G.1 FLORA GENERAL


Tablelands Dry Shrub/Tussock Grass Forest in the north of the study area


Tablelands Acacia/Grass/Herb Dry Forest within gullies in the north of the study area


Tableland Dry Grassy Woodland in the south of the study area


Dense Birch Pomaderris growth within drainage lines in the north of the study area


Left: Button Wrinklewort in bud in Queanbeyan NR. Right: *Diuris sulphurea* in flower during the surveys


Silky Swainson-pea in flower within Royalla Nature Reserve


Hoary Sunray populations within the study area


Hoary Sunray populations within the locality (Left: Severne Street, Queanbeyan. Right: Queanbeyan NR)

G.2 VEGETATION QUADRATS

DS1 – southern end of study area

DS2 – shrubby woodland northern end of study area

DS3 - in drainage line among drier FE114 shrubby woodland

DS4 - on hill crest north of Queanbeyan River

DS5 – within gully head southern end of study area

DS6 – southern end of study area

LC1 - within Queanbeyan Nature Reserve

LC2 - at Queanbeyan Lawn Cemetery disturbed with maintained u/storey

LC3 - just inside gate in SE section of Cuumbuen Nature Reserve

LC4 – woodland in drainage line within Cuumbuen Nature Reserve SW corner.

LC5 - within Cuumbuen Nature Reserve north side of Captains Flat Road

LC6 – within drainage line in Cuumbuen Nature Reserve adjacent to corner of Kings Hwy and Captains Flat Road

LC7 - within Cuumbuen Nature Reserve north side of Captains Flat Road

LC8 - in drainage line within Stoney Creek Nature Reserve

LC9 - on low hill crest within Stoney Creek Nature Reserve

LC10 - on mid slope of Googong Dam foreshore

G.3 FAUNA GENERAL

Dry shrub forest

Dry grass forest

Woodland north of the river

Box-Gum Woodland south of the river

Ecotone between shrubland and dry forest

Northern extent of shrubland along Queanbeyan River

Southern patch of grassland

Northern patch of grassland along easement between suburban development across Barrack Drive from Queanbeyan River

Example of reedy habitat on the southern bank of the river, with thick shrubs visible on the north bank

Example of tracks leading up along trunk toward a hollow

Hollow relatively low to the ground (within two metres)

APPENDIX H OFFSET STRATEGY

H.1 REQUIREMENT TO OFFSET

Section 6.1.2 of the DGR's issued for the SIS states that:

> "*If significant modification of the proposal to minimise impacts on subject species, populations or ecological communities is not possible, then compensatory strategies shall be considered. These may include other off-site or local area proposals that contribute to long term conservation of the subject species, populations or ecological communities. These areas should be assessed in accordance with the Principles for the use of biodiversity offsets in NSW…"*

The proposal has minimised impacts to subject species and communities however, residual impacts are still considered likely for five subject species and communities that have been assessed as being likely to be affected by the proposal. Of the 26 ha within the subject site, approximately 19 ha of native vegetation and habitat will be impacted with the remainder consisting of highly disturbed, exotic or planted vegetation. This includes the permanent removal of 4 ha of Box-Gum Woodland EEC, approximately 13 ha of habitat for Rosenberg's Goanna, approximately 11 ha (only 8.1 ha of breeding habitat) for the Speckled Warbler, approximately 11 ha (only 7.5 ha of breeding habitat) for the Gang-gang Cockatoo and approximately 8 ha for the Eastern False Pipistrelle. A total of 41 hollow-bearing trees will be removed as part of the proposal. However, not all hollow-bearing trees were considered appropriate for use by individual subject species and no evidence of breeding was recorded. Thirteen termite mounds will be removed in habitat appropriate for the Rosenberg's Goanna. Table H-1 details the habitat features that will be impacted specific to the above threatened fauna.

The purpose of this appendix is to outline options in relation to the offset strategy required for the proposal, specifically addressing:

- How offsets will be identified
- How offsets will be managed
- How offsets will be secured
- How OEH's *Principles for the use of Biodiversity Offsets in NSW* will be addressed

Impacts to MNES listed under the EPBC Act are subject to the requirements of the EPBC Act environmental offsets policy. The policy states that "*offsets are not required where the impacts of a proposed action are not thought to be significant…"*. Assessments of significance for MNES to be impacted by the proposal (Box-Gum Woodland CEEC and Hoary Sunray, Appendix **I.2**) concluded that a significant impact to these entities is unlikely. As such, offsets are not required under the EPBC Act environmental offsets policy, however offsets are still required under NSW state policy.

H.2 IDENTIFYING OFFSETS

The key components in identifying offsets are:

a) Calculating the areas to be impacted
b) Determining an appropriate ratio of impacted : offset land, to achieve the offset objectives
c) Selecting the offset site (if required) to satisfy this ratio

H.2.1 Calculating the areas to be impacted (area required to be offset)

The assessments included in the SIS conclude that the proposal will affect one subject endangered ecological community and four subject threatened species to the extent that offsets are considered to be required (refer Section 5.2 of the SIS). As stated in the DGRs, compensatory strategies are only required for

subject species populations and communities where impacts have not been avoided or minimised (affected species). As such, more common vegetation types are only included where they provide habitat for an affected species. Table H-1 summarises the areas required to be offset for the proposed 4.6km Ellerton Drive extension. It should be noted that many of the other subject species share common habitat types and offsets would be suitable for these species also.

Table H-1 Area required to be offset for subject species and communities

Subject species or community	Vegetation type	Area of habitat to be impacted (ha of native vegetation)	Habitat features to be impacted
Box-Gum Woodland	Tableland Dry Grassy Woodland	4	N/A
Rosenberg's Goanna	Tablelands Dry Shrub/Tussock Grass Forest	13	13 termite mounds
Gang-gang Cockatoo	Tablelands Dry Shrub/Tussock Grass Forest and Tableland Dry Grassy Woodland	11	12 hollow-bearing trees
Speckled Warbler	Tableland Dry Grassy Woodland and Tablelands Dry Shrub/Tussock Grass Forest	11	N/A
Eastern False Pipistrelle	Tablelands Dry Shrub/Tussock Grass Forest	8	31 hollow-bearing trees

H.2.2 Determining a suitable offset method

Three methods are being considered for determining an appropriate ratio of impacted : offset land, to achieve the offset objectives:

1. Proposing a predetermined set ratio of habitat area impacted to that to be offset for subject species and communities affected by the proposal. An offset site would then be selected meeting these requirements.
2. Employing the OEH endorsed BioBanking assessment methodology (BBAM) to calculate the credits required by the development with regard to subject species and communities affected by the proposal and retire these credits through the BioBanking scheme.
3. Using the BBAM to determine the suitability of a proposed offset site by comparing the credits required at the development site to those generated at a proposed offset.

Proposing a predetermined ratio

A ratio of 1:6 habitat impacted : offset is proposed for the affected Box-Gum Woodland community. This ratio is based on previous BioBanking assessments conducted by **ngh**environmental which included this community:

- Old Cooma Road Offset Plan (**ngh**environmental 2010, BioBanking Credit Calculator (BCC) v1), offset ratio of 1:3.8 required to offset Box Gum Woodland in moderate to good condition.
- Capital Solar Farm Offset Plan (**ngh**environmental 2013 in prep, BCC v2), average offset ratio of 1:6 required to offset Box Gum Woodland in moderate to good condition.
- Chaffey Dam Offset Plan (**ngh**environmental 2013, BCC v2), offset ration of 1:4.5 required to Offset Box-Gum Woodland and derived grassland in moderate to good condition.

Clearly, the ratio calculated by the BioBanking methodology is site specific and dependent on a number of factors including the qualities of the habitats at the development and offset sites. As the Box-Gum

Woodland to be impacted at the development site is high quality, the upper ratio of 1:6 is considered appropriate. Considering that 4ha will be impacted by the development, any proposed offsets under this methodology would contain a minimum of 24ha of this community.

A ratio of 1:10 is proposed for threatened species habitat to be impacted. Based on the previous Chaffey Dam assessment above, a ratio of 1:4 was determined for a threatened species with a Tg value (a measure used in BioBanking to indicate the species ability to respond to management actions) of 0.75[9]. Within the BioBanking assessment methodology (BBAM), Rosenberg's Goanna is the only affected species proposed to be offset that would require species credits under the BBAM and has a Tg value assigned. The Tg value for this species is 0.3 indicating that the species would respond less to management actions and therefore a larger offset is required. Within the BBAM, the threatened species credits required to be offset are directly proportional to the Tg value. Considering the Tg value of Rosenberg's Goanna (0.3), an offset ratio of 1:10 is suggested to be reasonable when compared to the 1:4 ratio required for a species with a 0.75 Tg value (ratio 2.5 x greater).

Rosenberg's Goanna has the largest amount of Tablelands Dry Shrub/Tussock Grass Forest habitat at the subject site to be impacted. Offsetting this amount of habitat would adequately compensate for the other species to be affected which rely on the same habitat types. Considering that 12.6ha of habitat will be impacted, any proposed offsets under this methodology would contain a minimum of 126ha of Tablelands Dry Shrub/Tussock Grass Forest habitat suitable for all affected species.

Using this methodology to arrive at a pre-determined offset ratio to offset the construction impacts of the Ellerton Drive extension would result in an offset requirement of 150ha (24ha of Tableland Dry Grassy Woodland and 126ha of Tablelands Dry Shrub/Tussock Grass Forest), providing a total offset ratio of approximately 1:8. This would be used to offset the 19ha of native vegetation to be impacted within the subject site. Surveys would be required at any proposed offset site to determine the extent of the vegetation communities present and the suitability of habitats for affected species and communities to confirm the suitability of the offset.

Employing the BioBanking methodology

The above method makes many assumptions that could be disputed to arrive at an offset ratio. Employing the BioBanking methodology would make this process transparent and in accordance with the only currently endorsed OEH tool to ensure a 'maintain or improve' outcome for TSC Act listed entities is realised.

Standardised surveys in accordance with the BBAM would be required at the subject site. A BioBanking assessment would be undertaken by an accredited BioBanking Assessor, using the OEH online calculator, arriving at a credit value for the subject site. Following this, a BioBanking Statement would be issued for the development. QCC would then look to purchase a sufficient amount of credits to retire those generated at the development site, according to the methodology. Once the credits have been retired, the Council would not be required to participate in any way in the management or funding or auditing of the offset site. This becomes the responsibility of the land owner and OEH.

Alternatively, QCC may choose to conduct a BioBanking assessment of a proposed offset site to determine if the biodiversity values of the offset site generate credits that are comparable to those required by the

[9] The Tg values for individual species are contained within the BioBanking Threatened Species Profile Database

development. In this case, the BBAM would solely be used as a method to determine the suitability of a proposed offset. An official BioBanking agreement would not be entered into.

H.3 THE PROPOSED OFFSET SITE PATHWAY

While retiring credits under a BioBanking agreement absolves the Council from further responsibilities regarding selecting a specific offset site and managing and securing it, the use of a pre-determined ratio or the BBAM to identify an offset site requires Council to manage these activities. If this pathway is preferred, a detailed offset plan would be required, justifying the selection of the site and detailing proposed management measures and methods of securing the site. Some guidance on these activities is outlined below.

H.3.1 Selecting the offset site

When selecting the offset site (or sites), QCC will ensure the selected offset site is:

- Not already a type of biodiversity conservation reserve or an existing offset
- Of sufficient size to achieve the proposed ratios or meet the credit requirements according to the BBAM
- Of appropriate type to achieve a 'like for like' or 'like for better' offset
- Complying with the *Principles for the use of biodiversity offsets in NSW*

Any areas of ambiguity will be clearly stated within the offset plan for the proposal so that a decision can be made about the overall suitability of the site. For example, it may be that exact ratios and types are not achieved but the overall package is still considered to achieve an overall neutral or beneficial outcome. If so, this will be identified and justified within the offset plan.

In selecting the offset site, a principle aim will be to offset vegetation containing trees of similar or greater maturity to ensure that habitat for hollow dependant fauna is also adequately offset. Connectivity to surrounding areas of similar vegetation will also be a priority.

