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• Ian and James Taylor (the landowners) and Lee Evans who provided access to the offset site and onsite management information within the offset site.



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1 INTRODUCTION

1.1 Background

Ecology and Heritage Partners Pty Ltd was engaged by Warrambeen Landcare Farm to undertake vegetation monitoring and Golden Sun Moth *Synemon plana* population and habitat quality for Year 2 (2015/2016) for the Rosenthal Offset Site, Warrambeen, Victoria. The requirement for Golden Sun Moth offsets was associated with the construction of the Rosenthal Estate, 100 Vineyard Road, Sunbury, Victoria (Ecology and Heritage Partners Pty Ltd 2015).

The offset requirements were set under the EPBC Act for the removal of 42.27 hectares of Golden Sun Moth habitat from the Rosenthal Estate. A total of 86.0 hectares of Golden Sun Moth habitat is to be protected within the Warrambeen Group 2, Areas B1, B2 & E offset site as part of the offset requirements for the Rosenthal Estate.

An Offset Management Plan (OMP) for the Rosenthal offset Site has been identified and endorsed by all stakeholders (Ecology and Heritage Partners Pty Ltd 2015), including the City of Hume and the Department of Environment, Land, Water and Planning (DELWP), as a valid pathway to fulfil offset obligations. As per the OMP, only Area B1 is required to be protected and managed to satisfy the State offset requirements for removal of remnant vegetation within the Rosenthal Estate.

Vegetation and Golden Sun Moth population and habitat monitoring will be undertaken in accordance with Section 5.5 of the endorsed Offset Management Plan (OMP) (Ecology and Heritage Partner Pty Ltd 2015). The following report outlines the results of Year 2 monitoring results which will provide future targets over subsequent years for the ongoing monitoring and management within the Rosenthal offset site.

1.2 Scope and Objectives

The offset site will be managed for the purposes of conservation. Management of these sites will involve physical protection of the proposed offset site, the control of pest animals and a number of high threat environmental weeds, biomass reduction and general maintenance of the character and quality of the native vegetation, consistent with its historic context. The offset management plan and specified management actions will form part of a broader strategy for long-term management of Golden Sun Moth and its habitat as well as associated threatened species and ecological communities.

The objectives of the vegetation assessment and Golden Sun Moth monitoring were to:

- Determine the abundance and distribution of Golden Sun Moth throughout the offset site;
- Determine any potential impacts to Golden Sun Moth and their associated habitat in response to current management practices;
- Overall condition and composition of vegetation as well as consideration of measurable vegetation quality outcomes i.e. habitat hectare assessment;
- Biomass levels;



- The extent, severity, trend and presence of current weed species and any new and emerging weed species;
- Implementation of permanent photo points. Photographs must be taken at the same location and during the same time of each year by the landowner; and
- Provide advice on recommendations that may be undertaken to avoid and/or mitigate potential adverse impacts on significant ecological values.

1.3 Study Area

The Rosenthal offset site is located within the Woolly and Creek Paddocks within the Warrambeen Demonstration Landcare Farm, approximately 60 kilometres northwest of Geelong (Figure 1). The Rosenthal offset site includes areas known as Group 3 Areas B & E which cover a total of 86.0 hectares (Figure 2). The Warrambeen Demonstration Landcare Farm is privately owned and supports extensive areas of remnant native grassland.

The Warrambeen property has in recent history been used for wool production and substantial parts of the property have never been improved with fertilisers or cleared of embedded and scattered rock. Large tracts of remnant vegetation therefore persist throughout the property.

According to the Department of Environment, Water, Land and Planning (DEWLP) Biodiversity Interactive Map (DEWLP 2017), the study area occurs within the Victorian Volcanic Plain Bioregion. It is located within the jurisdiction of the Corangamite Catchment Management Authority (CMA) and the Golden Plains municipality (DEWLP 2017).



