



Murra Warra wind farm:
Golden Sun Moth survey 2014 - 15 season

DRAFT REPORT

Prepared for RES Australia

11th February 2015

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Document information

Report to: RES Australia

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Biosis project no.: 18813

File name: 18813.Murra Warra wind farm.GSM.DRA.20150211.docx

Citation: Biosis (2014). *Murra Warra wind farm: Golden Sun Moth Survey 2014 -15 season*. Report for Res Australia. Author: G Thomas, Biosis Pty Ltd, Ballarat Project no. 18813

Document control

Version	Internal reviewer	Date issued
Draft version 01	MSG	03/02/2015

Acknowledgements

Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- RES Australia: Kevin Garthwaite
- Department of Environment & Primary Industries for access to the Victorian Biodiversity Atlas
- Rohan Clarke for cover photo
- Clive Crouch – secretary of the Nhill Golden Sun Moth Reserve

The following Biosis staff were involved in this project:

- Matthew Gibson for assistance with mapping

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1. Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by RES Australia to undertake targeted survey of Golden Sun Moth *Synemon plana* (GSM) within the study area of the proposed Murra Warra wind farm (Figure 1).

The GSM is listed as a Matter of National Environmental Significance under the *Environment and Protection Biodiversity Conservation (EPBC) Act 1999*, is listed as threatened in all states and territories in which it occurs (Gilmore et al. 2008) and is listed as threatened under Victoria's *Flora and Fauna Guarantee Act 1988*.

1.2 Objectives

The objectives of the GSM surveys are to:

- Conduct a survey of GSM within the suitable habitat identified by Biosis in 2013.
- Record observed individuals within suitable habitat within the wind farm study area.
- Present the results of the survey program including; pre-season checks, reference site checks, weather conditions on survey days, survey methods and habitat characteristics of the study area.

1.3 Study area

The proposed Murra Warra wind farm study area is approximately 10km (east-west) by 7.5 km (north-south) encompassing approximately 6,500 ha of private land between the Blue Ribbon Road and the Henty Highway (Figure 1).

The study area is predicted to have GSM or GSM habitat by the *EPBC Act* Protected Matters Search Tool (search report created on 06/02/2013). The nearest GSM records on the DELWP Biodiversity Interactive Map occur near Salisbury and adjacent to the township of Nhill, approximately 43 and 55 km respectively NNW of the study area.

Several patches of potential GSM habitat have been previously identified by Biosis (2013) along Newells Road and the Dimboola-Minyip Road (Figure 2) and Plate 1. The Newells Road survey area extended north from the intersection with Schmidts Road to the boundary of the wind farm study area on the eastern side of the road reserve. The Dimboola – Minyip Road survey area extended from the intersection with Newells Road in the west to the Barrat Quarry Road in the east and included habitat on both sides of the existing roadway to the edge of the road reserve. The GSM surveys were limited to these patches of potential habitat.

1.4 Biology of the Golden Sun Moth

The GSM is a medium sized, diurnal (day flying) moth with clubbed antennae (Edwards 1993). The species is sexually dimorphic with the females having an enlarged abdomen and ovipositor that aids in egg laying. The species is also sexually dichromatic in wing colour. The forewings of female GSM are brown and grey while the hind wings are yellow with black spots. Male GSM have dark brown forewings with grey scales and bronze-coloured hind wings. The underside of both pairs of wings is white with small black spots along the margin in females and pale grey with dark brown spots in the males.

The females, which only fly irregularly, position themselves on the ground in a conspicuous location (usually inter-tussock spaces), flashing their golden hind wings (petticoats) to the males, who fly low over the grasses searching for them.

Potential habitat for the GSM consists of areas which previously or currently have native grasslands or grassy woodlands (including derived grasslands) across the historical range of the species. Previous studies found that GSM show a preference for wallaby grasses *Rytidosperma* spp. (particularly *R. carphoides*, *R. auriculata*, *R. setacea*, *R. eriantha*, *R. racemosa*). However, more recent surveys have found GSM present in degraded grasslands and patches invaded with weedy species, including exotic Chilean Needle-grass (*Nassella neesiana*), native Red-leg grass *Bothriochloa macra*, spear grasses (*Austrostipa* spp.) and Weeping Grass (*Microlaena stipoides*) dominated areas (Braby and Dunford 2006; Gilmore et al. 2008).