H.3.2 Management of the offset site

QCC would be responsible for the management of the offset site, during the operational life of the road, although management actions may be subcontracted to another party. QCC may:

1. Retain or obtain ownership of the offset site or,
2. Finance the landowner of the site to undertake management actions but would retain responsibility for the management of the site.

As it is assumed that the requirement to offset would be a condition of consent for the development, QCC must remain responsible for these actions.

Specific management requirements for the offset site will be developed as part of an offset plan once a site is determined however, the following actions are examples of what may be required, considering the type of land that would be targeted:

- Fencing and signage to ensure the site is protected from inadvertent impacts of adjacent land use.

- A highly controlled light grazing regime (using biomass indicators to ensure adequate ground cover is maintained in all seasons) may be appropriate, if it can enhance native species diversity.
- Controlled burning may be appropriate as a strategy to enhance native seed germination.
- Weed control and monitoring.
- Feral animal control and monitoring.
- Replanting native trees (species to be determined by an ecologist) to enhance landscape connectivity in specific areas.

Land use restrictions (enforced through an 88B covenant or zoning, for example) would be established for the offset site so that any activities undertaken on the offset site remain compatible with the site's overall function: to improve biodiversity values.

As an ongoing part of the management of the site, the success of the management actions would be audited and reported as part of an annual environmental report for the offset site.

H.3.3 In-perpetuity security of the offset site

An appropriate vehicle is required that:

- Secures the site in perpetuity
- Allows for the ongoing management of the site (including how the designated management actions will be funded)

The following six (6) options are considered by the Office of Environment and Heritage (OEH) as being suitable and acceptable for securing an offset site in perpetuity. The OEH *Guidance on Appropriate Mechanisms for Securing Biodiversity Offsets* document has been utilised in the preparation of this information. Note that option 6 (a CPVP) is only considered acceptable where the first 5 are not able to be negotiated:

1. BioBanking agreement, a system set up by OEH and offering the most security in terms of ongoing management outcomes (discussed above under A.2.2)
2. Dedication to the public reserve system
3. Conservation Agreement
4. Trust Agreement
5. Planning Agreement
6. Conservation Property Vegetation Plan (PVP)

Queanbeyan City Council is required to secure the offset site in perpetuity utilising one of the above management vehicles.

H.4 PRINCIPLES FOR THE USE OF BIODIVERSITY OFFSETS IN NSW

OEH has provided 13 principles that can be used as a frame work for considering environmental impacts and developing offset proposals. How well the current proposed development meets each of these principles is outlined below, providing further guidance on the requirements of the final offset package in several areas.

1. Impacts must be avoided first by using prevention and mitigation measures.

Offsets are then used to address remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.

The proposal has avoided impacts by minimising the footprint of the development to the smallest extent possible whilst still achieving the objectives of the proposal. A number of recommendations have been made in this SIS to further minimise or mitigate impacts from the proposal. Measures have been recommended within this SIS to prevent offsite impacts.

2. All regulatory requirements must be met.

Offsets cannot be used to satisfy approvals or assessments under other legislation, e.g. assessment requirements for Aboriginal heritage sites, pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

This Offset Strategy aims to satisfy the DGR's for the SIS. Approvals or assessments under other legislation are not relevant to this proposal.

3. Offsets must never reward ongoing poor performance.

Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

This can be addressed in two ways:

The offset site can be set up in perpetuity – this removes the incentive to degrade the offset site to facilitate development at a later date

The management measures can have clear targets and be set out to push most management to the beginning of the agreement, where successful accomplishment of targets would be rewarded by less intensive management in ongoing years. This suits measures such as weed control which are more easily achieved with intensive efforts than with small ongoing efforts.

This strategy provides direction in addressing both aspects, as discussed in Sections H.3.2 (Management) and H.3.3 (In-perpetuity security) of this strategy.

4. Offsets will complement other government programs.

A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks and incentives for private landholders.

The offset site has not yet been selected. As discussed in Section H.3.1, it has been established that it cannot be a site already used as a type of biodiversity conservation reserve. The establishment of an offset site on private land would contribute to the NSW Government's conservation objectives and would complement existing conservation areas. Dedication to the reserve system is a management vehicle considered in Section H.3.3 of this strategy.

5. Offsets must be underpinned by sound ecological principles.

They must:

include the consideration of structure, function and compositional elements of biodiversity, including threatened species

- *enhance biodiversity at a range of scales*
- *consider the conservation status of ecological communities*

- *ensure the long-term viability and functionality of biodiversity.*

Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.

These are features that need to be considered in the selection of the offset site as well as the management actions for the site. As set out in Section H.2 of this strategy, the selection of the offset site will consider the ability to enhance landscape connectivity. As set out in Section H.3.2, it will be managed, subject to a management plan prepared for the offset site specifically. The success of management actions will be monitored and adapted as required to achieve their set objectives.

6. Offsets should aim to result in a net improvement in biodiversity over time.

Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site.

Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset against the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.

Offsets may include enhancing habitat, reconstructing habitat in strategic areas to link areas of conservation value, or increasing buffer zones around areas of conservation value and removal of threats by conservation agreements or reservation.

As above, this is incorporated in Sections H.2 and H.3.2 of this strategy.

7. Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs.

As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or a private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

The offset security for this development is most appropriate in perpetuity. This is discussed in Section H.3.3 of this strategy.

8. Offsets should be agreed prior to the impact occurring.

Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

This strategy sets out two pathways to establish an offset site and its management. This strategy requires input from OEH and landholders prior to any impacts occurring. It is anticipated that this strategy would be developed further into a final offset package, prior to approval of the proposed works.

9. Offsets must be quantifiable - the impacts and benefits must be reliably estimated.

Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best

available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- *the area of impact*
- *the types of ecological communities and habitat/species affected*
- *connectivity with other areas of habitat/corridors*
- *the condition of habitat*
- *the conservation status and/or scarcity/rarity of ecological communities*
- *management actions*
- *level of security afforded to the offset site.*

The first five points have been addressed in this SIS. The final two points are addressed in Sections H.3.2 and H.3.3 of this strategy. Offsets proposed have been based on previous assessments which utilised the BioBanking methodology in assessing the loss in biodiversity at a development site and the gain in biodiversity at an offset. This is a robust quantitative methodology endorsed by the NSW OEH.

The best available information/data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:

- *they protect land with high conservation significance*
- *management actions have greater benefits for biodiversity*
- *the offset areas are not isolated or fragmented*
- *the management for biodiversity is in perpetuity (e.g. secured through a conservation agreement).*

Extensive field assessment by experts has ensured that the best information and data has been used in assessing the impacts of the Proposal. Detailed desktop and field assessment would be afforded to the offset site once selected. The definition of the offset site will be done according to Section H.3.1, to ensure like for like (or better) and considering ways to enhance landscape connectivity. Section H.3.3 addresses perpetuity.

Management actions must be deliverable and enforceable

The management plan for the offset site is discussed in Section H.3.2. This guidance information is intended to ensure that the actions achieve their objectives, to improve biodiversity values at the offset site.

Unless a BioBanking agreement is entered into, QCC must remain responsible for these actions. As an ongoing part of the management of the site, it is proposed that the success of the management actions would be audited and reported as part of an annual environmental report for the offset site.

10. Offsets must be targeted.

They must offset impacts on the basis of like-for-like or better conservation outcome. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

Offsets will be selected based on biodiversity values and achieve a like for like or like for better outcome as outlined in Section H.3.1.

11. Offsets must be located appropriately.

Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

Current options for offsetting are being investigated within the Queanbeyan LGA. Investigations within the locality conducted as part of this SIS, suggest that it is likely that the offset site would contain the same or similar ecological characteristics as the areas to be affected by the development.

12. Offsets must be supplementary.

They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space cannot be used as offsets.

Any potential offset areas would not be covered by any existing covenants or agreements. If the offset is already owned by local government, it would not be being managed for conservation. QCC commit to any potential offset sites being supplementary.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.

Discussed under Point 9.

H.7 CONCLUSION

This Offset Strategy sets out two pathways to identify, manage and secure an offset in perpetuity, to offset the impacts of the proposed Extension of Ellerton Drive. A methodology has yet to be decided upon and an offset site yet to be identified, but it is considered likely that there are adequate credits available for purchase or land of a suitable type and size within the local area available for offsetting. This strategy sets out three pathways to compensate for residual impacts on affected species and communities. This strategy requires input from OEH and landholders prior to any impacts occurring. It is anticipated that this strategy would be developed further into a final offset package, prior to commencement of construction works.

APPENDIX I THREATENED SPECIES ASSESSMENTS OF SIGNIFICANCE

I.1 THREATENED SPECIES CONSERVATION ACT SEVEN-PART TEST

Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) specifies seven factors to be taken into account in deciding whether a development is likely to significantly affect threatened species, populations or ecological communities, or their habitats, listed at the state level under the *Threatened Species Conservation Act 1995*.

Ecological communities

This *Seven-part Test* characterises the significance of likely impacts associated with the proposal on the following species:

- White Box-Yellow Box-Blakely's Red Gum woodland

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

I. The proposal will result in the permanent removal of 4 ha of the community. Approximately 14 ha of the community occurs within the study area (the local occurrence). As such approximately 30% of the local occurrence will be permanently removed. The 4 ha to be permanently removed is located at the northern most extent of the existing patch of the community. This would result in a remaining contiguous patch of 10 ha adjacent to the southern perimeter of the development. The Commonwealth listing advice for the Box-Gum Woodland community (of which the community on site meets the definition off) states that *the size and life form of understorey species are such that viable populations can exist in very small areas*. Where a high diversity understorey exists (present within the study area), a patch need only be 0.1 ha to constitute the community. Where a lower diversity, predominately native understorey is present and there is overstorey regeneration (present within the study area), a patch need only be 2 ha in size to constitute the community. Given that 10 ha of the community will remain, that there are areas of high understorey diversity and active regeneration of the overstorey, it is considered that this area will represent a viable local occurrence of the community. Therefore it is considered unlikely that the removal of 4 ha of the 14 ha local occurrence, would place it at risk of extinction however, the removal of 30% of the local occurrence is considered to be substantial.

II. The local occurrence of the community is situated in close proximity to areas of intense development. It has been historically disturbed by clearing and more recently is being utilised as a recreational space. Common and noxious weeds are already present within the community that have modified its composition to some extent. The proposed works have the potential to further introduce and/or spread weeds within the local occurrence of the community outside of the subject site. However, ameliorative measures recommended in this SIS, will minimise this potential. Following the works, the perimeter of the community adjoining the subject site would be monitored and managed to prevent the establishment and spread of weed species. It is likely that this management would be beneficial to the remaining local occurrence of the community. With

the implementation of these ameliorative measures, it is considered unlikely that the proposal would result in the modification of the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

I. The proposal is expected to permanently remove up to 4 ha (30%) of the local occurrence of the Box-Gum Woodland community

II. The local occurrence of the community is already isolated from other areas of habitat in the locality due to residential and rural development and existing roads. The proposal would result in a reduction of the extent of the local occurrence of the community on its northern boundary which is adjacent to an existing residential area and would not result in further fragmentation or isolation.

III. The habitat to be removed by the proposal represents an area of the community that is considered to be of high quality. Such areas are patchy and isolated within the locality however, most known areas occur within established reserves or managed areas and are considered to be secure. Field surveys by **ngh**environmental identified approximately 187 ha of the community considered to be of high quality within the locality. As discussed in Part (c) above, it is considered likely that the local occurrence of the community within and adjacent to the study area will remain viable and with appropriate management, continue to represent a high quality example of the community. Validated mapping by BES (2008) estimates that 1546 ha of the community exists in the locality that is in moderate to good Biometric condition. The 4 ha to be removed by the proposal is not considered to be important to the long term survival of the community in the locality.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

A draft national recovery plan for the Box-Gum Woodland CEEC has been produced by DECCW (2010). The overall aim of the plan is to promote the recovery and prevent the extinction of the Endangered ecological community through:

- achieving no net loss in extent and condition of the ecological community throughout its geographic distribution;
- increasing protection of sites in good condition;
- increasing landscape functionality of the ecological community through management and restoration of degraded sites;
- increasing transitional areas around remnants and linkages between remnants; and
- bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland.