2 METHODS

2.1 Vegetation Assessment

2.1.1 Site Assessment

A field assessment was undertaken on 1 and 2 February 2017 to obtain information on flora values within the study area. The study area was walked, with all observed vascular flora species recorded, any significant records mapped, the overall condition of vegetation noted and the percentage cover of native plants, weeds, leaf litter, bare ground estimated. Where remnant vegetation was identified a habitat hectare assessment was undertaken following methodology described in the Vegetation Quality Assessment Manual (DSE 2004).

2.2 Targeted Golden Sun Moth Surveys

Targeted surveys for Golden Sun Moth were undertaken on 7 December 2016 in accordance with approved monitoring guidelines for Golden Sun Moth prepared by the Department of the Environment and Energy (DoEE) (DEWHA 2009). Surveys concentrated in areas identified as supporting indigenous grassland, namely those supporting Wallaby-grass *Rytidosperma* spp., which is a known food source for Golden Sun Moth (DEWHA 2009).

Areas of suitable habitat were walked or driven by a qualified zoologist over one day during the known flight season (i.e. late-October to early January). Surveys were undertaken at a time which is considered suitable for detecting the species (i.e. when adult males are likely to be flying). The male of this species generally flies between 11am and 3pm on calm, warm (over 20°C), sunny days.

2.3 Assessment Qualifications and Limitations

Vegetation Assessment

Ecological values identified on site are recorded using a hand-held GPS or tablet with an accuracy of +/-5 metres. This level of accuracy is considered adequate to provide an accurate assessment of the ecological values present within the study area; however this data should not be used for detailed surveying purposes.

The field assessment was undertaken during a sub-optimal season for the identification of flora species (late-summer); annual or cryptic flora species such as those that persist via underground tubers may have been absent at the time of assessment. Targeted flora surveys were not undertaken, as this was beyond the preliminary scope of the project. Nevertheless, the flora data collected during the field assessment and information obtained from relevant desktop sources is considered adequate to provide an accurate assessment of the ecological values present within the study area.

Golden Sun Moth

Targeted Golden Sun Moth surveys were undertaken by experienced personnel during the known flight period of the species and during appropriate conditions by following suitable survey guidelines. Fauna surveys were conducted under the Ecology and Heritage Partners Pty Ltd Research Permit (#10006893) issued by DELWP under the *Wildlife Act 1975*.



Given the species was confirmed on site as a result of previous targeted surveys, no additional 'reference' sites were visited to confirm the species flight activity prior to undertaking surveys.

However, given the species presence on site and the experience of surveyors, the results of this assessment are considered adequate for the purposes of confirming the species presence/absence on site and providing recommendations for managing the offset site over subsequent years.

The high number of Golden Sun Moth recorded during the surveys is considered to be associated with the species first emergence for the 2016/17 core flight season. Accordingly, subsequent surveys of the site were not considered warranted given the high population numbers for the species across the entire offset site.



3 RESULTS

3.1 Golden Sun Moth Monitoring

The following sections summarises the previous and current Golden Sun Moth monitoring results for the Rosenthal offset site.

3.1.1 Previous Population Monitoring

Table 1. Golden Sun Moth Population Monitoring within the Rosenthal offset site during previous monitoring periods.

Survey Year	Golden Sun Moth Abundances	Management Recommendations
2015/16 (Baseline Data – Year 1)	62 moths over three days (30 November, 4 and 17 December 2015)	The offset site was considered to provide favourable habitat for Golden Sun Moth at the time of the targeted surveys (Ecology and Heritage Partners Pty Ltd 2016).
2016/17 (Year 2)	238	The results of Golden Sun Moth surveys indicate that a high overall population density of the species remains within the Rosenthal offset site. Additional biomass control and weed management is recommended to increase the overall habitat quality of remnant vegetation and Golden Sun Moth in subsequent years of the OMP implementation.

3.1.2 Golden Sun Monitoring Results 2016/17

Targeted surveys identified a total of 238 Golden Sun Moth flying within the Rosenthal offset site on 7 December 2016 and during favourable conditions (Table 2; Figure 3). Golden Sun Moth was detected across the entire offset site and given the majority of the site contains suitable host plants, the species was recorded using most areas of the offset site during the assessment (Figure 3).

