

Attachment L

Ecological Assessment Gap Analysis
for Canberra Brickworks

31 May 2017

David Carey
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Dear David

Re: Ecological Assessment Gap Analysis for the Canberra Brickworks (Blocks 1, 7 and 20, Section 102, Yarralumla)

Project no. 24105

Biosis Pty Ltd was commissioned by Doma Group to complete a gap analysis of past ecological assessments relating to the Canberra Brickworks Precinct (the subject site) (Blocks 1, 7 and 20, Section 102, Yarralumla) following the selection of Doma Group as the preferred tenderer for the Canberra Brickworks development.

The objective of this gap analysis is to provide Doma Group with an understanding of ecological assessment requirements necessary to support approval of the proposed development of the subject site under the *ACT Planning and Development Act 2007* (PD Act) and Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Background

The subject site covers an area of approximately 16 hectares in south-east Yarralumla and includes the former brickworks, a quarry and railway remnants with open grassland in the south. The subject site and adjoining areas previously included in the Canberra Brickworks and Environs (CB&E) site, have been the subject of several ecological assessments dating back to 2010. Most recently, the subject site was the subject of an ecological assessment completed by Umwelt (2015) with subsequent targeted surveys for Golden Sun Moth *Synemon plana*, completed by Umwelt (2016). A Stage 1 site investigation report for subject site has been produced by AECOM (2016) for the ACT Land Development Authority and summarises the planning framework and key site investigations completed for the subject site, including the Umwelt (2015 and 2016) ecological assessments.

Method

Database and literature review

Information provided by Doma Group as well as other key publically accessible information was reviewed in order to inform the gap analysis. Field-based assessment or verification of information contained in information sources outlined below was beyond the scope of this report. Information reviewed included:

- Previous ecological assessment reports pertaining to the subject site and adjacent areas previously included in the CB&E development area, including:

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- Canberra Brickworks and Environs Ecological Assessment (Umwelt 2014a).
- Addendum to the Canberra Brickworks and Environs Ecological Assessment (Umwelt 2014c).
- Stage 1 Site Investigation Report for Canberra Brickworks Precinct (AECOM 2016).
- Stage 1 Site Investigation Report for Canberra Brickworks Precinct - Appendix F – Golden Sun Moth Assessment at Revised Brickworks Project Area (Umwelt 2015).
- Draft ACT Native Grassland Conservation Strategy and Action Plans (ACT Government 2017).
- Publically accessible threatened species databases:
 - Commonwealth Department of the Environment and Energy (DEE) Protected Matters Search Tool for matters protected by the EPBC Act.
 - The ACT Government ACTMapi interactive mapping service.
 - The Atlas of Living Australia.
 - Canberra Nature Map.
 - NSW Office of Environment and Heritage (OEH) BioNet Atlas of NSW Wildlife, for items listed under the *Threatened Species Conservation Act 1995* (TSC Act).
- The future ecological assessment requirements for the proposed development of the subject site were assessed in relation to key biodiversity legislation and policy including:
 - EPBC Act
 - PD Act
 - Nature Conservation Act 2014 (NC Act)
 - EPBC Act Environmental Offsets Policy and Offsets Assessment Guide (Commonwealth of Australia 2012)
 - ACT Weed Strategy 2009 – 2019 (DECCEW 2009)
 - Draft ACT Native Grassland Conservation Strategy and Action Plans (ACT Government 2017)
 - Significant impact guidelines for the critically endangered golden sun moth (*Synemon plana*) (Commonwealth of Australia 2009).

Results

Literature review

The subject site and adjoining areas previously included in the Canberra Brickworks and Environs (CB&E) site, have been the subject of eight ecological studies dating back to 2010. These studies and their key findings are summarised in Table 1. Summaries of assessments undertaken by Rowell (2010, 2011 and 2012) have been obtained from Umwelt (2014), and were not available for review as part of the current report.

