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IMPACT ASSESSMENT REPORT

Canberra Brickworks Access Road and
Dudley Street Upgrade Area, Yarralumla,
ACT

FINAL

May 2018

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Street Upgrade Area, Yarralumla, ACT

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Prepared by
Umwelt (Australia) Pty Limited
on behalf of
**Chief Minister, Treasury and Economic
Development Directorate**

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1.0 Introduction

1.1 Introduction

Umwelt (Australia) Pty Limited (Umwelt) were engaged by the Chief Minister, Treasury and Economic Development Directorate of the Australian Capital Territory (ACT) Government to prepare an impact assessment to support a referral made under the *Environment Protection Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act). The referral is for the proposed upgrade of an existing road and the construction of a new road, described in detail in **Section 1.2**.

The objectives of this report are to:

- describe the avoidance measures undertaken as part of the design process for the proposed actions
- assess the impacts of the proposed action under relevant Commonwealth and ACT approvals legislation and
- quantify the extent and quality of impacted habitat areas, according to Commonwealth and ACT offset policies as required.

1.2 Project Description

The proposed action is to upgrade Dudley Street, Yarralumla, Australian Capital Territory (ACT), which is currently a minor collector road, to a major collector road. These works are required as Dudley Street currently operates above capacity and the upgraded road will improve safety for the public. Upgrade works will generally include road widening and re-alignment however Dudley Street will remain a single carriageway road.

Included in these works will be a new access road that will be built to service the proposed future urban area within the Canberra Brickworks Precinct (CBP). The CBP is located at the southern and western edge of Yarralumla, in the area surrounding the former Canberra Brickworks site. It is proposed that this access road will be constructed concurrently with the Dudley Street upgrade to minimise disruption to the public and achieve budget efficiencies. Both the upgrade works and the construction of the new access road are referred to herein as ‘the Project’.

The current preliminary sketch plan (PSP) (AECOM 2017) for the Project is shown in **Figure 1**. In addition to the actual road alignment, the construction will require a temporary access point in the west, near the intersection of Dudley Street and Cotter Road, which will also provide access to and site compounds. It should be noted that the current PSP, has been amended based on advice regarding the location of ecological constraints, with the aim of minimising impacts to protected environmental matters. This is discussed in greater detail in **Section 2**.

1.3 Project Area

The Project Area encompasses the existing Dudley Street alignment and the future alignment of the access road, up to where it meets the CBP boundary; and includes the impact footprint for the roads, construction access, including temporary traffic diversion, and the site compounds (**Figure 1**). The Project Area is bounded by Yarra Glen to the south, North Curtin Horse Holding Paddocks to the west, and Denman Street and the CBP to the north and east. Residential areas of Curtin, Deakin, and Yarralumla occur to the south, east, and north respectively.

The Project Area is 1.8 kilometres to the east of the Molonglo River and one kilometre south east of Lake Burley Griffin, there is no defined watercourse through the Project Area. The vegetation within the Project Area is contiguous with the North Curtin Horse Paddocks and the Royal Canberra Golf Club.

Dudley Street links the arterial Cotter Road to the residential suburb of Yarralumla. The environment is generally highly disturbed and fragmented by the existing road network. Much of the Project Area is covered with stands of exotic trees, namely *Pinus canariensis*, *P. radiata*, *P. patula*, *Ulmus procera*, and *Quercus palustris*. The majority of grassland areas are also exotic, dominated by Chilean needlegrass (*Nassella neesiana*). The exceptions are some patches of natural temperate grassland of the south eastern highlands (natural temperate grassland) (a threatened ecological community), which are of varying quality; and some areas of mixed grassland also of varying quality.



FIGURE 1

Locality Plan

1.4 Legislation

The following sections briefly outline the relevant legislation to this impact assessment.

1.4.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Commonwealth Government's key piece of environmental legislation. It provides the legal framework for the protection and management of nationally and internationally important flora, fauna, ecological communities, and heritage places; defined as matters of national environmental significance (MNES).

There are nine MNES, which are:

- World Heritage Properties
- National Heritage Places
- wetlands of international importance (i.e. Ramsar wetlands)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth Marine Areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining) or
- a water resource, in relation to coal seam gas development and large coal mining development.

If a proposed development is likely to result in a significant impact to MNES, it must be referred to the Minister for the Environment and Energy for approval. This process requires the proponent to discuss likely impacts to MNES (direct, indirect, cumulative and facilitated as appropriate) and the range of avoidance, mitigation, or offset measures incorporated into the development plan which address these impacts.

To assist with the assessment of impacts, the Commonwealth Government has developed the 'Significant Impact Guidelines 1.1' (DoE 2013), which outline criteria to be considered for each MNES assessment. In addition to these, guidelines targeting particular MNES have been released; where these exist they have also been considered in this assessment. The impact assessment relevant to the EPBC Act is in **Section 4.1** of this report.

1.4.2 Nature Conservation Act 2014

The *Nature Conservation Act 2014* (NC Act) is the ACT's key piece of environmental legislation; protecting and conserving native animals and plants and reserving land for these purposes. To achieve this, the NC Act allows for: the declaration of species and communities that are at risk of extinction within an ACT context; requires an action plan to be developed for each of these matters; provides a regime of offences, licences, and penalties; and, provides a definition of a native vegetation area.

1.4.3 Planning and Development Act 2007

The *Planning and Development Act 2007* (ACT) (PD Act) provides a legislative mechanism that allows for the sustainable development of the ACT. Among other things, the PD Act sets out the development application and approvals processes which will be applicable for this development.

Under the PD Act, there are a number of possible assessment ‘tracks’ for approval depending upon the nature of the development and the severity of its impacts. The ‘impact track’ applies for developments that trigger Schedule 4 of the PD Act, when a development table identifies that a development requires assessment under the ‘impact track’, or where a lease permits a use that is prohibited by the Territory Plan 2008 (Territory Plan). This Project is of a type that triggers the ‘impact track’ approval under Schedule 4, Part 4.3 as it is likely to have a significant adverse environmental impact on threatened species and threatened ecological communities (see **Table 1.1**).

‘Impact track’ developments require the preparation of an Environmental Impact Statement (EIS), unless granted exemption under Section 211 of the PD Act, or granted an Environmental Significance Opinion (ESO).

Table 1.1 Triggers for Impact Track Assessment under the PD Act (Schedule 4, Part 4.3) Relevant to the Project

Part	Item	Development Type
4.3	1	<p>proposal that is likely to have a significant adverse environmental impact on or more of the following, unless the conservator of flora and fauna produces an environmental significance opinion that the proposal is not likely to have a significant adverse environmental impact:</p> <ul style="list-style-type: none"> (a) a critically endangered species (b) an endangered species (c) a vulnerable species (d) a conservation dependent species (e) a regionally threatened species (f) a regionally conservation dependent species (g) a provisionally listed threatened species (h) a listed migratory species (i) a threatened ecological community (j) a protected native species (k) a Ramsar wetland (l) any other protected matter.

2.0 Design Changes

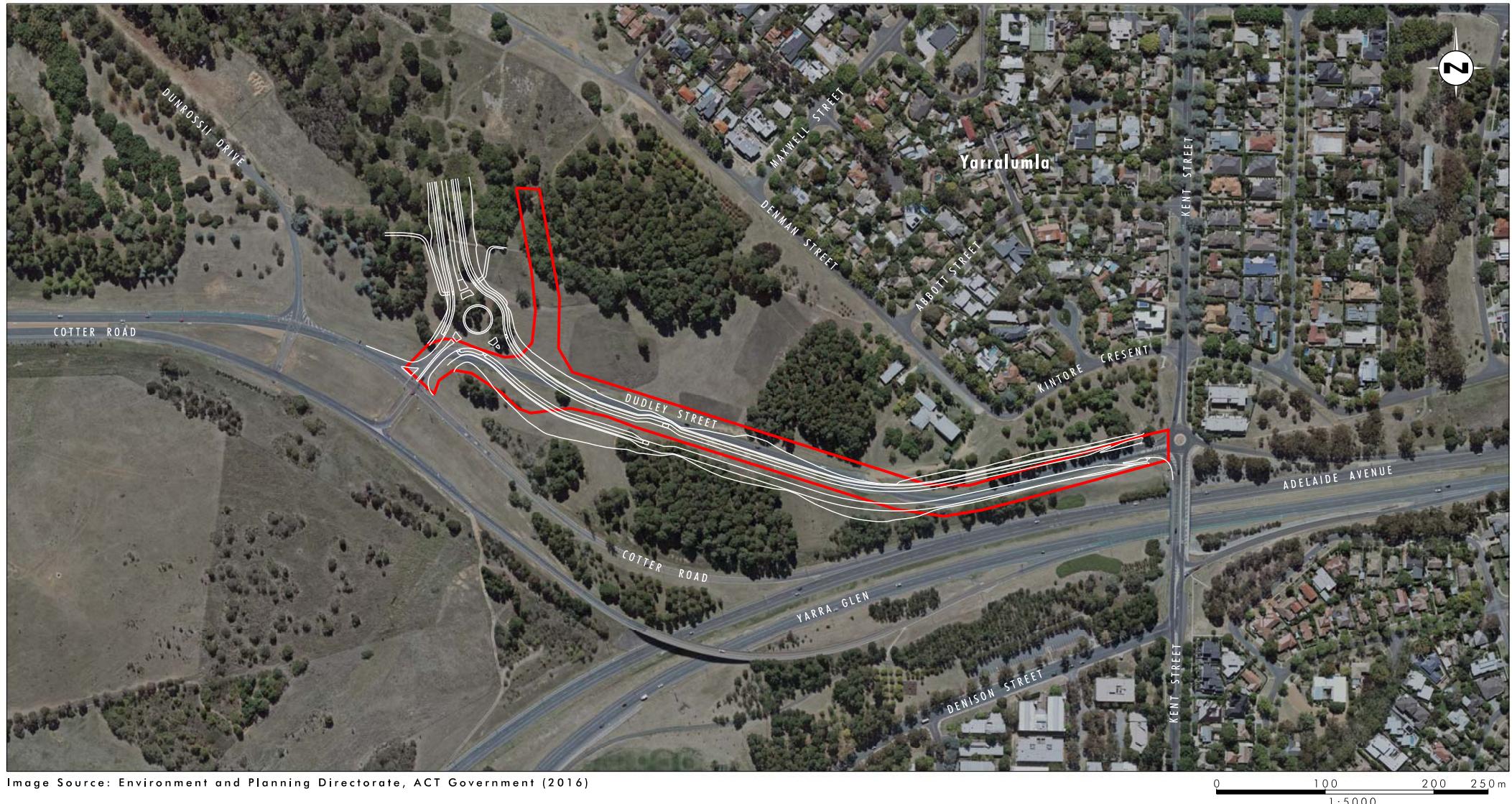
A number of ecological surveys have been completed within the Project Area and surroundings as part of the broader CBP project (Rowell 2010; Rowell 2011; Rowell 2012; Umwelt 2014; Umwelt 2016; Umwelt 2017). These surveys have guided the planning phase of the Project, such that potential impacts to ecological values can be minimised as much as possible. The most recent surveys undertaken by Umwelt (2017) included advice on ecological constraints and opportunities of the then current PSP (Cardno 2016) and provided alternative routes for consideration to reduce these impacts.

The Umwelt (2017) surveys aimed to confirm the current extent and quality of the ecological community ‘natural temperate grassland of the south eastern highlands’ (natural temperate grassland) (EPBC critically endangered, NC Act endangered) and golden sun moth (*Synemon plana*) (EPBC critically endangered, NC Act endangered) habitat quality and species abundance. A total of 0.45 hectares of natural temperate grassland and 7.39 hectares of golden sun moth habitat were recorded.

To avoid and minimise impacts on natural temperate grassland and golden sun moth habitat, Umwelt (2016) recommended that the Cardno (2016) PSP be amended so that the proposed road alignment followed the tree line and existing tracks as much as possible

Figure 2 shows the Cardno (2016) footprint relative to the AECOM (2017) PSP, demonstrating the changes made to the alignment in order to reduce the impacts to ecological values present within the Project Area. The new alignment of Dudley Street (see **Figure 2**) has been moved further south and extends marginally further north than the existing road. This avoids the two largest patches of natural temperate grassland (see **Figure 3**), to the north, and helps ensure that indirect impacts as a result of the construction and operation of the upgraded road are limited to existing magnitudes.

To avoid golden sun moth habitat, the intersection and alignment of the new CBP access road was moved further west (see **Figure 4**). This also helped to reduce the fragmentation of golden sun moth habitat, by moving the alignment as far west as possible, where the trees already form a significant barrier to movement for the species.



Legend

- Cardno 2016 Road Design Footprint
- AECOM 2017 Road Design

FIGURE 2

Changes in Road Designs

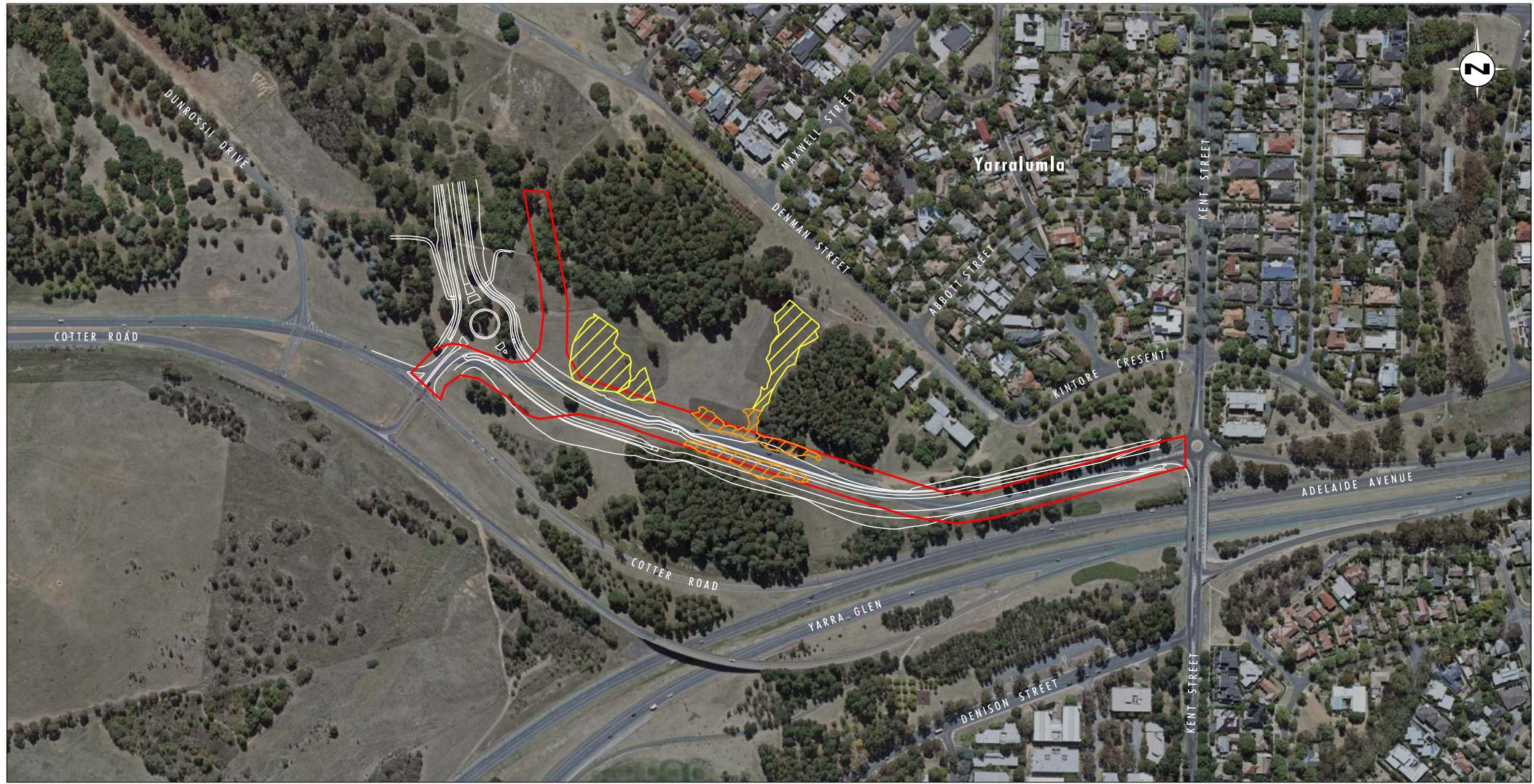


Image Source: Environment and Planning Directorate, ACT Government (2016)

0 100 200 250m
1:5000

Legend

- Cardno 2016 Road Design Footprint
- AECOM 2017 Road Design
- Current Natural Temperate Grassland - High
- Current Natural Temperate Grassland - Very High

FIGURE 3

Changes in Road Designs with
Natural Temperate Grassland



Image Source: Environment and Planning Directorate, ACT Government (2016)

0 100 200 250m
1:5000

Legend

- Cardno 2016 Road Design Footprint
- AECOM 2017 Road Design
- Low Quality Habitat
- Low-Moderate Quality Habitat
- Moderate Quality Habitat
- Moderate (Disturbed) Quality Habitat

File Name (A4): R02/8112_011.dgn
20170920 16.31

FIGURE 4

Changes in Road Designs with
Golden Sun Moth Habitat

3.0 Environmental Values

This section describes the likelihood of occurrence for matters protected under the EPBC Act (**Section 3.1**) and under the NC Act (**Section 3.2**). **Table 3.1** outlines the definitions used in this section with regard to the likelihood of occurrence.

