flowers of Syzygium spp..

The foraging behaviour of the species alters when native food sources are scarce. They have no biological adaptations to withstand food shortages (e.g. torpor) and migrate in response to changes in the quantity and location of food. The majority of eucalypts have regular seasonal flowering events, but do not flower every year and there are few areas within the species' range where nectar is available continuously. The species forage over extensive areas and have been known to fly as far as 40 km to feed, before returning to their roost the same night.

They roost in large aggregations, known as camps, in the exposed branches of trees. The locations of camps have in the past generally been stable through time, and several sites have documented histories that exceed 100 years. Camps provide resting habitat, sites of social interactions and refuge for animals during significant phases of their annual cycle, such as birth, lactation and conception. Camps are used as day

refuges by animals that forage in surrounding areas over several weeks, as maternity camps, and as short-term stopover sites by migrating animals.

Impact assessment

Anecdotally the species has been observed feeding on exotic palm trees at the rear of a residence on Lot 199 Aldington Road (Lot 26 DP 255560) in Area 2 of the project land. Although back yard fruit trees, orchards or non-native trees that may be used for foraging are not considered to be habitat critical to the survival of the survival DAWE 2021).

A number of BioNet records also occur within the Precinct and the wider search area.

It is likely that the more mature trees within regenerating patches of native vegetation and scattered paddock trees provide foraging habitat when flowering for the species.

Native vegetation to be removed (excluding farm dam macrophytes) amounts to 1.45 ha from a total area of 63.3 hectares. The areas of vegetation to be removed comprise three isolated patches of CPW (0.33ha, 0.43ha, 0.46ha) and one isolated patch of RFEF (0.23).

Is there an important population?

Important populations for this species occur where maternity and roosting camps occur and vegetation communities that contain important winter and spring flowering vegetation communities.

Occurrences of this species within the project area and wider landscape are not at the limits of the species' distribution.

The project area does not contain maternity or roosting camps and does not contain any sizeable extent of important winter and spring vegetation communities (i.e., those that contain *Eucalyptus tereticornis, E. albens, E. crebra, E. fibrosa, E. melliodora, E. paniculata, E. pilularis, E. robusta, E. seeana, E. sideroxylon, E. siderophloia, Banksia integrifolia, Castanospermum australe, Corymbia citriodora citriodora, C. eximia, C. maculata, Grevillea robusta, Melaleuca quinquenervia* or *Syncarpia glomulifera*).

Therefore it is concluded that the project land does not contain or provide habitat for a population of the species 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.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:

1. **Lead to a long-term decrease in the size of an important population of a species**

Not applicable. The species in the project area is not part of an important population.

2. **Reduce the area of occupancy of an important population**

Not applicable. The species in the project area is not part of an important population.

3. **Fragment an existing population into two or more populations**.

Not applicable. The species in the project area is not part of an important population.

4. **Adversely affect habitat critical to the survival of a species.**

Habitat critical to the survival of the species includes:

- Native species used for foraging and occur within 20 km of a nationally important camp

  Nationally important camps are located in Macquaries Fields, Windsor and Paramatta Park. While the project land is located within 20kms of Parramatta Park, the native species that would be removed are considered to provide marginal and sporadic foraging habitat.

- Native and or exotic species used for roosting at the site of a nationally important camp.

The project land does not contain a nationally important camp

- Where the existence of important winter and spring flowering vegetation communities is verified in the field

  The project land does not contain any significant areas of important winter and spring flowering vegetation communities.

5. **Disrupt the breeding cycle of a population.**

Not applicable. The species in the project area is not part of an important population.

6. **Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.**

Native vegetation to be removed (excluding farm dam macrophytes) amounts to 1.45 ha from a total area of 63.3 hectares. The areas of vegetation to be removed comprise three isolated patches of CPW (0.33ha, 0.43ha, 0.46ha) and one isolated patch of RFEF (0.23). All patches are dominated by young regrowth with limited mature and larger trees.

It is considered unlikely that the removal of this vegetation would affect the availability or quality of habitat for this species to the extent that it is likely to decline.