Table 1 Summary of previous ecological assessments

Ecological assessment	Summary	Key ecological values identified	Assessment considerations relevant to current gap analysis
Rowell (2010)	Preliminary assessment of the CB&E area for threatened species and communities listed under the EPBC and NC Acts. The scope of works were to map vegetation communities, habitat for Golden Sun Moth, survey for presence of Golden Sun Moth, and make recommendations for future surveys.	<p>Confirmed presence of Golden Sun Moth and patches of diverse Natural Temperate Grassland within the CB&E study area but outside current subject site.</p> <p>Confirmed presence of Golden Sun Moth in the North Curtin Horse Paddocks south of the subject site.</p> <p>Natural Temperate Grassland identified between Denman Street and Dudley Street beyond the subject site. Floristic Value Score (FVS) of Natural Temperate Grassland calculated as 27 indicating the grassland patches were high conservation value.</p>	<p>Study area included the subject site however no targeted surveys undertaken within the subject site.</p> <p>Ecological values identified beyond the subject site.</p> <p>Spatial extent of Natural Temperate Grassland and Golden Sun Moth shown in Figure 2.2, 3.2 and 4.3 of Umwelt (2014).</p> <p>Grassland survey results analysed using the previous method to calculate Floristic Value Score (Rehwinkel 2007). This method has since been superseded by Rehwinkel (2015).</p> <p>Grassland survey results assessed against the previously listed <i>Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory</i> endangered ecological community (Endangered Species Scientific Subcommittee 2000). This community has since been superseded by <i>Natural Temperate Grassland of the South Eastern Highlands</i> critically endangered ecological community (TSSC 2016).</p> <p>Insufficient information to determine whether survey effort meets current survey guidelines for Golden Sun Moth (i.e. DEWHA 2009).</p>
Rowell (2011)	<p>Investigation of the CB&E site, to determine extent of occupancy of Golden Sun Moth, its relative abundance, breeding sites and habitat quality.</p> <p>CB&E site also assessed for the extent of Natural Temperate Grassland Threatened Ecological Community, and its potential as habitat for other threatened species.</p>	<p>Confirmed presence of 1.5 hectares of Natural Temperate Grassland, and approx. 5 ha of Golden Sun Moth habitat in both native and exotic dominated vegetation. Both located beyond current subject site.</p> <p>Natural Temperate Grassland and Golden Sun Moth population considered likely to be viable in the medium term.</p> <p>Average Golden Sun Moth observations from 2011 surveys reported in Umwelt (2014) as approx. 10 moths per hour.</p>	<p>Ecological values identified beyond the subject site.</p> <p>Grassland survey results analysed using the previous method to calculate Floristic Value Score (Rehwinkel 2007). This method has since been superseded by Rehwinkel (2015).</p> <p>Grassland survey results assessed against the previously listed <i>Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory</i> endangered ecological community (Endangered Species Scientific Subcommittee 2000). This community has since been superseded by <i>Natural Temperate Grassland of the South Eastern Highlands</i> critically endangered ecological community (TSSC 2016).</p> <p>Insufficient information to determine whether survey effort meets current survey guidelines for Golden Sun Moth (i.e. DEWHA 2009).</p> <p>Spatial extent of Natural Temperate Grassland and Golden Sun Moth habitat shown in Figure 2.2, 3.2 and 4.3 of Umwelt (2014).</p>
Rowell (2012)	Assessment of three sites, including subject site to map vegetation community extent and quality, and survey / map habitat for threatened fauna including Golden Sun Moth, Perunga Grasshopper <i>Perunga ochracea</i> and threatened woodland birds.	<p>No threatened bird species records or habitat were identified.</p> <p>Potential habitat for Perunga Grasshopper was identified, however the species was not identified during targeted surveys.</p> <p>Floristic Value Score of Natural Temperate Grassland – 29 indicating the grassland patches assessed by Rowell (2010) continued to have high conservation value.</p>	<p>Study area included the subject site however no targeted surveys undertaken within the subject site.</p> <p>Ecological values identified beyond the subject site.</p> <p>Grassland survey results analysed using the previous method to calculate Floristic Value Score (Rehwinkel 2007). This method has since been superseded by Rehwinkel (2015).</p> <p>Grassland survey results assessed against the previously listed <i>Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory</i> endangered ecological community</p>