The draft recovery plan lists 34 recovery actions for the community, under five strategies:

- Improve baseline information;
- Increase protection of Box-Gum Grassy Woodland;
- Improve Community Engagement;
- Continue ecosystem function and management research; and

- Improve compliance and regulatory activities.

An Offset Strategy is included with this SIS (Appendix H) which aims to address the objectives of the recovery plan in relation to no net loss of the community. This potentially includes increased protection of sites in good condition and increasing landscape functionality of the community through management and restoration of degraded sites.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The following Key Threatening Processes (KTP's) apply to the proposal:

- Bushrock removal
- Clearing of native vegetation
- Invasion of native plant communities by exotic perennial grasses
- Removal of dead wood and dead trees
- Loss of hollow bearing trees

The proposal will result in the clearing of approximately 25 ha of native vegetation including up to 4 ha of the White Box-Yellow Box-Blakely's Red Gum woodland EEC. It is estimated that between 96% and 99% of the pre 1750 extent of this community has been cleared (NSW SC 2002) and as such the proposal is contributing to an increase in the clearing of native vegetation KTP relative to this community. It is noted however that an estimated 3121 ha of the community occurs within the locality and in this context, the clearing of 4 ha is considered to be relatively minor.

The importation and use of construction vehicles and machinery during construction has the potential to introduce and/or result in the exacerbation of the invasion of native plant communities by exotic perennial grasses KTP. During the works strict weed hygiene protocols would be implemented. Following the completion of works, the development perimeter would be managed for the life of the development to reduce the potential for edge effects associated with weed invasion and human disturbance. With the implementation of ameliorative measures described in this SIS, it is considered unlikely that the proposal would contribute to this KTP.

Conclusion

White Box-Yellow Box-Blakely's Red Gum woodland

The proposal will result in the removal of up to 4 ha (30%) of the 14 ha local occurrence of this community. The remaining 10 ha is considered likely to remain viable following the proposed works and unlikely to be placed at risk of extinction. The proposal would not result in the further fragmentation or isolation of the community. In the context of similar habitats within the locality, the 4 ha of the community to be removed is not considered important to the long term survival of the community. In addition, an offset strategy has been proposed as part of the proposal that will result in the protection and management of an appropriate area of this community in perpetuity.

When assessed against the criteria, the Proposal would not result in the extinction or further fragmentation of the local occurrence or remove habitat important to the survival of the community in the locality, however, it is recognised that the permanent removal of 30% of the local occurrence is a substantial impact. The local occurrence is of high quality, represents a viable patch within a highly modified and fragmented landscape and it is considered to contain high conservation values. In the context of current and future development pressures and considering the high conservation value of the area to be impacted and advice

received from OEH, the removal of 30% of the local occurrence would be considered to be significant. As such, the proposal is considered likely to have a significant impact on the White Box-Yellow Box-Blakely's Red Gum woodland EEC.

Fauna species

This *Seven-part Test* characterises the significance of likely impacts associated with the proposal on the following fauna species:

- Pink-tailed Worm-lizard
- Rosenberg's Goanna
- Brown Treecreeper
- Scarlet Robin
- Hooded Robin
- Diamond Firetail
- Painted Honeyeater
- Gang-gang Cockatoo
- Speckled Warbler
- Koala
- Eastern False Pipistrelle
- Eastern Bent-wing Bat
- Golden Sun Moth

Pink-tailed Worm-lizard

The Pink-tailed Worm-Lizard inhabits sloping, open woodland areas with predominantly native grass groundlayers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Typically these areas are well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks in burrows below these rocks; the burrows usually have been constructed by and are often still inhabited by small black ants and termites. This species feeds on the larvae and eggs of these ants (DECCW 2010).

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

In general, the study area provides little habitat for the Pink-tailed Worm-lizard, with the exception of the southern end of the study area which supports potential, but low quality, habitat for this species. This area contains dry shrub forest (Box Gum Woodland) over an open grassy understory and disturbed grassland habitat. The potential habitat is marginal as the area is generally absent of rock habitat, with some sporadic loose scattered rock present, and is surrounded by degraded areas that have been subject to clearance and invasion by exotic grass species.

The dry grass forest habitat north of Queanbeyan River supports a greater density of embedded rock habitat more appropriate for the lizard, but is not considered typical habitat due to the absence of native grasses and a generally closed forest canopy. These areas are therefore considered potential, but low-quality habitat for the species.

Known pressures that can affect the life cycle of the Pink-tailed Worm-lizard include heavy grazing (rabbits) and predation pressures from domestic animals (Cats and Dogs). These pressures were clearly evident within the Box Gum Woodland habitat and surrounds, and to a lesser degree the dry grass forest habitat. In particular, the grazing pressure of rabbits and hares has substantially reduced the cover of native grass species.

Targeted surveys were undertaken for this species in the above areas, with focus on the Box Gum Woodland habitat during November 2012 and March 2013. A total of 5 person hours was spent active searching for the species through rolling rocks and logs; where rock habitat was extensive enough, a minimum of 150 rocks were rolled during each search to obtain some level of confidence of the presence or absence of the species. No evidence of the species was detected during the surveys.

The proposal would result in the removal of 4 ha of low quality habitat in the southern parts of the study area. Given that no evidence of the species was detected during surveys and the potential habitat within the study area is considered low quality, it is unlikely the proposal would have an adverse effect on the life cycle of the species such that a viable local population would be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

IV. The proposal would result in the removal of4 ha of habitat in the southern parts of the study area.

V. The potential habitat for this species is bordered by residential housing to the west and shows evidence of disturbance, and generally contiguous vegetation to the east. As the habitat to be removed is low quality and is adjacent to cleared and developed land, the proposal will not fragment or isolate other areas of habitat.

VI. The proposal would result in the removal of 4 ha of low quality habitat in the southern parts of the study area. Much of this area is subject to ongoing disturbances due to prior clearing and its proximity to residential housing (i.e. weed invasion, heavy rabbit grazing, predation by domestic animals, and other infrastructure construction). Given the targeted surveys did not detect the species and the habitat is low quality the proposal is not considered to remove habitat important to the long-term survival of the species in the locality.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

There is no recovery plan for the Pink-tailed Worm-lizard. However, OEH identify 17 priority actions to help recover this species which centre on further research into the biology, ecology and management of the species, including implementation of several management plans in areas to which the species is known or has the potential to occur. The 17 priority actions were reviewed and the proposal is not considered to be at variance to these actions given that the habitat to be disturbed is low-quality and unlikely to be used by the species.

No threat abatement plans have been prepared for the threatening processes which apply to the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed will contribute to the following KTPs relevant to the Pink-tailed Worm-lizard and include: clearing of native vegetation; removal of dead wood and trees; and invasion of native plant communities by exotic perennial grass.

The proposal will result in the removal of 4 ha of low quality habitat within the southern section of the study area supporting some areas of dead wood and trees and a limited amount of bushrock; however, the species has not been recorded in this area during targeted surveys and is considered very unlikely to occur in the subject site. Additionally, this area is already largely disturbed from surrounding development and current land uses associated with residential areas (i.e. clearing, walking tracks, predation and disturbance by domestic dogs, weed invasion). The KTPs listed above are therefore unlikely to affect the Pink-tailed Worm-lizard.

Rosenberg's Goanna

Rosenberg's Goanna is found in heath, open forest and woodland habitat and shelters in logs, rock crevices and burrows where adequate foraging resources, shelter sits and terrestrial termite mounds are available (OEH 2012). The species forages on birds, eggs, reptiles, mammals and carrion. The species shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens. Termite mounds are a critical habitat component for the species as Rosenberg Goanna's dig into termite mounds to lay their eggs. Observations of a related and similar species, Lace Monitor *Varanus varius*, show that the animals moves around each day within a large home range (~ 500 ha), regularly using a number of different roost sites (Weavers 1993).

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Rosenberg's Goanna is a terrestrial goanna, which occurs in heath, open forest and woodland. Termitaria are a critical habitat component in which the species lays their eggs. The species is known from the locality, primarily east and south of the study area within Cuumbuen Nature Reserve, nearby the Queanbeyan River Corridor and Old Cooma Road and Wickerslack Lane (OEH 2012; ELA 2010a). The species was not recorded during the survey period, but was not targeted directly due to the presence of suitable habitat and known records in the area; however termite mounds were mapped.

The dry grass forest habitat in the study area (i.e. the middle section) provide likely habitat for this species, including termite mounds (13 mounds) and fallen hollow logs for breeding and shelter. The good condition dry grass forest, particularly within the middle section of the study area supports increased structural diversity supporting potential breeding sites as well as foraging resources. The moderate habitat quality dry grass forest north of this area could potentially be used by the species for foraging and as it traverses its large home range (> 500 ha), however this area does not support key breeding habitat resources for this species (i.e. termite mounds and large hollow logs are largely absent).

Exclusion fencing will be installed within the good condition dry grass forest habitat suitable to this species along the eastern edge of the road corridor. The exclusion fencing will assist in restricting movement of this species across the road and reducing possible vehicle collisions. Two fauna underpasses will also be constructed under the road within this habitat. The fauna underpasses will assist in promoting a safe passage under the road for this species in this area. The vehicle speed limit through this corridor will be 80 km/h and advisory signs for motorists will also be installed.

The proposal would result in the direct clearance of 13 ha, including 13 termite mounds of dry grass forest habitat for this species. Greater than 7000 ha of largely contiguous dry forest habitat is available within the locality which also supports a similar density of termite mounds to the study area, as determined during locality surveys. In this context, the direct impact of the proposal is not considered to place the Goanna at risk, given the extent of surrounding habitat and large home range of this species. However, in the context of

the local population for the study area as defined by the TSC Act, a local population consists of individuals known or likely to use habitats within the study area (DECC 2007). Given the large home range it is expected the study area would support one or two individuals only, therefore it is possible if the proposal resulted in mortality through vehicle collisions the local population would be affected if it only consists of one or two individuals.

While it is agreed the direct impacts of habitat loss are relatively minor, the indirect impact of eventual increased traffic volume through an area of known habitat which could result in mortality is likely to have a significant effect on the local population of Rosenberg's Goanna, in the context of the local population within the study area, as defined by the TSC Act.

Therefore, in this context the indirect impacts of the proposal have the potential to place the species at risk over the long-term and may have an adverse effect on the life cycle of the species such that a viable local population could be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i. The proposal would result in the direct clearance of 7.6 ha of good quality habitat (including 13 termite mounds) in the middle section of the study area. A further 5.4 ha of moderate quality habitat would also be removed, but this habitat is considered less likely to be used by the species due to the lack of termite mounds for breeding and large logs for sheltering, as well as the on-going disturbances of clearing, fragmentation through residential development, and predation or disturbance by domestic dogs.

ii. Habitat in the study area is already fragmented to the west and south by residential development and existing roads. The footprint of the proposal will run linear to existing disturbances to the west and will not result in large areas of land being isolated from each other (i.e. from east to west),

however the action will result in isolating a small area of habitat east of the proposed road corridor nearby the existing residential development.

iii. Based on known records of the species in the locality, the 7.6 ha of good quality dry grass forest habitat in the middle section of the study area is considered similar to known habitat of this species and is therefore likely to be used, at least on occasions. This area also forms part of a regional biolink defined by BES (2008) supporting known habitat for the Goanna.

A total of 13 ha and 13 termite mounds will be directly removed by the proposal and greater than 7000 ha of similar habitat are available within the locality, resulting in less than 1% of available habitat being cleared. Additionally, at least 37 termite mounds will remain within the study area. In this context, the proposal is not likely to adversely affect the long-term survival of the species in the locality in regard to the importance of habitat to be removed. While the area to be cleared also forms part of a regional biolink the proposal will affect the edge of this corridor, therefore reducing its size, but not resulting in fragmentation.