Inter-tussock spaces are considered important in assisting patrolling males to locate females displaying from a sedentary position (Gilmore et al. 2008). This is supported by observations of male moths showing a preference for relatively open areas with reduced biomass, suggesting females are in turn present in those areas (Gilmore et al. 2008).

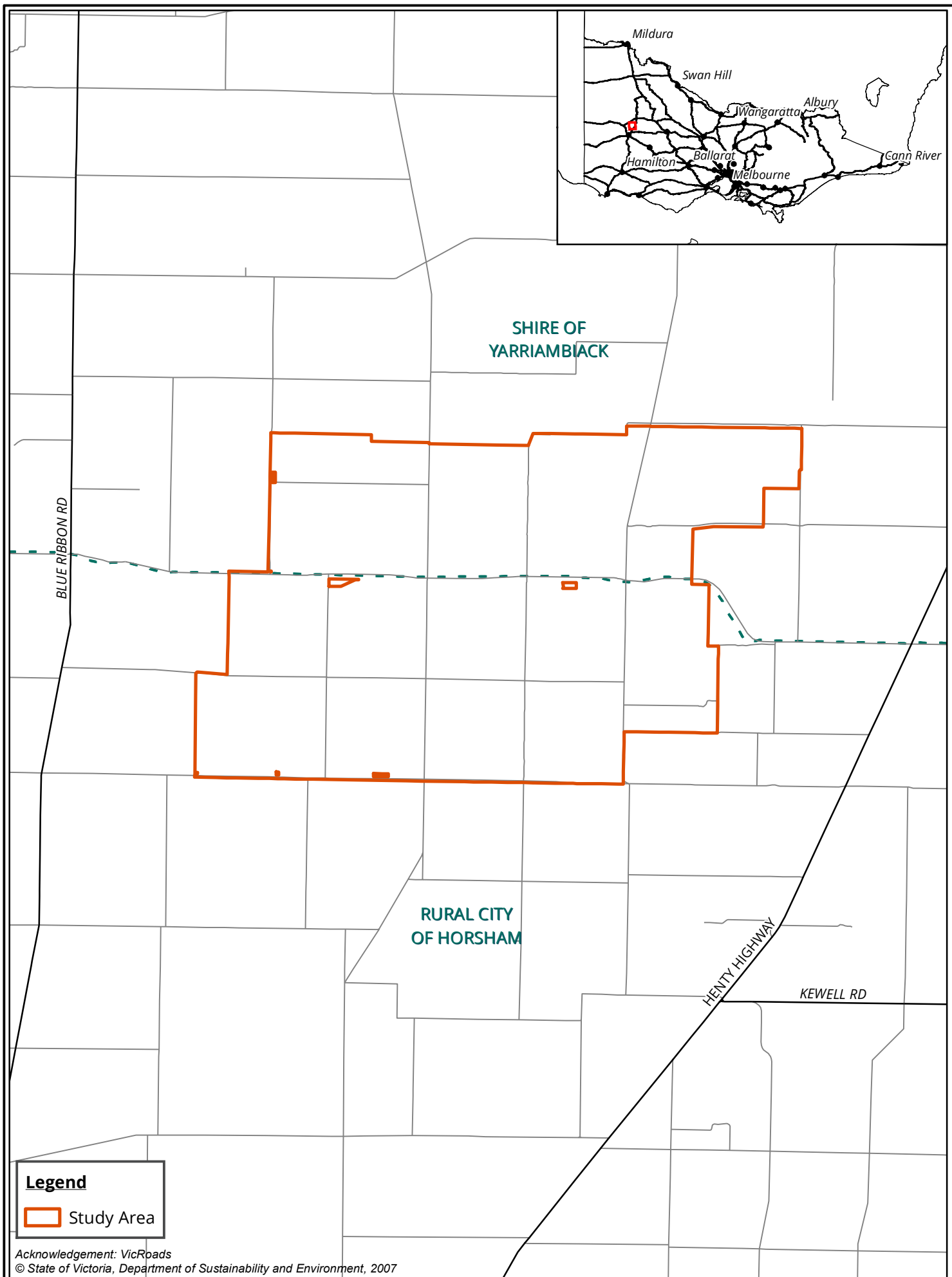
Sites considered marginal or unsuitable for GSM include cropped or recently ploughed areas (Gilmore et al. 2008). However, virtually all other grassland and grassy woodland supporting some native grasses or introduced grasses from the genus *Nassella* within the species' historic range have the potential to support the species.