7. **Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.**

The referred action is not likely to increase the likelihood of an invasive species becoming established in the habitat of the species.

8. **Introduce disease that may cause the species to decline.**

The referred action is unlikely to result in a disease becoming established or proliferating in a local population that would result in a decline of the species.

At the time of writing this report, information relating to diseases that may impact on microbat populations could not be found.

9. **Interfere with the recovery of the species.**

Due to the small amount of potential foraging habitat likely to be affected and the absence of roosting/breeding habitat and other habitat considered critical for the species, the referred action is not likely to interfere with the recovery of this species.

Conclusion

The proposal is unlikely to significantly impact upon the species due to the following:

- The project area does not critical habitat for the species.
- The project area does not occur at the limit of the species' range.
- The project area is not considered to contain an important population of the species.
- The vegetation to be removed comprise four disjunct and small patches of immature woodland with limited mature larger trees.
- 98% of the project area comprises pasture, market gardens, rural residences, agricultural dams and other cleared areas.
- Anecdotal evidence of the species using the site is limited exotic species which are not included in the definitions of habitat important to the species.

2.2.3 Litoria aurea (green and golden bell frog)

Status:

The green and golden bell frog is listed as a vulnerable species under the EBPC Act.

Description:

The green and golden bell frog now mostly occurs in coastal lowland areas in New South Wales and Victoria. The current species' range is thought to extend from around Brunswick Heads in northern New South Wales (about 50 kilometres south of the Queensland border) to around Lake Wellington, just west of Lakes Entrance in south-eastern Victoria. The species occurs as far inland as Bungendore and Hoskinstown in the southern tablelands of New South Wales. The green and golden bell frog is historically known from the Australian Capital Territory and central slopes of Bathurst in New South Wales (DEWHA 2009).

Green and golden bell frogs need various habitats for different aspects of their life cycle including foraging, breeding, over-wintering and dispersal. They will also use different habitats or habitat components on a temporal or seasonal basis. The habitat of the green and golden bell frog comprises one or more water bodies and associated terrestrial habitats (grassy areas and vegetation no higher than woodlands) within its known range (DEWHA 2009).

The species inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas (TSProfile 2017).

Because of the continued decline of the green and golden bell frog, the restricted nature of all known populations in New South Wales and the uncertainty about the current status of the Victorian populations, all current populations of green and golden bell frog are regarded as an 'important population'. A current population is defined as a site where one or more green and golden bell frogs have been detected on at least one occasion since 1995, even if they have not recently been discovered at the site (due to the species tendency towards local extinction and recolonisation cycles) (DEWHA 2009).

Impact assessment

The green and golden bell frog, while considered unlikely to occur within the project land, has not been surveyed in accordance with the Significant Impact Guidelines (DEWHA 2009) and is therefore a significance of impact assessment is provided.

The project area contains several farm dams that vary in size from 0.22 ha up to 2 ha. Most of the dams (not all) contain patches of *Typha orientalis* (broad leaf cumbungi), which is known to provide habitat for the species.

The likelihood of the species was discounted as suitable microhabitat is absent from the project land and the species has not been detected despite a number of targeted surveys for the species in the locality (refer Figure 5 provided with the referral).

Amphibian surveys were limited to 30-60-minute listening surveys at dusk and dawn at dams where emergent cumbungi was present in small to medium size patches, but repetitive surveys were not completed. Surveys commenced prior to a severe flood event in Sydney (during March 2021) at which time many areas of the project land became inaccessible.

Is there an important population?

The species has not been recorded from the search area (despite numerous surveys being completed) and the project land is not proximal to any known populations of the species. Farm dams within the project area contain limited quantities of broad leaf cumbungi, *Gambusia holbrooki* is evident, and the surrounding environment is not considered to provide suitable shelter or overwintering habitat.

It is concluded that the project land does not contain or provide habitat for a population of the species 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.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:

1. **Lead to a long-term decrease in the size of an important population of a species**

Not applicable. The project area does not contain an important population.

2. **Reduce the area of occupancy of an important population**

Not applicable. The project area does not contain an important population.

3. **Fragment an existing population into two or more populations**.