Table 3.1 Definitions of Likelihood of Occurrence

Likelihood of Occurrence	Definition
known	Recent and reliable records of this matter exist within the Project Area.
likely	Despite a lack of records, it is probable that the matter occurs in the Project Area.
potential / potential habitat	Characteristics of the locality are not inconsistent with the requirements of the matter; however use of this area would be infrequent and episodic, potentially associated with unusual or extreme climatic events (e.g. prolonged drought).
unlikely	There are no records for this matter, habitat requirements are not met or its normal distribution range does not coincide with the locality. Despite this, the matter may be present in rare circumstances.
no	There is no potential for the species to occur within the locality.

The assessments in this section are based on the numerous ecological surveys that have occurred in the Project Area and surroundings as part of the broader CBP project (Rowell 2010; Rowell 2011; Rowell 2012; Umwelt 2014; Umwelt 2016; Umwelt 2017). These surveys have targeted identifying threatened ecological communities (most notably natural temperate grassland) and potential habitat for threatened species. Where potential threatened species habitat has been recorded (e.g. perunga grasshopper *Perunga ochracea*) targeted surveys at appropriate times of year, such as during flowering season, or adult flying/emergence. Details of methods and conclusions may be found in the particular reports referenced below.

3.1 Matters of National Environmental Significance

The Project does not occur within a Commonwealth Marine Area or the Great Barrier Reef; or involve nuclear actions (including uranium mining), coal seam gas development, or large coal mining development. As such, these MNES are not assessed further in this report.

The ‘protected matters search tool’ (PMST) (DoEE 2017a) was used to identify MNES that may occur within ten kilometres of the Project Area. The following **Sections 3.1.1 to 3.1.5** discuss the results of this search and assess the likelihood of occurrence for matters identified in the PMST. The full PMST report is provided as **Appendix 1**.

3.1.1 World Heritage Properties

No World Heritage Properties were identified as being within ten kilometres of the Project Area.

The proposed action will not impact upon any World Heritage Properties.

3.1.2 National Heritage Places

Four National Heritage Places were identified as being within ten kilometres of the Project Area. These are the following:

- Australian Academy of Science Building
- Australian War Memorial and the Memorial Parade
- High Court – National Gallery Precinct and
- Old Parliament House and Curtilage.

All of these buildings and relevant associated landscapes are a sufficient distance from the Project Area such that the proposed action will not impact them. Furthermore, as the Project involves the upgrade of an existing road and the construction of a new road within an existing built-up area, it is not likely that it will affect any views or vistas associated with these National Heritage Places.

3.1.3 Wetlands of International Importance

The Project Area is within the catchment (Murray Darling Basin) of four wetlands of international importance (Ramsar Wetlands). These are the following:

- Banrock Station wetland complex
- Hattah-Kulkyne lakes
- Riverland; and
- the Coorong, and Lakes Alexandrina and Albert wetland.

As these wetlands are located a substantial distance downstream from the Project Area (in Victoria and South Australia) there is unlikely to be any measurable impact to these wetlands as a result of the proposed action.

3.1.4 Listed Threatened Species and Ecological Communities

Two threatened ecological communities and 33 threatened species were identified as being within ten kilometres of the Project Area. The likelihood that each matter occurs within or nearby the Project Area has been assessed in **Sections 3.1.4.1 to 3.1.4.8**. Further justification is provided of the likelihood of the occurrence using the guidance provided in **Table 3.1**.

3.1.4.1 Threatened Ecological Communities

Table 3.2 Listed Threatened Ecological Communities identified

Community	EPBC Status	Likelihood of Occurrence
natural temperate grassland of the South Eastern Highlands	critically endangered	known
white box – yellow box – Blakely's red gum grassy woodland and derived native grassland	critically endangered	unlikely

Natural temperate grassland has been identified within the Project Area on numerous occasions, most recently by Umwelt (2016). The Project will directly impact natural temperate grassland; therefore it is assessed in further detail in Section 4.1.1.

Given the elevation of the Project Area (less than 600 metres above sea level), it is unlikely that white box – yellow box – Blakely's red gum grassy woodland and derived native grassland (box gum woodland) occurs within the Project Area (Rowell 2010). Furthermore, given that most of the vegetated areas within the Project Area are not considered native, the only area where box gum woodland may occur is within areas that have been identified as natural temperate grassland. Accordingly the grassland is unlikely to have been derived from the clearance of box gum woodland. Accordingly, this ecological community is not considered further in this report.

3.1.4.2 Threatened Bird Species

Table 3.3 Listed Threatened Bird Species identified

Species (<i>Scientific Name</i>)	EPBC Status	Likelihood of Occurrence
swift parrot (<i>Lathamus discolor</i>)	critically endangered	unlikely
superb parrot (<i>Polytelis swainsonii</i>)	vulnerable	unlikely
regent honeyeater (<i>Anthochaera phrygia</i>)	critically endangered	no
painted honeyeater (<i>Grantiella picta</i>)	vulnerable	no
curlew sandpiper (<i>Calidris ferruginea</i>)	critically endangered	no
bar-tailed godwit (<i>Limosa lapponica baueri</i>)	vulnerable	no
northern Siberian bar-tailed godwit (<i>Limosa lapponica menzbieri</i>)	critically endangered	no
eastern curlew (<i>Numenius madagascariensis</i>)	critically endangered	no
Australian painted snipe (<i>Rostratula australis</i>)	endangered	no

There are no records of any of the above EPBC Act listed bird species within the Project Area (ACT Government 2015; Canberra Nature Map 2017; COG 2017).

Swift parrot and superb parrot are known throughout the Canberra region, and have been recorded within the locality (Canberra Nature Map 2017). Both species occur in eucalypt woodlands and are generally associated with box gum woodland in the ACT (DoEE 2017b). They may be found in urban areas if eucalypt species are present and flowering. There are no eucalypt species present within the Project Area, therefore these species are considered unlikely to occur.

Regent honeyeater, are associated with native woodlands and forest (DoEE 2017b). As such, there is no habitat for them within the Project Area (Rowell, 2012). Painted honeyeaters require mistletoe fruits, on which they almost exclusively feed (DoEE 2017b). These are not present within the Project Area; therefore painted honeyeaters are not expected to occur.

Curlew sandpiper, bar-tailed godwit, northern Siberian bar-tailed godwit, eastern curlew, and Australian painted snipe are all generally associated with coastal areas and are rare or uncommon non-breeding migrants in the ACT, where they may be found inland in smaller numbers. They are generally associated with water bodies or wetlands that have appropriate roosting habitat along the shoreline (COG 2017; DoEE 2017b). This habitat does not occur within the Project Area; therefore none of these species are expected to occur.

As all of these species are assessed as having no or an unlikely probability of occurrence, they are not assessed further in this report.

3.1.4.3 Threatened Fish Species

Table 3.4 Listed Threatened Fish Species identified

Species (Scientific Name)	EPBC Status	Likelihood of Occurrence
Murray cod (<i>Maccullochella peelii</i>)	vulnerable	known in nearby Lake Burley Griffin
Macquarie perch (<i>Macquaria australasica</i>)	endangered	no

While Murray cod are known to occur in nearby Lake Burley Griffin (ACT Government 2015); given that there are no watercourses through the Project Area and the urban context of the environment in which the Project is to occur, it is not expected to have any measurable impact on this threatened species or its habitat. Murray cod is therefore not considered further in this report.

In the ACT, Macquarie perch is known from the Murrumbidgee, Cotter, and Paddys Rivers, and the Queanbeyan River above Googong Reservoir (ACT Government 2015). They are not expected to occur within nearby Lake Burley Griffin and are therefore not expected to be impacted by the Project. Macquarie perch is therefore not considered further in this report.

3.1.4.4 Threatened Frog Species

Table 3.5 Listed Threatened Frog Species identified

Species (Scientific Name)	EPBC Status	Likelihood of Occurrence
green and golden bell frog (<i>Litoria aurea</i>)	vulnerable	no
yellow-spotted tree frog (<i>Litoria castanea</i>)	endangered	no

Both frog species identified by the PMST (Green and golden bell frog and yellow-spotted tree frog) commonly occupy a wide range of water bodies, except for fast flowing streams (DoEE 2017b). There are no water bodies within the Project Area; therefore neither species is expected to occur in the Project Area. Neither species is considered further in this report.

3.1.4.5 Threatened Insect Species

Table 3.6 Listed Threatened Insect Species identified

Species (Scientific Name)	EPBC Status	Likelihood of Occurrence
golden sun moth (<i>Synemon plana</i>)	critically endangered	known

Golden sun moth has been identified within the Project Area on numerous occasions, most recently by Umwelt (2016). The Project will directly impact golden sun moth habitat, therefore it is assessed in further detail in Section 4.1.2.

3.1.4.6 Threatened Mammal Species

Table 3.7 Listed Threatened Mammal Species identified

Species (Scientific Name)	EPBC Status	Likelihood of Occurrence
spotted-tail quoll (<i>Dasyurus maculatus maculatus</i>) (south-east mainland population)	endangered	likely
grey-headed flying-fox (<i>Pteropus poliocephalus</i>)	vulnerable	flyover only
koala (<i>Phascolarctos cinereus</i>) (combined populations of Queensland, New South Wales, and the ACT)	vulnerable	unlikely
greater glider (<i>Petauroides volans</i>)	vulnerable	no

Spotted-tail quoll generally inhabit the forested areas of the Brindabella Mountains to the west of Canberra. Despite this, there are semi-regular records of the species throughout the urban area of Canberra, including a record from the Project Area in 1968 (ACT Government 2015). As such, impacts to this species are discussed in greater detail in **Section 4.1.3**.

A colony of grey-headed flying-fox is known to occur in Commonwealth Park (approximately four kilometres north-east, across Lake Burley Griffin from the Project Area). This is the only known roosting site for the species in the ACT, however as grey-headed flying-fox have a wide foraging range (up to approximately 50 kilometres from their roosting site) they are considered likely to fly over the Project Area. However, as there are no feed species present within the Project Area they are not considered likely to occur there (DoEE 2017b).

Koalas occur in the forested areas of the Brindabella Mountains to the west of Canberra, and they are only rarely seen in the urban area (Canberra Nature Map 2017). There are no records of koala within or nearby the Project Area, and there are no feed trees. As they are considered unlikely to occur, they are not considered further in this report.

Greater glider is only known from the Brindabella Mountains to the west of Canberra (Canberra Nature Map 2017). There is no record of this species within or nearby the Project Area, nor is there habitat for this species. As they are considered unlikely to occur, they are not considered further in this report.

3.1.4.7 Threatened Plant Species

Table 3.8 Listed Threatened Plant Species identified by the PMST

Species (<i>Scientific Name</i>)	EPBC Status	Likelihood of Occurrence
button wrinklewort (<i>Rutidosis leptorrhynchoides</i>)	endangered	potential habitat
basalt peppercress (<i>Lepidium hyssopifolium</i>)	endangered	potential habitat
Ginninderra peppercress (<i>Lepidium ginninderense</i>)	vulnerable	unlikely
Austral toadflax (<i>Thesium australe</i>)	vulnerable	unlikely
small purple-pea (<i>Swainsona recta</i>)	endangered	no
hoary sunray (<i>Leucochrysum albicans</i> var. <i>tricolor</i>)	endangered	no
Canberra spider orchid (<i>Caladenia actensis</i>)	critically endangered	no
Tarengo leek orchid (<i>Prasophyllum petilum</i>)	endangered	no
Omeo stork's-bill (<i>Pelargonium</i> sp. <i>Striatellum</i> (G. W. Carr 10345))	endangered	no
Tuggeranong lignum (<i>Muehlenbeckia tuggeranong</i>)	endangered	no
pale pomaderris (<i>Pomaderris pallida</i>)	vulnerable	no
black gum (<i>Eucalyptus aggregata</i>)	vulnerable	no

In the ACT, button wrinklewort is generally associated with natural temperate grassland, though may also be found on the margins of box gum woodland (AHE 2005). Natural temperate grassland is known to occur within the Project Area; however button wrinklewort has not been identified within the Project Area, despite numerous vegetation and flora surveys within their known flowering period since 2010 (Rowell 2010; Rowell 2011; Rowell 2012; Umwelt 2014; Umwelt 2016; Umwelt 2017). There is a record of button wrinklewort east from the Project Area, between Guilfoyle Street and Adelaide Avenue (ACT Government 2015), indicating that it is likely that the species occurred in the locality historically. However, given the lack of records despite numerous surveys, while potential habitat occurs within the Project Area, it is unlikely that the species is present, and is not considered further in this report.

Basalt peppercress is known to occur in highly modified areas, including beneath radiata pine (*Pinus radiata*), though appears to rely on a lack of competition from other shade tolerant species (DoEE 2017b). As such, potential habitat for the species occurs within the Project Area. Despite this, the closest known population is at Bungendore (New South Wales, approximately 30 kilometres east from the Project Area) and it has not been recorded within the Project Area (Rowell 2010; Rowell 2011; Rowell 2012; Umwelt 2014; Umwelt 2016; Umwelt 2017) or within the ACT (ACT Government 2015; Canberra Nature Map 2017). It has limited natural dispersal capabilities, therefore it is unlikely to occur within the Project Area and it is not considered further in this report.

Whilst Ginninderra peppercress is known to occur within natural temperate grassland (DoEE 2017b) it is only known from populations in Belconnen, in the north of Canberra. It has not been identified within the Project Area, despite numerous vegetation and flora surveys since 2010 (Rowell 2010; Rowell 2011; Rowell 2012; Umwelt 2014; Umwelt 2016; Umwelt 2017). It is unlikely to occur within the Project Area, and is not considered further in this report.

Austral toadflax may be associated with woodland and grassland habitats, though it shows a strong reliance on native grass species to which it is semi-parasitic (e.g. kangaroo grass (*Themeda triandra*)) (DoEE 2017b). In the ACT most records are associated with the Murrumbidgee River (Canberra Nature Map 2017) and it has not been recorded in the Project Area despite numerous surveys (Rowell 2010; Rowell 2011; Rowell 2012; Umwelt 2014; Umwelt 2016; Umwelt 2017). It is unlikely to occur within the Project Area and is not considered further in this report.

In the ACT region, hoary sunray and small purple-pear are only known from higher elevations associated with forest and woodland habitats (DoEE 2017b). Neither species are expected to occur within the Project Area and is therefore not considered further in this report.

In the ACT region, both Canberra spider orchid and Tarengo leek orchid are associated with grassy woodland or transitional forest/woodland communities. The Tarengo leek orchid in particular is only known from a limited number of relatively undisturbed sites such as cemeteries; the nearest being the Hall Cemetery and the Captains Flat Cemetery. Other known populations in the region occur near Boorowa and Bowning in New South Wales (Environment ACT 2004). Canberra spider-orchid occurs at higher elevations, and is known from Mount Majura and Mount Ainslie (ACT Government 2012a). The Project Area does not contain suitable habitat and these species are not expected to be present, therefore they are not considered further in this report.

Omeo stork's-bill is known to occur in areas located above the high water mark of ephemeral lakes (DoEE 2017b). The Project Area does not include any such habitat; therefore the species is not considered likely to occur in the Project Area and is not considered further in this report.

As its name suggests, Tuggeranong lignum is only known from the Tuggeranong Valley, within the Murrumbidgee River corridor (ACT Government 2015). It is not expected to occur within the Project Area and is not considered further in this report.

In the ACT pale pomaderris is known to occur mainly along the eastern border of river corridors (Canberra Nature Park). The Project Area does not occur in this locality and the species has not been identified despite numerous surveys (Rowell 2010; Rowell 2011; Rowell 2012; Umwelt 2014; Umwelt 2016; Umwelt 2017). Pale pomaderris is not expected to occur within the Project Area and is not considered further in this report.

Black gum is only known from a few individuals on the far eastern border of the ACT (ACT Government 2017). It has not been identified within the Project Area, therefore this species is not considered further in this report.

3.1.4.8 Threatened Reptile Species

Table 3.9 Listed Threatened Reptile Species identified

Species (<i>Scientific Name</i>)	EPBC Status	Likelihood of Occurrence
striped legless lizard (<i>Delma impar</i>)	vulnerable	unlikely
grassland earless dragon (<i>Tympanocryptis pinguicolla</i>)	endangered	unlikely
pink-tailed worm-lizard (<i>Aprasia parapulchella</i>)	vulnerable	no

No threatened reptile species have been recorded within the vicinity of the Project Area (ACT Government 2015; Canberra Nature Map 2017).

Natural temperate grassland is generally considered habitat for striped legless lizard and grassland earless dragon; however due to the highly fragmented and disturbed nature of the grassland within the Project Area, neither species is considered likely to occur (Rowell 2011), therefore these species are not considered further in this report.