Ecological assessment	Summary	Key ecological values identified	Assessment considerations relevant to current gap analysis
	<p>Floristic value scores were calculated for areas of Natural Temperate Grassland previously assessed by Rowell (2010).</p>	<p>Golden Sun Moth were found in very low numbers (Average number of observations – 3 per hour); however, it was noted that it was a poor season for observations across Canberra and this may have also affected results of surveys for the Brickworks site.</p> <p>Two locally uncommon flora species were identified: Swainson’s Purple-pea <i>Swainsona sericea</i> and Native Storksbill <i>Pelargonium australe</i>.</p>	<p>(Endangered Species Scientific Subcommittee 2000). This community has since been superseded by <i>Natural Temperate Grassland of the South Eastern Highlands</i> critically endangered ecological community (TSSC 2016).</p> <p>Insufficient information to determine whether survey effort meets current survey guidelines for Golden Sun Moth (i.e. DEWHA 2009).</p> <p>Spatial extent of Natural Temperate Grassland and Golden Sun Moth shown in Figure 2.2, 3.2 and 4.3 of Umwelt (2014).</p>
Umwelt (2014a)	<p>Targeted surveys of Golden Sun Moth and Perunga Grasshopper using habitat polygons mapped by Rowell (2012) within the CB&E site.</p> <p>Survey to validate the extent of Natural Temperate Grassland within the CB&E site and calculate Botanical Significance Rating (BSR).</p> <p>Re-survey of floristic plots previously surveyed by Rowell (2012) to calculate Floristic Value Score (FVS) as per Rehwinkel (2007).</p>	<p>No Perunga Grasshopper recorded.</p> <p>Golden Sun Moths observed within previously mapped habitat. Average number of observations -approx. 12.5 per hour.</p> <p>No Natural Temperate Grassland mapped within current subject site.</p> <p>Natural Temperate Grassland located outside subject site between Dudley and Denman Streets. Floristic Value Score of Natural Temperate Grassland – 19. Both FVS and number of native species was identified as lower than in previous years (i.e. Rowell 2009, 2012).</p>	<p>Study area included the subject site however no targeted surveys undertaken within the subject site.</p> <p>Ecological values identified beyond the subject site.</p> <p>Golden Sun Moth survey timing, effort and method meets guidelines.</p> <p>No quantitative assessment of Golden Sun Moth habitat quality.</p> <p>Grassland survey results analysed using the previous method to calculate Floristic Value Score (Rehwinkel 2007). This method has since been superseded by Rehwinkel (2015).</p> <p>Grassland survey results assessed against the previously listed <i>Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory</i> endangered ecological community (Endangered Species Scientific Subcommittee 2000). This community has since been superseded by <i>Natural Temperate Grassland of the South Eastern Highlands</i> critically endangered ecological community (TSSC 2016).</p> <p>No targeted surveys for threatened flora or fauna species other than Perunga Grasshopper and Golden Sun Moth reported.</p>
Umwelt (2014b)	<p>Site reconnaissance survey to identify Natural Temperate Grassland and potential Golden Sun Moth and Perunga Grasshopper habitat in expanded CB&E footprint – entry and exit ramps to Yarra Glen via Cotter Road – outside current subject site.</p> <p>Golden Sun Moth targeted surveys as per EPBC Act guidelines.</p>	<p>Mix of very low and low quality habitat along the road reserve on western side of Cotter Road, and north and south side of Yarra Glen.</p> <p>Low numbers of Golden Sun Moth detected – average approx. 10 moths per hour. Low quality habitat supported the greatest number of moths.</p> <p>Very low quality habitat links Golden Sun Moth population within CB&E to the Curtin Horse Paddocks population.</p>	<p>Study area outside the subject site.</p> <p>Golden Sun Moth survey timing, effort and method meet guidelines. However, conditions sub-optimal for past two survey days.</p> <p>No quantitative assessment of Golden Sun Moth habitat quality.</p> <p>Unclear whether native grassland areas meet Natural Temperate Grassland NC Act and/or EPBC Act listing.</p> <p>Umwelt (2015) determined additional survey for GSM not required in areas targeted.</p>
Umwelt (2015)	<p>Targeted Golden Sun Moth surveys within subject site in line with EPBC Act guidelines in order to confirm presence.</p>	<p>Golden Sun Moth recorded in low abundance north of Denman Street in south east of subject site.</p> <p>A total of 0.5 hectares of ‘confirmed habitat’ and further 0.4 hectares of ‘potential habitat’ comprising exotic pasture dominated by Chilean Needle-grass and African Lovegrass <i>Eragrostis curvula</i>.</p> <p>Habitat considered low quality.</p>	<p>Golden Sun Moth survey timing, effort and method meet guidelines.</p> <p>No quantitative assessment of Golden Sun Moth habitat quality.</p> <p>Golden Sun Moth population within the subject site considered unlikely to contribute to overall ecological health of the species as extremely small, isolated and degraded habitat.</p>
AECOM (2016)	<p>Provides a summary of the planning framework and key site investigation for the subject site</p>	<p>Golden Sun Moth identified as the key ecological constraint.</p>	<p>Information contained within report is based on findings of previous studies outlined above.</p>