Table 2. Golden Sun Moth survey results during the 2015/16 flight season.

Date	Survey times	Reference Site	Temperature (°C) (9am and 3pm)			Cloud cover (%)	No. of days since rain	No. GSM
7/12/2016	08:30 – 14:15	Flying during survey	17.2	24.2	9	5%	2	238

While the species is likely to have had several additional emergences throughout the core 2016/17 flight period (as previously observed within the Warrambeen Landcare Farm), the high number of moths detected on 7 December indicates that the species was in high enough abundances to confirm the offset site is providing suitable habitat for the species. The high abundances also indicate the Golden Sun Moth population is currently being sustained to sufficient levels within the offset site under the current land management regimes.

3.2 Habitat Assessment

The study area comprised Plains Grassland in good condition. Four habitat zones (areas of differing quality) were recorded (Figure 2; Table 3).



The site condition scores for some areas were lower than that recorded during the baseline assessment (Table 3); however, this is likely to be at least partially a result of a wet winter/spring, resulting in increased growth of environmental weeds and annual pasture grasses.

The predominant weed species within the study area was Wild Oat *Avena fatua*, which will require active management to ensure the percentage cover of biomass meets the objectives of the OMP (Plates 1-6) (Section 4; Figure 2). Other dominant weeds include Quacking-grass *Briza maxima*, Squirrel-tail Fescue *Vulpia myuros*, Soft Brome *Bromus hordeaceus* subsp. *hordeaceus* and Cat's Ear *Hypochoeris radicata*.

High threat weeds recorded comprised, Toowoomba Canary-grass *Phalaris aquatica*, Briar Rose *Rosa rubiginosa*, Blackberry *Rubus fruticosus* spp. agg. and the noxious Saffron Thistle *Carthamus lanatus*. The most abundant of these weeds being Saffron Thistle, of which moderate to dense infestations were recorded, particularly along or adjacent to the ridges, adjacent to Warrambeen Creek (Figure 2). Saffron Thistle is considered to present the highest threat to ecological values within the study area, therefore management should prioritise the active control of this weed species as a priority.



Plate 1. Plains Grassland (PG1) within the study area (Ecology and Heritage Partners Pty Ltd 2 February 2017).

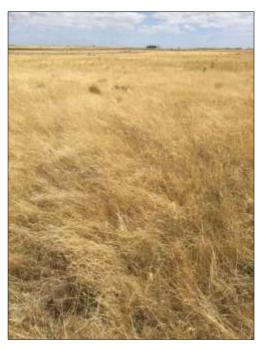


Plate 2. Plains Grassland (PG2) within the study area (Ecology and Heritage Partners Pty Ltd 2 February 2017).





Plate 3. Plains Grassland (PG3) within the study area (Ecology and Heritage Partners Pty Ltd 2 February 2017).



Plate 4. Plains Grassland (PG4) within the study area (Ecology and Heritage Partners Pty Ltd 2 February 2017).



Plate 5. Wild Oat along Warrambeen Creek (Ecology and Heritage Partners Pty Ltd 7 December 2016).



Plate 6. Wild Oat along Warrambeen Creek (Ecology and Heritage Partners Pty Ltd 7 December 2016).



4 MANAGEMENT TARGETS AND RECOMMENDATIONS

The following section discusses the performance measures outlined within the OMP (Ecology and Heritage Partners Pty Ltd 2015), and the recorded cover of biomass, bare ground and pest plant cover during the 2016/17 monitoring of the Rosenthal offset site. The following information aim to compare the overall targets of the vegetation quality noted within the OMP and baseline assessment with the current levels measured on site during the spring and summer of 2016/17 assessments.