Indirect impacts of increased traffic volume are likely to result in mortalities and will have some effect on the species within the locality, but it is not considered to threaten the long-term survival of the species in the region due to the vast amount of habitat (breeding, sheltering, and foraging resources) of equal or superior quality remaining within the locality, especially that conserved within Cuumbuen Nature Reserve.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

There is no recovery plan for the Rosenberg's Goanna. However, OEH identify nine priority actions to help recover this species which include:

- Identify key habitats or areas for protection and enhanced management on private land through management agreements and incentives.
- Identify suitable habitat across the range of the species with reference to satellite imagery and vegetation surveys.
- Undertake surveys for the species within identified suitable habitat.
- Develop habitat identification, management and enhancement guidelines.
- Implement management strategies that reduce the prevalence of bush rock removal, including surveillance.
- Develop and undertake community education strategy that reduces demand for bush rock as landscaping material and provides/promotes alternatives.
- Provide map of known occurrences to Rural Fire Service and seek protection of rocky outcrops and riparian zones on Bush Fire Risk Management Plan(s), risk register and/or operation map(s).
- Undertake investigations into general biology and ecology of the species, particularly movement patterns and tree use, rock crevice use and termitaria use.

- Undertake investigations into taxonomic distinctions/genetic (DNA) differences between the various forms of the 'species'.

The proposal is not directly at variance with any of the above priority actions.

No threat abatement plans have been prepared for the threatening processes which apply to the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed will contribute to the following KTPs relevant to the Rosenberg's Goanna and include: clearing of native vegetation; removal of dead wood and trees; and to a minor extent bushrock removal.

The proposal will result in the removal of 13 ha of potential habitat supporting dead wood and trees and a limited amount of bushrock. Similar contiguous habitat supporting dead wood and trees, as well as bushrock, is extensive in the locality and will remain available to the species.

Brown Treecreeper

Brown Treecreepers are found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest, mainly inhabiting woodlands dominated by stringybarks or other rough-barked eucalypts with an open grassy understorey (OEH 2012). The Brown Treecreeper is dependent on hollows for breeding and dead timber for foraging (provides habitat for invertebrate prey) (Noske 1991). The species feeds on insects by foraging on tree trunks, amongst leaf litter and on fallen logs.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Brown Treecreeper was not recorded during the targeted surveys of the study area, although is known from the locality and has been recorded approximately 6 km south of the subject site.

This species is not usually found in woodlands with a dense shrub layer and fallen timber is an important habitat component for foraging. Hollows in standing dead or live trees and tree stumps are essential for nesting (Noske 1982; OEH 2012). Woodland (Box Gum Woodland) south of the Queanbeyan River is considered the most suitable habitat in the study area for this species and supported some rough-bark eucalypts.

Open grassy dry forest in the northern section of the study area was generally dominated by smooth-barked trees was accompanied by a shrub layer rather than being open and grassy. In this context, habitat for the Brown Treecreeper is available within the south of the study area, but is not considered optimal.

The proposal would not remove any known habitat for this species but would result in the removal of 5.4 ha of potential habitat and nesting habitat in the form of 2 hollow-bearing trees in the southern parts of the study area, although the habitat is not considered unique to this species. There is potential for the species to occur in other areas of the study area, although the habitat is not typical to the species and is not unique in the locality. The locality supports extensive areas of similar woodland habitat, including contiguous vegetation to the south of the study area (> 3000 ha).

Given that no evidence of the species was detected during surveys, despite the fact the species is gregarious and conspicuous, and the potential habitat within the study area does not support habitat of particular

importance, it is unlikely the proposal would have an adverse effect on the life cycle of the species such that a viable local population would be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i. The proposal would result in the removal of 5.4 ha of potential habitat in the southern parts of the study area, which is generally considered marginal habitat for this species which may be used on occasions.

ii. No areas of known or potential habitat for the species will become isolated or fragmented as a result of the proposal. Habitat in the south of the study area is already fragmented by existing disturbances including roads and residential development. The proposal will increase the extent of clearance, but contiguous vegetation will remain beyond the southern end of the study area allowing the species to move through the locality.

iii. Given the targeted surveys did not detect the species, the proposal is not considered to remove habitat important to the species and extensive areas of similar habitat occur in the locality (> 3000 ha) the proposal is unlikely to affect the long-term survival of the species in the locality.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

There is no recovery plan for the Brown Treecreeper. However, OEH identify seven priority actions to help recover this species which centre on research into the ecology of the species, increasing public awareness of the species, identification of habitat and enhanced management, including management in reserves and public land.

No threat abatement plans have been prepared for the threatening processes which apply to the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed will contribute to the following KTPs relevant to the Brown Treecreeper and include: clearing of native vegetation; loss of hollow-bearing trees; and removal of dead wood and dead trees.

The proposal will result in removal of up to 5.4 ha of potential habitat including two hollow-bearing trees within the southern section of the study area; however, the species has not been recorded in this area during targeted surveys and is considered unlikely to rely on the habitat in the subject site. Therefore the KTPs on the Brown Treecreeper are considered to be minor.

Scarlet Robin and Hooded Robin

Scarlet Robins occur in dry eucalypt forests and woodland with open grassy understorey with abundant logs and fallen timber (OEH 2012). The Scarlet Robin utilises open areas in their habitat and some studies have found higher abundance of Scarlet Robins along forest edges than the interior (Berry 2001). Birds forage from low perches, fence-posts or on the ground, from where they pounce on small insects and other invertebrates which are taken from the ground, or off tree trunks and logs; they sometimes forage in the shrub or canopy layer. This species' nest is an open cup built in the fork of tree usually more than 2 metres above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub (OEH 2012).

Hooded Robins are found in open eucalypt forest and woodland often in or near clearings or open areas (OEH 2012). The species requires structurally diverse habitats including ample fallen timber and logs for insect prey (Schodde and Tidemann 2007). The species favour open areas with a sparse shrub layer as it will forage in bare ground or open ground and through leaf litter for insects. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season. Small cup-shaped nests are constructed in a tree fork or crevice, from less than 1 m to 5 m above the ground (OEH 2012).

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Hooded Robin or Scarlet Robin were not recorded during the targeted surveys of the study area, although the species are known from the locality. The Scarlet Robin has been recorded west of the study area, with the nearest record occurring about 800 m away. This species was also regularly observed within Cuumbuen Nature Reserve during locality surveys in March 2013. The Hooded Robin has been recorded about 4 km south-west of the study area.

These species generally require structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Habitat also usually contains abundant logs and fallen timber. Suitable habitat for these species is associated with dry grass forest, woodland and dry shrub forest south of the study area. However, of this habitat, the good quality dry grass forest in the middle section of the study area is considered to provide the most suitable habitat as it supports better structure diversity compared to other areas of the study area. These species are not expected to occur elsewhere in the study area due to the disturbed condition of this habitat and proximity to adjacent developed land.

The proposal would result in the removal of 19 ha of potential habitat, although both species do not appear to occur within the site regularly. The locality supports extensive areas of similar habitat, including contiguous vegetation to the west and south of the study area.

Considering that both species are conspicuous and no evidence of the species was detected during surveys, it is considered both species do not regularly occur within the habitat to be affected; it is therefore unlikely the proposal would have an adverse effect on the life cycle of the Scarlet and Hooded Robin such that a viable local population of each species would be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i. The proposal would result in the removal of 19 ha of potential habitat, although these species are not known to use the study area.

ii. No areas of known or potential habitat for the species will become isolated or fragmented as a result of the proposal. Habitat in the study area is already fragmented by existing disturbances including roads and residential development to the west and south. The proposal will increase the extent of clearance, but contiguous vegetation will remain beyond the eastern and southern end of the study area allowing both species to move through the locality.

iii. Given the targeted surveys did not detect the species, the proposal is not considered to remove habitat important to the species and extensive areas of similar habitat occur in the locality (> 7000 ha) the proposal is unlikely to affect the long-term survival of the Scarlet and Hooded Robin.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

There is no recovery plan for the Scarlet or Hooded Robin. However, OEH identify 5 priority actions to help recover the Hooded Robin, but none are available for the Scarlet Robin. The 5 priority actions for the Hooded Robin centre on: conducting ecological research to determine habitat and resource requirements, threats and conservation issues, conducting annual monitoring of key populations and increasing public awareness of the species.

The 5 priority actions were reviewed and the proposal is not considered to conflict with these actions given that the study area is not considered to support habitat of particular importance to this species.

No threat abatement plans have been prepared for the threatening processes which apply to the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed will contribute to the following KTPs relevant to the Scarlet and Hooded Robins and includes: clearing of native vegetation; and invasion of native plant communities by exotic perennial grass.

The proposal will result in removal of up to 19 ha of potential habitat; however, both species have not been recorded in these areas during targeted surveys and are considered unlikely to rely on the habitat in the subject site. Therefore the KTPs listed above are considered minor for the Scarlet and Hooded Robin.

Diamond Firetail

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Diamond Firetail was not recorded during the targeted surveys of the study area, although is known from the locality and has been recorded approximately 2 km south, and 5 km south, south-west, and west of the subject site. Suitable habitat for the species is associated with shrubland, grassland, open woodland, and dry shrub forest south of study area although no particularly important habitat for this species was observed (no dense shrubbery for nesting). The species is unlikely to forage in the dry grass forest habitat in other areas of the study area as this habitat constitutes closed forest and is not preferred habitat of this species and is therefore considered atypical habitat for the species.

The proposal would result in the removal of 13.4 ha of potential habitat in the southern parts of the study area (including open grassy woodland and exotic grassland), although only 6.6 ha constitutes native vegetation and none is considered unique to this species. The locality supports extensive areas of similar woodland habitat, including contiguous vegetation to the south of the study area.

Given that no evidence of the species was detected during surveys and the potential habitat within the study area does not support habitat of particular importance, it is unlikely the proposal would have an adverse effect on the life cycle of the species such that a viable local population would be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No Endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i. The proposal would result in the removal of 13.4 ha of potential habitat (only 6.6 ha is native vegetation) in the southern parts of the study area, which is generally considered marginal habitat for this species which may be used on occasions.

ii. No areas of known or potential habitat for the species will become isolated or fragmented as a result of the proposal. Habitat in the study area is already fragmented by existing disturbances including roads and residential development. The proposal will increase the extent of clearance, but contiguous vegetation will remain beyond the southern end of the study area allowing the species to move through the locality.

iii. Given the targeted surveys did not detect the species, the proposal is not considered to remove habitat important to the species and extensive areas of similar habitat occur in the locality (> 3000 ha), the proposal is unlikely to affect the long-term survival of the species in the region.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

There is no recovery plan for the Diamond Firetail. However, OEH identify 5 priority actions to help recover this species which centre on research into the ecology of the species, identification of habitat and documenting guidelines for management, including management in reserves and on a regional basis. The 5 priority actions were reviewed and the proposal is not considered to conflict with these actions given that the study area is not considered to support habitat of particular importance to this species.

No threat abatement plans have been prepared for the threatening processes which apply to the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed will contribute to the following KTPs relevant to the Diamond Firetail and includes: clearing of native vegetation; and invasion of native plant communities by exotic perennial grass.

The proposal will result in removal of up to 13.4 ha of potential habitat within the southern section of the study area; however, the species has not been recorded in this area during targeted surveys and is considered unlikely to rely on the habitat in the subject site. Therefore the KTPs listed above are unlikely to affect the Diamond Firetail.

Painted Honeyeater

The Painted Honeyeater is a highly specialised honeyeater that inhabits dry open woodlands and forests containing mistletoe, particularly choosing sites with abundance of mistletoe (Barea 2008; Barea 2012). It inhabits dry open forests and woodland including Boree, Brigalow and Box Gum Woodlands and Box-Ironbark open forests, also paperbark and casuarinas. It is a specialist feeder on mistletoe, particularly of genus *Amyema*, and generally requires five or more mistletoes per hectare (NSW Scientific Committee 2011). Extent of available vegetation is considered to be important for this species and it is considered less likely to be found in strips or fragmented patches of vegetation than it is in wider blocks (Robinson 1994).

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Painted Honeyeater distribution does not extend into Canberra or Queanbeyan LGA and the greatest concentrations of the species and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW. The species was not observed during the current survey and only one other record is known for the locality, which was observed by ELA (2010b) on one occasion within the Jumping Creek Estate assessment. The species is generally considered a rare nomadic or summer migratory species in the locality.