Not applicable. The project area does not contain an important population.

4. **Adversely affect habitat critical to the survival of a species.**

No critical habitat is listed for this species under the EPBC Act or NSW BC Act. Regardless the project area is not considered to provide suitable habitat for the species.

5. **Disrupt the breeding cycle of a population.**

Not applicable. The project area does not contain an important population.

6. **Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**.

Not applicable. The project area does not habitat for the species.

7. **Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.**

The referred action is not likely to increase the likelihood of an invasive species becoming established in the habitat of the species. The project area does not habitat for the species and the broader landscape is not known to support populations of the species.

8. **Introduce disease that may cause the species to decline.**

The referred action is unlikely to result in a disease becoming established or proliferating in a local population that would result in a decline of the species.

9. **Interfere with the recovery of the species.**

Due to the lack of habitat for the species the referred action will not interfere with the recovery of this species.

Conclusion

The proposal is unlikely to significantly impact upon the species due to the following:

- The project area does not occur at the limit of the species' range.
- The project area is not considered to contain an important population of the species.
- The project area does not habitat for the species and the broader landscape is not known to support populations of the species.

Table 2-2. Likelihood of PSMT listed threatened species to occur in subject lands

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
Amphibia		
Heleioporus australiacus		
Distributed in south eastern NSW and Vic. and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria (TSProfile). In NSW, where the majority of the Giant Burrowing Frog populations are found, 45% of the species' distribution occurs in reserved areas (NSW NPWS estate) (DAWE endangered listing-consultation).	Dependent upon forested habitat, having not been recorded from cleared land. The species can be found in heath, woodland, and open dry sclerophyll forest on a variety of soils, except clay-based soils. Historically the species was known from the Sydney-Hawkesbury sandstone region that occurs on the periphery of the Cumberland Plain on which Sydney occurs (DAWE endangered listing-consultation). Spends > 95% of its time in non-breeding habitat (up to 300 m from breeding sites) burrowing below the soil surface or in the leaf litter. Breeding habitat is generally soaks or pools within 1st or 2nd order streams. Also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water. A slow growing and long-lived species, living up to 10 years of age possibly more (TSProfile).	Unlikely • Project land does not contain forested habitat and lacks 1st and 2nd order streams. • Species not recorded within search area
Litoria aurea		
Refer Section 2.2.2	Refer Section 2.2.2	Refer Section 2.2.2
Litoria raniformis		
In NSW the species was once distributed along the Murray and Murrumbidgee Rivers and their tributaries, the southern slopes of the Monaro district and the central southern tablelands as far north as Tarana, near Bathurst. Currently, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. A few yet unconfirmed records have also been made in the Murray Irrigation Area in recent years. The species is also found in Victoria, Tasmania and	Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat (TSProfile)	Unlikely • Habitat absent • Species not known from the Sydney Basin bioregion and not recorded from search area

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
South Australia, where it has also become endangered (TSProfile)		
Aves		
Anthochaera phrygia		
Mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. 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 flocks converge on flowering coastal woodlands and forests (TSProfile).	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. 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 (TSProfile).	Unlikely • Habitat degraded and lacks mature trees in large numbers, high canopy cover and mistletoes. • Species not recorded from search area. • Project area not mapped as an area of important habitat for the species.
Botaurus poiciloptilus		
Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west (TSProfile).	Preferred habitat is comprised of wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds (e.g. Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus) or cutting grass (Gahnia) growing over a muddy or peaty substrate (Conservation Advice, 2011).	Unlikely • Habitat degraded and limited Typha growth in dams, absence of shelter habitat • Species not recorded from search area.
Calidris ferruginea		
In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. Records occur in all states during the non-breeding period, and also during the breeding season when many non-breeding one year old birds remain in Australia	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,	Unlikely • Habitat absent, farm dams within project area lack mudflats and/or shallow water for wading, and lack