4.1.1 Vegetation condition

Vegetation condition within the majority of the offset site was on target. However, areas mapped as PG2 (Figure 2) had a lower Site Condition Score than the baseline assessment, primarily due to high cover of annual grassy weeds and/or Saffron Thistle (Table 3). These areas require management of grassy and/or herbaceous weeds in order meet the required targets within the OMP (Ecology and Heritage Partners Pty Ltd 2015). Spot spraying and/or hand chipping of high threat weeds (Saffron Thistle) must be undertaken to control high threat weeds, in addition to biomass control using crash grazing during late summer and early autumn to reduce the cover of grassy weeds.

Table 3. Quantification of the current Site Condition Score and estimated improvement from the management of the Rosenthal offset site during the 2016/17 monitoring period.

EOI Code / land manager name		Rosenthal Estate						
Site code (number) / Habitat Zone ID (letter)			Group3 Area B1					
Land	tenure		Freehol	d				
Prop	erty Size		>=10 Ha	a				
Patcl	h Size		>=20Ha					
Zone	type		Offset (Stat Planr	ning)			
Prop	osal type		Remnar	nt patch				
Secu	rity arrangement		Registe	red on-tit	le agreer	nent or c	rown lan	d equivalent
Biore	egion		Victoria	ın Volcani	c Plain			
EVC	name		Plains G	irassland				
BCS			Endang	ered				
EVC	standardiser		1.36					
		Max Baseline condition		Year 1			Predicted condition following 10 years of management*	
			Baseli	PG1	PG2	PG3	PG4	Predic follov of mä
	Large Trees	10	n/a	n/a	n/a	n/a	n/a	n/a
	Tree Canopy Cover	5	n/a	n/a	n/a	n/a	n/a	n/a
SS	Understorey	25	15	15	15	15	15	15
Scores	Lack of Weeds	15	9	9	2	6	9	9
S	Recruitment	10	10	10	0	6	10	10
	Organic Litter	5	3	5	2	4	5	4
	Logs	5	n/a	n/a	n/a	n/a	n/a	n/a
	Total Site Condition Score	37	39	19	31	37	38	

Notes: Ha = Hectare, HHa = Habitat hectare; n/a = not applicable; * Based on improvement gain/ha, as specified in the Offset Management Plan (Ecology and Heritage Partners Pty Ltd 2015).



4.1.2 Biomass Control

Table 4. Biomass targets and current levels within the Rosenthal offset site during the 2016/17 monitoring period.

% Biomass Control Target*	Zone (see Figure 2)	Baseline (% Biomass)	Year 1 (% Biomass)	Management Recommendations
	PG1	70%	80%	Biomass levels are on target. Biomass
===/	PG2		75%	Control using crash grazing should continue
70%	PG3		70%	to be implemented during late January to maintain the overall biomass cover at 70%
	PG4		70%	across entire offset site.

Note: (*) = Control Targets set out in BY Ecology and Heritage Partners (Ecology and Heritage Partners Pty Ltd 2016).

4.1.3 Weed Cover

Table 5. Weed Cover and current levels within the Rosenthal offset site during the 2016/17 monitoring period.

% Weed Cover Target*	Offset Site Location (see Figure 2)	Baseline (% cover)	Year 1 (% cover)	Management Recommendations
	PG1		40%	Weed cover was measured to be higher than the required target and is
Low threat	PG2		60%	predominantly related to the presence of introduced annual pasture grasses such as
weeds: Control, and if possible reduce cover	PG3	25%	30%	Wild Oat. Strategic grazing and weed management should be actively undertaken to ensure
	PG4		20%	the required targets outlined in the OMP are met annually.
	PG1		10%	Medium threat weed cover was measured
Medium threat	PG2	10%	10%	to on target. Strategic grazing and weed management
weeds: <5%	PG3		10%	should be actively undertaken to maintain the required targets outlined in the OMP
	PG4		10%	are met annually.
	PG1		1-10%	High threat weed cover was measured to be higher than the required target in
High threat	PG2		1-15% (Figure 2)	some areas, primarily due to infestations of Saffron Thistle.
weeds: <1%	PG3	5%	<1%	Spot spraying and/or hand chipping of Spear Thistle and Saffron Thistle, and
	PG4		<1%	newly emerging high threat weeds must be actively undertaken to meet the required targets outlined in the OMP.