The species inhabits dry open forests and woodland. It is a specialist feeder on mistletoe, particularly of genus *Amyema*, and generally requires five or more mistletoes per hectare (NSW Scientific Committee 2011). On this basis, dry shrub forest and woodland (Box Gum Woodland) habitat supporting mistletoe is considered potential habitat for this species. Mistletoe is present throughout the study area, but generally in low abundance apart from the regenerating dry grass forest at the far northern end of the study area and amongst the older trees in woodland patches on north and south of the Queanbeyan River. However, mistletoe diversity is limited in areas of potential habitat and the study area does not provide important habitat unique

to this species. The species may forage within the study area as part of a much larger home range during migration events.

While some of the trees supporting mistletoe will be removed for the proposal, a large extent of eucalypts supporting mistletoe will be retained both within the study area and surrounding lands.

The proposal would result in the removal of up to 4 ha of potential, but marginal, foraging habitat in the study area, although none is considered important to this species. The locality supports extensive areas of similar woodland habitat, including contiguous vegetation to the south and east of the study area.

Given that no evidence of the Painted Honeyeater was detected during surveys, the species is a rare visitor to the Queanbeyan LGA and potential habitat within the study area does not support habitat of particular importance, it is unlikely the proposal would have an adverse effect on the life cycle of the species such that a viable local population would be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i. The proposal would result in the removal of up to 4 ha of potential foraging habitat in the northern and southern parts of the study area, as well as nearby the Queanbeyan River. The potential habitat to be removed is generally considered marginal for this species and at best would be used as part of a much larger home range during migration events.

ii. No areas of known or potential habitat for the species will become isolated or fragmented as a result of the proposal. The proposal will increase the extent of clearance, but contiguous vegetation will remain beyond the southern and eastern edge of the study area allowing the species to move through the locality.

iii. Given the targeted surveys did not detect the species, the study area is outside the known distribution of the species, and extensive areas of similar habitat occur in the locality, the proposal will affect the long-term survival of the species.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

There is no recovery plan for the Painted Honeyeater. However, OEH identify 5 priority actions to help recover this species which centre on retaining natural densities of Mistletoes, undertaking studies to determine the ecology of the species, and promoting sustainable grazing and habitat restoration in agricultural areas. The 5 priority actions were reviewed and the proposal is not considered to conflict with these actions given that the study area is not considered to support habitat of particular importance to this species as it is a rare visitor to the region.

No threat abatement plans have been prepared for the threatening processes which apply to the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed will contribute to the following KTPs relevant to the Painted Honeyeater and includes: clearing of native vegetation.

The proposal will result in removal of up to 4 ha of potential habitat within the most northern and southern sections of the study area, including an area around Queanbeyan River; however, the species has not been recorded in this area during targeted surveys and is rare in the locality and is considered unlikely to rely on the habitat in the subject site. Therefore the KTPs listed above are unlikely to affect the Painted Honeyeater.

Gang-gang Cockatoo

The Gang-gang Cockatoo is sedentary or seasonally nomadic (also part-migratory in Autumn-Spring) and occurs in single pairs to small flocks. It is found in tall mountain forest and woodlands, especially mature wet sclerophyll forests in summer. In winter, it moves to lower altitudes occupying drier more open eucalypt forests and woodlands (particularly box-ironbark assemblages or dry coastal forest) and urban areas (DECC 2005b). The Gang-gang Cockatoo favours vegetation with old growth elements for nesting and roosting. Birds nest in large hollows in the trunk or limbs of living or dead eucalypt trees. Hollows of sufficient size generally do not form in eucalypt trees less than 150 - 200 years old (Mackowski 1984). The species feeds mainly on the fruits of eucalypts and acacias but will feed on other seeds and fruit such as Callitris, garden fruits, Hawthorn (*Crataegus monogyna*) and Callistemon as well as some insects and their larvae. They have been observed foraging and nesting in dry forest on the tablelands and roadside trees in the suburbs of Canberra (pers. ob. Bianca Heinze). The nest trees have been of moderate size (approximately 60 centimetres DBH) with a medium hollow entrance size. It is likely that the internal dimensions of the hollow were large. Breeding in the Canberra area has been observed over winter, with young fledging during October (pers. ob. Bianca Heinze).

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Gang-gang Cockatoo was targeted during November 2012 and November 2013 surveys during their known breeding season. The species was recorded in the southern and northern section of the study area, most notably, two adults and two juveniles were seen flying around and roosting in trees at the far southern end of the study area in the late afternoon and early morning over 5-6 November 2012, while two more adults were observed in 2013 flying through the northern section of the study area. Several other records are known to the east of the study area and a female / male pair was also observed within Cuumbuen Nature Reserve during the March 2013 survey. The Gang-gang Cockatoo is a regular and wide ranging inhabitant of the Queanbeyan LGA.

The entire length of study area provides potential foraging habitat and it is considered the species is likely to forage throughout the study area as part of a much larger home range. However, the more intact forest and woodland areas within the middle section and southern end of the study area are considered most appropriate to this species as it supports more mature vegetation, including 12 hollow-bearing trees. These areas also join or comprise part of the regional biolink that extends east of the study area into contiguous forest habitat.

The Gang-gang Cockatoo requires old growth habitat for nesting in hollows in the trunks, limbs or dead spouts of tall living trees, especially eucalypts, and often near water. Eleven medium hollow-bearing trees, including four that support larger hollows that may be suitable for nesting are present north of the Queanbeyan River. These trees were stag watched in 2013 during the known breeding season of the Cockatoo and the species was not observed using any of these hollows. While this habitat is better quality than other habitats of the study area, the habitat is still not considered typical for the species as it does not constitute old growth habitat and is limited in its structural diversity (i.e. a mosaic of foraging resources are not present).

As no observations of nesting Gang-gang Cockatoos were observed in any of the hollow bearing trees to be removed the hollow-bearing trees to be removed are considered 'potential' breeding habitat for this species. At least 72 hollow-bearing trees will remain within the study area, with 29 of these supporting a medium or large hollow. Greater than 7000 ha of largely contiguous dry forest habitat are available within the locality which also supports a similar density of hollow-bearing trees to the study area, as determined during locality surveys. Parts of the dry forest in the locality are known to support habitat of higher conservation value due to increased structural diversity and absence of disturbance, especially habitat within Cuumbuen Nature Reserve.

The Gang-gang Cockatoo is a mobile, high-flying species and unlikely to collide with vehicles and has been observed flying over road corridors within the Queanbeyan LGA (pers. obs. Bianca Heinz). The proposal is therefore unlikely to affect the species from indirect impacts.

As the habitat to be removed is expected to be predominantly used for foraging and to a lesser extent breeding, no nesting Gang-gang Cockatoos were observed in any of the hollow bearing trees to be removed, numerous hollow-bearing trees of similar quality remain in the locality, and the species is mobile and occupies a large home range, it is considered unlikely the proposal would have an adverse effect on the life cycle of the species such that a viable local population would be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i. A total of 26 ha of foraging habitat are present throughout the length of the study area, although the 7.5 ha of good quality dry grass forest supporting 12 hollow-bearing trees is considered most likely to be utilised by this species.

ii. Habitat in the study area is already fragmented to the west and south by residential development and existing roads. The footprint of the proposal will run linear to existing disturbances to the west and will not result in large areas of land being isolated from each other (i.e. from east to west). The southern and eastern edge of the study area connects to contiguous vegetation and movement of the species will not be affected.

iii. The habitat to be removed from the subject site is adjacent to residential development to the west of the proposal and is not considered to be particularly important to the Gang-gang Cockatoo due to the presence of large tracts of good quality forest to the east. While the habitat affected is predominantly likely to be used for foraging, some potential breeding sites occur; however no nesting Gang-gang Cockatoos were observed in any of the hollow bearing trees to be removed during the survey. The 12 hollow-bearing trees to be removed are considered 'potential' breeding habitat for this species. Sixty-seven hollow-bearing trees will remain within the study area, with 29 of these supporting a medium or large hollow. Hollows of suitable size for nesting by this species are well represented in the locality.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

There is no recovery plan for the Gang-gang Cockatoo. However, OEH identify 11 priority actions to help recover this species which centre on increasing public awareness of the species, understanding and managing for wildfire impacts, investigate the breeding biology and movement patterns of the species and identify nesting habitat on public lands, while also negotiating management agreements in areas of important habitat.

The 11 priority actions were reviewed and the proposal is not considered to be at variance to these actions as the species was not observed nesting in the study area and is likely to use the area as part of a much larger home range.

No threat abatement plans have been prepared for the threatening processes which apply to the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed will contribute to the following KTPs relevant to the Gang-gang Cockatoo and include: clearing of native vegetation; removal of dead wood and trees; and loss of hollow-bearing trees.

The proposal will result in the removal of 26 ha of foraging habitat, including 7.5 ha of potential breeding habitat supporting 12 hollow-bearing trees. Similar contiguous habitat supporting hollows is extensive in the locality and will remain available to the species. Proposed offsets are likely to mitigate some of the impacts from this current proposal as they are likely to conserve habitat supporting hollow-bearing trees. Therefore the KTPs listed above are considered manageable for the Gang-gang Cockatoo.

Speckled Warbler

The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Habitats typically are structurally diverse with a grassy understorey, a sparse shrub layer and an open canopy (Watson *et al.* 2001). Preferred foraging habitat is a combination of open grassy patches, leaf litter and shrub cover. Declines have been linked to habitat fragmentation as the species appears to be locally extinct in districts where no habitat fragments larger than 100 ha remain (Watson *et al.* 2001). Further, larger remnants (about 300 ha) may be required for populations to be viable (Gardner 2002a). This species nests and forages for seeds and insects on the ground utilising grass tussocks, dense litter and fallen branches. The home range of the species varies from approximately 6-12 ha.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

One individual of the Speckled Warbler was recorded north of Queanbeyan River in November 2013 in low shrubs and grassland habitat. The assessment of Jumping Creek Flat Estate completed by ELA (2010b) recorded two Speckled Warblers in riparian habitats nearby the same location of the individual recorded this assessment. Jumping Creek Estate crosses the current study area and extends to the west indicating that the individual recorded this assessment is likely from the same population as those recorded by ELA (2010b).

The species was detected this survey in an area that has been highly modified, but is located within an ecotonal area of different habitat types including shrubland, grassland, forest and riverine area; the proximity of different habitat types supports a mosaic of habitat features and provides structural diversity for this

species. Habitat descriptions of this species suggest it is likely to inhabit more intact patches of open woodland and forest of the study area that are structurally diverse. The understorey component appears to be important for the species, and it prefers an open grassy understorey with tussocks, fallen timber and rocks (Pizzey & Knight 1997). Further, larger remnants (about 300 ha) may be required for populations to be viable (Gardner 2002). Declines have been linked to habitat fragmentation as the species appears to be locally extinct in districts where no habitat fragments larger than 100 ha remain (Watson *et al.* 2001).

Based on the above, suitable potential habitat for this species could occur within various habitat types of the study area but the area immediately north and east of Queanbeyan River is considered the most important habitat within the study area for this species as it supports breeding habitat for the known population in this area.

Birds are often less affected by the impacts associated with roads than other species because of their greater mobility. The Speckled Warbler is mobile, but as it has been recorded within and nearby the study area and the species tends to utilise habitats close to the ground, it may be more susceptible to vehicle impacts when moving across roads. This indirect impact has the potential to affect the life cycle of the resident population.

