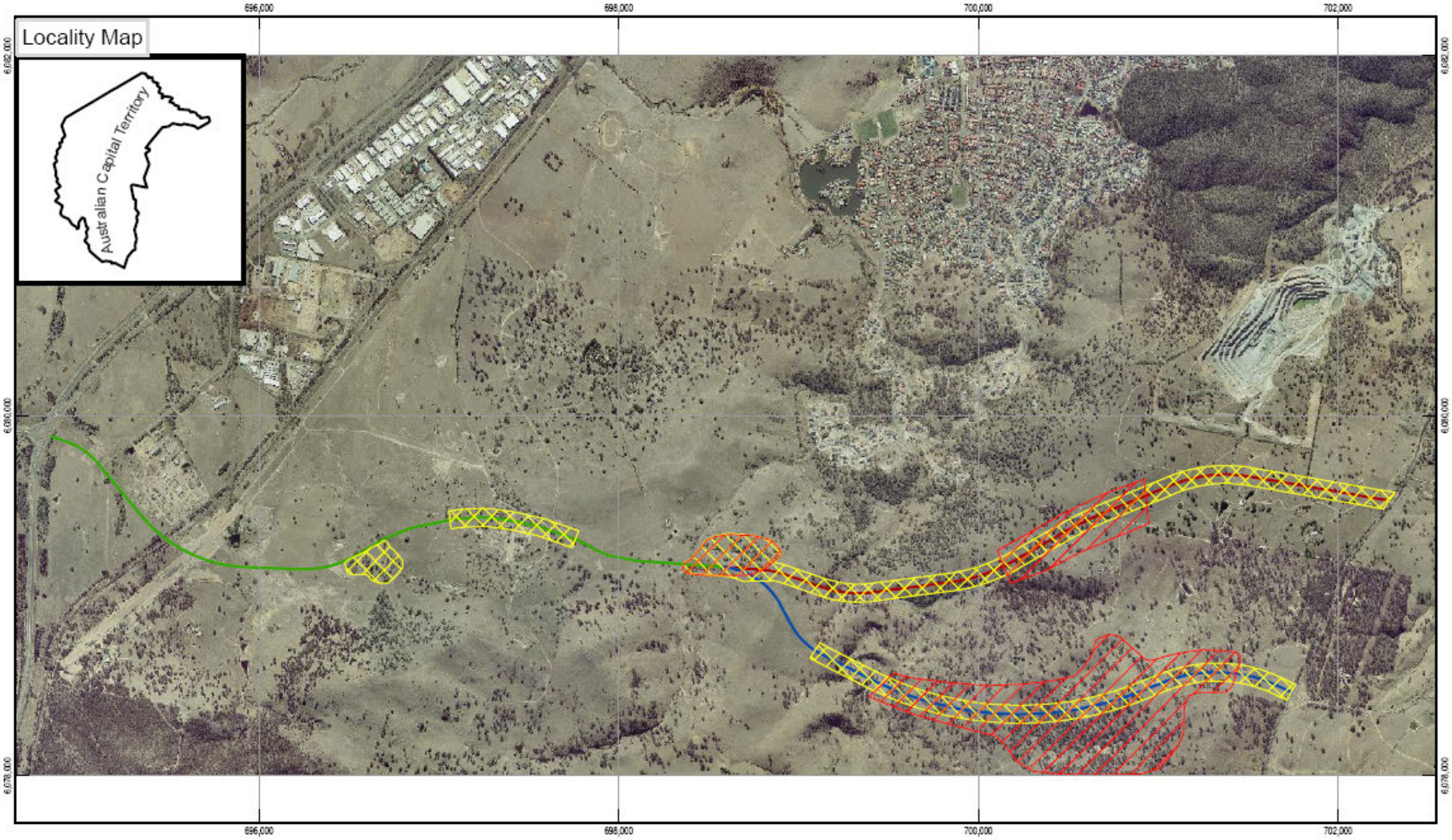

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N

LEGEND Alignment Option

- Common Route
- Option 1B (Preferred Route)
- Option 5

- EPBC Box-Gum Woodland
- TSC Box-Gum Woodland

GHD

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GHD: Box-Gum Woodland and Natural Temperate Grassland areas 2008, Queanbeyan City Council: Alignment Options, Department of Lands: Aerial photography. Created by: R. Robinson