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
rather than migrating north. There are sparsely scattered records inland. In NSW, they are widespread east of the Great Divide, especially in coastal regions. They are occasionally recorded in the Tablelands and are widespread in the Riverina and south-west NSW, with scattered records elsewhere (SPRAT).	including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They forage on mudflats and nearby shallow water. In non-tidal wetlands, they usually wade, mostly in water 15–30 mm, but up to 60 mm, deep. 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 (SPRAT).	roosting habitat. • Species not recorded from search area. • Project area not mapped as an area of important habitat for the species.
Grantiella picta		
The Painted Honeyeater is 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 (TSProfile).	The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens. Prefers woodlands with a higher number of mature trees, as these host more mistletoes. More common in wider blocks of remnant woodland than in narrower strips, although it breeds in quite narrow roadside strips if ample mistletoe fruit is available (Conservation Advice, 2015).	Unlikely • Habitat absent (ample mistletoes absent). • Species not recorded from search area.
Hirundapus caudacutus		
Widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (SPRAT).	In Australia, almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps. When flying above farmland, they are more often recorded above partly cleared	Unlikely • Habitat most often recorded from absent. • Although known to fly above partly cleared pasture, the project land is predominantly cleared and unlikely to provide habitat of importance to the species. • Species not recorded from search

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
	pasture, plantations or remnant vegetation at the edge of paddocks (SPRAT).	area.
Lathamus discolor		
During summer, the species breeds in colonies in blue gum forest of south-east Tasmania. Infrequent breeding also occurs in north-west Tasmania. The entire population migrates to the mainland for winter (SPRAT). In NSW mostly occurs on the coast and south west slopes (TSProfile).	On the mainland it disperses widely and forages on flowers and psyllid lerps in eucalypts. The birds mostly occur on inland slopes, but occasionally occur on the coast (SPRAT). 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 *Eucalyptus robusta, Corymbia maculata, C. gummifera, E. tereticornis, E. sideroxylon*, and *E. albens*. Commonly used lerp infested trees include Inland *E. microcarpa, E. moluccana, E. pilularis*, and *E. melliodora*. Return to some foraging sites on a cyclic basis depending on food availability (TSProfile).	Unlikely • Habitat lacks an abundance of profusely flowering eucalypts and abundant lerps. • Species not recorded from the Mamre Road Precinct.
Neophema chrysogaster		
Breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia and southern Victoria. There are occasional reports from NSW, with the most recent records from Shellharbour and Maroubra in May 2003. It is expected that NSW habitats may be being more frequently utilised than observations suggest (TSProfile).	On the mainland, the species spends winter mostly within 3 km of the coast in sheltered coastal habitats including bays, lagoons, estuaries, coastal dunes and saltmarshes. The species also inhabits small islands and peninsulas and occasionally saltworks and golf courses. Birds forage in low samphire herbland or taller coastal shrubland. Diet mainly comprises seeds and fruits of sedges and salt-tolerant coastal and saltmarsh plants. Occasionally, flowers and stems are eaten (TSProfile).	Unlikely • Habitat absent. • Species not recorded from the search area.
Numenius madagascariensis		
Breeds in Russia and north-eastern China. During the non-breeding season a few birds occur in southern Korea and China, but most spend the non-breeding season in north,	Generally occupies coastal lakes, inlets, bays and estuarine habitats, and in NSW is mainly found in intertidal mudflats and sometimes saltmarsh of	Unlikely

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
east and south-east Australia. Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Eastern Curlews are rarely recorded inland. In NSW the species occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast (TSProfile).	sheltered coasts. Forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. Roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. A carnivorous species, mainly eating crustaceans (including crabs, shrimps and prawns), small molluscs, as well as some insects. The birds may delay breeding until three to four years of age. Within Australia, immature birds, which do not migrate, move northward in winter (TSProfile).	• Habitat absent. • Species not recorded from search area. • Project area not mapped as an area of important habitat for the species.
Rostratula australis		
Restricted to Australia, with most records from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys (TSProfile).	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. The nest consists of a scrape in the ground, lined with grasses and leaves. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter (TSProfile).	Unlikely • Habitat absent. • Species not recorded from the Mamre Road Precinct.
Mammals		
Chalinolobus dwyeri		
Refer Section 2.2.1	Refer Section 2.2.1	Call recorded from Anabat surveys within Area 1 (refer Section 2.2.1)
Dasyurus maculatus maculatus		
The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still	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. The species uses hollow-bearing trees, fallen logs, other animal burrows, small caves and rock	Unlikely • Habitat absent. • Species not recorded from the