Given the detection of the species this survey and the presence of other known records in close proximity to the proposal in similar habitat the species is likely to utilise the subject site regularly. As the species is sedentary and occupies a discrete home range (~ 10 ha), and has been reported to require large relatively undisturbed remnants to persist it is expected the study area is part of the home range of the individuals found this assessment and within the Jumping Creek Flat Estate study (ELA 2012b). As this species has been found south of the study area as well (GHD 2009; ELA 2010a) it is expected a population is present with the locality and is very likely to use habitat within the study area. The loss of habitat from this proposal and an increase in traffic volume through known habitat may have an adverse effect on the life cycle of the species such that a viable local population would be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i. The proposal would result in the removal of 26 ha of potential habitat in the southern parts of the study area, which includes 8.1 ha of habitat where the species is known to be present and would include breeding habitat.

ii. Based on the known presence of records and the alignment of the road corridor, the proposal is not considered to isolate or fragment habitat for the species, rather the action would result in a reduction of the extent of available habitat given that the area to be removed lays adjacent existing disturbances of residential property to the west.

iii. The 26 ha of habitat to be removed includes potential breeding habitat and forms part of permanent home range for the individuals detected within and nearby the study area from other studies. The 8.1 ha of habitat to be removed north of the Queanbeyan River is considered to be important habitat for the species on a permanent basis and could also be used as a movement corridor. While the proposal will not isolate any habitat, it will eventually increase the width of fragmentation and traffic volume passing through one regional biolink (habitat corridor) where the species has been recorded. However, given the number of other Speckled Warbler records in the locality and extent of suitable habitat, the loss of up to 26 ha of habitat in area the species is residing may affect the long-term survival of the species in the locality.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

There is no recovery plan for the Speckled Warbler. However, OEH identify 7 priority actions to help recover this species which centre on research into the ecology of the species, increasing public awareness of the species, identification of habitat and enhanced management, including management in reserves and public land. The 7 priority actions were reviewed and the proposal is not considered to conflict with these actions.

No threat abatement plans have been prepared for the threatening processes which apply to the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed will contribute to the following KTPs relevant to Speckled Warbler and includes: clearing of native vegetation; alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; invasion of native plant communities by exotic perennial grass; and removal of dead wood and dead trees.

The proposal will result in the direct removal of up to 26 ha of potential habitat for the Speckled Warbler, including 8.1 ha of known habitat. A range of mitigation measures and offsets will be employed to minimise the proposal's contribution to the above KTPs. In particular, offsets will target the long-term conservation of Box Gum Woodland habitat which is known habitat of this species.

Koala

The Koala inhabits eucalypt woodlands and forests including coastal forests, the woodlands of the tablelands and western slopes, and the riparian communities of the western plains. The species feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. The home range of Koalas varies depending on the quality of the habitat and the number of available food trees and ranges from less than 2 ha to several hundred ha in size; if feed trees are sparse or primary feed trees absent, the home range of the Koala is expected to be on the larger side of the above range. The species is generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery.

The quality of forest and woodland communities as habitat for Koalas is influenced by a range of factors (Reed *et al*. 1990), such as: species and size of trees present; structural diversity of the vegetation; soil nutrients; climate and rainfall; and size and disturbance history of the habitat patch.

The most important factor influencing Koala occurrence is the suite of tree species available. In any one area, Koalas rely primarily on regionally specific primary and/or secondary food tree species. If primary food tree species are not present or occur in low density, Koalas will rely on secondary food tree species, but the carrying capacity of the habitat (i.e. number of animals per ha) is inevitably lower (DECC 2008).

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

There is potential for Koalas to move through all woodland and forest habitats of the study area; however Koalas were not detected during the survey, nor detected by call during call playback surveys. It is generally recommended that searches are completed every 500m to ascertain the presence or absence of a Koala, or 30 trees are searched every 25 ha (Chris Allen pers. comm. 2013). Seven RapSAT surveys were undertaken this assessment, equating to a survey approximately every 3 ha within the subject site which is an adequate survey intensity for the size of impact of the proposed works. No Koala scats or scratching on trees attributed to the Koala were detected during RapSAT surveys.

The study area does not support preferred food trees for the Koala, but supports four secondary food trees, as listed in the Koala Recovery Plan for the Southern Tablelands (DEC 2008). The dry grass forest and woodland habitats of the study area supports potential, but low quality habitat, for the Koala given the absence of preferred food trees and paucity of sheltering sites. The absence of primary food trees indicates the Koala would occur, if present, in very low densities as populations usually centre around primary food trees; secondary food trees being more important to the species if they occur amongst primary food trees (DEC 2008). The lack or records in the study area and Queanbeyan LGA suggest the known records of the Koala are from that of a dispersing animal rather than from a resident population.

Known threats that can affect the life cycle of the Koala include predation pressures from domestic animals (cats and dogs) and clearing, preventing movement through the forest. These pressures are already clearly evident within study area, particularly within the north and south of the site.

The proposal would result in the removal of up to 20 ha of marginal habitat. Given that no evidence of the species was detected during surveys despite 12 person hours of scat searching and call playback, the potential habitat within the study area does not support primary food trees, and dogs are prevalent in the study area, it is unlikely the proposal would have an adverse effect on the life cycle of the species such that a viable local population would be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

I. The proposal would result in the removal of 20 ha of low quality woodland and forest habitat (secondary feed tree habitat) throughout the study area.

II. The potential habitat for this species is bordered by residential housing to the west and generally contiguous vegetation to the east. As the habitat to be removed is low quality and is directly adjacent to cleared and developed land, the proposal will not fragment or isolate other areas of habitat for this species.

III. The proposal would result in the removal of 20 ha of low quality woodland and forest habitat. Much of this area is subject to ongoing disturbances due to prior clearing and its proximity to residential housing (i.e. predation by domestic animals, clearing, and other infrastructure construction). Greater than 10 000 ha of similar woodland and forest habitat is available in the locality. Given the targeted surveys did not detect the species, the study area is not known to support a Koala population, the habitat is low quality and the large extent of available habitat in the surrounding area, the proposal is not considered to remove habitat important to the long-term survival of the species in the locality.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

A state recovery plan has been drafted for the Koala (DECC 2008). The overall objectives of the plan are to reverse the decline of the koala in NSW, to ensure adequate protection, management and restoration of koala habitat, and to maintain healthy breeding populations of koalas throughout their current range.

The recovery lists 7 specific objectives that include:

- Conserve Koalas in their existing habitat
- Rehabilitate and restore Koala habitat and populations
- Develop a better understanding of the conservation biology of Koalas
- Ensure that the community has access to factual information about the distribution, conservation and management of Koalas at a national, state and local level
- Manage captive, sick or injured Koalas and orphaned wild Koalas to ensure consistent and high standards of care
- Manage over-browsing to prevent both Koala starvation and ecosystem damage in discrete patches of habitat
- Coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.

The study area is not known to support a Koala population and the locality has never supported a known viable population, with very few records of the species documented; therefore the proposal is not considered to be at variance to the recovery of this species.

No threat abatement plans have been prepared for the threatening process which applies to the action proposed, clearing of native vegetation.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed will contribute to the following KTPs relevant to the Koala and includes: clearing of native vegetation.

The proposal will result in the removal of 20 ha of low quality habitat; however, the species has not been recorded in this area during targeted surveys and is considered very unlikely to support a viable population within subject site. Additionally, this area is already largely disturbed from surrounding development and current land uses associated with residential areas (i.e. clearing, walking tracks, predation and disturbance by domestic dogs). In particular, the presence of the domestic dog in the area is an existing threat to the Koala that is ongoing and would affect the ability of the species to persist in the area prior to this proposal being implemented. The KTPs listed above are therefore unlikely to affect the Koala.

Eastern False Pipistrelle

The Eastern False Pipistrelle is found in wet sclerophyll forest, preferring tall and wet forests where trees are more than 20 m high and the understorey is dense. They generally roost in hollow trunks of eucalypt trees, but can be occasionally found in caves and old wooden buildings. These bats have a home range up to 136 ha and are known to change roosts nightly. The species forages primarily on beetle, moths, some bugs and ants. The species forages within continuous forest where they primarily forage along tracks, creeks and rivers just below the canopy avoiding dense understorey (Churchill 2008).

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

A small number of Anabat files (two) were attributed to the Eastern False Pipistrelle on 5 November 2012; recordings were made in shrubland at survey site A1. One record of this species is listed approximately 2 km east of the study area in Cuumbuen Nature Reserve.

The study area provides potential habitat in the form of forest and woodland foraging and roosting resources. In particular, the dry grass forest habitat within the middle section of the study area and north of the Queanbeyan River is considered the most suitable habitat providing both foraging and roosting resources for this species. Within the study area this habitat supports a taller canopy layer and several hollow-bearing trees. The remainder of the study area provides foraging habitat, but limited and unlikely roosting habitat.

The proposal will result in approximately 26 ha of vegetation removal along the length of the subject site which could conceivably be considered potential foraging habitat for this species. Of this habitat, the proposal will remove approximately 7.5 ha of dry grass forest habitat supporting 31 hollow-bearing trees and therefore potential roosting habitat. Of the hollow-bearing trees to be removed, the majority are not large enough to be considered maternity roost sites. Additionally, four stags will be removed for the proposal but are generally considered marginal for this species as none of these stags supported large hollows suitable for a maternity roost site.

However, at least 72 hollow-bearing trees of varying sizes and quality will be retained within the study area, with many more known to be present within the locality in similar habitat (i.e. in vegetation directly east of the study area and within Cuumbuen Nature Reserve.

Given that this species was only recorded on one occasion in low density (2 calls), despite 10 overnight Anabat surveys during different survey periods (November 2012 and March 2013), it is expected that the study area is not regularly used by this species. The location of the recorded calls on November 5 indicates the species was likely to be foraging nearby Queanbeyan River within an accessible flyway. It is considered Queanbeyan River would be an important foraging area for several microbat species, including those assessed as part of this proposal.

Given the Eastern False Pipistrelle was recorded in low numbers, the large home range of the species, the quality of foraging and roosting resources remaining within the study area is high, and the proposal will affect habitat on the boundary of residential development it is considered the action is unlikely to have an adverse effect on the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i. The proposal will directly remove 26 ha of foraging habitat, including 7.5 ha of suitable forest habitat supporting 31 hollow-bearing trees.

ii. Habitat in the study area is already fragmented to the east and south by residential development and existing roads. The footprint of the proposal will run linear to existing disturbances to the east and will not result in large areas of land being isolated from each other (i.e. from east to west), however the action will result in isolating a small area of habitat east of the proposed road corridor nearby the existing residential development but will not disrupt connectivity of this species.

iii. Of the habitat to be removed, 7.5 ha of forest habitat, including 31 hollow-bearing trees, within the middle section of the study area are considered to be of most importance as foraging and potential roosting resources. However, the hollow-bearing trees are unlikely maternity sites and at least 54 hollow-bearing trees of varying sizes and quality will be retained within the study area, with many more known to be present within the locality in similar habitat (i.e. in vegetation directly east of the study area and within Cuumbuen Nature Reserve). As extensive areas of less disturbed habitat occur in the locality and the species traverses a large home range, the proposal is not considered to affect the long-term survival of the Eastern False Pipistrelle in the locality.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

There is no recovery plan for Eastern False Pipistrelle. However, OEH identify 16 priority actions to help recover this species which centre on monitoring known populations, researching the ecology of the species, investigating private land supporting high conservation value habitat for the species, reducing use of

pesticides and understanding key roost site selection. The 16 priority actions were reviewed and the proposal is not considered to be at variance to these actions.

No threat abatement plans have been prepared for the threatening processes which apply to the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed will contribute to the following KTPs relevant to the Eastern False Pipistrelle and include: clearing of native vegetation; removal of dead wood and trees; and loss of hollow-bearing trees.

Given that the removal of 26 ha of habitat is restricted to a linear area already adjacent residential development, the study area is not considered any more important to the Eastern False Pipistrelle than the vast amount of available habitat remaining in the locality. As extensive areas of resources will remain within the locality, the impacts of the above KTPs on the Eastern False Pipistrelle are considered minor.

Eastern Bent-wing Bat

The Eastern Bent-wing Bat is found in a range of habitat types from Rainforest to wet and dry sclerophyll forest, open woodland and open grasslands. Eastern Bent-wing Bats primarily roost in caves but also use derelict mines, storm-water tunnels, buildings and other man-made structures, with discrete populations centred on maternity caves that are used annually for birth and development of young. The species forages both above and below the canopy layer and are known to travel large distances during foraging bouts; one female was recorded to travel 65 km in one night (Churchill 2008).

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Two Anabat files were recorded for the Eastern Bent-wing Bat on 5 March 2013; recordings were made in open woodland at survey site A8. One record of this species occurs in the locality and is listed approximately 3.5 km south of the study area along Queanbeyan River.