Within the ACT, pink-tailed worm-lizard is associated with grassland in river corridors and on hilltops that also contain rocky outcrops or scattered partially buried rocks (TaMS 2007). This habitat does not occur within the Project Area, therefore the species is not considered likely to occur (Rowell 2011). This species is not considered further in this report.

3.1.5 Migratory Species

The PMST identified 14 migratory species as being within ten kilometres of the Project Area. These are listed in **Table 3.10**.

Table 3.10 Migratory Species identified

Species (Scientific Name)	EPBC Status	Likelihood of Occurrence
fork-tailed swift (<i>Apus pacificus</i>)	migratory marine bird	flyover only
white-throated needletail (<i>Hirundapus caudacutus</i>)	migratory terrestrial bird	flyover only
black-faced monarch (<i>Monarcha melanopsis</i>)	migratory terrestrial bird	no
yellow wagtail (<i>Motacilla flava</i>)	migratory terrestrial bird	no
satin flycatcher (<i>Myiagra cyanoleuca</i>)	migratory terrestrial bird	no
rufous fantail (<i>Rhipidura rufifrons</i>)	migratory terrestrial bird	no
common sandpiper (<i>Actitis hypoleucos</i>)	migratory wetland bird	no
sharp-tailed sandpiper (<i>Calidris acuminata</i>)	migratory wetland bird	no
pectoral sandpiper (<i>Calidris melanotos</i>)	migratory wetland bird	no
Latham's snipe (<i>Gallinago hardwickii</i>)	migratory wetland bird	no
curlew sandpiper (<i>Calidris ferruginea</i>)	migratory wetland bird	no
bar-tailed godwit (<i>Limosa lapponica</i>)	migratory wetland bird	no
eastern curlew (<i>Numenius madagascariensis</i>)	migratory wetland bird	no
osprey (<i>Pandion haliaetus</i>)	migratory wetland bird	no

Fork-tailed swift and white-throated needletail are both almost exclusively aerial; occurring over a range of habitat types. In the ACT, fork-tailed swift occur between December and March, with several flocks passing through within this period; white-throated needletails are not very common and are usually associated with the arrival of weather fronts in the region (COG 2017; DoEE 2017b). It is therefore considered likely that the species would fly over the Project Area; however they are unlikely to be reliant upon habitats in the Project Area. These species are not considered further in this report.

Black-faced monarch is unlikely to occur within the Project Area as its preferred habitat is rainforest (DoEE 2017b). There are no records of this species within the vicinity of the Project Area.

Yellow wagtail is an extremely uncommon migrant to Australia, being noted as a vagrant in southern NSW. Whilst a majority of the continent is mapped as habitat for the species, the nearest sightings to the Project Area are from the Sydney and Melbourne regions (DoE 2015). There are no records of this species within the Project Area.

Both satin flycatcher and rufous fantail breed in the ACT during summer, departing in late autumn. Most records are from the tall, wet forests of the Brindabella Range, though there are a few records of the species in the urban areas. There are no records of the species in the Project Area (COG 2017; Canberra Nature Map 2017).

Common sandpiper, sharp-tailed sandpiper, pectoral sandpiper, and Latham's snipe are all wetland bird species. They rely on a range of saline and freshwater wetland types, including marshes and bogs in the case of Latham's snipe. No wetland habitat occurs within the Project Area. The closest records are from Lake Burley Griffin or Jerrabomberra wetlands (COG 2017), therefore these species are not expected to occur within the Project Area.

As described in **Section 3.1.4.2** no habitat for curlew sandpiper, bar-tailed godwit, and eastern curlew occurs within the Project Area. These species are not expected to occur in the Project Area and are not considered further in this report.

Osprey is generally found in coastal areas, particularly in the north of Australia, though will occasionally travel inland following major rivers. However, as they require extensive areas of open water for foraging, and have only rarely been recorded in the ACT associated with such water bodies, they are not considered likely to occur within the Project Area (DoEE 201).

3.2 ACT Listed Matters

The Project triggers the preparation of an EIS under Schedule 4, Part 4.3 of the PD Act. Furthermore, this report does not consider the likelihood of potential impacts to heritage places listed under the *Heritage Act 2004* (ACT), or contaminated land registered under the *Environment Protection Act 1997* (ACT).

The following **Sections 3.2.1** and **3.2.2** address the other PD Act triggers listed in **Table 1.1**; namely threatened and protected species and ecological communities; and native vegetation.

3.2.1 Threatened Species and Communities

Part 4.3, Item 1 refers to a proposal that is likely to have a significant adverse environmental impact on one or more of the listed threatened species, threatened communities, listed migratory species, protected native species, Ramsar wetlands, or any other protected matter (see **Table 1.1**).

This section discusses the likelihood of occurrence of threatened species and communities within or near the Project Area. If any of these matters are likely to be impacted by the Project, these impacts will be assessed further in **Section 4.2**.

Table 3.11 identifies matters that are listed under both the EPBC Act and NC Act. These species are not considered further in this section as relevant discussions in **Section 3.1** (as identified in **Table 3.11**) are considered to adequately assess the likelihood of occurrence. As identified in **Section 3.1**, golden sun moth and spotted-tailed quoll are assessed further in **Section 4.1**.

Table 3.11 Species Listed under the EPBC Act and NC Act

Species (Scientific Name)	ACT Status	Section Reference
regent honeyeater (<i>Anthochaera phrygia</i>)	endangered	3.1.4.2
painted honeyeater (<i>Grantiella picta</i>)	vulnerable	
superb parrot (<i>Polytelis swainsonii</i>)	vulnerable	
swift parrot (<i>Lathamus discolor</i>)	vulnerable	
Macquarie perch (<i>Macquaria australasica</i>)	endangered	3.1.4.3
golden sun moth (<i>Synemon plana</i>)	endangered	3.1.4.5
spotted-tailed quoll (<i>Dasyurus maculatus</i>)	vulnerable	3.1.4.6
button wrinklewort (<i>Rutidosis leptorrhynchoides</i>)	endangered	3.1.4.7
Canberra spider orchid (<i>Arachnorchis actensis</i>)	endangered	
Ginninderra peppercress (<i>Lepidium ginninderense</i>)	endangered	
small purple pea (<i>Swainsona recta</i>)	endangered	
Tarengo leek orchid (<i>Prasophyllum petilum</i>)	endangered	
Tuggeranong lignum (<i>Muehlenbeckia tuggeranong</i>)	endangered	3.1.4.8
grassland earless dragon (<i>Tympanocryptis pinguicolla</i>)	endangered	
striped legless lizard (<i>Delma impar</i>)	vulnerable	
pink-tailed worm-lizard (<i>Aprasia parapulchella</i>)	vulnerable	

The following ACT listed species are also listed under the EPBC Act:

- *Gentiana baueuerlenii*
- Brindabella midge orchid (*Corunastylis ectopa*)
- brush-tailed rock-wallaby (*Petrogale penicillata*)
- northern corroboree frog (*Pseudophryne pengilleyi*)
- silver perch (*Bidyanus bidyanus*)
- smoky mouse (*Pseudomys fumeus*) and
- trout cod (*Maccullochella macquariensis*).

None of these species, or their habitats were identified as likely to occur by the relevant database searches (ACT Government 2015; Canberra Nature Map 2017; DoEE 2017a; DoEE 2017b); they are not considered further in this report.

3.2.1.1 Threatened Ecological Communities

Table 3.12 ACT Threatened Ecological Communities

Community	NC Act Status	Likelihood of Occurrence
natural temperate grassland	endangered	known
yellow box/red gum grassy woodland	endangered	unlikely

Natural temperate grassland protected under the NC Act differs slightly from the community of the same name protected under the EPBC Act. In this instance however, vegetation described as natural temperate grassland in the Project Area meets both the NC Act and EPBC Act definitions. Natural temperate grassland has been identified within the Project Area on numerous occasions, most recently by Umwelt (2016). As natural temperate grassland (under the NC Act) is known to occur within the Project Area it is discussed further in **Section 4.2.1**.

The definition of box gum woodland differs between the NC Act and the EPBC Act. Box gum woodland in the ACT occurs at higher elevations than at which the Project Area occurs. Given this, it is considered unlikely that box gum woodland occurs in the Project Area; and it is not considered further in this report.

3.2.1.2 Threatened Bird Species

Table 3.13 ACT Threatened Bird Species

Species (<i>Scientific Name</i>)	NC Act Status	Likelihood of Occurrence
little eagle (<i>Hieraetus morphnoides</i>)	vulnerable	likely
varied sittella (<i>Daphoenositta chrysopera</i>)	vulnerable	unlikely
brown treecreeper (<i>Climacteris picumnus</i>)	vulnerable	no
glossy black-cockatoo (<i>Calyptorhynchus lathami</i>)	vulnerable	no
hooded robin (<i>Melanodryas cucullata</i>)	vulnerable	no
scarlet robin (<i>Petroica boodang</i>)	vulnerable	no
white-winged triller (<i>Lalage sueurii</i>)	vulnerable	no

Little eagle occurs in a range of open habitats where they can access prey species. Typically, they nest in open woodland and forage in areas with a mosaic of open forest, woodland, riparian corridors, and grassland where the greatest abundance of prey can be found. The species has been recorded throughout the ACT; however most of these are associated with hunting or fly-over records.

Little eagles' breeding range is in the northern parts of Canberra and the Molonglo Valley, where they nest in tall living trees in remnant habitat with little human activity (ACT Government 2013a). Given little eagle have been recorded in the vicinity of the Project Area, potential impacts to this species is discussed further in **Section 4**.

Varied sittella will occupy a range of treed habitats, except rainforest; showing a preference for rough barked trees (Environment ACT 2004). Records of the species in Canberra are widespread in the lowland regions, including throughout all of the urban areas. Whilst they may be found in exotic trees, they show a preference for eucalypts. They are not considered suburban birds, due to a lack of eucalypts at sufficient density to provide adequate food (COG 2017). Records in urban areas, such as near the Project Area, are not likely to reflect areas of critical habitat for the species, and impacts to trees in this area are not considered likely to impact varied sittella. It is therefore not expected to be impacted by the Project and is not considered further in this report.

In the ACT, brown treecreeper occurs in relatively undisturbed woodland and dry open forest with a native understorey. The species has been recorded in the area (COG 2017); however, it is rarely seen in urban areas; therefore, it is not expected to occur within or near the Project Area (Environment ACT 2004). Brown treecreeper is therefore not considered further in this report.

Glossy black-cockatoo occupy open forests and woodlands that include stands of sheoak species (*Allocasuarina* spp.); in the ACT they are particularly associated with drooping sheoak (*Allocasuarina verticillata*). Preference is also shown to intact landscapes, with less general disturbance in the surrounding areas (ACT Government 2013b). Glossy black-cockatoo is uncommon in Canberra, with scattered records focussing on areas that support the required sheoak species. There are no sheoaks within the Project Area (dsb Landscape Architects 2010) therefore the species is not expected to occur. It is therefore not considered further in this report.

Hooded robin occupies a range of eucalypt forests, woodlands, scrub, and cleared paddocks with regrowth or stumps. However, the species avoids dense forests and urban areas (Environment ACT 2004). There are no records of hooded robin within or near the Project Area (COG 2017). Given the urban context, high density of trees, and the exotic nature of most of the tree species, hooded robin is not expected to occur in the Project Area. It is therefore not considered further in this report.

Scarlet robins occur in dry eucalypt forest and woodlands and require shrub cover, native grasses, a healthy canopy, and abundant logs and fallen timber (ACT Government 2016). This habitat does not occur within the Project Area, despite the species being recorded within the vicinity (Red Hill, Stirling Ridge, and urban open space in north Curtin) (Canberra Nature Map 2017). It is therefore not expected to occur in the Project Area and is not considered further in this report.

White-winged triller is a summer visitor to the ACT generally associated with grassy eucalypt woodland in the ACT (Environment ACT 2004) requiring eucalypts, fallen timber, and leaf litter for feeding and nesting habitat. While the species has been recorded in the area (COG 2017) preferred habitat for the species does not occur within the Project Area. The white-winged triller is not expected to occur in the Project Area and is not considered further in this report.

3.2.1.3 Threatened Aquatic Species

Table 3.14 ACT Threatened Aquatic Species

Species (Scientific Name)	NC Act Status	Likelihood of Occurrence
Murray River crayfish (<i>Eustacus armatus</i>)	vulnerable	known in nearby Lake Burley Griffin
two-spined blackfish (<i>Gadopsis bispinosus</i>)	vulnerable	no

Murray River crayfish is known to occur in nearby Lake Burley Griffin (TaMS 2007; ACT Government 2015). Given the urban context of the environment in which the Project is to occur and the lack of a watercourse within the Project Area; it is not expected to have any measurable impact on Lake Burley Griffin. Murray River crayfish is therefore not considered further in this report.

In the ACT, two-spined blackfish is only known from the Cotter River above the Cotter Reservoir (TaMS 2007; ACT Government 2015). They are not expected to occur within nearby Lake Burley Griffin. Two-spined blackfish is not considered further in this report.

3.2.1.4 Threatened Insect Species

Table 3.15 ACT Threatened Insect Species

Species (Scientific Name)	NC Act Status	Likelihood of Occurrence
perunga grasshopper (<i>Perunga ochracea</i>)	vulnerable	unlikely

Rowell (2010) identified that potential habitat for perunga grasshopper occurred within the Project Area in the native dominated grassland patches. Targeted survey for perunga grasshopper occurred in 2006, 2009, 2010 (Rowell 2011), 2012 (Rowell 2012) and 2013 (Umwelt 2014) within the Project Area, with no individuals recorded. Given this, and a lack of previous opportunistic records, it is considered unlikely to be present.

If it does occur, it would be at low densities that were undetectable during surveys (Umwelt 2014). Currently, the only remaining potential habitat occurs within the natural temperate grassland patches (Umwelt 2017).

Given that it is considered unlikely to occur, it is not expected to be significantly adversely impacted by the Project. It is therefore, not considered further in this report.

3.2.1.5 Threatened Plant Species

Table 3.16 ACT Threatened Plant Species

Species (Scientific Name)	NC Act Status	Likelihood of Occurrence
Murrumbidgee bossiaea (<i>Bossiaea grayi</i>)	endangered	no

Murrumbidgee bossiaea occurs exclusively in the ACT in shallow, sandy substrates amongst rock outcrops along the Murrumbidgee River (ACT Government 2012; 2015). Given that the Project Area is a significant distance from the Murrumbidgee River, and does not occur in a riparian area, Murrumbidgee bossiaea is not expected to occur. It will not be considered further in this report.

3.2.2 Native Vegetation

According to Part 4.3, Item 2 in Schedule 4 of the PD Act an EIS is required if more than 0.5 hectares of native vegetation will be cleared in a native vegetation area.

The NC Act defines a native vegetation area as an area where:

- (a) either –
 - (i) *10% or more of the area is covered with vegetation (whether dead or alive); and*
 - (ii) *no more than 60% of the ground layer vegetation cover is exotic annual (at any time of the year); and*
 - (iii) *more than 50% of the perennial group layer vegetation cover is native vegetation; or*
- (b) *trees or shrubs indigenous to the area have a canopy cover of 10% or more in any stratum over the area.*

The only areas within the Project Area that meet the above definition of a native vegetation area are the natural temperate grassland patches. These occur across 0.45 hectares (Umwelt 2017), of which, 0.13 hectares will be directly impacted by the Project.

The Project will not result in the clearing of more than 0.5 hectares of native vegetation, therefore this trigger will not be considered further in this report.

4.0 Impact Assessment

The results of the database searches and review of existing information identified that the Project may or will impact upon the following protected matters:

- natural temperate grassland
- golden sun moth
- spotted-tail quoll and
- little eagle.

The following sections assess the significance of these potential impacts against the relevant legislation and policies. This impact assessment considers direct and indirect impacts, including those that may affect areas outside of the Project Area.

The ‘works area’ of the Project not only includes the new alignment and road upgrade areas (as shown in **Figure 1**) but also areas required for construction access and site compounds. The ‘works area’ is shown in all relevant figures and has been used to determine the extent of likely direct impacts as a result of the Project.

4.1 Matters of National Environmental Significance

The ‘Significant Impact Guidelines 1.1’ (DoE 2013) define a significant impact as '*an impact which is important, notable, or of consequence, having regard to its context or intensity*' (DoE 2013 p. 2). When determining whether a proposed action may result in a significant impact, consideration is given to the sensitivity, value, and quality of the environment which is impacted; and upon the intensity, duration, magnitude, and geographic extend of the impacts. The ‘Significant Impact Guidelines 1.1’ outlines specific criteria to use when making such an assessment, based on the MNES that are being considered; which are to be complemented by additional guidelines that have been prepared for specific MNES (as available). These criteria are used as relevant in the following sections.

4.1.1 Natural Temperate Grassland

The area surrounding the Project Area contains a total of 0.75 hectares of natural temperate grassland, a critically endangered ecological community under the EPBC Act (**Figure 3**). It occurs in the two following vegetation associations, and ranges from high to very high quality (as assessed under the Commonwealth Conservation Advice (TSSC 2016)):

- r5: wallaby-grass – tall speargrass – common everlasting tussock grassland of the south eastern highlands bioregion and
- r7: kangaroo grass – wallaby-grass – snow-grass moist tussock grassland of the south eastern highlands bioregion (Umwelt 2017).