The GSM breeding season begins in mid October and continues through to early January (DEWHA 2009). The breeding season differs slightly from year to year depending on climate and location. During this time adult moths emerge continuously in cohorts and males are seen actively flying in search of females.

It was previously thought that GSM only fly on warm (> about 20 degrees Celsius), calm days with little or no cloud and in the hottest part of the day (between 10:00 hrs and 14:00 hrs) (Clarke and O'Dwyer 2000). However, since 2005 Biosis have often recorded active male GSM on cooler days, on days of partial or full cloud cover, on days within 24 hours following rainfall, during times of moderate to strong wind conditions and also at times earlier and later in the day than previously thought. Sometimes this involves large numbers of individuals. However more typically this has involves smaller numbers of moths than those observed during 'optimal' conditions. Surveying in less than optimal conditions can be sufficient to determine presence / absence of the species at a locality, but is considered less reliable when trying to determine abundance and extent and distribution at a site.

Male flight is low, to about a metre above the ground, fast and typically in a zig zag pattern as they 'patrol' for females. Females have been observed flying without provocation and are capable of flying distances of > 40 m and sometimes a number of females can be observed flying across a site (D. Gilmore, pers. obs.). However, compared to males they are relatively sedentary. Females then tend to walk from tussock to tussock to lay between 100 and 150 eggs between either the tillers of a grass tussock or between the tillers and the soil (Gibson 2006).

GSM larvae are thought to spend 1 - 4 years underground feeding on the roots of native perennial grasses. However, the larval lifespan is unknown. The diet of GSM larvae is thought to consists of the roots of wallaby-grasses, spear-grasses, Red-leg Grass and the introduced Chilean Needle-grass (Braby and Dunford 2006; Gilmore et al. 2008). Adult moths do not have functional mouthparts and therefore are unable to feed. This reduces their adult life to a few days, generally (O'Dwyer and Attiwill 1999).



2. Methods

2.1 Survey

Survey was undertaken during the 2014/15 GSM flight season. As the timing of the flight season varies annually and geographically, the best indicator of key survey period is the presence of flying males at known local sites. Reference sites were monitored during the expected flying period and used to guide survey timing at the target site, as specified in the *Significant Impact Guidelines for the Critically Endangered Golden Sun Moth* (EPBC Act Policy Statement 3.12). Pre-season checks were undertaken by a local naturalist based in Nhill on behalf of Biosis to determine the commencement of the GSM flight season for 2014/2015 in the local area. GSM activity was also monitored throughout Victoria during the season through communication between Biosis and other ecological consultants, using the GSM email group maintained by Biosis.

Targeted GSM surveys were undertaken at the study area on 31/10/2014, 7/11/2014, 19/11/2014 and 28/11/2014. The surveys were undertaken at approximately weekly intervals to allow for variations in emergence patterns. Surveys took place when conditions were suitable for male flight (generally >20°C, bright, clear days, full sun or sparse cloud, absence of rain and wind other than a light breeze) between 10:00 hrs and 15:00 hrs.

On each survey the entire survey area was searched systematically by driving the length of each potential patch of habitat and by walking a series of transects, spaced approximately 5 m apart. To guide the timing of survey, weather information was obtained from BOM website www.bom.gov.au.

Habitat characteristics of the study area were recorded during the GSM survey.

2.2 Weather Conditions

Weather conditions, including temperature, humidity and wind speed including, were measured on site using a Kestrel Weather Meter (Model 4000). Weather data collected on site is provided in Appendix 2.