The study area provides potential habitat in the form of forest, woodland and open grassland foraging resources for this species and it is possible the species could forage throughout the study area and roost there during foraging bouts. However, while multiple hollow-bearing trees will be removed as part of the proposal and are possible roosting sites, the species is primarily known to roost in caves and roosting is not expected apart from short-term opportunistic sheltering. Additionally, at least 72 hollow-bearing trees will remain within the study area, with more known in the locality.

The proposal will result in approximately 26 ha of vegetation removal within the subject site which could be considered potential foraging habitat for this species. There are no known cave roosts or maternity caves in close proximity to the study area.

Given the Eastern Bent-wing Bat was recorded in low numbers, breeding habitat will not be affected, the large home range of the species, the quality of foraging and roosting resources remaining within the study area is high, and the proposal will affect habitat on the boundary of residential development it is considered the action is unlikely to have an adverse effect on the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

iii. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

iv. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

i. The proposal will result in approximately 26 ha of vegetation removal within the subject site which could be considered potential foraging habitat for this species.

ii. Habitat in the study area is already fragmented to the east and south by residential development and existing roads. The footprint of the proposal will run linear to existing disturbances to the east and will not result in large areas of land being isolated from each other (i.e. from east to west), however the action will result in isolating a small area of habitat east of the proposed road corridor nearby the existing residential development but will not disrupt connectivity of this species.

iii. The habitat to be removed is not considered to be of particularly good quality or otherwise important to the species in the locality. Extensive areas of less disturbed habitat occur in the locality and are available to the species. Given the mobility of the species and the good quality contiguous habitat remaining within the region the proposal is not considered to affect the long-term survival of the Eastern Bent-wing Bat in the locality.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

There is no recovery plan for the Eastern Bent-wing Bat. However, OEH identify 25 priority actions to help recover this species which centre on monitoring known populations, researching the ecology of the species,

preventing access to known roost cave sites and maternity caves. The 25 priority actions were reviewed and the proposal is not considered to be at variance to these actions.

No threat abatement plans have been prepared for the threatening processes which apply to the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed will contribute to the following KTPs relevant to the Eastern Bent-wing Bat and include: clearing of native vegetation; and loss of hollow-bearing trees.

Given that the removal of 26 ha of vegetation is restricted to a linear area already adjacent residential development, the study area is not considered any more important to the Eastern Bent-wing Bat than the vast amount of available habitat remaining in the locality, and extensive areas of resources will remain within the locality, the impacts of the above KTPs on the Eastern Bent-wing Bat are considered minor.

Golden Sun Moth

No Golden Sun Moths were observed during the survey period, despite a targeted focus over four days of those areas containing potential habitat. Several records are known to the south and west of the study area nearby Lanyon Drive (east of the Monaro Highway) (Biosis 2003), Jerrabomberra Valley and Old Cooma Road (ELA 2010a). The species has not been recorded in the locality during other studies (GHD 2009; ELA 2010a, ELA 2010b; BES 2007) indicating that the species is confined to discrete areas of suitable habitat where it is known.

The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Yass, Young and Tumut. The species is reported from 48 sites in NSW, with 32 sites occurring in the ACT (DSEWPaC 2013). Forty-eight Bionet records of the species are known for the Murrumbidgee Catchment region, with the heaviest concentrations north of Canberra towards Yass.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

No Golden Sun Moths were observed, despite a targeted focus over four days of those areas containing potential habitat, including areas dominated by wallaby grasses in small or extensive patches, and areas containing spear grasses and Redleg grass. Several records are known to the south and west of the study area nearby Lanyon Drive, east of the Monaro Highway.

The Golden Sun Moth could potentially occur within a very limited area of suitable habitat within the southern end of the study area which supports potential, but low quality, habitat for this species. This area is classified as open grassland and dry forest (Box Gum Woodland) that is primarily disturbed over some exotic and native grass species. Most of this habitat however, is considered unsuitable for the species, as the northern area of potential habitat contains a substantial amount of fill and the most southern end has been disturbed by the construction of the Edwin Land Parkway and subsequent rehabilitation works. Elsewhere in the broader study area habitat for this species is considered unsuitable.

The proposal would result in the removal of 4 ha of low quality habitat in the southern parts of the study area. Given that no evidence of the species was detected during surveys and the potential habitat within the study

area is considered unsuitable it is unlikely the proposal would have an adverse effect on the life cycle of the species such that a viable local population would be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule 1 Part 2 of the TSC Act are found in the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

iii. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

iv. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

iv. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

v. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

vi. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

iv. The proposal would result in the removal of 4 ha of low quality in the southern parts of the study area which is considered unlikely habitat for this species.

v. No areas of known or potential habitat for the species will become isolated or fragmented as a result of the proposal.

vi. The proposal would result in the removal of 4 ha of low quality habitat in the southern parts of the study area that has been subject to ongoing disturbances due to prior clearing and its proximity to residential housing. Given the targeted surveys did not detect the species and the habitat is low quality, the proposal is not considered to remove habitat important to the long-term survival of the species in the locality.

Suitable habitat does not occur between the study area and the known Golden Sun Moth records nearby Lanyon Drive. Approximately 3 km of unsuitable habitat (i.e. residential development or non-preferred habitat) exists between the study area and the known records and it is very unlikely the species would move through this area given that its dispersal ability through unfavourable habitat is limited to approximately 100 m (DEWHA 2009).

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal will not affect any critical habitat declared under the TSC Act.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.

There is no recovery plan for Golden Sun Moth. However, OEH identify 20 priority actions to help recover this species which centre on further research into the biology, ecology and management of the species, including implementation of several management plans in areas to which the species is known or has the potential to occur. The 20 priority actions were reviewed and the proposal is not considered to be at variance to these actions given that the habitat to be disturbed is low-quality and unlikely to be used by the species.

No threat abatement plans have been prepared for the threatening processes which apply to the proposal.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposal will result in the removal of 4 ha of potential habitat, but low quality habitat, within the southern section of the study area; however, the species has not been recorded in this area during targeted surveys and is considered very unlikely to occur in the subject site. The potential habitat to be removed in the southern parts of the study area is already subject to ongoing disturbances due to its proximity to residential housing and prior clearing has resulted in weed invasion in the area. Therefore the KTPs listed above are unlikely to affect the Golden Sun Moth.

Conclusion

Of the 13 fauna species assessed, the proposal is considered to have a significant impact on two species: the Rosenberg's Goanna and Speckled Warbler.

The Rosenberg's Goanna was not detected during the survey but is known to occur nearby the study area and it is expected the study area would include habitat that forms a part of the home range for this species. For the Rosenberg's Goanna the study area is expected to support breeding and foraging habitat for the species and the indirect impacts of an on average 60-m wide road corridor resulting in mortalities through vehicle collisions have the potential to place the species at risk over the long-term. This species is particularly susceptible to mortalities through increased road corridors nearby their habitat.

The Speckled Warbler was detected north of the Queanbeyan River during this assessment and has previously been detected in other studies (ELA 2010b) in the same area. This particular area is considered to support a resident population of the species and the study area therefore forms part of a known home range. The Speckled Warbler is at risk of greater mortality from vehicle collisions due to its ground foraging characteristics. As the Speckled Warbler is sedentary and occupies a discrete home range (~ 10 ha) and has been reported to require large relatively undisturbed remnants to persist, the loss of habitat from this proposal is considered to result in a significant impact for this species.

For the other 11 species assessed, the proposal will not result in a significant impact. For these species the proposal will either not affect habitat suitable for their occurrence, or it will only affect a portion of potential habitat not large enough to place these species and their populations at risk over the long-term. Additionally, similar contiguous habitat to be removed in the study area (primarily Box Gum Woodland and dry grass forest

supporting hollows and termites) is extensive in the locality and will remain available to these species. The western edge of the proposal runs linear to residential development and disturbed land, while the eastern edge abuts large tracts of native vegetation that is considered to provide better quality habitat (more foraging and breeding resources) than that of the study area. In this context, the proposal will not contribute to fragmentation or isolation of habitats in the locality. Proposed offsets are likely to mitigate some of the impacts from this current proposal as they will target both dry grass forest and Box Gum Woodland habitats that support hollow-bearing trees and termite mounds suitable for these species.

I.2 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT PRINCIPAL SIGNIFICANT IMPACT ASSESSMENT

The *Environment Protection and Biodiversity Conservation Act* 1999 specifies factors to be taken into account in deciding whether a development is likely to significantly affect Endangered Ecological Communities, threatened species and migratory species, listed at the Commonwealth level. The following assesses the significance of the likely impacts associated with the proposed works on:

- White Box-Yellow Box-Blakely's Red Gum grassy woodland and derived native grassland (Critically Endangered Ecological Community)
- Hoary Sunray (Endangered)
- Pink-tailed Worm-lizard (Vulnerable)
- Golden Sun Moth (Critically Endangered)

White Box-Yellow Box-Blakely's Red Gum grassy woodland and derived native grassland

An assessment of significance (seven-part test) pursuant to the TSC Act has been completed for the White Box-Yellow Box-Blakely's Red Gum woodland EEC (refer Appendix I.1). The following assessment should be read in conjunction with the TSC assessment as detailed information will not be repeated.

a) Will the action reduce the extent of an ecological community?
The proposal is expected to reduce the extent of the local occurrence of the community by up to 4 ha. This would result in a decrease of the local extent from 14 ha to 10 ha
b) Will the action fragment or increase fragmentation of an ecological community?
The existing local occurrence of the community is already isolated from other occurrences in the locality. The action will not increase the isolation or fragment the community.
c) Will the action adversely affect habitat critical to the survival of an ecological community?
The action will not affect habitat listed on the Register of Critical Habitat under the EPBC Act. It is anticipated that the remaining 10 ha of the local occurrence of the community will be viable for the long term and approximately 187 ha of the community is known to occur within a 10km radius of the study area (mostly secured in Nature Reserves). The 4 ha of habitat to be removed by the action is not considered critical to the survival of an ecological community.
d) Will the action 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?
Aside from the 4 ha of habitat to be permanently removed by the proposed action, there will be no impacts to soils within areas of the community outside of the subject site. As discussed in Section 5.2.1, there are unlikely to be any impacts to local hydrology that would impact on the community.
e) Will the action 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, for example through regular burning or flora and fauna harvesting?
There is potential for alteration to the species composition of the community through the introduction and or spread of weeds. Ameliorative measures have been described in this SIS to minimise this potential and it is considered unlikely that the threat to the community from weeds will increase. Weed species are already established at the site and proposed control measures are likely to result in a net reduction in weeds. No burning or flora and fauna harvesting is proposed within areas that are not directly impacted by the proposal. A decline or loss of functionally important species within the community is considered unlikely.

f) Will the action cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

i. Assisting invasive species, that are harmful to the listed ecological community to become established; or

ii. 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?

I. Roads are a vector for the introduction and spread of invasive weed species. The establishment of a major road within close proximity to the community may assist invasive weed species to become established however, measures have been described in this SIS to monitor and control the establishment and spread of weeds. With the implementation of these measures it is considered unlikely that weed species will become established to the extent that they are harmful to the community.

II. It is likely that herbicides will be used in the control of weed species within the community. The use of herbicides will be strictly controlled and only applied by qualified individuals who are trained in the identification of weed species and appropriate application of herbicides. It is considered unlikely that non target species within the community would be adversely affected by the use of herbicides. A spill response protocol will be in place to effectively manage spills should they occur.

Roads can be a source of pollutants, particularly hydrocarbons, which could potentially adversely affect the community. The road has been designed with drainage structures that would direct runoff away from adjacent vegetation communities.

g) Will the action interfere with the recovery of an ecological community?

The local occurrence of the community exhibits evidence of natural overstorey regeneration. This process is occurring across the study area including areas outside of the subject site that would not be impacted. The action would not interfere with this process outside of the area of impact.

Weeds are established within the community and present a threat to its understorey diversity. As discussed above it is considered unlikely that the action would increase the threat from weed invasion and would potentially be beneficial in reducing the impacts from weeds thereby assisting in the recovery of the local occurrence of the community.