The most recent changes to the Project designs (AECOM 2017) have aimed to avoid areas of natural temperate grassland as much as possible. Where impacts could not be avoided (e.g. patches directly adjacent to the existing Dudley Street), the alignment was designed to target areas of lower quality that have a demonstrated pattern of decline, which are therefore less likely to persist in the short to medium term.

The current Project is expected to directly impact a total of 0.13 hectares (0.01 hectares of very high and 0.12 hectares of high quality) of natural temperate grassland (**Figure 3**). This is equivalent to 17 percent of the total community present within and adjacent to the Project Area. Indirect impacts to remaining patches of natural temperate grassland are not expected to exceed current levels, as a result of the existing road alignment.

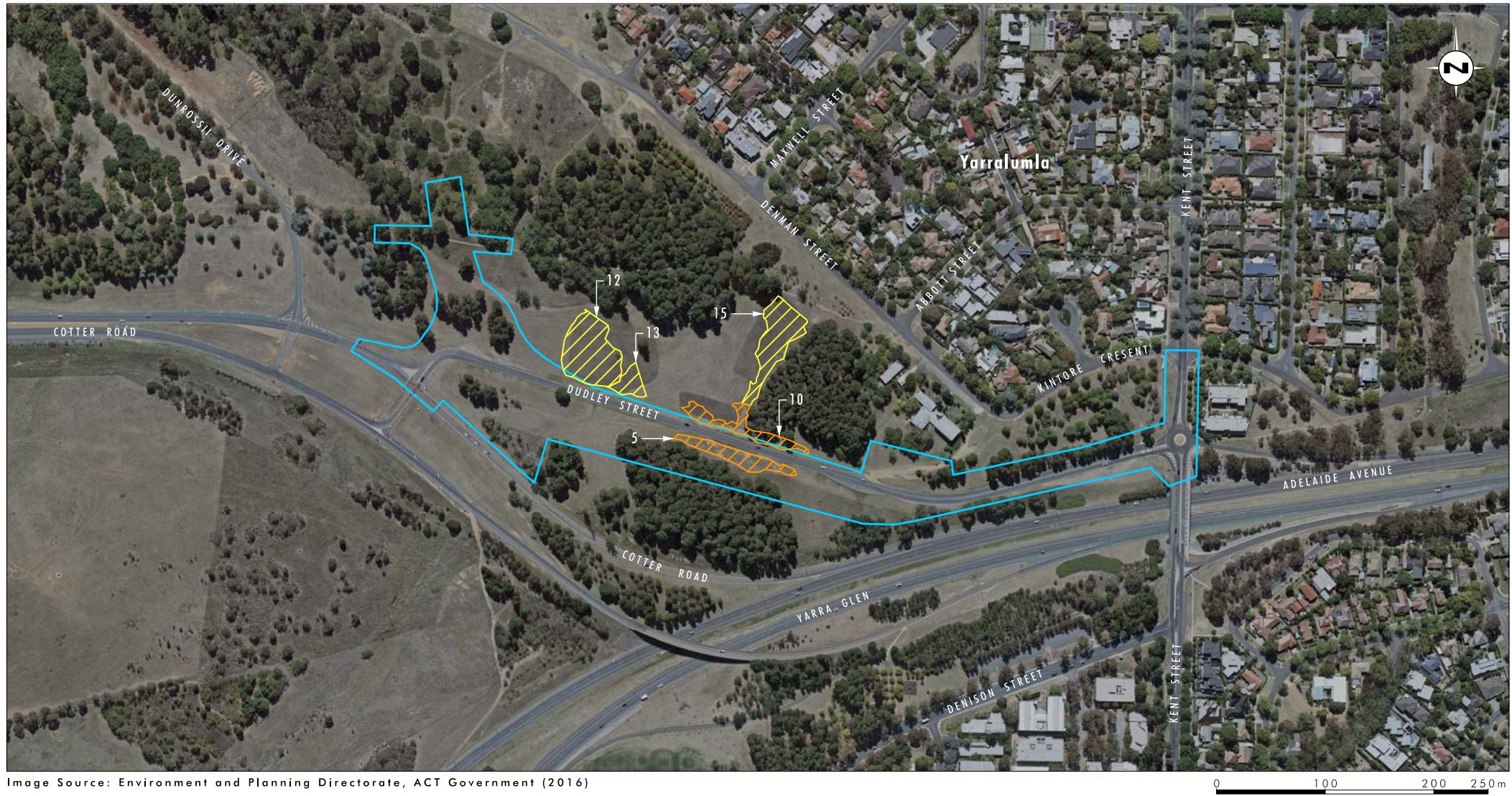
To determine whether this is likely to be a significant impact, **Table 4.1** addresses the relevant criteria as stated in the ‘Significant Impact Guidelines 1.1’.

Table 4.1 Significant Impact Criteria for Critically Endangered and Endangered Ecological Communities

Significant Impact Criteria	Assessment of Natural Temperate Grassland
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	
Reduce the extent of an ecological community.	The extent of natural temperate grassland within the Project Area would be reduced by 0.13 hectares. This constitutes the entirety of patch ‘5’ (0.11 hectares) and small areas from the roadside edge of patches ‘10’, ‘12’, and ‘13’ (Figure 3).
Fragment or increase fragmentation of an ecological community.	The native vegetation within, and surrounding, the Project Area is highly fragmented and disturbed as a result of previous urban development and road construction, exotic tree plantings, and weed incursion. The removal of one 0.11 hectare patch of natural temperate grassland (patch 5) is considered to result in a minor increase in fragmentation of the community, given that this patch is currently separated from the remaining areas by Dudley Street. The component of the Project that includes construction of the CBP access road, will not fragment or increase fragmentation of natural temperate grassland.
Adversely affect habitat critical to the survival of an ecological community.	Habitat critical to the survival of natural temperate grassland is defined as all remaining areas of vegetation that meet the EPBC Act definition of the ecological community and a 30 metre buffer around each of these patches (TSSC 2016). The Project will result in the loss of 0.13 hectares of natural temperate grassland and will affect approximately 1.1 hectares of buffer area (including the existing Dudley Street). It will therefore adversely affect habitat critical to the survival of an ecological community.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community’s survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	The patches of natural temperate grassland that are to be retained occur uphill from the proposed Dudley Street upgrade. Therefore, this component of the Project is not expected to modify or destroy abiotic factors necessary for the survival of natural temperate grassland. The construction of the CBP access road is likely to result in localised changes to water drainage patterns and increased pollutants from road run-off. These are likely to result in indirect impacts to retained patches of natural temperate grassland.

Significant Impact Criteria	Assessment of Natural Temperate Grassland
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species.	The construction of the CBP access road is likely to result in localised changes to water drainage patterns and increased pollutants from road run-off. These are likely to result in indirect impacts to retained patches of natural temperate grassland, which may result in a change to the species composition of the patches. Given that these patches already exist alongside a road, and are subject to altered surface water flows it is not likely that the Project will alter species composition such that it causes a decline or loss of functionally important species.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including but not limited to: <ul style="list-style-type: none"> • assisting invasive species that are harmful to the listed ecological community, to become established; or • causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community. 	<p>The Project will include measures to protect the integrity of retained patches of natural temperate grassland, including fencing off and restricting access. Re-seeding of verges post construction will use a native seed mix compatible with the surrounding natural temperate grassland and golden sun moth habitat.</p> <p>The Project is not expected to cause a substantial reduction in the quality or integrity of an occurrence of natural temperate grassland.</p>
Interfere with the recovery of an ecological community.	The National Recovery Plan for natural temperate grassland outlines the recovery objectives in Table 2 (Environment ACT 2006). The Project will not interfere with any of these objectives, therefore is not considered to interfere with the recovery of an ecological community.

As the Project will reduce the extent of a critically endangered ecological community, including affecting its critical habitat; will result in a minor increase in fragmentation; and may result in indirect impacts that affect remaining patches of natural temperate grassland it is considered likely to result in a significant impact to natural temperate grassland. As all possible avoidance and mitigation measures have been considered and implemented, the remaining impacts will be offset in accordance with the EPBC Act environmental offsets policy (DSEWPaC 2012). This is discussed further in **Section 5**.



Legend

- Expected Project Impact Area
- ▨ Current Natural Temperate Grassland - High
- ▨ Current Natural Temperate Grassland - Very High

FIGURE 5

Natural Temperate
Grassland Extent

4.1.2 Golden Sun Moth

Umwelt (2017) identified 7.39 hectares of golden sun moth habitat in the area immediately surrounding the Project Area. This is within the context of a broader patch of semi-connected golden sun moth habitat that occurs within the CBP, Cotter Road verges, North Curtin horse paddocks, Lady Denman Drive verges, and Yarra Glen verges (Rowell 2011; ACT Government 2015).

Golden sun moth has been recorded throughout most of the Project Area, except for treed patches, bare ground, and the r7 natural temperate grassland association. Due to this, the Project is not able to avoid golden sun moth habitat entirely. The updated PSP (AECOM 2017) aimed instead to minimise fragmentation, and target areas of lower habitat quality dominated by Chilean needlegrass (*Nassella neesiana*) (a Weed of National Significance) or affected by shading. **Table 4.2** summarises the expected direct impacts to golden sun moth as a result of the Project.

Table 4.2 Impact to Golden Sun Moth Habitat

Habitat Quality	Area (ha)
Direct Impacts	
Low (native grassland with a moderate component of native C3 grasses on shallow, eroded soils; or moderately dense mixed grassland)	0.42
Low – Moderate (understorey includes a moderate cover native C3 grasses but is affected by shading of planted trees)	0.15
Moderate (native grassland with a moderate component of native C3 grasses)	0.04
Moderate (Disturbed) (exotic grassland dominated by Chilean needlegrass)	1.93
Sub-total, Habitat Directly Impacted	2.54
Indirect Impacts	
Moderate (Disturbed) (exotic grassland dominated by Chilean needlegrass)	0.63
Total	3.17

The Project will result in the removal of 2.54 hectares or 34 percent of golden sun moth habitat within the Project Area (**Figure 4**). Habitat areas to the south of Dudley Street are also expected to be impacted by changes in surface water run-off (including increased pollutants) and small patch size; resulting in a further 0.63 hectares of habitat indirectly impacted by the Project. A total of 3.17 hectares or 43 percent of golden sun moth habitat is expected to be impacted by the Project.

As a result of the topography, presence of planted trees, and highly disturbed nature of the remaining areas of golden sun moth habitat, indirect impacts as a result of the Project are not expected to exceed existing levels. This includes golden sun moth habitat present in areas adjacent to the proposed CBP access road.

To determine whether this is likely to be a significant impact, **Table 4.3** addresses the relevant criteria as stated in the ‘Significant Impact Guidelines 1.1’.

Table 4.3 Significant Impact Criteria for Critically Endangered Golden Sun Moth

Significant Impact Criteria	Assessment of golden sun moth
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:	
Lead to a long term decrease in the size of a population.	<p>The construction of the Project will lead to the loss of larvae within the construction footprint. The extent of this loss cannot be quantified due to the destructive effects of golden sun moth larval survey methods.</p> <p>These impacts will be temporary as the road verges will be landscaped with appropriate grass species to facilitate the re-colonisation of golden sun moth into the area. Construction activities will also be timed to avoid the flying season for adult moths, when they are most vulnerable.</p> <p>Furthermore, the golden sun moth habitat areas that are going to be impacted by the Project are either dominated by, or have significant cover of exotic perennial grasses (e.g. Chilean needlegrass). These grasslands typically experience regular changes in extent, density, cover, and species composition based on seasonal weather conditions. As such, the golden sun moth population that occurs in them also fluctuates.</p> <p>As the impacted population has a demonstrated history of rebounding from changes in habitat (including loss or degradation of habitat), and the road verges will be re-habilitated post-construction; the Project is not expected to lead to a long term decrease in the size of a population of golden sun moth.</p>
Reduce the area of occupancy of the species.	<p>The Project will directly result in a reduction of a total of 2.54 hectares of habitat for golden sun moth. Equivalent to 34 percent of the local habitat. This will be a reduction in the area of occupancy for the species and in excess of the significant impact threshold (any habitat loss, degradation or fragmentation) established by the golden sun moth significant impact guidelines (DEHWA 2009).</p>

Significant Impact Criteria	Assessment of golden sun moth
<p>Fragment an existing population into two or more populations.</p>	<p>The golden sun moth population that occurs within the Project Area is currently fragmented, and part of a broader semi-connected patchwork of habitat within an urban environment. This fragmentation currently limits the ability for the moths to disperse. As Dudley Street already fragments the population, the proposed upgrades are not expected to fragment the existing population into two or more populations.</p> <p>The proposed construction of the CBP access road is also not expected to fragment the existing golden sun moth population. The AECOM (2017) PSP amended the proposed alignment, moving it west to follow the existing tree line as much as possible. The trees do not constitute habitat for the species, and are an existing barrier to movement. Furthermore, the proposed CBP access road is a single carriageway design of a width golden sun moths are known to cross (e.g. nearby Cotter Road).</p> <p>As such, the golden sun moth population is already fragmented and the construction of the access road is not expected fragment the population further.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>There is no critical habitat identified for golden sun moth at a National scale. Action Plan 28 defines 'key habitat' as natural temperate grassland dominated by low-growing wallaby grasses, and NSW Office of Environment and Heritage have identified three key management sites (north of Yass, between the Barton Highway and Lake George, and south of Queanbeyan) (OEH 2017). As the habitat within the Project Area does not meet either of these criteria it is not considered to be critical to golden sun moth survival. As such the Project will not adversely affect habitat critical to the survival of golden sun moth.</p>
<p>Disrupt the breeding cycle of a population</p>	<p>Given the highly fragmented nature of the existing population of golden sun moth, that the moths are known to cross similar sized roads, and that construction activities will avoid adult moth flying season; the Project is not expected to further disrupt the breeding cycle of a population.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>The Project will result in the removal and modification of 2.54 hectares of golden sun moth habitat within the Project Area. Habitat areas to the south of the existing Dudley Street are also expected to be impacted by changes in surface water run-off (including increased pollutants) and small patch size. The Project is expected to impact a total of 3.17 hectares of golden sun moth habitat, equivalent to 34 percent of the local habitat. This is considered likely to cause a local decline for the species.</p>

Significant Impact Criteria	Assessment of golden sun moth
<p>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat</p>	<p>Golden sun moth habitat within the Project Area has been invaded by the exotic Chilean needlegrass, which has a significant impact on the biodiversity of ground layer vegetation in areas where it establishes dominance. This invasive species has the potential to further reduce values in the remainder of the Project Area.</p> <p>The greatest threat to these areas is the risk of continued invasion of native communities by Chilean needlegrass that might occur in the event of poor weed management controls during construction, and poor maintenance during the operational phase. Despite the threats represented by this species, it will have a positive impact on golden sun moth population density as this weed is a feed species for the moth.</p> <p>This outcome however will be avoided as a result of targeted measures in the construction environment management plan (CEMP) for retained areas to avoid dispersal of Chilean needlegrass.</p> <p>Such measures will also ensure other potentially invasive species are not introduced to the Project Area. Accordingly, the proposed action will not result in the introduction of new invasive species that will be harmful to golden sun moth.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>The Program will result in no known disease or other pathogen likely to impact golden sun moth.</p>
<p>Interfere with the recovery of the species</p>	<p>There is no approved National Recovery Plan for golden sun moth. The conservation advice for golden sun moth (TSSC 2013) notes recovery actions targeted towards research priorities, control of invasive weeds, management of grazing impacts and fire, and minimisation of habitat loss, disturbance, and modification. As the Project will result in the loss of 2.54 hectares of habitat, it is expected to interfere with the recovery actions for the species.</p>

As the Project is expected to reduce the area of occupancy of golden sun moth in excess of the amount stated in the golden sun moth significant impact guidelines (DEWHA 2009a) and adversely affect avoided habitat such that the species may decline, it is considered likely to result in a significant impact to golden sun moth. As all possible avoidance and mitigation measures have been considered and implemented, the remaining impacts will be offset in accordance with the EPBC Act environmental offsets policy (DSEWPaC 2012). This is discussed further in **Section 5**.



Image Source: Environment and Planning Directorate, ACT Government (2016)

0 100 200 250m
1:5000

Legend

- Expected Project Impact Area
- Low Quality Habitat
- Low-Moderate Quality Habitat
- Moderate Quality Habitat
- Moderate (Disturbed) Quality Habitat

File Name (A4): R02/8112_009.dgn
20170920 16.28

FIGURE 6

Golden Sun Moth Extent

4.1.3 Spotted-tail Quoll

Spotted-tail quoll are a vulnerable species under the EBPC Act. They have a preference for mature, wet forests that contain sufficient structural diversity to supply den sites and plentiful prey. Dens are fashioned from a range of landscape features such as rock crevices, hollow logs, tree hollows, caves, dense vegetation, or in the right substrate be dug into the soil (DELWP 2016). Prey varies throughout the species' distribution, however in the ACT region generally consists of brush-tailed possum (*Trichosurus vulpecula*), ring-tailed possum (*Pseudocheirus peregrinus*), greater glider (*Petauroides volans*), and rabbit (*Oryctolagus cuniculus*) (D Fletcher 2016, pers. comm. 28 September).