2.3 Limitations

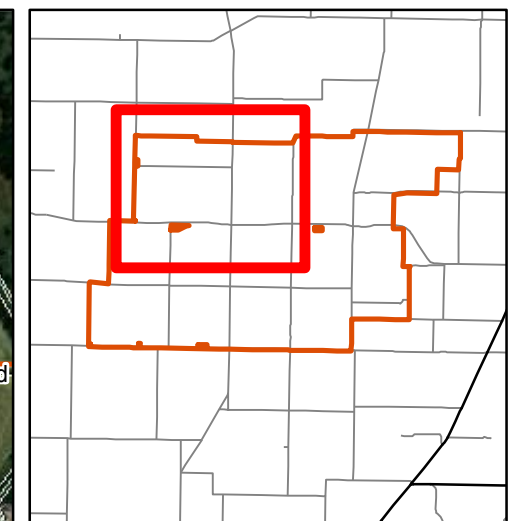
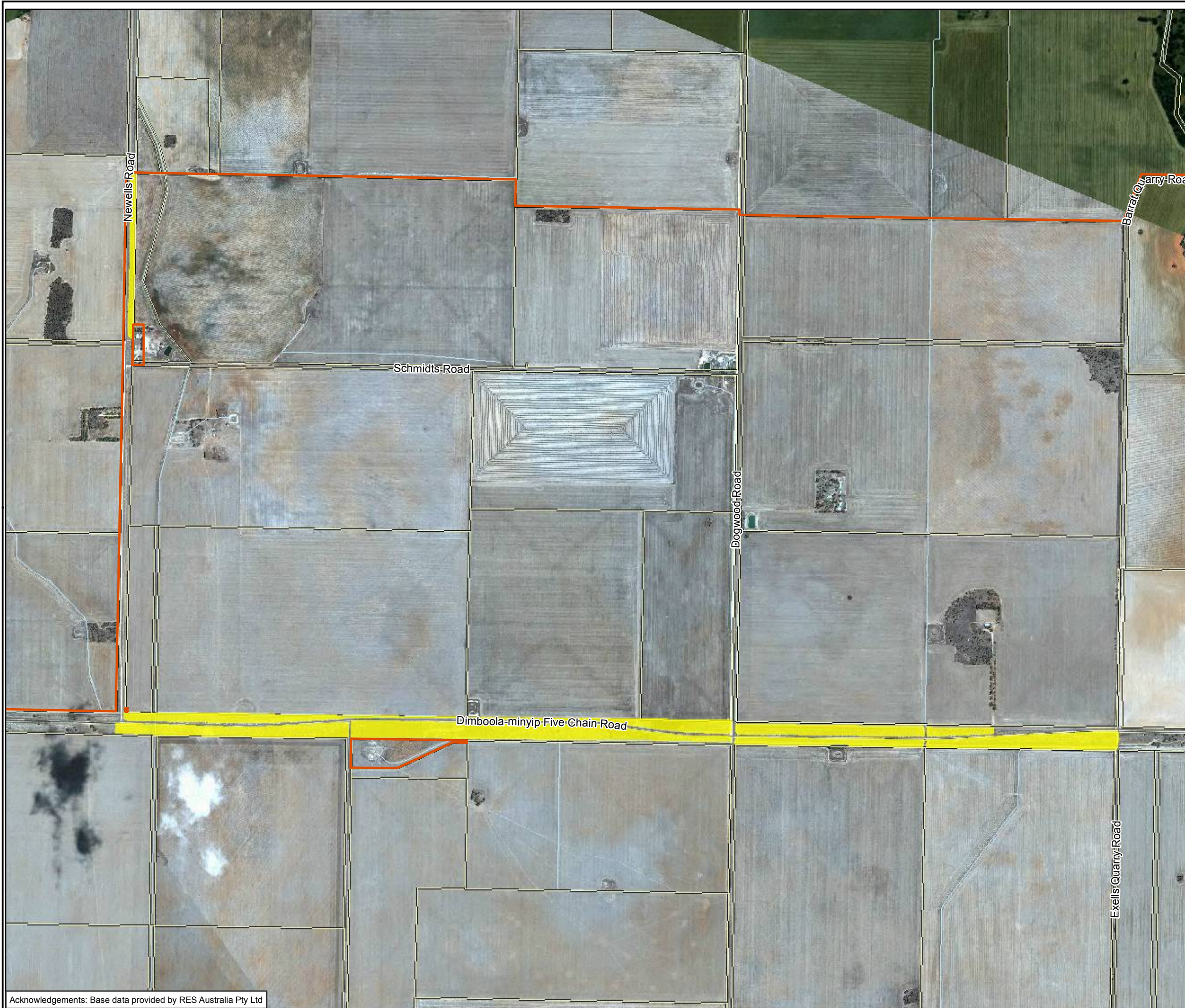
The nearest reference site was located on the eastern outskirts of Nhill some 50 km from the study area. The site (known as the Nhill Golden Sun Moth Reserve) was checked prior to each survey of the study site. The reserve is a known location for GSM and has been reserved for the conservation of the species. GSM has been observed flying at this location consistently over a number of years and is monitored by a local naturalist who has consistently recorded GSM flying within the reserve from the first week of November each year. Despite consistent monitoring during this flight season at this location GSM were, not recorded by Biosis or any other observer. Biosis has therefore relied on surveys from other reference sites within the broader region to provide information on the flight activity of GSM at the time of survey within the wind farm site. Other reference sites being monitored included sites near St Arnaud, Yea, and within the greater Melbourne area.