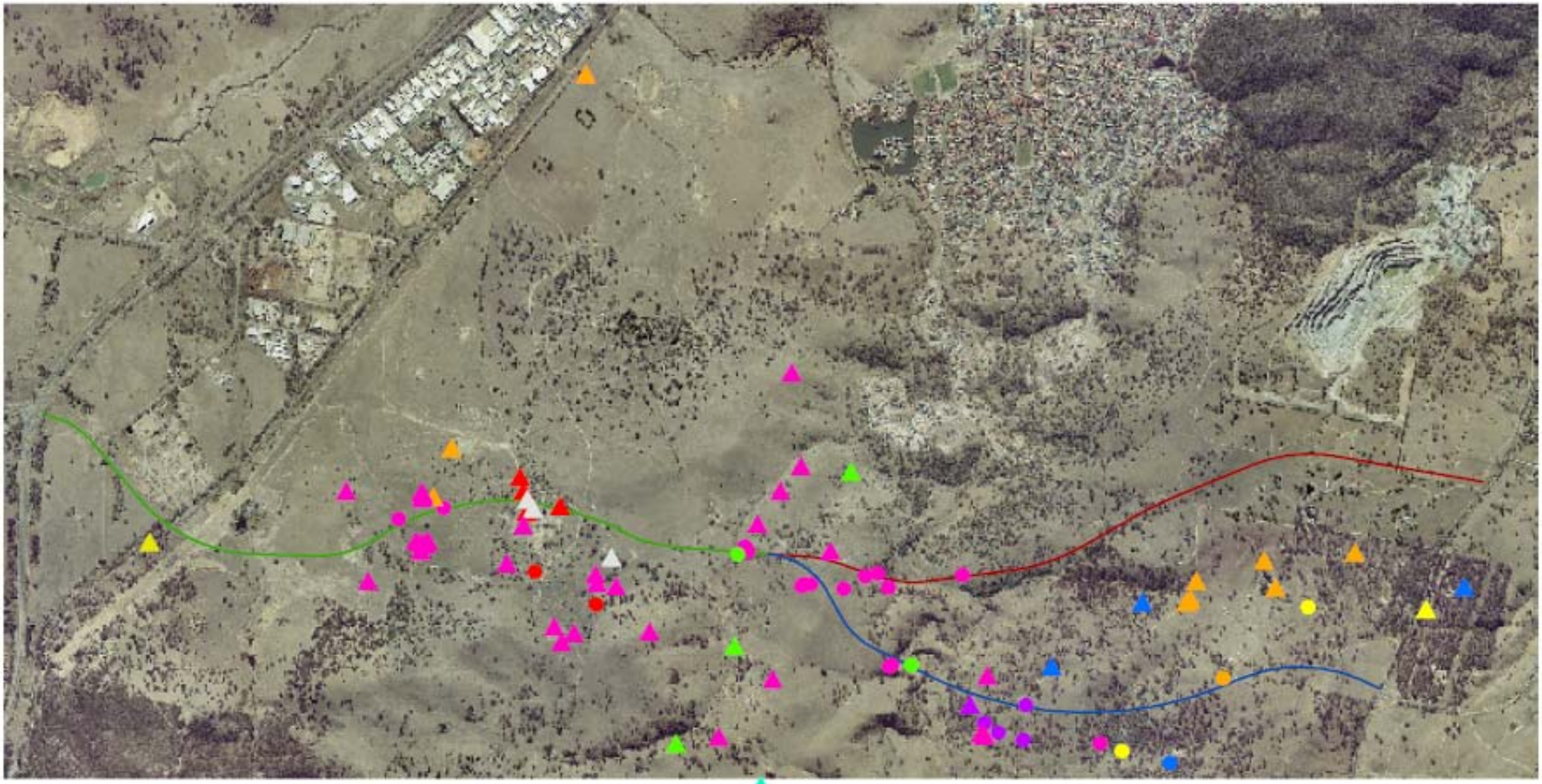
3.2.2 Flora

The Silky Swainson-pea (*Swainsona sericea*), listed as Vulnerable under the TSC Act, was observed during the October survey period in a number of locations. Four observations of this species were recorded during surveys in the vicinity of Option 5 (Figure 4). The observations included a patch of approximately 50 plants and three smaller patches of less than 10 plants. All plants observed occurred within one property east of Jerrabomberra Creek on the Option 5 alignment. Although no individuals were observed within the proposed Option 1B alignment, suitable habitat is present throughout the study area which includes the Option 1B alignment.

This species is known to occur in Natural Temperate grasslands on the Monaro and is also known to occur within Box Gum Woodland on the Southern Tablelands and South West slopes (DECC 2008b). Box Gum woodland is located within the preferred route and also within Option 5. Natural Temperate Grasslands are also located within the study area surrounding the common route. Both the Box Gum woodland and Natural Temperate Grasslands within the study area represent potential habitat for the Silky Swainson-pea.