Note: (*) = Control Targets set out in the Golden Sun Moth OMP (Ecology and Heritage Partners Pty Ltd 2015).

4.1.4 Pest Plant and Animal Control

The details of any pest animal control will be provided by the landowner. Specific weed management actions (i.e. physical removal, spraying, slashing) will be undertaken by the landowner.



4.2 Management Actions Summary – 2016/2017

A summary of the required management actions and completion dates for 2016/17 of the OMP are provided below in Table 6.

Table 6. Management Action Table for the Rosenthal offset site for the 2016/17 monitoring period.

Actions	Management action	Resource	Timing of action	Key performance target	Completed (Yes/No)	Date
2.1	Conduct weed control	Landowner	At least three times per year, late winter, early spring and late spring	Reduce high threat weeds to <1% and medium threat weeds to <5%. Control, and if possible, reduce cover of low threat weeds.	Partially met. High and medium threat weeds require active management to meet <1% and <5% thresholds as per the OMP.	See Section 4 above. Control methods to be provided by lan Taylor (landholder)
2.2	Monitor populations of pest animals and conduct control works if required	Landowner / Pest Animal Contractor	After peak breeding season - late summer/early autumn	No increase in pest animal activity from approval of this plan; and, Minimal soil disturbance and no native vegetation loss from pest animal management activities.	l of this plan; and, soil disturbance and no native on loss from pest animal	
2.3	Conduct monitoring for vegetation and Golden Sun Moth and progress reporting	Suitably qualified ecological specialist	October to early January	Golden Sun Moth has persisted in grassland areas and to ensure that management actions and habitats are suitable for a viable Golden Sun Moth population in the future.	Yes	See Section 3.1 above.
2.4	Maintain fences	Landowner/ Fencing Contractor	As required	No gaps/holes in fences	Yes	Provided by Ian Taylor (landholder)
2.5	Monitor biomass density and implement stock grazing regime or develop ecological burn/ fuel reduction plan if appropriate	Landowner/ Bushland Management Contractor/CFA	During late Summer, Autumn and Winter (if dry)	Maintain at least 70% vegetation cover and adhere to seasonal spelling.	Yes – biomass levels are on target but crash grazing is still required at equal of higher levels to maintain the targets of the OMP	Provided by lan Taylor (landholder)
2.6	Monitor and assess works, and prepare progress report	Suitably qualified ecological specialist	Two years after commencement of OMP	The details of monitoring are covered by this report.	Yes	March 2017



4.3 Recommendations

Recommended measures to improve vegetation and associated Golden Sun Moth habitat within the Rosenthal offset site include:

- 1. Continue Biomass Control using crash grazing during late January, early autumn and winter (if dry) to maintain the overall biomass cover to 70% across entire offset site.
- 2. Weed cover was measured to be higher than the required target and is predominantly related to the presence of introduced annual pasture grasses such as Wild Oat and high and medium threat weeds (predominantly Saffron Thistle, Wild Sage and Horehound). Strategic grazing late January, early autumn and winter (if dry) will be implemented to reduce the spread of annual weeds on site.
- 3. Additional active weed control by the landowner or a suitable contractor will be required to reduce the cover of weed species below their respective thresholds for high (<1%) and medium (<5%) threat weeds. Spot spraying and/or hand chipping of Saffron Thistle, and newly emerging high threat weeds must be actively undertaken to meet the required target across the Rosenthal offset site.