Ecological assessment	Summary	Key ecological values identified	Assessment considerations relevant to current gap analysis
	including a summary of ecological assessment completed by Umwelt (2015).	<p>Areas of landscape tree plantings occupy parts of the site and contain exotic tree species providing sheltering habitat for common wide-ranging species only. Planting do not provide habitat for threatened species.</p> <p>Exotic pasture in the south east around Denman Street is dominated by Chilean Needle-grass and provides habitat for Golden Sun Moth.</p> <p>Native vegetation within the subject site is less than 0.5 hectares.</p>	
Biosis (2017)	Targeted Golden Sun Moth surveys within current subject site (as per areas surveyed by Umwelt 2015) in line with EPBC Act guidelines, in order to confirm presence.	<p>Golden Sun Moth recorded north and south of Denman Street within habitat previously mapped by Umwelt (2015).</p> <p>Average Golden Sun Moth observations – 17 per hour.</p>	<p>Golden Sun Moth observations within the subject site substantially higher than Umwelt (2015).</p> <p>No quantitative assessment of Golden Sun Moth habitat quality undertaken.</p>

Database review

Background searches of publically accessible databases (refer Method section above) identified 11 threatened flora species and 25 threatened fauna species recorded or predicted to occur (DEE 2017) within 5 kilometres of the study area. Based on the desktop review of previous surveys conducted within the subject site it is considered unlikely that the subject site provides habitat for any threatened flora species, as native vegetation within the subject site is substantially degraded and isolated from patches of better quality native vegetation.

The Golden Sun Moth is known to inhabit the south eastern corner of the subject site. Potential habitat for an additional five threatened fauna species was also identified, including:

- Perunga Grasshopper
- Little Eagle *Hieraaetus morphnoides*
- Swift Parrot *Lathamus discolor*
- Superb Parrot *Polytelis swainsonii*
- Scarlet Robin *Petroica boodang*

Based on the degraded nature of available habitats within the subject site and the habitat preferences of the threatened bird species described above, the threatened bird species are considered to have a moderate likelihood of occurrence within the subject site, using the site as occasional foraging and dispersal habitat only. Grassland habitat within the subject site is degraded and dominated by exotic grasses, including Chilean Needle-grass. As such, the Perunga Grasshopper is considered to have a low likelihood of occurrence.

Vegetation communities

The subject site contains a range of predominately exotic vegetation types, including areas of landscape plantings and exotic pasture; all of which are considered highly modified and dominated by exotic species. No areas of native vegetation have been reported to occur within the subject site (AECOM 2016).

Noxious weeds

A comprehensive list of weed species occurring within the subject site was not available from the previous studies reviewed. However, AECOM (2016) reports Chilean Needle-grass as a dominant species within exotic pasture in the south east of the site. Chilean Needle Grass is also a weed of national significance (WONS) and a declared Class 3 pest plant in the ACT pursuant to the Pest Plants and Animals (Pest Plants) Declaration 2005 (No 1). Under the ACT declaration, Chilean Needle Grass must be managed and contained (DECEW 2009).

Conclusions

Parts of the subject site have been the subject of ecological assessments dating back to 2010 which, taken together, provide a relatively detailed assessment of the known and potential ecological values of the site. More recently, targeted surveys for threatened species considered likely to occur have been undertaken (Umwelt 2015; Biosis 2017) and have shown the subject site to support relatively small numbers of Golden Sun Moth, listed as endangered under the NC Act and as critically endangered under the EPBC Act.

Ecological values known or likely to occur within the subject site are relatively few and, based on previous studies include:

- Golden Sun Moth individuals and potential habitat.
- Foraging and dispersal habitat for four highly mobile threatened bird species (Little Eagle, Superb Parrot, Swift Parrot, Scarlet Robin).
- Foraging, dispersal and breeding habitat for common and widespread native fauna.
- Provision of landscape connectivity (e.g. between Lake Burley Griffin and areas of intact native vegetation to the south associated with Red Hill Nature Reserve).