Records in the ACT region most regularly occur within the Brindabella Ranges, with scattered records throughout the urban area. There is a record from 1968 of a spotted-tail quoll in the Project Area (ACT Government 2015; Canberra Nature Map 2017), but none more recently.

Despite their preference for wet forest, spotted-tail quolls have been recorded throughout numerous forest, woodland, heathland, grassland, rocky outcrops, and urban areas; particularly where these habitats occur adjacent to forest (DELWP 2016). This is understood to reflect the high mobility and large home ranges of the species, rather than as evidence of a resident population (D Fletcher 2016, pers. comm. 28 September).

As the preferred wet forest habitat of the spotted-tail quoll does not occur within the Project Area and given the urban context; the record from 1968 is considered to be evidence of a vagrant dispersing through the landscape. The Project Area is not considered likely to be regularly utilised by the species and does not meet its usual habitat requirements.

The Project is not considered likely to have a significant impact on spotted-tail quoll as there is no resident population, nor habitat present; and it will not affect the ability of the species to move through the landscape.

4.2 ACT Protected Matters

The PD Act states that an EIS is required if a proposed development is likely to have a significant adverse environmental impact on a protected matter. Section 124A of the PD Act identifies that an adverse environmental impact is considered to be significant if:

- the environmental function, system, value or entity that might be adversely impacted by a proposed development is significant or
- the cumulative or incremental effect of a proposed development might contribute to a substantial adverse impact on an environmental function, system, value or entity.

This definition is used to assess the significance of impacts to matters protected under ACT legislation in the following sections.

4.2.1 Natural Temperate Grassland

As discussed above, the description of natural temperate grassland under the NC Act differs slightly to that under the EPBC Act. Despite this, all areas of EPBC Act natural temperate grassland also complies with the NC Act definition and no further vegetation patches meet the NC Act definition. The Project is therefore expected to impact 0.13 hectares of NC Act natural temperate grassland. As this is considered significant under the EPBC Act, it would also be considered significant under the PD Act.

While the Project is considered likely to result in a significant impact under both the PD Act and the NC Act; the ACT environmental offset policy (Environment and Planning Directorate 2015) states that for MNES, offsets are only required to be established under the EPBC Offset Policy (DSEWPaC 2012) and no additional offset are required under the PD Act. See **Section 5** for a further discussion regarding offsets for the Project.

4.2.2 Golden Sun Moth

Similarly, as impacts to golden sun moth are considered significant under the EPBC Act; they are also considered to be significant under the PD Act. Further offsets under the ACT environmental offsets policy (Environment and Planning Directorate 2015) are not required, as the EPBC Act environmental offset policy (DSEWPaC 2012) is considered sufficient. See **Section 5** for a further discussion regarding offsets for the Project.

4.2.3 Spotted-tail Quoll

In addition to the reason described in **Section 4.1.3**, the Project is considered unlikely to result in a significant adverse environmental impact to spotted-tail quoll for the following reasons:

- A single record of the species within the Project Area from 1968 is not considered significant with regard to abundance, location/ distribution, habitat type, nor behaviour of the animal.
- The Project is not expected to result in a cumulative or incremental effect as it is not expected to alter the species' use of the Project Area over time.

4.2.4 Little Eagle

Little eagle occurs in a range of open habitats where they can access prey species. The species has been recorded throughout the ACT; however most of these are associated with hunting or fly-over records. Little eagle has been recorded in the Project Area (COG 2017), which is within the ranging distance of the species.

However given the urban context, relatively small patches of open grassland and lack of open woodland, history of disturbance, and high level of traffic and human use of the area; it is not considered likely to provide substantial prey items for the eagle. As such, the Project is considered unlikely to result in a significant adverse environmental impact to little eagle for the following reasons:

- The habitat within the Project Area is not significant for little eagle, and its loss is unlikely to result in any substantial long-term effects.
- The Project is not expected to result in a cumulative or incremental effect as it is not expected to alter the species' use of the Project Area over time.

5.0 Environmental Offsets

As discussed in **Section 4**, the Project is considered likely to result in a significant impact to the following protected matters:

- natural temperate grassland (EPBC Act critically endangered ecological community and NC Act endangered ecological community) and
- golden sun moth (EPBC Act critically endangered species and NC Act endangered species).

As a result of this, the Project would need to incorporate an offset strategy targeting these matters in order to gain approval under both the EPBC Act and PD Act.

The ACT environmental offsets policy (Environment and Planning 2015) states that for MNES, application of the Commonwealth environmental offsets policy is considered sufficient to offset residual environmental impacts within the ACT, and no further offsetting is required under the PD Act. As both natural temperate grassland and golden sun moth are MNES, only the Commonwealth environmental offsets policy (DSEWPaC 2012) is discussed in this section.

The Commonwealth environmental offsets policy uses a combination of habitat area and quality to determine whether a proposed offset site is considered to sufficiently compensate for impacts to MNES. A potential offset area at the North Mitchell Grasslands has been identified and has been agreed to in principle by the Territory Land Custodian. As the details regarding this offset area are still being determined, this report only discusses the offset policy as it relates to impact areas. Once all relevant details regarding the potential offset area have been confirmed, further assessment will be required to demonstrate its suitability.

The quality score is a measure of the importance of the area for the threatened species or community, and its contribution to the ongoing viability (DSEWPaC 2012 ‘How to Guide’). **Sections 5.1** and **5.2** outline the methodology for determining quality of the impact areas for natural temperate grassland and golden sun moth respectively.

Generally speaking, the Commonwealth offsets policy states that the following three components of quality must be considered when calculating the quality score for input into the offset assessment tool:

- Site condition: relates to the ecological requirements of the threatened species or ecological community. It may include vegetation condition and structure, species diversity, and relevant habitat features.
- Site context: that is, the relative importance of the site in the landscape and broader context of the population or community extent. Consideration should be given to site connectivity and movement patterns of relevant species.
- Species stocking rate: is the usage and/or density of species at the site. For threatened species, this may be an abundance score or population count. Consideration should be given to relative importance of these populations for overall species viability.

These components are further explained in **Figure 7**.

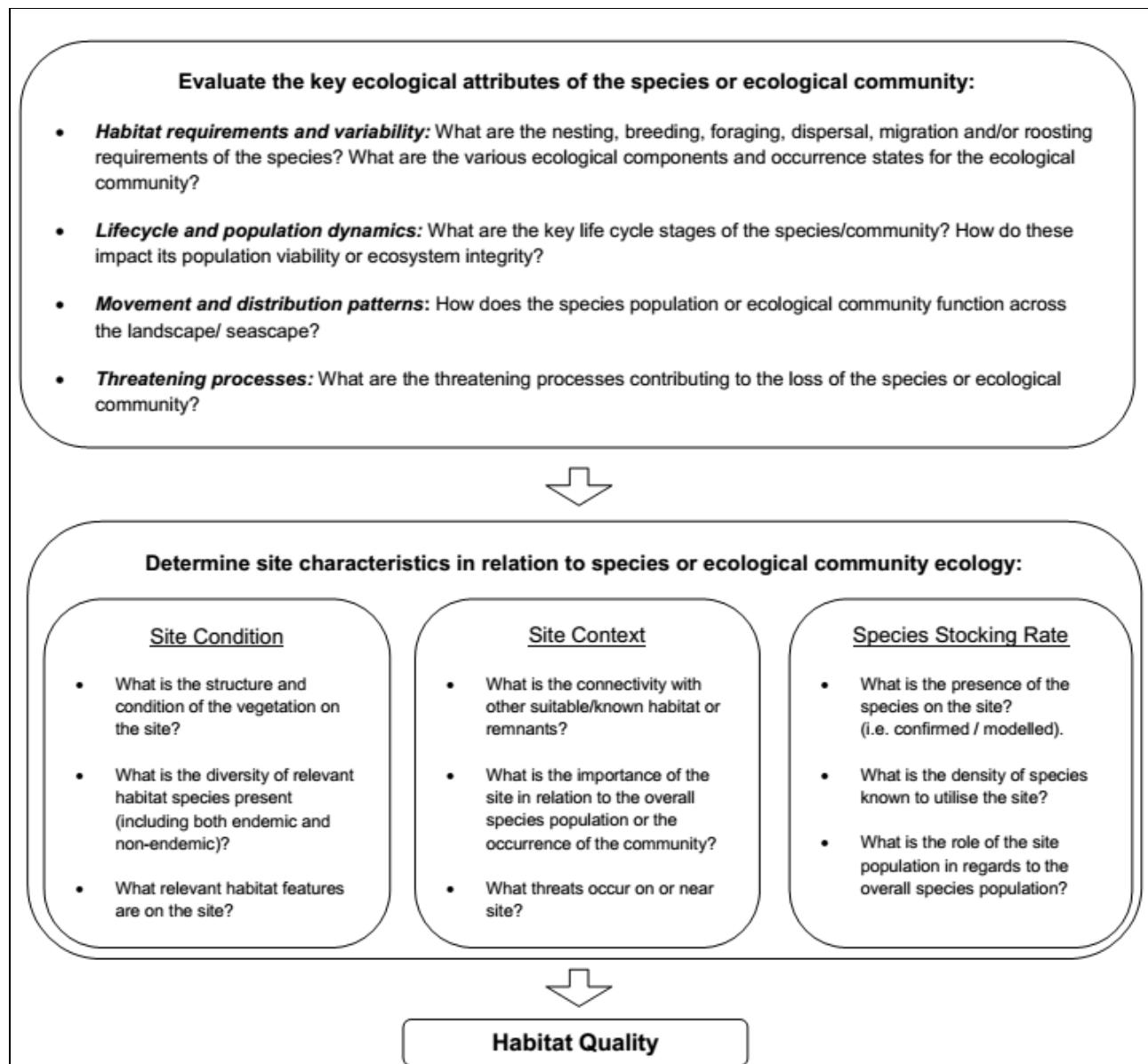


Figure 7 Key Considerations in Determining Habitat Quality under the Commonwealth Offsets Policy

© DSEWPaC, 2012

For application to this Project, the overall quality is determined by averaging out various sub-scores assigned to each site characteristic shown in **Figure 7**. These scores and characteristics are adapted to suit each MNES (discussed briefly in the following sections and in detail in **Appendix 2**). Overall habitat quality is derived by combining the final scores that contribute to each category (i.e. sub-scores) and adjusting them to derive a final score out of 10. All elements are considered equally important and no weightings have been applied. This allows for the final figure to be used in the offset assessment tool, which only allows input of integers, up to 10.

5.1 Natural Temperate Grassland

The assessment of offset requirements for an ecological community is relatively simpler than that for species. ‘Species stocking rate’ is irrelevant in determining habitat quality for an ecological community, and in the case of grassland, structure is a non-variable and in the case of natural temperate grassland, owing to the detailed conservation advice and its prescribed assessment techniques, the aspect of ‘diversity’ is also irrelevant (refer to **Figure 7**). The site condition and site context characteristic scores have been broken down into sub-scores, the parameters of which are based on the key ecological attributes of natural temperate grassland. The scores and associated calculations are described in detail in **Appendix 2**, and summarised in **Table 5.1**.

Table 5.1 Habitat Quality Score for the Impacted Natural Temperate Grassland

Characteristic	Raw Score	Transformed Score	Score
Site Condition			
condition	2	6.7	6.7
Site Context			
connectivity	4.8	4.8	4
importance	2.0	4.0	
threats	4.0	3.3	
OVERALL HABITAT QUALITY SCORE			5

The overall natural temperate grassland habitat quality score, for input into the Commonwealth Environmental Offset Tool, is ‘5’. This is equivalent to a moderate quality. This score is lower than that derived from the Conservation Advice (TSSC 2016) as provided in Umwelt (2016) however this overall habitat quality score is based upon not only floristics but has considered threats, patch size and context. Golden Sun Moth

The parameters used to determine the habitat quality score for golden sun moth are based on the three site characteristics defined in the Commonwealth offsets policy: Site Condition, Site Context, and Species Stocking Rate (see **Figure 7**). Each of these characteristic scores has been broken down into sub-scores, the parameters of which are based on the key ecological attributes of golden sun moth. Each score is based on current available information for the site and reflects the site quality at the time of assessment. The quality of these habitats may change over time, in response to climatic influences.

The scores and associated calculations are described in detail in **Appendix 2**, and summarised in **Table 5.2**.

Table 5.2 Habitat Quality Score for the Impacted Golden Sun Moth Habitat

Characteristic	Raw Score	Transformed Score	Score
Site Condition			
structure	2	6.7	6.7

Characteristic	Raw Score	Transformed Score	Score
condition	2	6.7	
Site Context			
connectivity	4.5	9	7.00
importance	2.0	4.0	
threats	8.0	8.0	
Species Stocking Rate			
Presence	2.0	10.00	5.33
Density	3.0	6.00	
Importance	0	0	
OVERALL HABITAT QUALITY SCORE			6

The overall golden sun moth habitat quality score, for input into the Commonwealth Environmental Offset Tool, is '6'. This is equivalent to moderate quality, and reflects the species stocking rate within the disturbed Chilean needlegrass vegetation. This is consistent with previous habitat assessments undertaken by Umwelt (2016).

6.0 Conclusions

Impacts to 0.13 hectares of natural temperate grassland and 2.54 hectares of golden sun moth habitat as a result of the Project are considered likely to be significant under both Commonwealth and ACT legislation. In order to compensate for these impacts, an offset strategy for the Project will need to be developed. The values provided in **Section 5** can be used for input in the Commonwealth offset assessment tool for the impacted area, as summarised in **Table 6.1**.

Table 6.1 Summary of Impacts to MNES as a Result of the Project

MNES	Impact Area (ha)	Impact Area (percent of total present)	Quality of Impacted Habitat
natural temperate grassland	0.13	17%	5
golden sun moth	2.54	35%	6

As both matters are MNES, the offset strategy must be prepared in accordance with the Commonwealth environmental offsets strategy (DSEWPaC 2012). No further offsetting under the ACT environmental offsets policy will be required. An appropriate offset site has not been identified as yet; however the information in this report can be used to determine the adequacy of a future proposed offset site.

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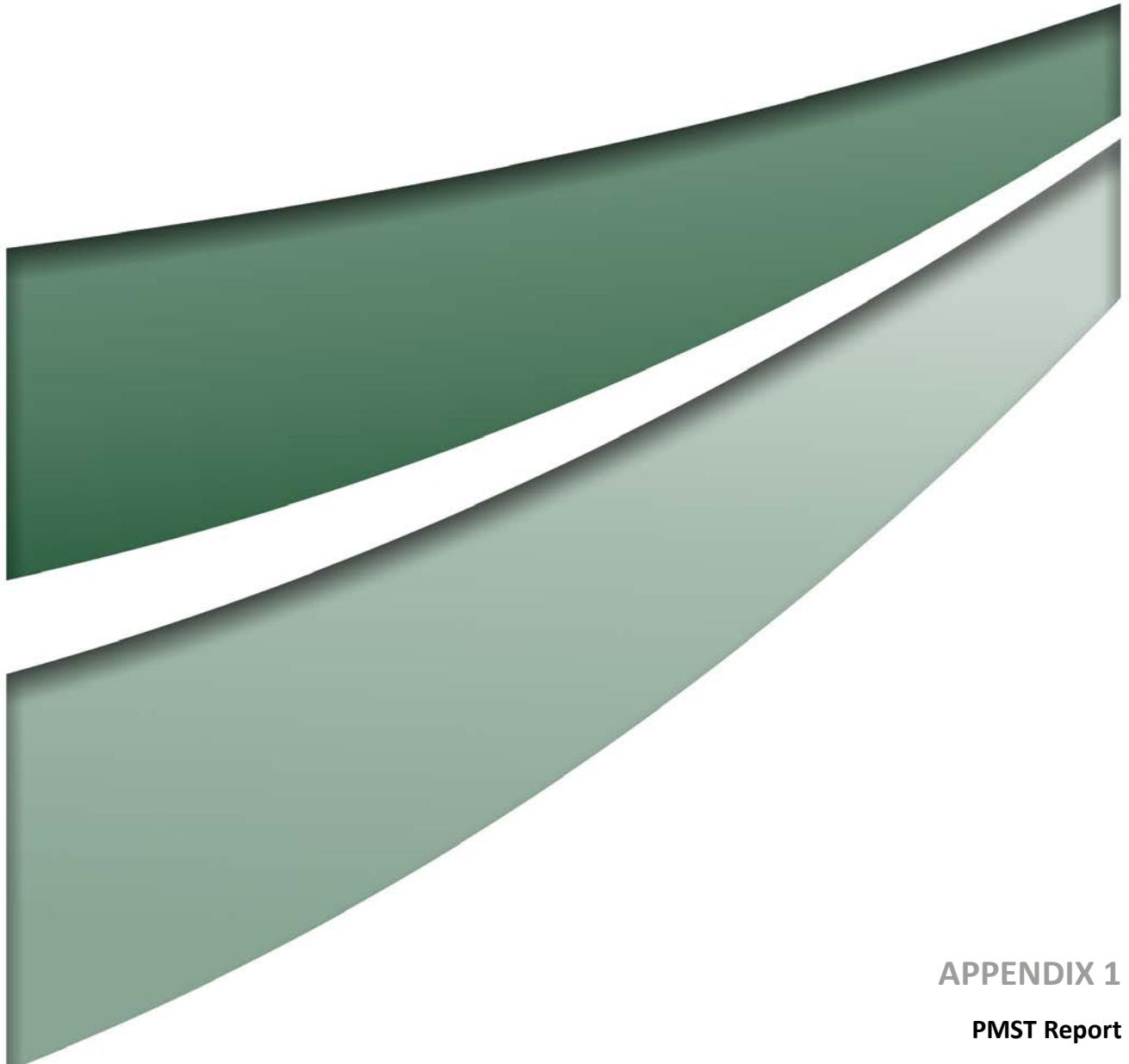
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APPENDIX 1
PMST Report