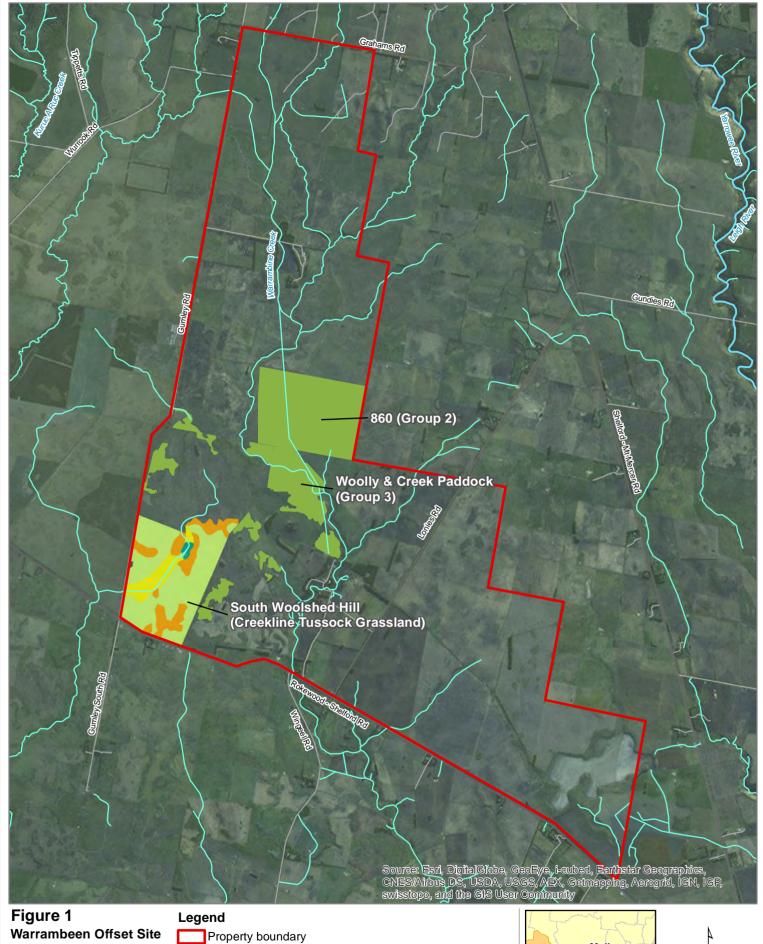
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FIGURES