Hoary Sunray (*Leucochrysum albicans* var. *tricolor*), listed as endangered under the Commonwealth EPBC Act, was observed within the study area in two locations (Figure 4). Both observations were in the east of the study area; one to the south of the proposed Option 5 (one plant) and another located between Option 5 and Option 1B (approximately 53 plants). This species is known to occur in a wide range of environments (DECC 2008b). This species is common in the locality, inhabiting roadside reserves where soil surface disturbance has occurred. Potential habitat occurs within the study area in hilly areas with shallow soils. Box-Gum Woodland within the study area represents potential habitat. This species may also occur outside Box-Gum Woodland areas in Natural Temperate Grassland and also in non-threatened ecological communities.

Swainsona recta has been recorded in the locality to the west of the study area. There are records in the ACT at Mt Taylor, Kambah and on Long Gully Road. The largest known population of this species occurs within a 22-kilometre length of railway line between “Tralee”, in the west of the subject site, and Williamstown, to the south. The railway easement is critical for the survival of this species as it contains a large percentage of the entire remaining population of this species (ACT Government 1997). Within the region this species historically occurred in the following areas, where it no longer occurs: Queanbeyan, Black Mountain, O’Connor, Harman and Mawson (ACT Government 1997). No *Swainsona recta* were observed during the current survey period, despite surveys being conducted at an appropriate time of year. Surveys for this species were limited to random meanders along the alignment routes. There is a known record of this species from south the of the proposed subject site alignment route in the study area within the old railway line easement (Kevin Mills and Associates 2007).



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Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N

LEGEND

Alignment Option
- Common Route
- Option 1B (Preferred Route)
- Option 5

Previous observations
- Brown Treecreeper
- Speckled Warbler
- Gang-gang Cockatoo
- Pink-tailed Worm-lizard
- Diamond Firetail
- Golden Sun Moth
- Hoary Sunray
- Hooded Robin
- *Swainsona sericea*
- *Swainsona recta*

Survey observations
- Pink-tailed Worm-lizard
- Brown Treecreeper
- Diamond Firetail
- Golden Sun Moth
- Hoary Sunray
- Speckled Warbler
- *Swainsona sericea*

GHD
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GHD: Threatened species locations 2008, Charles Sturt University: Previous threatened species locations 2004, Biosis: Previous threatened species locations 2003 & 2005, URS: Previous threatened species locations 2005, Queanbeyan City Council: Alignment Options, Department of Lands: Aerial photography.
Created by: R. Robinson

3.3 Fauna

Six reptile species, one amphibian species, 13 mammals (including confirmed observations of six bat species), 73 bird species and a number of invertebrates were observed during the current survey period. This included five species listed as threatened under either the NSW TSC Act or Commonwealth EPBC Act (Figure 4):

- Pink-tailed Worm-lizard (Aprasia parapulchella) - Vulnerable TSC Act and EPBC Act;
- Brown Treecreeper – eastern subspecies (*Climacteris picumnus victoriae*) - Vulnerable TSC Act;
- Diamond Firetail (*Stagonopleura guttata*) - Vulnerable TSC Act;
- Speckled Warbler (*Pyrrholaemus saggitatus*), Vulnerable TSC Act; and
- Golden Sun Moth (*Synemon plana*) - Endangered TSC Act and Critically Endangered EPBC Act

The study area contained high value habitat for a range of threatened and common fauna species.

3.3.1 Reptiles

Threatened species and their habitat were recorded throughout the study area. A number of non-threatened reptiles were observed during targeted surveys and incidental observations. High quality reptile habitat in the form of rocky outcrops and woody debris is common across the subject site, in a range of treed and treeless habitats. Snakes and lizards, including the Robust Ctenotus (*Ctenotus robustus*), Copper-tailed Skink (*Ctenotus taeniolatus*) and Eastern Brown Snake (*Pseudonaja textilis*) were observed within the study area. Potential habitats for the Striped Legless Lizard, Little Whip Snake, Grassland Earless Dragon and Rosenberg's Goanna were also identified during site surveys.

The survey conducted by Biosis (2003) at south "Tralee" included intensive surveys for threatened species including the Grassland Earless Dragon, Striped Legless Lizard and the Pink-tailed Worm Lizard. The surveys identified 11 records of the Pink-tailed Worm Lizard from three locations within south "Tralee". Of the three locations where Biosis recorded this species, one is within the subject site of the current survey and the remaining two are within the study area. Surveys were conducted over three days in March and April 2003.

The Grassland Earless Dragon was surveyed by Biosis (2003) by placing 306 artificial arthropod burrows within grasslands of south "Tralee". These artificial burrows were checked every second day for a period of 30 days. No individuals were detected during this survey period despite suitable habitat being present. It is noted that Biosis conducted similar surveys at "The Poplars" to the north of the study area at the same time during 2003. The survey at "The Poplars" recorded 64 individuals of the Grassland Earless Dragon. This indicates that survey effort and timing was sufficient and the presence of this species in Grasslands of south "Tralee" is considered unlikely.