Biosis has since confirmed that GSM do not appear to have flown this year within the expected flight period of the species at the Nhill Golden Sun Moth Reserve on any occasion where it was being monitored by Biosis or by a local naturalist (C. Crouch pers. comm.). Biosis has since confirmed that several moths have since been recorded flying in the Nhill Golden Sun Moth Reserve during early February where up to five moths have been recorded flying. This is thought to be as a result of very dry conditions in the period from June to December 2014 followed by heavy rain in January 2015 that may have resulted in increased plant growth and consequently induced moth larvae to hatch later in the season than would otherwise be expected (C. Crouch pers. comm.).

The EPBC Act survey guidelines for GSM require that surveys are conducted during the local flying season. As the timing of the flight season varies annually and geographically, the guidelines specify that reference sites should be monitored during the expected flying period and used to guide survey timing at the target site. Outside of the Melbourne Strategic Assessment Area there is no requirement to conduct reference site checks on the same day as subject site surveys, provided surveys are conducted during suitable weather conditions. However, we confirmed that GSM were flying at other reference sites at the time of our targeted surveys.

2.4 Permits

Biosis undertook the GSM survey under a Research Permit/Management Authorisation and Permit to Take Protected Flora & Protected Fish issued by the Department of Sustainability and Environment under the *Wildlife Act 1975*, *Flora and Fauna Guarantee Act 1988* and *National Parks Act 1975* (Permit number 10006240, expiry date 9 May 2015).



Legend

- Study Area
- Cadastre
- GSM survey areas

Figure 5: GSM survey areas - 2014



Metres
 Scale: 1:15,000 @ A3
 Coordinate System: GDA 1994 MGA Zone 54

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Matter: 15581
 Date: 11 February 2015,
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 Location: P:\15500s\15581\Mapping\15581_F5_GSM_SurveyAreas

3. Results

3.1 Habitat description

The two patches of potential GSM habitat identified within the study area is located within the roadside reserve. The area is dominated by native Wallaby Grasses *Rytidosperma* spp., along with large areas of *Austrostipa* spp. and introduced grasses, particularly *Vulpia* spp.



Plate 1. Potential GSM habitat at Newells Road, Murra Warra.

3.2 Survey results

No GSM were recorded on site during any of the targeted surveys (Table 1). The conditions under which the surveys were undertaken were suitable as outlined in the guidelines and are included in Table 2.

Non-target insects were recorded on site during the GSM surveys including other diurnal moths, butterflies, wasps, flies and beetles.

Positive sightings of flying GSM males recorded during the survey period at a range of reference sites are listed in Appendix 1.

Table 1: GSM survey results at Murra Warra

Date	Time Start	Time Finish	Observer initials	GSM observed on site?
31/10/2014	11:35 am	13:40 pm	GLT	No
7/11/2014	13:05 pm	14:35 pm	GLT	No
19/11/2014	12:30pm	14:00 pm	MSG	No
28/11/2014	12:00 pm	14:10 pm	GLT	No

Table 2: Summary of (onsite) weather meter data

Date	Temp during survey (°C)	Cloud cover (%)	Wind direction	Average wind speed (km/hr)	Ground conditions	Humidity (%)
31/10/2014	31	<10	N	15	Dry	15
7/11/2014	34	<10	NE	7	Dry	7
19/11/2014	28	10	N	10	Dry	31
28/11/2014	27	<10	SE	4	Dry	15

4. Conclusion and recommendations

Potential GSM habitat has been identified at two patches of Plains Savannah within the Murra Warra wind farm site. Targeted surveys were conducted during the 2014/2015 GSM flying period, in suitable weather conditions as specified by the survey guidelines (DEWHA 2009).

No GSM were recorded during the surveys.

Based on these findings, the site is considered unlikely to support a current GSM population.

No further GSM surveys are considered necessary.

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Appendices

Appendix 1: Reference site data

Reference sites with sightings of flying males.

Date	Site
30/10/2014	St Arnaud
11/11/2014	Rokewood, Yea
13/11/2014	Epping, Merrimu, Craigieburn
19/11/2014	Craigieburn, Campbelltown
23/11/2014	Epping
28/11/2014	Yea, Altona, Epping, Merrimu
29/11/2014	Epping