Warrambeen Offset Site

ecology & heritage

Native vegetation

Heavier-soils Plains Grassland

Creekline Tussock Grassland

Plains Grassland

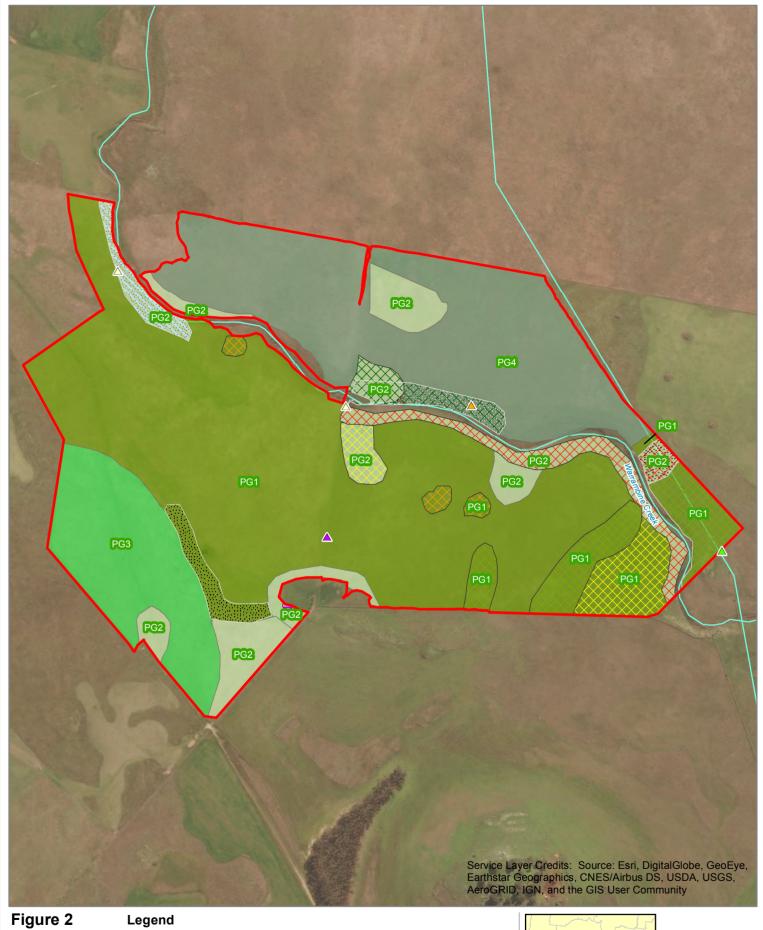
Plains Grassy Wetland

Stony Knoll Shrubland





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Vegetation **Assessment** Warrambeen Group 3 Areas B1, B2 and E

ecology & heritage partners

Rosenthal Estate Offset Area

Artichoke Thistle \triangle

Blackberry Horehound

Spiny Rush

Rock Coverage:

30% rock

40% rock

30% cover rock

Zones 1% Saffron Thistle 2% Saffron Thistle 5% Saffron Thistle 10% Saffron Thistle PG4 15% Saffron Thistle

15% Wild Sage

1% Horehound

Plains Grassland

PG1

PG2

PG3

Weed Coverage:

Melbourne Golden Plains (S) ★ Shelford



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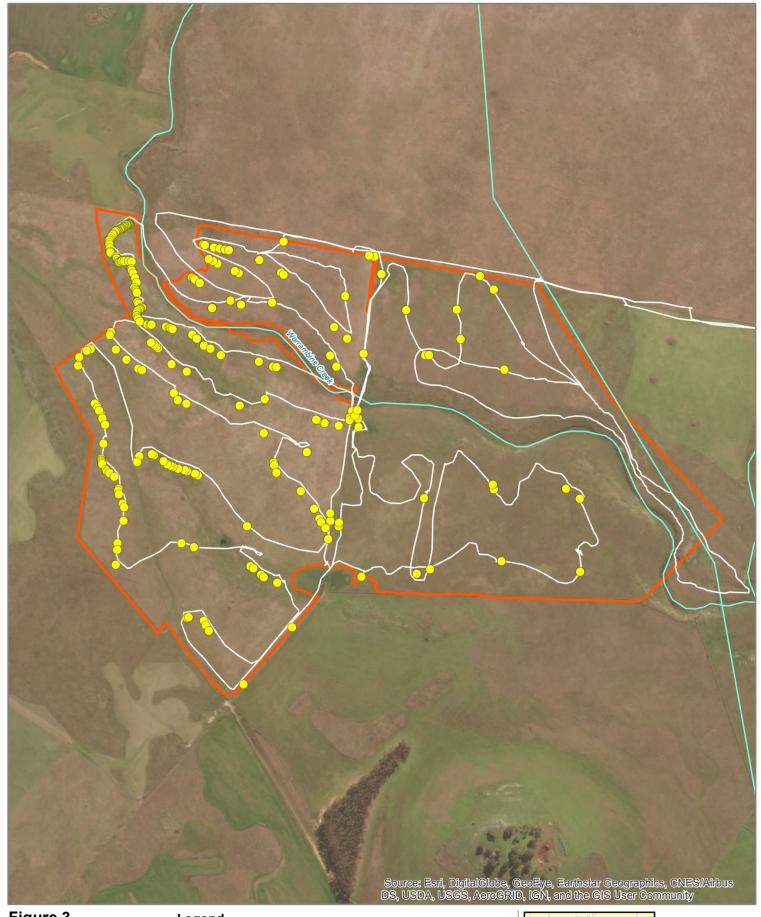


Figure 3
Golden Sun Moth
population and habitat
monitoring - survey
tracks
Warrambeen

Legend Rosenthal Estate Offset Area GSM Recorded during Monitoring





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