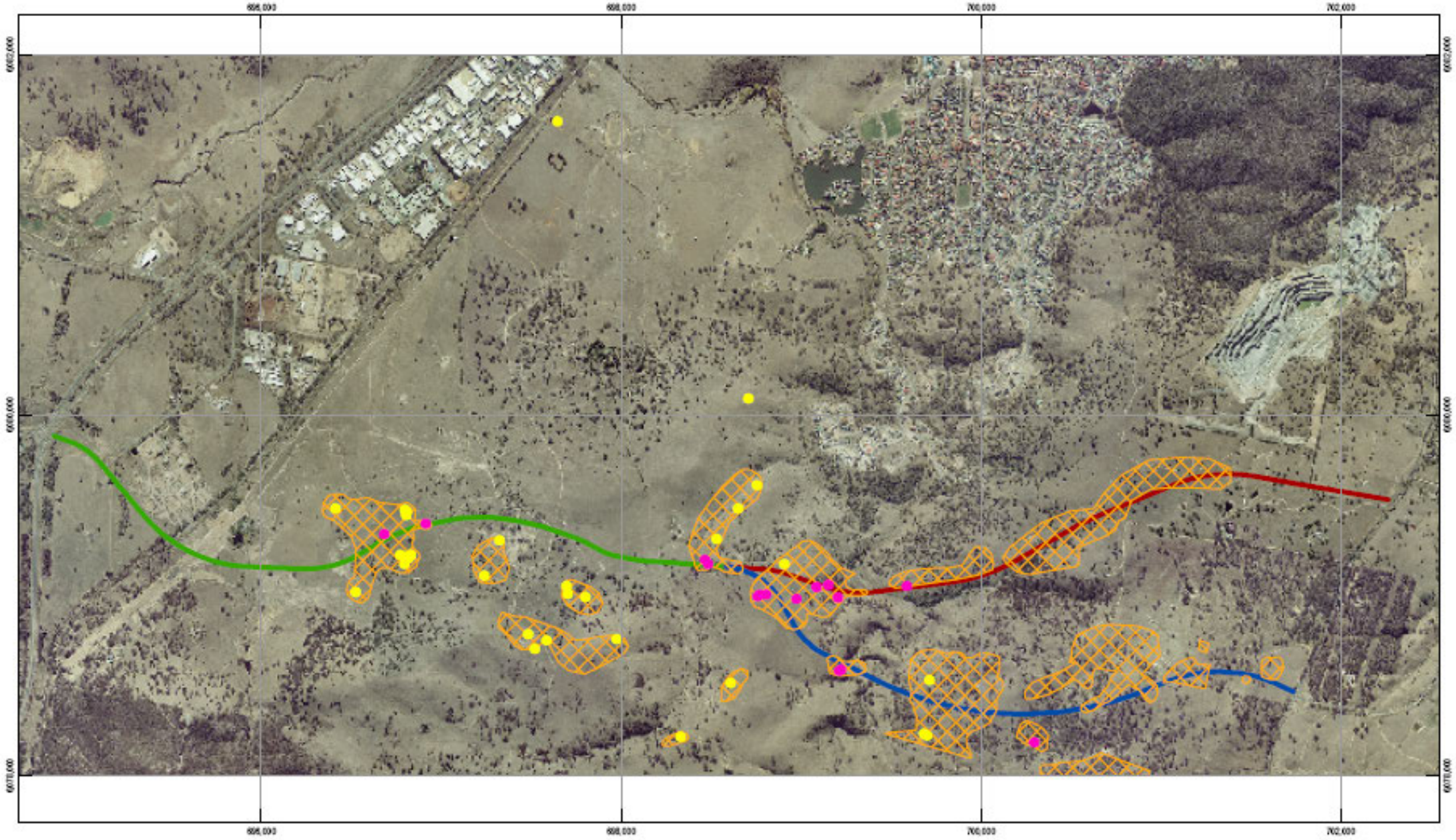
Targeted surveys were also conducted, within south "Tralee" for the Striped Legless Lizard by placing 12 x 10 metre pitfall traps in the south "Tralee" (Biosis 2003). Traps were set for a period of 33 days during December 2002 and January 2003. There were no Striped Legless Lizards trapped during the survey period. The assessment suggests that the study site it is considered unlikely to support either species (Grassland Earless Dragon and stripped Legless Lizard, Biosis 2003).

Targeted surveys for the Pink-tail Worm Lizard conducted by Thompson and Mullins (2004) identified 17 individuals of this species within the locality. Four of these records are from east of Jerrabomberra Creek

within the study area of Option 5. The remaining 13 records are from “Talpa”, which is located to the east of Old Cooma Road.