While a number of studies have been completed, several of these have been undertaken across the broader CB&E and as such the locations and scope (i.e. effort) of ecological assessment undertaken specifically within the subject site is difficult to ascertain. The assessment of Natural Temperate Grassland patches located beyond the subject site have been undertaken in accordance with the now outdated methodology of Rehwinkel (2009) (recently superseded by Rehwinkel (2015)) and previous authors (Rowell 2010, 2011, 2012 and Umwelt 2014) have assessed native grassland against a now superseded listing of the Natural Temperate Grassland endangered ecological community.

Surveys completed for the Golden Sun Moth within the subject site and broader CB&E study area appear consistent with the current survey guidelines (DEWHA (2009)). However, previous studies have not attempted to quantify the quality of Golden Sun Moth habitat. An understanding of Golden Sun Moth habitat quality will be required to support ongoing impact assessment and design of appropriate mitigation measures and offsets.

Based on database and literature review detailed above, it is recommended that additional ecological assessment is undertaken in order to:

- Validate and ground-truth information contained within earlier ecological studies.
- Obtain quantitative data regarding the quality of Golden Sun Moth habitat across the subject site.
- Obtain quantitative data regarding structure and composition of grassland in order to confirm the absence of native vegetation and, specifically, Natural Temperate Grassland ecological community listed as endangered under the NC Act and as critically endangered under the EPBC Act.
- Confirm the absence of habitat for other threatened flora and fauna, particularly those with the potential to utilise degraded habitats within the locality.

Recommendations for future ecological assessment

The following actions are recommended in order to ensure a sufficient understanding of the ecological values and to support future assessment of ecological impacts of the proposed subject site development under provisions of the PD Act and EPBC Act. Actions have been identified as 'Priority' where the action is considered critical to inform ongoing environmental impact assessment and as 'Preferred' where the action

is not essential but considered likely to better inform the assessment and future development of mitigation and offsetting measures.

- Obtain outstanding relevant ecological information pertaining to the subject site:
 - The full report of Umwelt (2015a) and any supporting ecological information relied upon by Umwelt (2015) (i.e. Rowell 2010, 2011 & 2012) should be obtained and reviewed for adequacy in terms of any general and targeted surveys completed. **Priority.**
 - Request all spatial data relevant to the site including, where available, spatial extent and type of native and exotic plant communities, weed locations, native and exotic flora and fauna records (particularly Golden Sun Moth records). **Priority**
- Undertake additional ecological field investigation of the subject site, including:
 - A general field survey of the subject site to validate, and where necessary map, existing ecological information including:
 - Location and extent of exotic vegetation and confirmation that not more than 0.5 hectares of native vegetation (as defined in the PD Act) occurs within the subject site. **Priority**
 - Map extent of environmental weeds, noxious weeds and WONS across the subject site in order to inform future weed management during construction and operation of the subject site development. **Preferred**
 - Map type and extent of disturbance across the subject site in order to allow accurate characterisation of the environmental condition of the subject site during environmental impact assessment. **Preferred**
 - Vegetation survey of areas of exotic pasture / grassland within the subject site using the methodology of Rehwinkel (2015) in order to confirm the absence of Natural Temperate Grassland as listed under the NC Act and *Natural Temperate Grasslands of the South Eastern Highlands* critically endangered ecological community as listed under the EPBC Act. The vegetation survey will simultaneously enable quantitative assessment of Golden Sun Moth habitat within the subject site and will therefore inform future offset calculations under the EPBC Act Environmental Offsets Assessment Guide, should they be required. **Priority**
 - Targeted survey for Golden Sun Moth and Perunga Grasshopper within the subject site. Additional surveys will provide further information on species stocking rates (for use in future EPBC Act offset calculations, if required) and will allow the subject site records to be placed in the context of the local unimpacted population beyond the subject site. **Preferred.**

- Undertake additional ecological field investigations of potential road approaches to the subject site.

AECOM (2016) notes the possibility of access to the subject site via an upgrade at the intersection of Dudley Street / Cotter Street and current access to the subject site is via Denman Street.