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
considered relatively common (TSProfile).	outcrops as den sites, 'latrine sites' often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. Are known to traverse their home ranges along densely vegetated creeklines (TSProfile).	search area. • Project area and surrounding landscape does not provide sufficient home ranges.
Petauroides volans		
Restricted to eastern Australia, occurring from the Windsor Tableland in north Qld through to central Vic. The broad extent of occurrence is unlikely to have changed appreciably since European settlement. However, the area of occupancy has decreased substantially mostly due to land clearing and is probably continuing to decline due to further clearing, fragmentation impacts, fire and some forestry activities (Conservation advice, 2016)	An arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. Primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers, typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows and favours forests with a diversity of eucalypt species. Shelters in tree hollows, with a particular selection for large hollows in large, old trees. In Grafton/Casino Forestry Management Areas (FMAs) the abundance of greater gliders on survey sites was significantly greater on sites with a higher abundance of tree hollows and absent from surveyed sites with fewer than six tree hollows per hectare. Modelling suggests that they require native forest patches of at least 160 km2 to maintain viable populations (Conservation advice, 2016).	Unlikely • Habitat absent. • Species not recorded from the search area. • Project area and surrounding landscape does not provide sufficient home ranges.
Phascolarctos cinereus		
The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In New South Wales, koala populations	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select	Unlikely • Species not recorded from the

Known distribution (referenced from EPBC Act SPRAT and NSW threatened species profiles (TSProfile) unless referenced otherwise	Habitat requirements	Likelihood of occurrence
are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range (TSProfile).	preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size (TSProfile).	search area. • Project area and surrounding landscape does not provide sufficient feed trees and home ranges.
Pseudomys novaehollandiae		
The species has a fragmented distribution across Tas., Vic., NSW and Qld. The species has undergone a large range contraction since European settlement. Given the number of sites from which the species is known to have disappeared between 1999 and 2009, it is likely that the species' distribution is actually smaller than current estimates (TSProfile).	Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals.	Unlikely • Habitat absent. • Species not recorded from the search area.
Pteropus poliocephalus		
Refer Section 2.2.2	Refer Section 2.2.2	Present within project area based on anecdotal evidence from landowner in Area 2 (refer Section 2.2.2)

3. Migratory species

3.1. EPBC Act protected matters report

Fifteen migratory species were returned in the EPBC Act protected matters search tool (PMST) for the search area surrounding and including the project land.

Seven of this species are migratory shorebird species (see Table 3-1) and a further eight species are included in the 'Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (Commonwealth of Australia 2015) (see Table 3-2).

Table 3-1. Migratory shorebird species returned in EPBC Act PMST

Species name	Common Name	Status	PMST category for a 10km search radius:
Actitus hypoleucos	Common sandpiper	Migratory wetland	Likely to occur
Calidris acuminata	Sharp-tailed sandpiper	Migratory wetland	Likely to occur
Calidris ferruginea[#]	Curlew sandpiper	Migratory wetland	May occur
Calidris melanotos	Pectoral sandpiper	Migratory wetland	May occur
Gallinago hardwickii	Latham's snipe	Migratory wetland	Known to occur
Numenius madagascariensis[#]	Eastern Curlew	Migratory wetland	May occur
Tringa nebularia	Common greenshank	Migratory wetland	Likely to occur

Table 3-2. Other migratory species returned in EPBC Act PMST

Species name	Common Name	Status	PMST category for a 10km search radius:
Apus pacificus	Fork-tailed swift	Migratory marine	Likely to occur
Cuculus optatus	Oriental cuckoo	Migratory terrestrial	Known to occur
Hirundapus caudacutus[#]	White-throated needletail	Migratory terrestrial	Known to occur
Monarchus melanopsis	Black-faced monarch	Migratory terrestrial	Known to occur
Motacilla flava	Yellow wagtail	Migratory terrestrial	Likely to occur
Myiagra cyanoleuca	Satin flycatcher	Migratory terrestrial	Known to occur
Rhipidura rufifrons	Rufous fantail	Migratory terrestrial	Known to occur
Pandion haliaetus	Osprey	Migratory wetland	Likely to occur