There were 18 observations of the threatened Pink-tailed Worm-lizard throughout the study area (Figure 5, Figure 6 and Table 1) in the current survey period. These observations included 14 observations of live specimens and four observations of Pink-tailed Worm-lizard sloughs. Seven of the observations were recorded within the subject site along Option 5, five were recorded along the Common Route and one record was located between Option 5 and Option 1B (junction of the two alignment routes with the Common Routes).

Figure 5 ***Aprasia parapulchella*** **Found in the Alignment Route (left) and the Habitat Rock under which it was found (right)**



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N

LEGEND

Alignment Option
- Common Route
- Option 1B (Preferred Route)
- Option 5

- Pink-tailed Worm-lizard previous observations
- Pink-tailed Worm-lizard survey observations
- Pink-tailed Worm-lizard habitat

GHD
CLIENTS | PEOPLE | PERFORMANCE

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GHD: Aprasia habitat areas 2008, Charles Sturt University: Aprasia habitat areas 2004, Queanbeyan City Council: Alignment Options, Department of Lands: Aerial photography. Created by: R. Robinson

Table 6 Targeted Threatened Reptile Species Surveys for the Dunn's Creek Road Proposal

Record No.	Alignment	No. Rocks Rolled	Species Observed	Observations
1	Option 5	75	*Ctenotus taeniolatus*, *Ctenotus robustus*	Rocky outcrop amongst open woodland with a shrubby understorey, leaf litter and bare ground common.
2	Option 5	40	none	Open woodland within the drainage line, 0.5 hectares of loosely embedded rocks on flats and steep slopes.
3	Option 5	60	***2 x Aprasia parapulchella under one rock***	Small 20 x 20 metre rock outcrop. Grassy woodland, weedy site dominated by *Verbascum thapsus* and *Hypericum perforatum* with some (<5%) *Themeda australis* present.
4	Option 5	40	None	Open woodland, 5 percent tree cover. Loosely embedded boulders uncommon on this slope.
5	Option 5	30	***Aprasia parapulchella skin***	20 x 30 metre area, 5 percent tree cover, sparse shrub cover, primarily grassy understorey
6	Option 5	20	Ctenotus robustus	Open grassland with scattered trees. 15 x 15 metre area of small loosely embedded boulders
7	Option 5	60	None	Open grassland with less than 10 percent canopy cove. Moderately steep slope.
8	Option 5	30	*Ramphotyphlops nigrescens*	10 x 10 metre area. Small rocky outcrop on steep slope above drainage line.
9	Option 1B	None	None	Transect walked during bird survey also represents good *Aprasia parapulchella* habitat. Loosely embedded rocks on steep slope with minimal tree cover.
10	Option 1B	20	***2 x Aprasia parapulchella under adjacent rocks***	Open grassland surrounded by Briar Rose (*Rosa rubignosa*) and native shrubs (*Bursaria spinosa*) on very steep slope. No trees within 30 metres of observation

Record No.	Alignment	No. Rocks Rolled	Species Observed	Observations
11	Option 1B	None	None	Marginal habitat either side of the creek.
12	Option 1B	120 rocks total	***1 x Aprasia parapulchella***	Located between two drainage lines on steep sandy slope. Open grassland dominated by weeds.
13	Option 1B	Included above	***1 x Aprasia parapulchella***	Steep south facing slope where Briar Rose and *Bursaria spinosa* are common. *Themeda sp.* and exotic species are the dominant species
14	Option 1B	Included above	***1 x Aprasia parapulchella***	Very steep rock slope where *Themeda australis*, *Avena fatua*, grasses, herbs and forbs are dominant.
15	Option 1B/ Option 5	Included above	***1 x Aprasia parapulchella***	Steep slope where *Avena fatua* is the dominant species, *Themeda australis* less common. Only one tree within 50 metres and no shrub layer.
16	Option 5	60 rocks	***2 x Aprasia parapulchella***	Very steep slope above the creek. Shrubs common but trees are sparse, leaf litter and bare ground common, grasses also common.
17	Option 5	150 rocks	None	Habitat search and rock roll may have been conducted too late in the day for *Aprasia parapulchella* detection. Suitable potential habitat throughout. Known habitat, as observed by previous records (Thompson and Mullins 2004)
18	Option 1B/ Option 5	70	None	Potential *Aprasia parapulchella* habitat however some of the rocks are deeply embedded and unable to be rolled.
19	Option 5	Included above	***1 x Aprasia parapulchella skin***	*Austrostipa* sp., *Acetosella vulgaris and Avena fatua* the dominant ground covers, no canopy or midstorey species.
20	Option 5	Included above	***2 x Aprasia parapulchella***	*Lomandra* sp., *Avena fatua* and *Trifolium arvense* were the dominant ground covers, sparse tree cover and no shrub layer. The site was very steep with a sandy loam soil surface. Two live Pink-tailed Worm-lizards observed approximately 15 metres apart from each other on the same rocky slope.