Previous studies have identified Natural Temperate Grassland and Golden Sun Moth habitat south east of the subject site between Dudley and Denman Streets, south of Cotter Street and north and south of Yarra Glen. We recommend completing additional surveys for Natural Temperate Grassland and Golden Sun Moth in these areas in order to provide flexibility to future designs for access to the subject site. Additional surveys of these areas are not required if there is little likelihood of these areas being directly or indirectly impacted by the proposed development.

If undertaken, additional surveys should include:

- Vegetation survey of areas of exotic pasture / grassland using Rehwinkel (2015) to determine presence of NC Act and EPBC Act listed Natural Temperate Grassland.
- Targeted surveys of Golden Sun Moth and Perunga Grasshopper including quantitative assessment of grassland habitat quality for Golden Sun Moth.

Timing of additional ecological investigations

All actions identified as 'Priority' above can be completed in winter (additional report and spatial data review, weed species survey and mapping) and spring (vegetation survey). Therefore, a field survey undertaken in spring 2017 would be suitable to complete the majority of recommended actions.

Targeted surveys for Golden Sun Moth would be undertaken in November and December subject to seasonal conditions in accordance with relevant guidelines.

I trust that this advice is of assistance to you however please contact me if you would like to discuss any elements of this ecological advice further.

Yours sincerely



Samuel Luccitti

Senior Botanist

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- Umwelt 2014a. Canberra Brickworks and Environs Ecological Assessment. Unpublished report to the Land Development Agency, December 2014.

Umwelt 2014b. Addendum to the Canberra Brickworks and Environs Ecological Assessment. Unpublished letter advice to the Land Development Agency, December 2014.

Umwelt 2015. Ecological Assessment at Revised Brickworks Project Area and Golden Sun Moth Assessment at Revised Brickworks Project Area. Unpublished letter advice to the Land Development Agency, 2015.

Umwelt 2015b. Golden Sun Moth assessment of the revised Brickworks Project Area. Unpublished letter advice to the Land Development Agency, December 2015.

31 May 2017

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Dear David

Targeted Survey for the Golden Sun Moth at the Yarralumla Brickworks (Blocks 1, 7 and 20, Section 102, Yarralumla).

Project no. 23847

Biosis Pty Ltd was commissioned by Doma Group to undertake targeted surveys for the Golden Sun Moth *Synemon plana* at the Canberra Brickworks Precinct at Blocks 1, 7 and 20 Section 102 Yarralumla, ACT (herein referred to the subject site). The subject site is located in south-west Yarralumla and is bounded by residential development to the north and east, open landscape to the south and a landscape buffer to the Royal Canberra Golf Club to the west. The subject site includes the western end of Denman Street and is bordered by Bentham Street in the north.

The Golden Sun Moth is listed as endangered under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Habitat for the Golden Sun Moth was identified within the Canberra Brickworks and Environs (CB&E) area by Rowell (2010) and subsequently identified within the subject site following targeted surveys by Umwelt (2015).

Umwelt (2015) recorded a total of eight Golden Sun Moth within a patch of exotic pasture in the south east of the subject site. The exotic pasture was dominated by Chilean Needle-grass *Nassella trichotoma* (a weed of national significance (WONS) and a declared Class 3 pest plant in the ACT, pursuant to the *Pest Plants and Animals (Pest Plants) Declaration 2005 (No 1)*). Umwelt (2015) described the available Golden Sun Moth habitat within the subject site as low quality. Approximately 0.5 hectares of exotic pasture immediately north of Denman Street was mapped by Umwelt (2015) as 'confirmed habitat' with a further 0.4 hectares north of 'confirmed habitat' and south of Denman Street mapped as 'potential habitat'.

Based on the findings of the 2015 targeted survey, Umwelt (0215) concluded that Golden Sun Moth habitat within the subject site represents an extremely small, isolated and degraded patch; however the habitat on site is connected to better quality habitat to the south east between Denman Street and Dudley Street.

The objective of this letter report is to describe the findings of Golden Sun Moth targeted surveys completed during the 2016 flying season within areas mapped as 'confirmed habitat' and 'potential habitat' by Umwelt (2015). The results of targeted survey will inform an environment impact assessment for the proposed future development of the subject site.