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

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[Summary](#)

[Details](#)

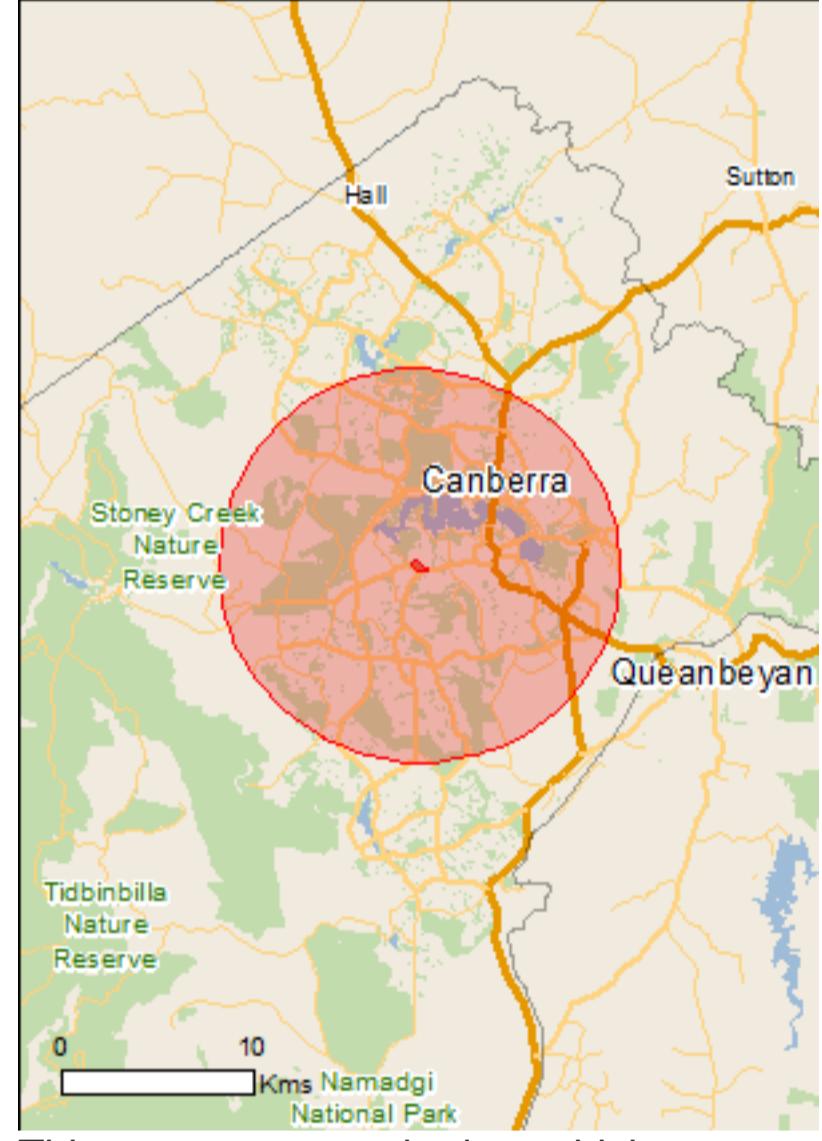
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[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

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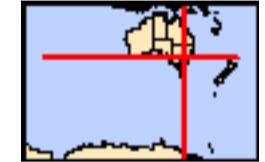
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Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	4
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	33
Listed Migratory Species:	14

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	23
Commonwealth Heritage Places:	77
Listed Marine Species:	20
Whales and Other Cetaceans:	None
Critical Habitats:	1
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	27
Regional Forest Agreements:	None
Invasive Species:	37
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		<u>[Resource Information]</u>	
Name	State	Status	
Historic			
Australian Academy of Science Building	ACT	Listed place	
Australian War Memorial and the Memorial Parade	ACT	Listed place	
High Court - National Gallery Precinct	ACT	Listed place	
Old Parliament House and Curtilage	ACT	Listed place	

Wetlands of International Importance (Ramsar)		<u>[Resource Information]</u>
Name		Proximity
Banrock station wetland complex		700 - 800km upstream
Hattah-kulkyne lakes		500 - 600km upstream
Riverland		700 - 800km upstream
The coorong, and lakes alexandrina and albert wetland		800 - 900km upstream

Listed Threatened Ecological Communities		<u>[Resource Information]</u>
For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.		

Name	Status	Type of Presence
Natural Temperate Grassland of the South Eastern Highlands	Critically Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species		<u>[Resource Information]</u>
Name	Status	Type of Presence
Birds		
Anthochaera phrygia	Critically Endangered	Species or species habitat known to occur within area

Calidris ferruginea	Critically Endangered	Species or species habitat known to occur within area
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Grantiella picta	Vulnerable	Species or species habitat known to occur within area

Lathamus discolor	Critically Endangered	Species or species habitat known to occur within area
Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area

Limosa lapponica baueri	Vulnerable	Species or species habitat may occur within area
Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]		

Limosa lapponica menzbieri	Critically Endangered	Species or species habitat may occur within area
Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]		

Numenius madagascariensis	Critically Endangered	Species or species habitat may occur within area
Eastern Curlew, Far Eastern Curlew [847]		

Name	Status	Type of Presence
<i>Polytelis swainsonii</i> Superb Parrot [738]	Vulnerable	Species or species habitat known to occur within area
<i>Rostratula australis</i> Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
<i>Maccullochella peelii</i> Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
<i>Macquaria australasica</i> Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Frogs		
<i>Litoria aurea</i> Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
<i>Litoria castanea</i> Yellow-spotted Tree Frog, Yellow-spotted Bell Frog [1848]	Endangered	Species or species habitat may occur within area
Insects		
<i>Synemon plana</i> Golden Sun Moth [25234]	Critically Endangered	Species or species habitat known to occur within area
Mammals		
<i>Dasyurus maculatus</i> maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
<i>Petauroides volans</i> Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
<i>Phascolarctos cinereus</i> (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
<i>Caladenia actensis</i> Canberra Spider Orchid [76138]	Critically Endangered	Species or species habitat known to occur within area
<i>Eucalyptus aggregata</i> Black Gum [20890]	Vulnerable	Species or species habitat likely to occur within area
<i>Lepidium ginninderense</i> Ginninderra Pepper-cress [78474]	Vulnerable	Species or species habitat known to occur within area
<i>Lepidium hyssopifolium</i> Basalt Pepper-cress, Pepper-cress, Rubble Pepper-cress, Pepperweed [16542]	Endangered	Species or species habitat may occur within area
<i>Leucochrysum albicans</i> var. <i>tricolor</i> Hoary Sunray, Grassland Paper-daisy [56204]	Endangered	Species or species habitat known to occur within area
<i>Muehlenbeckia tuggeranong</i> Tuggeranong Lignum [64934]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
<u>Pelargonium sp. Striatellum (G.W.Carr 10345)</u>		
Omeo Stork's-bill [84065]	Endangered	Species or species habitat may occur within area
<u>Pomaderris pallida</u>		
Pale Pomaderris [13684]	Vulnerable	Species or species habitat known to occur within area
<u>Prasophyllum petilum</u>		
Tarengo Leek Orchid [55144]	Endangered	Species or species habitat may occur within area
<u>Rutidosis leptorrhynchoides</u>		
Button Wrinklewort [7384]	Endangered	Species or species habitat likely to occur within area
<u>Swainsona recta</u>		
Small Purple-pea, Mountain Swainson-pea, Small Purple Pea [7580]	Endangered	Species or species habitat likely to occur within area
<u>Thesium australe</u>		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
<u>Aprasia parapulchella</u>		
Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat known to occur within area
<u>Delma impar</u>		
Striped Legless Lizard [1649]	Vulnerable	Species or species habitat known to occur within area
<u>Tympanocryptis pinguicolla</u>		
Grassland Earless Dragon [66727]	Endangered	Species or species habitat known to occur within area
Listed Migratory Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
<u>Apus pacificus</u>		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
<u>Hirundapus caudacutus</u>		
White-throated Needletail [682]		Species or species habitat known to occur within area
<u>Monarcha melanopsis</u>		
Black-faced Monarch [609]		Species or species habitat known to occur within area
<u>Motacilla flava</u>		
Yellow Wagtail [644]		Species or species habitat may occur within area
<u>Myiagra cyanoleuca</u>		
Satin Flycatcher [612]		Species or species habitat known to occur within area
<u>Rhipidura rufifrons</u>		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
<u>Actitis hypoleucus</u>		
Common Sandpiper [59309]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
<u>Calidris acuminata</u>		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<u>Calidris ferruginea</u>		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<u>Calidris melanotos</u>		
Pectoral Sandpiper [858]		Species or species habitat known to occur within area
<u>Gallinago hardwickii</u>		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
<u>Limosa lapponica</u>		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<u>Numenius madagascariensis</u>		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<u>Pandion haliaetus</u>		
Osprey [952]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land	[Resource Information]
The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.	
Name	
Defence - 10 WHYALLA ST - FYSHWICK	
Defence - 139 CANBERRA AVE - FYSHWICK	
Defence - 169 GLADSTONE ST - FYSHWICK	
Defence - ADC / JSSC - WESTON	
Defence - ADFA MARINE FACILITY - YARRALUMLA	
Defence - AIDAB Building	
Defence - AUSTRALIAN DEFENCE FORCE ACADEMY	
Defence - BELCONNEN RADIO STATION ; BELCONNEN COMMUNICATIONS STATION	
Defence - CAMPBELL PARK	
Defence - DEAKIN OFFICES	
Defence - DEFENCE RECRUITING UNIT - GIO BUILDING	
Defence - HEWLETT PACKARD BUILDING - FERNHILL PARK	
Defence - HMAS HARMAN - SYMONSTOWN	
Defence - MAWSON OFFICE ACCOMM	
Defence - NAVAL COMBAT DATA SYSTEM CENTRE - FYSHWICK	
Defence - NCC BUILDING - CANBERRA CITY	
Defence - NORTHBORNE HOUSE	
Defence - NORTHCOTT DRIVE PLAYING FIELDS (Addison Rd)	
Defence - PHYSICS FIELD TESTING STATION - CANBERRA	
Defence - RAAF BASE FAIRBAIRN	
Defence - ROYAL MILITARY COLLEGE - DUNTROON	
Defence - RUSSELL HILL COMPLEX	
Defence - WERRIWA DEPOT	

Commonwealth Heritage Places	[Resource Information]	
Name	State	Status
Natural		
<u>State Circle Cutting</u>	ACT	Listed place
<u>Synemon Plana Moth Habitat</u>	ACT	Listed place
Indigenous		
<u>Aboriginal Embassy Site</u>	ACT	Within listed place
Historic		

Name	State	Status
Acton Conservation Area	ACT	Listed place
Acton Peninsula Building 1	ACT	Listed place
Acton Peninsula Building 15	ACT	Listed place
Acton Peninsula Building 2	ACT	Listed place
Acton Peninsula Limestone Outcrops	ACT	Listed place
Anzac Memorial Chapel of St Paul	ACT	Listed place
Apostolic Nunciature	ACT	Listed place
Apple Shed Asset C58	ACT	Listed place
Australian American Memorial and Sir Thomas Blamey Square	ACT	Listed place
Australian Forestry School (former)	ACT	Listed place
Australian National Botanic Gardens (part)	ACT	Listed place
Australian War Memorial	ACT	Listed place
Blowfly Insectary Numbers 1 and 2	ACT	Listed place
Blundells Farmhouse, Slab Outbuilding and Surrounds	ACT	Listed place
CSIRO Main Entomology Building	ACT	Listed place
Cameron Offices (Wings 3, 4 and 5, and Bridge)	ACT	Listed place
Canberra School of Art	ACT	Listed place
Canberra School of Music	ACT	Listed place
Captains Quarters Assets B1 to B4	ACT	Listed place
Carillon	ACT	Listed place
Casey House and Garden	ACT	Listed place
Changi Chapel	ACT	Listed place
Commandants House Asset B9	ACT	Listed place
Commencement Column Monument	ACT	Listed place
Communications Centre	ACT	Listed place
Drill Hall Gallery	ACT	Listed place
Duntroon House and Garden	ACT	Listed place
East Block Government Offices	ACT	Listed place
Edmund Barton Offices	ACT	Listed place
General Bridges Grave	ACT	Listed place
Gungahlin Complex	ACT	Listed place
Gungahlin Homestead and Landscape	ACT	Listed place
High Court - National Gallery Precinct	ACT	Listed place
High Court of Australia	ACT	Listed place
Institute of Anatomy (former)	ACT	Listed place
John Gorton Building	ACT	Listed place
King George V Memorial	ACT	Listed place
Lennox House Complex	ACT	Listed place
Mount Stromlo Observatory Precinct	ACT	Listed place
National Gallery of Australia	ACT	Listed place
National Library of Australia and Surrounds	ACT	Listed place
National Rose Gardens	ACT	Listed place
Old Parliament House Gardens	ACT	Listed place
Old Parliament House and Curtilage	ACT	Listed place
Parade Ground and Associated Buildings Group	ACT	Listed place
Parliament House Vista	ACT	Listed place
Parliament House Vista Extension - Portal Buildings	ACT	Listed place
Patent Office (former)	ACT	Listed place
Phytotron	ACT	Listed place
R G Menzies Building ANU	ACT	Listed place
RMC Duntroon Conservation Area	ACT	Listed place
Reserve Bank of Australia	ACT	Listed place
Residence Asset B5	ACT	Listed place
Residence Asset B7	ACT	Listed place
Residence Asset C12	ACT	Listed place
Residence Asset C13	ACT	Listed place
Residence Asset C14	ACT	Listed place
Residence Asset C15	ACT	Listed place
Residence Asset C7	ACT	Listed place
Residence Asset C8	ACT	Listed place
Royal Australian Naval Transmitting Station	ACT	Listed place
Russell Precinct Heritage Area	ACT	Listed place
Sculpture Garden National Gallery of Australia	ACT	Listed place
The CSIRO Forestry Precinct	ACT	Listed place
The Lodge	ACT	Listed place
The Royal Australian Mint	ACT	Listed place

Name	State	Status
The Surveyors Hut	ACT	Listed place
Toad Hall ANU	ACT	Listed place
University House and Garden	ACT	Listed place
West Block and the Dugout	ACT	Listed place
Westridge House & Grounds	ACT	Listed place
Yarralumla and Surrounds	ACT	Listed place
York Park North Tree Plantation	ACT	Listed place
Russell Cafeteria	ACT	Within listed place

Listed Marine Species	[Resource Information]
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* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
<i>Actitis hypoleucus</i>		
Common Sandpiper [59309]		Species or species habitat known to occur within area
<i>Apus pacificus</i>		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<i>Ardea alba</i>		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
<i>Ardea ibis</i>		
Cattle Egret [59542]		Species or species habitat may occur within area
<i>Calidris acuminata</i>		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<i>Calidris ferruginea</i>		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<i>Calidris melanotos</i>		
Pectoral Sandpiper [858]		Species or species habitat known to occur within area
<i>Gallinago hardwickii</i>		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
<i>Haliaeetus leucogaster</i>		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
<i>Hirundapus caudacutus</i>		
White-throated Needletail [682]		Species or species habitat known to occur within area
<i>Lathamus discolor</i>		
Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
<i>Limosa lapponica</i>		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<i>Merops ornatus</i>		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
<i>Monarcha melanopsis</i>		
Black-faced Monarch [609]		Species or species habitat known to occur within area
<i>Motacilla flava</i>		
Yellow Wagtail [644]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Critical Habitats	[Resource Information]
Name	Type of Presence
Lepidium ginninderrense (Ginninderra Peppercress) - Northwest corner Belconnen Naval Transmission Station, ACT	Listed Critical Habitat