Record No.	Alignment	No. Rocks Rolled	Species Observed	Observations
21	Common	50 Rocks	***2 x Aprasia parapulchella*** ***1 x Aprasia parapulchella skin***	Steep rocky slope adjacent to the creek line. Sparse native groundcovers along with a native shrub layer.
22	Common	20	***1 x Aprasia parapulchella skin***	A series of small rocky outcrops along the length of the proposed route, contained within the larger native grasslands.
23	Common	20	***1 x Aprasia parapulchella***	Small rocky outcrop on a small rise. Groundcovers dominated by exotic species, Briar Rose and Bracken Fern (*Pteridium esculentum*) is common on this small outcrop. Surrounded by native grasslands.

3.3.2 Amphibians

No targeted amphibian surveys were conducted during the October or December survey periods. Although a number of aquatic habitats were identified, suitable threatened species habitat was not identified. The Common Eastern Froglet (*Crinia signifera*) was the only amphibian detected during the survey period. This species was recorded on a number of occasions as an incidental observation during other surveys. A number of features within the study area provide amphibian habitat, including farm dams and a number of drainage lines. At the time of the survey, Jerrabomberra Creek contained water, however it was not flowing and existed as a series of small shallow pools. At the time of the surveys this creek contained very little water and offered limited aquatic habitat. A number of farm dams and ephemeral contour banks were observed during the surveys. These dams and banks were generally utilised for watering domestic stock and provided various types of aquatic habitat. None of the dams surveyed are likely to provide threatened species habitat due to a lack of fringing aquatic vegetation and pugging by livestock.

3.3.3 Birds

Birds were the most diverse fauna group observed within the subject site and study area, with 73 species observed. Of the species observed, three species are listed under the NSW TSC Act as Vulnerable; the eastern subspecies of the Brown Treecreeper, Diamond Firetail and Speckled Warbler. The Starling (*Sturnus vulgaris*) and Common Myna (*Acridotheres tristis*) were the only exotic bird species observed during the survey period.

A number of habitat types available for birds were observed across the study area. Species common in the woodland areas included common species such as the Striated Pardalote (*Pardalotus striatus*), Rufous Whistler (*Pachycephala rufiventris*) and Noisy Miner (*Manorina melanocephala*). Where a shrubby understorey was present, small woodland birds such as Superb Fairy Wrens (*Malurus cyaneus*), Grey Fantails (*Rhipidura fuliginosa*) and thornbills were common. Larger species, common in both woodland and agricultural landscapes such as Australian Magpies (*Gymnorhina tibicen*) and Magpie Larks (*Grallina cyanoleuca*), were also common across the study area. Water birds such as the Pacific Black Duck (*Anas superciliosa*) and the Australian Wood Duck (*Chenonetta jubata*) were also observed on and near farm dams within the study area.

The Speckled Warbler was observed on two occasions within the study area. A single Speckled Warbler was observed foraging within a drainage line in the eastern section of the Common Route (Figure 4). The individual was observed foraging with Double-barred Finches (*Taeniopygia bichenovii*) during the October survey period. At least three and up to five Speckled Warblers were observed during the December survey period. They were observed foraging in grassland near Jerrabomberra Creek in the western section of Option 5 (Figure 4). The Speckled Warblers were foraging with a number of other small birds including Double-barred and Red-browed finches (*Neochmia temporalis*) and Silvereyes (*Zosterops lateralis*). The drainage lines where Speckled Warblers were detected are both vegetated with dense shrubs including *Bursaria spinosa* and some introduced species such as *Rosa rubignosa*.

The eastern subspecies of the Brown Treecreeper was detected in open woodland during the October survey period. One Brown Treecreeper was observed and others were detected by call within woodland adjacent to Option 5. The one individual recorded, was observed foraging on the trunks of Yellow Box

and Blakely's Red Gum. Large areas of suitable habitat are present within the study area for this species in the form of open woodland with hollow bearing trees, woody debris and native understorey for foraging. Thompson and Mullins (2004) observed this species "*on a number of occasions"* and considered that this species is "*common across the proposal site and it is likely that they breed and nest on the proposal site*."

Diamond Firetails were observed in woodland to the south of the common route. During the October field survey, two ecologists observed Diamond Firetails at the same time in different locations; the surveys were conducted concurrently on "Environa" and south "Tralee". Biosis (2003) recorded both Diamond Firetails and Hooded Robins within south "Tralee". The mapping conducted by Biosis indicates both the Hooded Robin and the Diamond Firetail have been recorded previously within the vicinity of the current proposals subject site.