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Method

Targeted surveys for Golden Sun Moth were undertaken in accordance with the survey guidelines provided in the *Background Paper to EPBC Act Policy Statement 3.12 - Significant Impact Guidelines for the Critically Endangered Golden Sun Moth (Synemon plana)* (DEWHA 2009). Surveys were undertaken in open areas of exotic pasture dominated by Chilean Needle-grass, which had previously been mapped as either 'confirmed habitat' or 'potential habitat' for the Golden Sun Moth (Umwelt, 2015). These areas focused on two areas immediately north and south of Denham Street as well as smaller isolated areas in the south and north of the subject site (Figure 1).

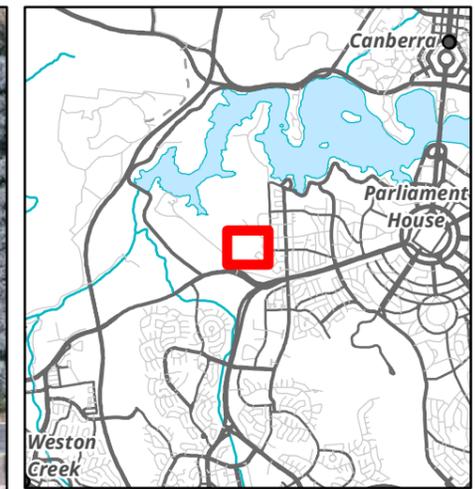
Targeted surveys were undertaken between 27 November 2016 and 21 December 2016. All surveys were conducted during the hottest period of the day, on days when moths were known to be flying at other locations in the ACT. This was determined through survey of a nearby reference site located at Campbell Park, and through communication with other ecologists surveying for the species in the ACT region. Survey replicates were spaced with a minimum of four days between replicates and surveys were not conducted within two days of rainfall.

Targeted surveys for Golden Sun Moth should involve fixed point counts or transects, as most suitable to the size and topography of the potential habitat (DEWHA 2009). Parallel transects were selected as the primary survey method for the subject site, with meandering transects used in some areas. Parallel transects, spaced 5 - 10 metres apart were walked across all open grassland areas within the subject site. The surveying ecologist continuously scanned for flying males while walking each transect; recording GPS location of all Golden Sun Moth detected. Attempts to locate females were made in areas where males were observed circling or landing in the grass. It is likely that the same flying males were recorded more than once on adjacent transects. Therefore, all records of Golden Sun Moth are reported as flight detections rather than absolute abundance.

Survey conditions and number of Golden Sun Moth flights detected are detailed in Table 1.

Table 1 Golden Sun Moth survey conditions and results

	Survey 1	Survey 2	Survey 3	Survey 4
Date	27/11/2016	2/12/2016	13/12/2016	21/12/2016
Time Period	2:15pm-3:00pm	12:24pm – 1:15pm	11:30am – 12:45pm	2:00pm – 3:00pm
No. Flights	0	21	18	9
Temperature	34	32	32	29
Humidity	32	22	22	26
Cloud Cover	Clear	Clear	Clear	Clear
Wind Speed	8 – 10 km/hr	3.5 -18 km/hr	7 -18 km/hr	3.5 – 14.5 km/hr
Ground Conditions	Dry	Dry	Dry	Dry



Legend

- Study area
 - Golden Sun Moth habitat
- Golden Sun Moth records**
- ▲ Rep 2 - 02/12/2016
 - Rep 3 - 13/12/2016
 - Rep 4 - 21/12/2016

Figure 1: Golden Sun Moth records and habitat



Metres
 Scale: 1:2,000 @ A3
 Coordinate System: GDA 1994 MGA Zone 56



Ballarat, Brisbane, Canberra, Melbourne,
 Newcastle, Sydney, Wangaratta & Wollongong

Matter: 23847
 Date: 31 January 2017,
 Checked by: CD, Drawn by: LH, Last edited by: Iharley
 Location: P:\23800s\23847\Mapping\23847 F2 GSM

Results

Golden Sun Moth was recorded a total of 48 times during targeted surveys. The first replicate of survey failed to detect the species flying within the subject site despite the species being recorded elsewhere in the ACT prior to survey. However, three of the four replicates confirmed the species flying within the subject site (Table 2)

Table 2 Golden Sun Moth targeted survey results

	Survey 1	Survey 2	Survey 3	Survey 4
Date	27/11/2016	2/12/2016	13/12/2016	21/12/2016
No. Flights	0	21	18	9

The locations of Golden Sun Moths detected within the subject site are shown in Figure 1. Golden Sun Moth were detected in three discrete areas within the subject site. The majority of these (80%) were recorded in an area of exotic pasture dominated by Chilean Needle-grass, north of Denham Street, within the area identified by Umwelt (2015) as 'confirmed habitat'. The grassy groundcover in this area appeared to be maintained through slashing while exotic pasture further to the north appeared to be less frequently maintained and consequently displayed a more closed grassland structure.