[#] species also assessed in Section 2

3.2. Significance of impact assessment

Two migratory species have been indicated as occurring within the subject land:

- *Rhipidura rufifrons* (rufous fantail)

One individual species *Rhipidura rufifrons* (rufous fantail) was observed in a small, isolated patch of CPW (0.46 ha) within Area 1, which will be removed as a result of the proposal. The species flew into the patch briefly, remaining for approximately 3 minutes of a 20 minute census being conducted.

- *Gallinago hardwickii* (Latham's snipe)

A BioNet record dated 22 February 2008 along the northern perimeter of the Area 2.

Impact assessment

Migratory shorebird species

The migratory shorebird species listed in Table 3-1 have been assessed against the thresholds provided in the 'EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species' (Commonwealth of Australia 2017)

Important habitat in Australia for these species[#] is prescribed as follows:

- Internationally important if it regularly supports:
  - 1 per cent of the individuals in a population of one species or subspecies of waterbird, OR
  - A total abundance of at least 20,000 waterbirds.
- Nationally important habitat for migratory shorebirds can be defined using a similar approach to these international criteria, i.e. if it regularly supports:
  - 0.1 per cent of the flyway population of a single species of migratory shorebird, OR
  - 2,000 migratory shorebirds, OR
  - 15 migratory shorebird species.

[#] *Gallinago hardwickii* (Latham's snipe) Latham's snipe does not commonly aggregate in large flocks or use the same habitats as many other migratory shorebird species. Consequently, habitat important to Latham's snipe is not regularly identified as above and different criteria are therefore necessary.

Threshold criteria are still considered the best way to identify important sites in the absence of data sufficient for more rigorous methods. For the purposes of this plan, important habitat for Latham's snipe is described as areas that have previously been identified as internationally important for the species, or areas that support at least 18 individuals of the species.

Conclusion: The subject land does not important habitat for any of the species listed in Table 3-1.

Other migratory species

The remaining migratory species listed in Table 3-2 have been assessed using the 'Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (Commonwealth of Australia 2015). This guideline applies to 14 migratory bird species, which are included in one or more international agreements, but are often detected during surveys for environmental impact assessments due to their widespread distributions and occupancy of relatively broad habitats.

This guideline therefore aims to outline those circumstances where a significant impact on one or more of these species is likely, as follows:

- **Is the proposed within the range of any of the 14 migratory species (with reference to the guideline maps 1-14)?**

Apus pacificus	Fork-tailed swift	Within range
Cuculus optatus	Oriental cuckoo	Not within range
Hirundapus caudacutus[#]	White-throated needletail	Within range
Monarchus melanopsis	Black-faced monarch	Within range
Motacilla flava	Yellow wagtail	Not within range
Myiagra cyanoleuca	Satin flycatcher	Within range
Rhipidura rufifrons	Rufous fantail	Within range
Pandion haliaetus	Osprey	Within range

- **Is the proposed activity likely to substantially modify, destroy or isolate an area of important habitat for any of one or more of the 14 migratory species?**

With reference to Sections 4 and 8 of the guidelines, an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify, destroy or isolate an area of important habitat for a migratory species, or
- Result in an invasive species that is harmful to the migratory species becoming established in an area of **important habitat** for the migratory species.

Table 3-3 outlines what is considered to be important habitat for each of the migratory species listed in Table 3-2 as well as the invasive species harmful to each species.