3.3.4 Mammals

Large native mammals were common within the study area, particularly Eastern Grey Kangaroos (*Macropus giganteus*). Grazing pressure at the site was high in some areas due to a combination of a large Eastern Grey Kangaroo population coupled with grazing pressure from domestic Goats, Donkeys, Horses, Cattle and Sheep. The Swamp Wallaby (*Wallabia bicolor*) and Wombat (*Vombatus ursinus*) were also detected within the study area by direct sightings or scats.

The introduced Wild Dog (*Canis familiaris*), Fox (*Vulpes vulpes*), European Rabbit (*Oryctolagus cuniculus*), and Brown Hare (*Lepus capensis*) were observed during the survey along with a number of domesticated exotic species. The impacts of European Rabbits varies across the study area but appeared to be having greater impact (as evidenced by number of scats and browsing) on the eastern half of the study area.

Anabat analysis of recorded bat calls revealed the definite presence of six bat species within the study area and the probable presence of an additional four species, including the TSC Act Vulnerable Yellow-bellied Sheath-tail Bat (*Saccolaimus flaviventris)*. The call recorded for the Yellow-bellied Sheath-tail Bat lacked sufficient information to confidently identify this species and hence was recorded as probable call identification only. The Anabat analysis did not positively identify any threatened species, however, for this study it is assumed that the Yellow-bellied Sheath-tail Bat may occur in the study area and locality.

A high number of bat calls were recorded from the study area, as indicated by the number of sequence files collected. Calls were generally of reasonable quality, however many calls (at least 30%) could not be identified to species level.

Table 7 Anabat Analysis Results

✓ = species group was recorded for that site. - = not recorded. * species listed as threatened under the TSC Act 1996. Total number of species recorded for each site is based on definite identification only.

	UNIT A	UNIT A	UNIT B	UNIT B
Date	**29-30/10/08**	**30-31/10/08**	**29-30/10/08**	**30-31/10/08**
Time start - finish	**18:37-05:26**	**18:24-08:48**	**16:55-06:16**	**15:28-05:51**
Species or group				
T. australis	D	D	D	D
M. planiceps species 4 (lpf)	D	D	D	D
C. gouldii	D	D	D	D
M. planiceps 3 (spf)	-	-	PR	-
C. gouldii/M. planiceps species 4 (lpf)	✓	✓	✓	✓
S. balstoni	-	PR	PO	-
C. gouldii/ S. balstoni	✓	✓	✓	✓
V. vulturnus	D	D	D	PR
V. darlingtoni	PR	D	PR	-
Vespadelus sp.	✓	✓	✓	✓
*Vespadelus sp/M. schreibersii**	✓	-	✓	-
C. morio	PR	-	-	PR
Nyctophilus sp.	✓	-	-	-
V. regulus	D	-	-	-
C. morio/V. vulturnus	✓	✓	✓	✓
*S. flaviventris**	-	-	-	PR
*Nyctophilus spp./M. macropus**	-	-	✓	-
~ Effort (hrs:mins)	**11**	**12**	**12**	**12**
Sequence files	**564**	**92**	**370**	**355**
~ No. bat calls	**85-80%**	**55-60%**	**80-85%**	**80-85%**
Total D species	**5**	**5**	**5**	**3**
Total PR species	**2**	**1**	**2**	**2**

N.B. for Table 7: start and finish times not true indication of survey effort.

Thompson and Mullins (2004) had “probable” identifications of the Large Bent-wing Bat and the Eastern False Pipistrelle during their surveys of the Googong area. The report suggests bat activity was low during the survey with most of the bat activity being recorded from “Talpa”.

3.3.5 Invertebrates

Targeted surveys for the Golden Sun Moth were conducted on 1 and 2 December 2008. Weather conditions during the survey period included generally moderate to high winds with periods of no wind or slight wind. Temperatures at the Canberra Airport reached maximums of 25.2°C on 1 December and 24.5°C on 2 December. Surveys were conducted during the warmest periods of the day between 1000 hours and 1430 hours (BOM 2008).

Despite the generally unsuitable survey conditions (high winds) one Golden Sun Moth was captured in close proximity to the proposed Option 5 alignment (Figure 4). The individual was detected on a moderately steep, east-facing, rocky slope. The grassland had a moderate cover (10-25 percent) of *Austrodanthonia carphoides* as well as St. John’s Wort (*Hypericum perforatum*), *Austrostipa* species and Sweet Briar. The individual was observed moving (less than 30cm flight distance per movement) amongst patches of *Austrodanthonia carphoides* and exotic species including St John’s Wort. The individual was captured in a sweep net for positive identification and released soon after. When released the individual made a short flight (3m at less than 0.5m height) before landing in a nearby patch of *Austrodanthonia* sp and *Themeda australis*. The individual was observed to have frayed wings and dull colouring.