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Aranda Bushland	ACT
Australian National	ACT
Black Mountain	ACT
Bruce Ridge	ACT
Callum Brae	ACT
Cooleman Ridge	ACT
Crace	ACT
Farrer Ridge	ACT
Gossan Hill	ACT
Isaacs Ridge	ACT
Jerrabomberra Wetlands	ACT
Kama	ACT
Lower Molonglo River Corridor	ACT
McQuoids Hill	ACT
Mt Ainslie	ACT
Mt Mugga Mugga	ACT
Mt Painter	ACT
Mt Pleasant	ACT
Mt Taylor	ACT
O'Connor Ridge	ACT
Oakey Hill	ACT
Red Hill	ACT
The Pinnacle	ACT
Unnamed	ACT
Urambi Hills	ACT
Wanniassa Hills	ACT
West Jerrabomberra	ACT

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
<i>Acridotheres tristis</i> Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
<i>Alauda arvensis</i> Skylark [656]		Species or species habitat likely to occur within area
<i>Anas platyrhynchos</i> Mallard [974]		Species or species habitat likely to occur within area
<i>Carduelis carduelis</i> European Goldfinch [403]		Species or species habitat likely to occur within area
<i>Carduelis chloris</i> European Greenfinch [404]		Species or species habitat likely to occur within area
<i>Columba livia</i> Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
<i>Passer domesticus</i> House Sparrow [405]		Species or species habitat likely to occur within area
<i>Streptopelia chinensis</i> Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
<i>Sturnus vulgaris</i> Common Starling [389]		Species or species habitat likely to occur within area
<i>Turdus merula</i> Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
<i>Bos taurus</i> Domestic Cattle [16]		Species or species habitat likely to occur within area
<i>Canis lupus familiaris</i> Domestic Dog [82654]		Species or species habitat likely to occur within area
<i>Felis catus</i> Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
<i>Feral deer</i> Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
<i>Lepus capensis</i> Brown Hare [127]		Species or species habitat likely to occur within area
<i>Mus musculus</i> House Mouse [120]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Senecio madagascariensis		
Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus		
Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Jerrabomberra Wetlands	ACT

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-35.312531 149.098155,-35.313599 149.098133,-35.313931 149.096267,-35.314106 149.095365,-35.314352 149.094271,-35.314369
149.093842,-35.314352 149.093413,-35.314246 149.092941,-35.314089 149.092511,-35.313914 149.092125,-35.312933 149.09073,-35.31232
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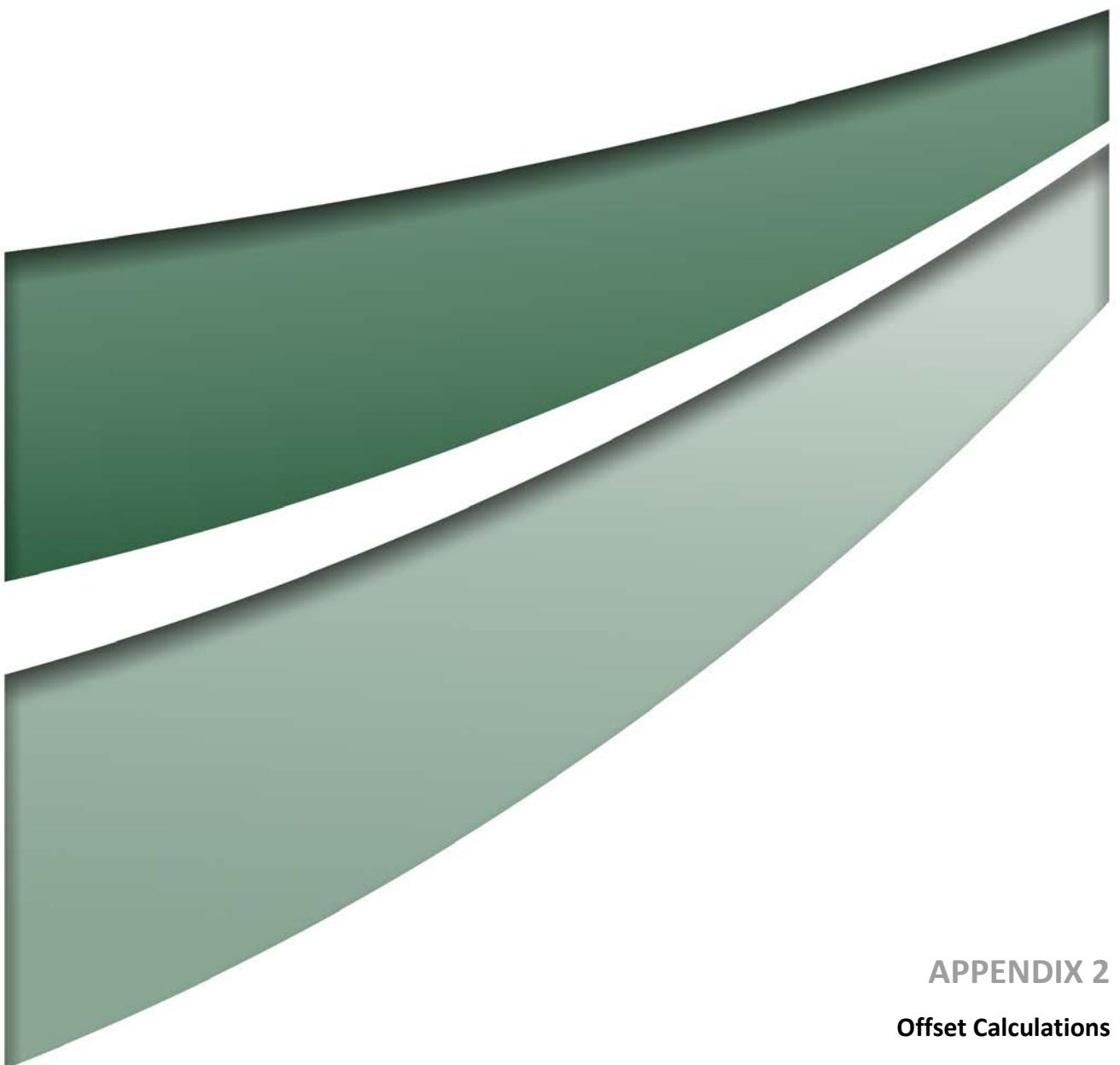
Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of Land and Resource Management, Northern Territory](#)
- [Department of Environmental and Heritage Protection, Queensland](#)
- [Department of Parks and Wildlife, Western Australia](#)
- [Environment and Planning Directorate, ACT](#)
- [Birdlife Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Museum Victoria](#)
- [Australian Museum](#)
- [South Australian Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Canberra](#)
- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- [Australian Tropical Herbarium, Cairns](#)
- [eBird Australia](#)
- [Australian Government – Australian Antarctic Data Centre](#)
- [Museum and Art Gallery of the Northern Territory](#)
- [Australian Government National Environmental Science Program](#)
- [Australian Institute of Marine Science](#)
- [Reef Life Survey Australia](#)
- [American Museum of Natural History](#)
- [Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

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APPENDIX 2
Offset Calculations

Calculations for Determining MNES Quality Scores

A2.1 Natural Temperate Grassland

A2.1.1 Site Condition Characteristic Score

The conservation advice for natural temperate grassland includes detailed information and methods for determining the presence and condition of natural temperate grassland (TSSC 2016). By following the guidance provided in determining which condition threshold any given example meets, the floristic diversity, presence of weeds, projected foliage cover, and presence of other diagnostic characteristics will be determined. Accordingly, the only aspect of the site condition component of the offset calculation for habitat quality that remains relevant is ‘condition’.

The other components being structure and diversity of relevant habitat species are unnecessary to include specific scores for as they are addressed by the prescribed field assessment methods.

A2.1.1.1 Condition Sub-Score

Condition is taken to be an indication of community resilience with the indicator being the presence or absence of non-native species within the patch. Application of the methodology in the Conservation Advice results in determining that natural temperate grassland if present exists in one of three conditions described as:

- Moderate-high
- High-Very High
- Excellent or ‘benchmark / reference’.

These have been adopted by this analysis method in addition to the point also raised in the Conservation Advice that some sites may not meet the threshold to be the community, however, with remedial work may be enhanced to qualify. This is also recognised in the assessment method. Accordingly **Table A2.1** describes the sub-score for condition of a natural temperate grassland patch.

Table A2.1 Condition Sub-Score for Natural Temperate Grassland

Score	Rationale
0	Not presently meeting the definition of natural temperate grassland due to poor floristic diversity, however, may be subject to recovery actions in order to improve quality to meet the community definition.
1	Moderate-High
2	High-Very High
3	Excellent / Benchmark / Reference

All natural temperate grassland within the Project Area is considered to be high or very-high. Therefore the condition sub-score for impacted natural temperate grassland is '2' (adjusted to '7').

A2.2 Site Context Characteristic Score

Site context is comprised of a number of factors based on landscape scale assessment of inter-patch relationships (connectivity), together with an understanding of the relative importance of the subject site and threats which might act against future potential quality.

A2.2.1 Connectivity Sub-Score

Connectivity is relative to individual taxa and for consideration of a community this will by necessity be an average. Given the structural characteristics of grassland communities and the dispersal range of likely pollination vectors, a figure of 200 metres has been adopted as the point beyond which functional connectivity no longer exists.

Principles guiding the calculation of connectivity also include an understanding of permeability (i.e. the ability for threatened species or component species of ecological communities to migrate over a distance). For natural temperate grassland patches, impermeable barriers in inter-patch areas would include:

- gaps over grassy communities (including grassy woodlands, secondary grassland, and native pasture) greater than 200 metres
- gaps over constructed, non-habitat areas such as paving, concrete, and other hard-stand in excess of 50 metres wide and
- urban development (comprised of residential houses, commercial facilities, and associated services and infrastructure).

It is likely additional factors could influence connectivity between patches of natural temperate grassland (such as the height of structures) however, as there are a wide variety of possible pollination vectors for grassland communities such an obstacle is unlikely to cause impermeability. It should also be noted that many of the fauna that provide ecosystem services to grassland communities include ants and other small invertebrates which are unable or unlikely to cover large distances through areas of non-habitat.

For the purposes of this calculation, all known natural temperate grassland patches that are not isolated by absolute barriers are considered a single patch. In this instance, all natural temperate grassland present within the Project Area is considered to be a single patch. It is comprised of three sub-patches of natural temperate grassland that maintain some connectivity with each other across a substrate with varying permeability. This substrate includes exotic grassland and Dudley Street.

Permeability (as a score out of 1) between each sub-patch is calculated using **Equation 1**, using the shortest distance between each sub-patch. **Table A2.2** shows the permeability scores for the Project Area.

$$\text{Equation 1: } P_{NTG} = 1 - \left(\frac{D}{200} \right)$$

Where:

P_{NTG} = the permeability score for natural temperate grassland

D = the smallest distance (metres) between two sub-patches, or the width of the impact area at its narrowest point through the patch

Table A2.2 Permeability Scores for the Project Area

Between Patches	Approx. distance (m)	Permeability
5 to 10	15	0.93
5 to 12	45	0.78
10 to 12	35	0.83
Average*		0.84

* The permeability score for the entire patch is taken as the average of all permeability scores.

The connectivity sub-score of a patch is determined by applying the patch permeability score to the total area of permeable non-natural temperate grassland substrate within the patch and adding this to the total area of the community, per **Equation 2**. This gives a weighted average of the permeability of a patch based on area by assigning a permeability of 1 to the habitat sub-patches.

$$\text{Equation 2: } C = \sum_{1 \rightarrow n} (A_i \times P_i)$$

Where:

C = connectivity raw score

A_i = area of each discrete patch

P_i = permeability score for each discrete patch

Calculating connectivity in this way, the maximum score will be achieved when the entire patch contains golden sun moth habitat. Patches will score lower depending upon the proportion of golden sun moth habitat to permeable substrate within it and the level of permeability of the substrate.

Connectivity scores for the Project Area are shown in **Table A2.3**.

Table A2.2 Connectivity Scores for the Project Area

Patch	Area (ha)	Permeability	Connectivity Score
5	0.11	1	0.11
10	0.32	1	0.32
12	0.32	1	0.32
non-natural temperate grassland substrate	0.24*	0.84	0.20
Adjusted Average (out of 5)			4.8

*Approximate area.

The adjusted connectivity sub-score is 4.8 out of 5 for the Project Area.

A2.2.2 Importance Sub-Score

The aim of the site importance sub-score is to demonstrate the importance of the Project Area in relation to other known natural temperate grassland habitat areas within the ACT. This is calculated based on the size class of the impacted area and the residual permeability of the impacted area.

The residual permeability is the patch permeability score from above (i.e. 0.84) rounded to the nearest tenth. The size class is based on the categories outlined in **Table A2.4**.

Table A2.3 Patch Size Scores for Natural Temperate Grassland

Score	Patch Size (ha)
1	0 – 1
2	1 – 4
3	4 – 22
4	22 – 99
5	99 and greater

The range of the size classes described in **Table A2.4** was determined using the habitat distribution for the ACT (Environment ACT 2004). The areas of natural temperate grassland within the ACT were graphed in size order from smallest to largest, and a generally sigmoidal curve fitted to the data on a logarithmic scale. This curve was used to define the size classes such that larger habitat patches were given a higher score to reflect the shape of the curve and the rarity of patches of such size.

The matrix shown in **FigureA2.1** has also been used to calculate the site importance sub-score. This matrix scores habitats that are of a larger size class and with high permeability the lowest, as these are the areas that should be avoided.

Impact Site – Importance Matrix										
size class (patch)	5	1	1	1	1	1	1	1	1	1
	4	2	2	2	2	2	2	2	1	1
	3	3	3	3	3	2	2	2	1	1
	2	4	4	4	3	3	3	3	2	2
	1	5	5	4	4	4	3	3	2	2
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Residual permeability of impacted area										

Figure A2.1 Impact Site Importance Matrix

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A total of 0.13 hectares of natural temperate grassland is to be impacted by the Project, giving it a patch size score of '1'. This combined with a permeability score 0.8, leads to an importance sub-score of '2'.

A2.2.3 Threats Sub-Score

The threats sub-score is based on the presence and intensity of key threats, as identified in the EPBC Act Conservation Advice for natural temperate grassland (TSSC 2016). There are seven threats identified but of those, only six provide a meaningful basis upon which to consider the relative threats applicable to both the impact and offset sites. The seventh being climate change is a pervasive threat and beyond the control of land managers to have any meaningful impact on.

The remaining six threats considered relevant for consideration within the calculation of habitat quality include:

- agricultural intensification
- urban development
- fragmentation
- inappropriate management
- invasive flora and
- invasive fauna.

Each of these threats is assigned a score out of 2 based on the presence and intensity of the threats at the site. For all threats, with the exception of 'urban development', the scores in **Table A2.5** apply. In the case of urban development, these scores are reversed such that where no threat is apparent, the score awarded is 2, while in the case where a high intensity threat from urban development is present, a score of 0 is awarded.

The overall threat sub-score is the sum of scores for each threat and has a maximum of 12; this is then adjusted so that it is a score out of '5'.

Table A2.4 Threat Intensity Scores for Natural Temperate Grassland

Score	Rationale
0	Threat absent.
1	Low intensity threat.
2	High intensity threat.

It is important to note that these threats must be assessed from the perspective of their potential to affect biodiversity as opposed to historical impacts. Past actions will have created conditions responsible for the vegetation and habitat quality evident in the present and it is on the present values that the sites must be assessed. As such a site that is at risk of being imminently lost to one or a combination of threats would be more highly valued as a target for protection if it could be secured as an offset. This addresses a consideration in the offset policy that seeks to avert risk through identification and protection of areas that are at greater risk of being lost and protecting them as offsets.

The threats sub-score for the Project Area is based on the scores shown in **Table A2.6**.

Table A2.5 Threats Sub-Score for the Project Area

Threat	Score
agricultural intensification	0
urban development	0
fragmentation	1
inappropriate management	1
invasive flora	2
invasive fauna	0
Adjusted Total Score (out of 5)	3

The threat sub-score for the Project Area is 3 out of 5.

A2.3 Determining Habitat Quality

As the offset assessment tool requires integer scores out of 10, each of the above raw scores was transformed prior to being combined for the final habitat quality score. The transformation is described by **Equation 3**.

Equation 3: $X' = bX$

Where:

X' = transformed score

$$b = \frac{\text{maximum transformed score}}{\text{maximum raw score}}$$

X = raw score

For the purpose of this calculation, all components of habitat quality score were considered equal, making the final quality score an equally weighted average of the transformed component scores, rounded to the nearest integer.

Despite each sub-score being weighted equally, due to the raw score range of some of the scores being different, it is noted that a single step change in some individual components will have a larger effect on the overall habitat quality score than others.

The natural temperate grassland habitat quality score is calculated based on the scores summarised in **Table A2.7**.

Table A2.6 Habitat Quality Score for the Impacted Natural Temperate Grassland

Characteristic	Raw Score	Transformed Score	Score
Site Condition			
condition	2	6.7	6.7

Characteristic	Raw Score	Transformed Score	Score
Site Context			
connectivity	4.8	4.8	4
importance	2.0	4.0	
threats	4.0	3.3	
OVERALL HABITAT QUALITY SCORE			5

A2.4 Golden Sun Moth

A2.4.1 Site Condition Characteristic Score

The Site Condition Characteristic Score has been separated into three component sub-scores: vegetation structure, vegetation condition, and forage species diversity. Relevant habitat features (as noted under ‘site condition’ in **Figure 5**) is not included as a specific sub-score as habitat features important to golden sun moth (e.g. inter-tussock space and presence of forage species) are incorporated in the vegetation structure and species diversity sub-scores.