Table 3-3. important habitat for each of the migratory species listed in Table 3.2

Species	Important habitat	Invasive species harmful to the migratory species	Assessment response
Osprey	Bays, estuaries, along tidal stretches of large coastal rivers, mangrove swamps, coral and rock reefs, terrestrial wetlands and coastal lands of tropical and temperate Australia and off shore islands. They feed primarily in the sea or nearby estuarine waters and nest in trees (often dead or with dead tops), rocky coastlines and on artificial structures such as telecommunication towers. Ospreys are generally found on or near the coast but also range inland along large rivers, mainly in northern Australia.	Any species that greatly reduces fish abundance	Habitat absent.
White-throated Needletail	Non-breeding habitat only: Found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial. Large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. Appears to have traditional roost sites.	Unknown	Key habitat requirement absent. Limited hollows available, which are inhabited by other non-threatened bird species.
Fork-tailed Swift	Non-breeding habitat only: Found across a range of habitats, from inland open plains to wooded areas, where it is exclusively aerial.	Unknown	Given broadness of non-breeding habitat requirements, foraging habitat cannot be discounted.
Oriental Cuckoo	Non-breeding habitat only: monsoonal rainforest, vine thickets, wet sclerophyll forest or open *Casuarina*, *Acacia* or *Eucalyptus* woodlands. Frequently at edges or ecotones between habitat types. Riparian forest is favoured habitat in the Kimberley region.	Unknown	Habitat absent.
Black-faced Monarch	Wet forest specialist, found mainly in rainforest and wet sclerophyll forest, especially in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs.	Black Rat *Rattus rattus*, invasive vines of riparian habitat (e.g. rubber vine *Cryptostegia grandiflora*)	Habitat absent.
Satin Flycatcher	Eucalypt forest and woodlands, at high elevations when breeding. They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland	Black Rat *Rattus rattus*, invasive vines of riparian habitat (e.g. rubber vine	Unlikely that subject land provides habitat, as only small, isolated and degraded patches

Species	Important habitat	Invasive species harmful to the migratory species	Assessment response
	types. During migration, habitat preferences expand, with the species recorded in most wooded habitats except rainforests.	*Cryptostegia grandiflora*)	of open woodland present.
Rufous Fantail	Moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey. When on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrublands.	Black Rat *Rattus rattus*, invasive vines of riparian habitat (e.g. rubber vine *Cryptostegia grandiflora*)	Given broadness of 'on-passage' habitat requirements, and species observed briefly within the subject land, foraging habitat cannot be discounted.
Yellow Wagtail	Non-breeding habitat only: mostly well-watered open grasslands and the fringes of wetlands. Roosts in mangroves and other dense vegetation.	Unknown	Habitat absent.

- **Is the proposed activity likely to seriously disrupt the lifecycle of an ecologically significant proportion of the species?**

  With reference to Sections 5 and 8 of the guidelines. An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

  Proportions are estimated based on published estimates of area occupied and recorded densities published in the Handbook of Australian, New Zealand and Antarctic Birds. These are outlined in Table 3-4.

Table 3-4. important habitat for each of the migratory species listed in Table 3.2

Species	Ecologically significant proportion of a population (individuals)		Assessment response
	1%	0.1%	
Fork-tailed Swift	1,000	100	Nearest observed account of one individual from bushland surrounding Prospect Dam (7km northeast of subject land)
Satin Flycatcher	17,000	1,700	Species not observed or recorded from subject land or wider search area.
Rufous Fantail (southern species)	11,000	1,100	One individual species was observed in a small, isolated patch of CPW (0.46 ha) within Area 1.

Conclusion:

Of the eight species returned within the EPBC PMST for the search area, the subject land is not within the range of the oriental cuckoo and yellow wagtail, and further consideration not required.

Of the remaining species, the subject land potentially provides foraging habitat for the fork-tailed swift, satin flycatcher and rufous fantail.

The subject land and wider search area do not contain an ecologically significant proportion of each of these species' population. Therefore, the proposed action will not pose a risk of seriously disrupting the lifecycle (breeding, feeding, migration or resting behaviour) of each of these species.

With reference to the guideline for 14 birds listed as migratory species under the EPBC Act (Commonwealth of Australia 2015), a referral is considered not recommended due to low risk of a significant impact.

4. References

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Australian Government Conservation Listing Advice (untitled):

- Botaurus poiciloptilus (Australasian Bittern) 2011
- Grantiella picta painted honeyeater 2015
- Petauroides volans (greater glider) Conservation Advice 2016