Conclusion

The proposal will result in the removal of up to 4 ha of the 14 ha local occurrence of this community leaving 10 ha remaining. The action would not fragment or increase the existing fragmentation of the community. The habitat to be removed is not considered critical to the survival of the community nor would the action destroy or modify abiotic factors necessary for the community's survival. A substantial change in the species composition of the community is considered unlikely and with the implementation of ameliorative measures, the risks to the community from invasive species and pollutants are considered to be low. The action is unlikely to interfere with the recovery of the community outside of the area of direct impact and weed control measures are likely to be beneficial. However, as discussed within the TSC Act assessment of significance above, in the context of current and future development pressures, the high conservation significance of the area to be removed and considering that the proposal would remove approximately 30% of the local occurrence, the impacts to the community as a result of the proposal are considered to be significant.

Hoary Sunray

a) Will the action lead to a long-term decrease in the size of a population of a species?

The action will result in the permanent removal of approximately 5,000 Hoary Sunray individuals. Approximately 13,000 individuals occur within and immediately adjacent to the study area and based on the ecology of the species (discussed in Section 5.2.2) are considered to comprise the one population. It is possible that the population may extend further off site however, this cannot be conclusively demonstrated.

Based on these assumptions, the action will result in a long-term decrease in the size of the Hoary Sunray population from approximately 13,000 to 8,000 individuals.

b) Will the action reduce the area of occupancy of the species?

The proposal will remove approximately 19ha of suitable habitat for this species however, not all of this habitat is ideal or currently being occupied by the species. The exact spatial extent of the species on the ground is unknown. The 4ha of Box-Gum Woodland to be impacted in the south of the site is considered to provide higher quality habitat for the species.

c) Will the action fragment and existing population into two or more populations?

The proposed action will fragment existing groups of the species however, it is considered unlikely that the action would result in the prevention of genetic exchange between groups on either side of the proposed road (refer Section 5.2.2). It is considered likely that groups of individuals on either side of the proposed road would continue to function as a single population.

d) Will the action adversely affect habitat critical to the survival of a species?

The species is widespread in the locality in a broad range of habitat types including disturbed areas such as road sides. A level of disturbance is important to the survival of populations of the species (Sinclair 2011) and disturbance from the proposed action may in fact result in creating new areas for recruitment. The habitat to be impacted by the action is not considered critical to the survival of the Hoary Sunray.

e) Will the action disrupt the breeding cycle of a population?

An estimated 8,000 individuals will remain within the local population. As discussed in Section 5.2.2, pollination is effected by many different insects, including bees and flies. Seed is wind dispersed, can probably disperse over many kilometres and will germinate fairly rapidly under a wide range of conditions. It is considered unlikely that the proposed action will disrupt the breeding cycle of the local population.

f) Will the action modify, destroy, remove or isolate of decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposed action will `decrease the availability of habitat for the species by approximately 19ha and result in an immediate decline of the local population by approximately 5,000 individuals. However, as discussed under (d) above, the action may also create new areas of habitat for the species. The species occupies a wide range of habitats in the locality and is locally common. It is considered unlikely that the action would result in a long-term decline in the species at the local scale.

g) Will the action result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat?

Roads are a vector for the introduction and spread of invasive weed species. The establishment of a major road within close proximity to existing groups of the Hoary Sunray may assist invasive weed species to become established however, measures have been described in this SIS to monitor and control the establishment and spread of weeds. With the implementation of these measures it is considered unlikely that weed species will become established to the extent that they are harmful to the species.

h) Will the action interfere with the recovery of the species?

A national recovery plan has been prepared for this species (Sinclair 2011). The overall objective of recovery is to minimise the probability of extinction of the Hoary Sunray in the wild and to increase the probability of populations becoming self-sustaining in the long term. An Offset Strategy is included as

part of the proposal (Appendix H) which will potentially contribute to the protection of habitat for this species. Weed control measures along the periphery of the development will contribute to recovery action 4.1 – Control threats from pest plants. The Hoary Sunray is common within the locality and readily colonises disturbed areas. Beyond the initial direct impact from the proposal, it is considered unlikely that the action would interfere with the recovery of the species

Conclusion

The proposed action will result in the permanent removal of approximately 5,000 Hoary Sunray individuals, decreasing the size of the local population from an estimated 13,000 to 8,000 individuals. Approximately 19ha of suitable habitat for this species will be permanently removed however, not all of this habitat is ideal or currently being occupied by the species. Disturbance caused by the action may in fact create additional areas of habitat and opportunities for recruitment. The action is considered unlikely to fragment the local population or disrupt the breeding cycle and habitat to be impacted is not considered critical to the survival of the species. Measures are described in this SIS to control weeds harmful to the species and it is considered unlikely that the action will interfere with the species recovery beyond the initial direct impact. The species is locally common within the Queanbeyan area and occupies a broad range of habitats. A significant impact to the Hoary Sunray as a result of the proposed action is considered unlikely.

Pink-tailed Worm-lizard and Golden Sun Moth

An assessment of significance (seven-part test) pursuant to the TSC Act has been completed for the Pink-tailed Worm-lizard and the Golden Sun Moth (refer Appendix I.1). The following assessment should be read in conjunction with the TSC Act assessment as detailed information will not be repeated for this assessment.

Pink-tailed Worm-lizard (Vulnerable)

a) Will the action lead to a long-term decrease in the size of a population of a species?

The species is not known to occur within the study area and no evidence of the species was detected during targeted surveys within potential habitat of the site. The species is known from the locality with most records south of the study area nearby Tralee or the Poplars, in which the species was identified in rock outcrops (Biosis 2003a; Biosis 2003b). Other records are noted west of Cooma Road nearby the Queanbeyan River on ridges (BES 2008), which is now predominantly surrounded by residential land. The species is not expected to occur within the study area and the proposal will not decrease the size of a population for the species.

b) Will the action reduce the area of occupancy of the species?

As the species was not detected during targeted surveys and the habitat is not considered optimal habitat for this species, the proposal will not reduce the area of occupancy for this species.

c) Will the action fragment an existing population into two or more populations?

The regional abundance of the species is unconfirmed and the distribution of the Pink-tailed Worm-Lizard is patchy with records known mostly south of the Queanbeyan LGA. The location of the proposal does not affect known populations of this species and does not fragment habitat of these populations.

d) Will the action adversely affect habitat critical to the survival of a species?

The potential habitat to be removed supports Box Gum Woodland over an understory supporting some native grass species; however this area is generally absent of rock habitat, with some sporadic loose scattered rock present and is surrounded by degraded areas from clearance and invasion by exotic grass species. As the species was not detected during the targeted survey and the habitat to be removed is marginal, the action will not affect habitat critical to the survival of the species.

e) Will the action disrupt the breeding cycle of a population?

No populations are known or thought to occur within the study area and therefore the breeding cycle of a population will not be disrupted.

f) Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposal would result in the removal of 4 ha of low quality habitat in the southern parts of the study area (Box Gum Woodland). The potential habitat is surrounded by degraded areas from clearance and invasion by exotic grass species. Known pressures that can affect the life cycle of the Pink-tailed Worm-lizard include heavy grazing (rabbits) and predation pressures from domestic animals (cats and dogs). These pressures were clearly evident within the Box Gum Woodland habitat and surrounds, in particular, the grazing pressure of rabbits and hares has substantially reduced the cover of native grass species. On this basis, the habitat to be removed is considered unsuitable for the species and the action will not contributed to the decline of the species.

g) Will the action result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species habitat?

The area of potential habitat is already largely disturbed from surrounding development and current land uses associated with residential areas (clearing, walking tracks, predation and disturbance by domestic dogs, weed invasion). The action may increase the spread of native weeds in the locality which could affect habitat of this species. However, as the species is not expected to occur in the area and the potential habitat is subject to ongoing disturbance, the action is unlikely to affect the Pink-tailed Worm-lizard.

h) Will the action introduce disease that may cause the species to decline?

There are no known diseases associated with the action and resulting land use impacts that may cause the Pink-tailed Worm-lizard to decline.

i) Will the action interfere with the recovery of the species?

The action will result in the removal of 4 ha of low quality habitat within the southern section of the study area supporting some areas of dead wood and trees and a limited amount of scattered rock in low densities. This area of potential habitat is considered very unlikely to be used by the species given that it was not detected during the targeted survey. This potential habitat is also isolated from other known populations by existing road corridors and therefore is not available to be used by the broader populations. The action will therefore not interfere with the recovery of the species.

Golden Sun Moth (Critically Endangered)

a) Will the action lead to a long-term decrease in the size of a population of a species?

Several records are known to the south and west of the study area nearby Lanyon Drive (east of the Monaro Highway) (Biosis 2003), Jerrabomberra Valley and Old Cooma Road (ELA 2010a). The species has not been recorded in the locality during other studies (GHD 2009; ELA 2010a, ELA 2010b; BES 2007) indicating that

the species is confined to discrete areas of suitable habitat where it is known. The action will not affect any other populations in the locality as habitat of known populations is isolated by existing road corridors.

b) Will the action reduce the area of occupancy of the species?

The area of occupancy for Golden Sun Moth has been estimated to be roughly 8.8 km² in Australia. The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Yass, Young and Tumut. The species is reported from 48 sites in NSW, with 32 sites occurring in the ACT (DSEWPaC 2013). The proposal will result in the removal of 4 ha of potential habitat within the southern section of the study area; however, the species has not been recorded in this area during targeted surveys and is considered very unlikely to occur in the subject site and the action would not reduce the occupancy for the species.

c) Will the action fragment an existing population into two or more populations?

Suitable habitat does not occur between the study area and the known Golden Sun Moth records nearby Lanyon Drive. Approximately 3 km of unsuitable habitat (i.e. residential development or non-preferred habitat) exists between the study area and the known records and it is very unlikely the species would move through this area given that its dispersal ability through unfavourable habitat is limited to approximately 100 m (DEWHA 2009).

d) Will the action adversely affect habitat critical to the survival of a species?

As the species was not detected during the targeted survey and the habitat to be removed is marginal, the action will not affect habitat critical to the survival of the species.

e) Will the action disrupt the breeding cycle of a population?

No populations are known or thought to occur within the study area and therefore the breeding cycle of a population will not be disrupted.

f) Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposal would result in the removal of 4 ha of Box Gum Woodland of low quality habitat that has been subject to ongoing disturbances due to prior clearing and its proximity to residential housing. Most of this area is considered unsuitable for the species, as the northern area of potential habitat contains a substantial amount of fill and the most southern end has been disturbed by the construction of the Edwin Land Parkway and subsequent rehabilitation works. Suitable open grassy woodland areas dominated by Wallaby Grass are largely absent from the area or only occur in patches. Given the targeted surveys did not detect the species and the habitat is low quality, the proposal is not considered to remove or modify habitat to the extent that the species is likely to decline.

g) Will the action result in invasive species that are harmful to a endangered species becoming established in the endangered species habitat?

The area of potential habitat is already largely disturbed from surrounding development and current land uses associated with residential areas, especially weed invasions. The action may increase the spread of native weeds in the locality which could affect habitat of this species. However, as the species is not expected to occur in the area and the potential habitat is subject to ongoing disturbance, the action is unlikely to affect the Golden Sun Moth.

h) Will the action introduce disease that may cause the species to decline?

There are no known diseases associated with human impacts that may cause the Golden Sun Moth to decline.

i) Will the action interfere with the recovery of the species?

The action will result in the removal of 4 ha of potential habitat within the southern section of the study area supporting some areas of native grasses. This area of potential habitat is considered very unlikely to be

used by the species given that it was not detected during the targeted survey. This potential habitat is also isolated from other known populations by existing road corridors and therefore is not available to be used by the broader populations. The action will therefore not interfere with the recovery of the species.

Conclusion for Pink-tailed Worm-lizard and Golden Sun Moth

The proposal would result in the removal of 4 ha of low quality, but unlikely, habitat in the southern parts of the study area. Much of this area is subject to ongoing disturbances due to prior clearing and its proximity to residential housing (i.e. weed invasion, heavy rabbit grazing, predation by domestic animals, and other infrastructure construction). Given the targeted surveys did not detect either species and the habitat is low quality, the action proposed will not result in a significant impact for the Pink-tailed Worm-lizard or the Golden Sun Moth.