A2.4.1.1 Vegetation Structure Sub-Score

Vegetation structure is a reflection of the habitat type (i.e. grassland or open woodland) and the amount of inter-tussock space available (i.e. rank or open grassland). Golden sun moth typically occupies grassland; therefore, grassland structures score higher than woodland. This is important for sites that were originally in a woodland form but through habitat modification exist as derived grassland into which golden sun moths have migrated. For such sites, there is often a sparse shrub or remnant tree component in addition to a soil seed bank that if left unmanaged would result in the area reverting to a woodland overtime. This noted, however, habitat structure as with all site characteristics is assessed on what is observable in the present and includes no consideration of possible future states as these are subject to future management decisions which are not certain.

The species also requires inter-tussock space in which the females bask to attract males during breeding (i.e. flying) season, therefore, open grassland scores higher than rank grassland (DEWHA 2009a). The range of vegetation structure scores is shown in **Table A2.8**. Any vegetation type that does not fit into one of these categories is not considered to be golden sun moth habitat from a structural perspective and is highly unlikely to support the species.

Table A2.7 Vegetation Structure Sub-Scores for Golden Sun Moth

Score	Rationale
1	Grassy open woodland or shrubland. It is the least suitable of habitats that are occupied by golden sun moth.
2	Rank (i.e. overgrown) grassland.
3	Open grassland. Provides optimal habitat structure.

The majority of the impacted golden sun moth habitat within the Project Area is rank grassland (vegetation structure sub-score '2'). This is predominantly due to the relatively high abundance of weed species, especially Chilean needlegrass.

A2.4.1.2 Vegetation Condition Sub-Score

The vegetation condition sub-score considers the proportion of exotic to native species and the availability of golden sun moth forage species in the Project Area. Scores are determined based on dominance to give an overall impression of the types of grass species that occur. Exotic species dominance is ranked lowest as it is considered to be a sign of poor ecosystem health and a detriment to biodiversity as a whole. It is noted that some exotic species (namely Chilean needlegrass) also provide habitat for golden sun moth (TSSC 2013). Often in such circumstances the population of golden sun moth within these exotic pastures is much higher than native communities. That aspect, however, is considered by the species stocking rate characteristic score (**Section 5.2.3**) and is not a relevant consideration in the vegetation condition sub-score. This decision is justified on the basis that the ability for a weed species to provide habitat for one species (albeit critically endangered) should not be valued over the detriment such species pose to native ecosystems as a whole.

Sites with mixed dominance, or dominance of native non-forage species (e.g. kangaroo grass (*Themeda triandra*)) are given an equal score. This is considered appropriate as it is believed that the presence (not dominance) of forage species is enough to provide habitat for golden sun moth in some circumstances. Despite this, sites with a dominance of forage species are ranked the highest as they provide the most habitat resources for golden sun moth and are considered to be of a higher quality. The range of habitat vegetation scores that may be assigned is shown in **Table A2.9**.

Table A2.8 Vegetation Condition Sub-Scores for Golden Sun Moth

Score	Rationale
1	Dominated by exotic species (e.g. Chilean needle-grass).
2	Mixed exotic and native forage species dominance.
3	Dominated by native forage species (e.g. short wallaby grass and spear grasses).

The impacted grassland covers a range of vegetation condition types, however, most areas contain mixed grassland with regard to golden sun moth feed species. The impacted golden sun moth habitat within the Project Area has a vegetation condition sub-score of '2'.

A2.4.2 Site Context Characteristic Score

The site context characteristic score is a more complex component of habitat quality and is considered for the purpose of golden sun moth to be a function of the following sub-scores: site connectivity, site importance, and threats.

A2.4.2.1 Connectivity Sub-Score

For the purpose of this offset strategy, site connectivity is considered to be a function of the size of a habitat area, the distance between habitat areas, and the ability for individual golden sun moths to traverse this distance (termed 'permeability' herein).

Golden sun moth has limited ability to disperse through landscapes. Females are not able to traverse any non-habitat substrate due to their poor flying ability, or lack thereof (AHE 2005). As such, any break in habitat connectivity is considered an absolute barrier that the females cannot cross. Males will traverse variable distances depending on the type of substrate they are crossing. A substrate that consists of non-habitat grassland will be permeable for male golden sun moths up to a distance of 200 metres (AHE 2005); whilst a substrate of concrete, water, bare ground, or the like is taken (on the basis of observation) to be permeable up to a distance of 15 metres. Beyond this distance they are considered absolute barriers and male moths will not cross. In addition, features such as trees, shrubs, or buildings are an absolute barrier for male golden sun moth (DEWHA 2009b). Effectively, any structure at the flying height of moths (up to 1.5 metres) will obstruct movement.

For the purposes of this calculation, all known golden sun moth habitat patches that are not isolated by absolute barriers are considered a single patch. In this instance, all golden sun moth habitats present within the Project Area is considered to be a single patch. It is comprised of six sub-patches that maintain some connectivity with each other across a substrate with varying permeability.

Permeability (as a score out of 1) between each sub-patch is calculated using **Equation 1**, using the shortest distance between each sub-patch. **Table A2.10** shows the permeability scores for the Project Area.

$$\text{Equation 1: } P_{NTG} = 1 - \left(\frac{D}{200} \right)$$

Where:

P_{NTG} = the permeability score for natural temperate grassland

D = the smallest distance (metres) between two sub-patches, or the width of the impact area at its narrowest point through the patch

Table A2.9 Permeability Scores for the Project Area

Between Patches	Approx. distance (m)	Permeability
North to Cotter Road West	12	0.94
North to Cotter Road East	30	0.85
North to South 1	15	0.93
North to South 2	15	0.93
Cotter Road West to Cotter Road South	17	0.92
Cotter Road West to Cotter Road East	10	0.95
Cotter Road West to South 1	18	0.91
Cotter Road East to Cotter Road South	15	0.98
Cotter Road East to South 1	13	0.94
South 1 to South 2	85	0.58
Average*		0.89

* The permeability score for the entire patch is taken as the average of all permeability scores.

The connectivity sub-score of a patch is determined by applying the patch permeability score to the total area of permeable non-habitat substrate within the patch and adding this to the total area of the community, per **Equation 2**. This gives a weighted average of the permeability of a patch based on area by assigning a permeability of 1 to the habitat sub-patches.

$$\text{Equation 2: } C = \sum_{1 \rightarrow n} (A_i \times P_i)$$

Where:

C = connectivity raw score

A_i = area of each discrete patch

P_i = permeability score for each discrete patch

Calculating connectivity in this way, the maximum score will be achieved when the entire patch contains golden sun moth habitat. Patches will score lower depending upon the proportion of golden sun moth habitat to permeable substrate within it and the level of permeability of the substrate.

Connectivity scores for the Project Area are shown in **Table A2.11**.

Table A2.10 Connectivity Scores for the Project Area

Patch	Area (ha)	Permeability	Connectivity Score
North	5.1	0.87	4.44
Cotter Road West	0.38	1	0.38
Cotter Road East	0.40	1	0.40
Cotter Road South	0.13	1	0.13
South 1	2.16	0.90	1.94
South 2	0.17	1	0.17
non-habitat substrate	1.19*	0.89	1.06
Adjusted Average (out of 5)			4.5

*Approximate area.

The adjusted connectivity sub-score is 4.8 out of 5 for the Project Area.

A2.4.2.2 Importance Sub-Score

The aim of the site importance sub-score is to demonstrate the importance of the Project Area in relation to other known golden sun moth habitat areas within the ACT. This is calculated based on the size class of the impacted area and the residual permeability of the impacted area.

The residual permeability is the patch permeability score from above (i.e. 0.89) rounded to the nearest tenth. The size class is based on the categories outlined in **Table A2.12**.

Table A2.11 Patch Size Scores for Natural Temperate Grassland

Score	Patch Size (ha)
1	0 – 14.9
2	15 – 74.9
3	75 – 124.9
4	125 – 159.9
5	160 and greater

The range of the size classes described in **Table A2.12** was determined using existing knowledge of occupied golden sun moth habitats in the ACT (Environment ACT 2004). The areas of these grasslands were graphed in size order from smallest to largest, and a logarithmic curve fitted to the data. This curve was used to define the size classes such that an equal weight was given to small or moderate size habitat patches, and higher scores given to the larger patches to reflect the pattern of habitat size distribution in the ACT.

This system is based on the general assumption that bigger habitat areas are better than smaller ones. However it is unknown what the minimum thresholds are for habitat size in relation to golden sun moth population viability. In future, pending further scientific investigation, a minimum patch size may be incorporated into this scoring system to reflect the minimum habitat size that can host a viable golden sun moth population. The same may be said for larger patches, and identifying the point (if any) after which patch size does not affect the viability or size of a golden sun moth population.

The key limitation of this methodology is that the data set used is ten years old, and since this time many more golden sun moth populations have been identified in Canberra. Despite not having access to a full inventory of current ACT golden sun moth habitat areas, it is considered likely that the sample is large enough to reflect the size trend of the population as most of the new sites described as being small and isolated.

This data is also based on the size of the grasslands, and this does not necessarily reflect the total area of golden sun moth habitat present. Due to the variety in reporting methods for the species, it is difficult to access data in the same format. It is, therefore, most likely that these areas have all been overestimated, however, the effect of this on the habitat quality score is considered negligible, given that it applies to all data being utilised for the golden sun moth habitat quality assessments.

The matrix shown in **Figure A2.2** has also been used to calculate the site importance sub-score. This matrix scores habitats that are of a larger size class and with high permeability the lowest, as these are the areas that should be avoided.

Impact Site – Importance Matrix										
size class (patch)	5	1	1	1	1	1	1	1	1	1
	4	2	2	2	2	2	2	2	1	1
	3	3	3	3	3	3	2	2	2	1
	2	4	4	4	3	3	3	3	2	2
	1	5	5	4	4	4	3	3	2	2
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Residual permeability of impacted area										

Figure A2.2 Impact Site Importance Matrix

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A total of 2.54 hectares of golden sun moth habitat is to be impacted by the Project, giving it a patch size score of ‘1’. This combined with a permeability score 0.9, leads to an importance sub-score of ‘2’.

A2.4.2.3 Threats Sub-Score

The threats sub-score is based on the presence and intensity of key threats, as identified in the EPBC Act Conservation Advice for natural temperate grassland (TSSC 2013). Six types of threats have been identified: habitat loss, habitat fragmentation, isolation of populations, habitat degradation, agricultural practices, and weed invasion. Given the considerable overlap and multiple drivers of these threats, they were narrowed into five specific threats for the purposes of this offset calculation:

- weed invasion (i.e. non-forage species, not necessarily exotic plants);
- under or over grazing
- pesticide use
- inappropriate fire and
- fertiliser use.

It should be noted that both grazing and fire may be used as management tools without being considered a threat to golden sun moth as long as they occur within the tolerance thresholds of the species.

Each of these threats is assigned a score out of 2 based on the presence and intensity of the threats at the site, the criteria for which is outlined in **Table A2.13**. The overall threat sub-score is the sum of scores for each threat and has a maximum of 10. The overall threat sub-score is the sum of scores for each threat and has a maximum of 10; this is then adjusted so that it is a score out of ‘5’.

Table A2.12 Threat Intensity Scores for Natural Temperate Grassland

Score	Rationale
0	Threat absent.
1	Low intensity threat.
2	High intensity threat.

It is important to note that these threats must be assessed from the perspective of their potential to affect biodiversity as opposed to historical impacts. Past actions will have created conditions responsible for the vegetation and habitat quality evident in the present and it is on the present values that the sites must be assessed. As such a site that is at risk of being imminently lost to one or a combination of threats would be more highly valued as a target for protection if it could be secured as an offset. This addresses a consideration in the offset policy that seeks to avert risk through identification and protection of areas that are at greater risk of being lost and protecting them as offsets.

The threats sub-score for the Project Area are based on the scores shown in **Table A2.14**.

Table A2.13 Threats Sub-Score for the Project Area

Threat	Score
weed invasion (i.e. non-forage species, not necessarily exotic plants)	0
under or over grazing	1
pesticide use	0
inappropriate fire	1
fertiliser use	0
Adjusted Total Score (out of 10)	4

The threat sub-score for the Project Area is '4' out of 10.

A2.4.3 Species Stocking Rate Characteristic Score

The species stocking rate score is an estimate of the number of golden sun moth that occupies a site. For the purpose of this assessment, this score has been separated into three sub-scores: species presence, species density, and role of site.

A2.4.3.1 Species Presence Sub-Score

The species presence sub-score is a simple three-tiered scoring system (**Table A2.15**) that scores highest when golden sun moth are known to occupy a site.

Table A2.14 Species Presence Scores for Golden Sun Moth

Score	Rationale
0	Golden sun moth are absent from the site.
1	Models predict that golden sun moth might occupy a site.
2	The presence of golden sun moth at the site has been confirmed.

Golden sun moth are known to occur within the impacted portion of the Project Area. Species presence sub-score is '2'.

A2.4.3.2 Species Density Sub-Score

Species density has been scored based on the following six tiered system (**Table A2.16**). This sub-score is somewhat subjective given the variability of golden sun moth observations between and during survey efforts and the lack of objective methods to determine the species density at a site.

Table A2.15 Species Density Scores for Golden Sun Moth

Score	Rationale
0	No golden sun moth present.
1	Very low numbers of golden sun moth observed during surveys.
2	Low numbers of golden sun moth observed during surveys.
3	Low to moderate numbers of golden sun moth observed during surveys.
4	Moderate numbers of golden sun moth observed during surveys.
5	High numbers of golden sun moth observed during surveys.

Impacted golden sun moth habitat within the Project Area has had low to moderate numbers of golden sun moth observed during surveys (Umwelt 2017). The species density sub-score is '3'.

A2.4.3.3 Role of Site Sub-Score

The role of site sub-score relates to the importance of the population from a national perspective. The aim of this is to reflect the role of the site in population dynamics of the species and thus provide higher scores to populations that play a larger role in this regard, regardless of their density. The scores are assigned based on the number of important population criteria that are met, as defined in the Significant Impact Guidelines in relation to species listed as vulnerable under the EPBC Act. Criteria for an 'important population' are:

- a key source population for either breeding or dispersal
- a population that is necessary for maintaining genetic diversity and
- a population that is near the limit of the species' range.

These criteria are considered appropriate as they are established in policy and although intended to be applied to an impact assessment for vulnerable species, they describe characteristics of populations that are ecologically important. Where these criteria are applied for assessment of a vulnerable species, should a population meet any criterion it would be considered as being ‘important’ for the purpose of impact assessment. As the intention of the assessment under the offset calculation is to determine relative importance, it is appropriate to recognise a population meeting all three criteria as being of greater importance than a population meeting only one criterion.

Scores are assigned based on the system defined in **Table A2.17**.

Table A2.16 Role of Site Sub-Score for Golden Sun Moth

Score	Rationale
0	None of the important population criteria met.
1	One important population criterion met.
2	Two important population criteria met.
3	Three important population criteria met.

The grassland within the Project Area is identified in Action Plan 28 (AHE 2005) as being a ‘complementary conservation site’. These areas have some areas of moderate vegetation condition but also contain (or are adjacent to) grassland of lower quality, contain threatened species habitat, or are of moderate size (between 10 and 100 hectares). By definition they are not considered key habitat within the ACT, rather they complement core conservation grassland areas. It is therefore considered unlikely that the population of golden sun moth present within the Project Area is a key source population for breeding or dispersal, or necessary for maintaining genetic diversity. Furthermore, it is not located near the limit of the species’ range.

The role of site sub-score for impacted golden sun moth habitat within the Project Area is ‘0’.

A2.4.4 Determining Habitat Quality

As the EPBC Act Guide requires integer scores out of 10, each of the above raw scores was transformed prior to being combined for the final habitat quality score. The transformation is described by **Equation 3**.

Equation 3: $X' = bX$

Where:

X' = transformed score

$$b = \frac{\text{maximum transformed score}}{\text{maximum raw score}}$$

X = raw score

For the purpose of this calculation, all components of the habitat quality score were considered equal. As such, the final habitat quality score is an equally weighted average of the transformed component scores, rounded to the nearest integer.

Despite each sub-score being weighted equally, due to the raw score range of some of the scores being different, it is noted that a single step change in some individual components will have a larger effect on the overall habitat quality score than others.

The golden sun moth habitat quality score is calculated based on the scores summarised in **Table A2.18**.

Table A2.17 Habitat Quality Score for the Impacted Golden Sun Moth Habitat

Characteristic	Raw Score	Transformed Score	Score
Site Condition			
structure	2	6.7	6.7
condition	2	6.7	
Site Context			
connectivity	4.5	9	7.00
importance	2.0	4.0	
threats	8.0	8.0	
Species Stocking Rate			
Presence	2.0	10.00	5.33
Density	3.0	6.00	
Importance	0	0	
OVERALL HABITAT QUALITY SCORE			6

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