Golden Sun Moths were also recorded within exotic pasture to the south of Denham Street within an area mapped as 'potential habitat' by Umwelt (2015). A total of seven records were recorded in habitat immediately south of Denman Street (Figure 1). The groundcover in this area was not slashed during the survey period but was subsequently mown in a similar manner to the adjacent habitat in subsequent prior to the second round of survey.

Finally, Golden Sun Moth were recorded from a small, somewhat isolated patch of exotic pasture which lay approximately equidistant between Denman Street and Dunrossil Drive. Three Golden Sun Moth were observed from this area which was not previously identified as 'potential habitat' by Umwelt (2015). These three records were returned from areas of tall closed grassland below an open pine tree canopy. This area did not appear to be maintained with any slashing or other type of biomass control. Furthermore, significant patches of blackberry were observed and appeared to be encroaching on the available exotic grassland.

Conclusions

The recent targeted survey reported here confirms the continued presence of Golden Sun Moth within exotic pasture habitat of the subject site and extends the area of known habitat previously described by Umwelt (2015). The following conclusions have been drawn from this assessment:

- Golden Sun Moth records were more widely distributed north of Denman Street than reported in Umwelt (2015).
- Records of Golden Sun Moth in a small isolated patch to the south of Denman Street (not recorded by Umwelt 2015) suggest the subject site population is likely connected with the population of Golden Sun Moth described by Umwelt (2014) between Denman and Dudley Streets south east of the subject site.

- Substantially more Golden Sun Moth observations were recorded in 2016 relative to Umwelt (2015). Umwelt (2015) recorded only eight male moths over four days in 2015, while an average of approximately 12 moths per hour were observed over four days in 2016.
- To date, surveys have failed to record the presence of any female Golden Sun Moth within the subject site (though it is unclear to what extent, if any, searching for female moths was undertaken by Umwelt (2015)) and as such, breeding of Golden Sun Moth within the subject site is yet to be confirmed.
- Given the life history traits of the Golden Sun Moth and the cryptic nature of females of this species, a lack of female records to date may not reflect a true absence. Chilean Needle-grass dominated exotic pasture, particularly the regularly slashed areas immediately north of Denman Street may provide suitable breeding habitat.
- The absence of native grassland within the subject site indicates Golden Sun Moth, if breeding, is likely wholly dependent on Chilean Needle-grass. Records of moths were noticeably fewer in areas of exotic pasture not subject to regular slashing. Regular road-side slashing of Chilean Needle-grass dominated exotic pasture is likely promoting the spread of this weed and maintaining grass biomass at levels suitable for the Golden Sun Moth.
- Counts of flying adult male moths are not a precise or reliable indicator of Golden Sun Moth population size at a locality and can vary greatly depending on prevailing daily and seasonal weather conditions (ACT Government 2017) and surveys over multiple years may be required to gain an understanding of population trends.
- Given the disparity between the extent and density of Golden Sun Moth records reported by Umwelt (2015) and those reported here, it is recommended that the completion of a third targeted survey is undertaken in 2017. Targeted survey should encompass areas of Golden Sun Moth habitat beyond the subject site between Denman and Dudley Streets in order to gain a better understanding of Golden Sun Moth extent in the locality. This information will provide important context to future environmental impact assessment associated with the proposed subject site development.

I trust that this advice is of assistance to you however please contact me if you would like to discuss any elements of this ecological advice further.

Samuel Luccitti



Senior Botanist

References

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Rowell, A. 2010. Preliminary Assessment of Ecological Values of Land in Yarralumla, Curtin and Deakin, ACT, Prepared for the National Capital Authority, Canberra.

Umwelt 2015. Golden Sun Moth assessment of the revised Brickworks Project Area. Unpublished letter advice to the Land Development Agency, December 2015.