Despite other suitable potential habitat being observed and searched during the survey period (Table 8), no other individuals were captured or observed. Due to the windy conditions during the survey period Golden Sun Moth activity may have been reduced, preventing detection at a number of potential habitat sites. The positive identification of the Golden Sun Moth during this survey and during previous surveys indicates that the study area provides known habitat for this species. Although Golden Sun Moths were not observed in most areas initially identified as potential habitat, these areas may still be considered potential habitat because of the windy conditions at the time of survey. The presence of a number of records in similar habitat within the locality and the unsuitable conditions during the current survey indicate that these areas are potential habitat. A number of areas identified as potential habitat are located between areas of known habitat, providing further justification for the classification of these areas as potential habitat. When a final alignment route is selected, targeted surveys are likely to be required to determine if this potential habitat is actual habitat.

In the west of the study area, north of the common route there is a record for the Golden Sun Moth from a previous survey (URS 2005). This record occurs outside of the subject site, and the area within the subject site near this record is not considered to be suitable habitat for this species. The area within the subject site is comprised of tall (30-50cm tall) *Austrostipa* grasses with very little spacing between tussocks. The grassland here is considered too dense to be habitat for the Golden Sun Moth.

Table 8 Survey effort and Locations of Golden Sun Moth Surveys within the Proposed Dunn's Creek Road Study Area

Easting	Northing	Stratification Unit	Weather Conditions	Time/Area (min) (ha)		Dominant Species	Golden Sun Moth Recorded
0700864	6078254	Slope	Moderate to high winds, 50% cloud, 20°C	40	0.5	St, John,s Wort, *A. carphoides,* Sweet Briar, *Austrostipa* sp.	Yes
0700647	6078299	Ridge/ slope/ gully	Moderate to high winds, 50 % cloud, 21°C	60	1		No
699159	6078679	Ridge	High winds, 60% cloud, 23° C	40	0.3	Patchy *Austrodanthonia* sp.	No
700984	6079723	Slope	Moderate winds, 30% cloud, 17°C	70	3	Scotch Thistle*, A. fatua, E. plantagineum, Bromus* sp.*, Austrostipa* sp.*, Austrodanthonia* sp.	No
699003	6079075	Ridge/ Slope	Moderate winds, 10% cloud, 24°C	40	2	*Avena fatua*, *Austrostipa* sp. Limited *Austrodanthonia* sp.	No
696021	6079084	Slope	Moderate to high winds, 5% cloud, 22°C	40	1		No
699617	6078383	Slope/ Gully	Slight to moderate winds, 30% cloud, 23°C	60	3	*Austrodanthonia* spp.*, Chrysocephalum* sp.*, Themeda* sp.	No

4. Likelihood of Threatened Species and Communities Occurring in the Study Area

In addition to the species and ecological communities that are known to occur within the study area, some species have additional records in the locality. Table 9 and Table 10 assesses the likelihood of each species occurring in the study area based on the observed habitat and known habitat preferences of each species.

N.B. It should be strongly noted that the likelihood of occurrence assessment is based on the study area *not* the subject site. The study area includes the subject site and surrounding land within a 500m radius of the subject site (see Figure 1 and report definitions), hence some species are recorded as likely based on known records in the study area not the subject site (e.g. *Swainsona recta*).

Table 9 Threatened Flora Species Recorded Within the Study Area

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood of Species Occurring Within Study Area
Button Wrinklewort *Rutidosis leptorrhynchoides*	Occurs in Box Gum Woodland, secondary grassland derived from Box Gum Woodland or in Natural Temperate Grassland; and often in the ecotone between the two communities. Grows on soils that are usually shallow, stony red-brown clay loams and tends to occupy areas where there is less competition from herbaceous species. Known to colonise disturbed areas (eg. vehicle tracks, bulldozer scrapings and areas of soil erosion).	E, E1	No	Yes	LIKELY - there is potential habitat across the study area
Silky Swainson-pea *Swainsona sericea*	Found in Natural Temperate Grassland and Snow Gum Woodland on the Monaro. Found in Box Gum Woodland in the Southern Tablelands and South West Slopes. Sometimes found in association with cypress-pines (*Callitris* spp.). Known to regenerate from seed after fire.	V	Yes	Yes	YES - this species was observed during October surveys

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood of Species Occurring Within Study Area
Mountain Swainson-pea *Swainsona recta*	Before European settlement Mountain Swainson-pea occurred in the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum, Yellow Box, Candlebark Gum and Long-leaf Box. Grows in association with understorey dominants that include Kangaroo Grass, poa tussocks and spear-grasses. Generally tolerant of fire.	E, E1	No	Yes	LIKELY - there is preferred habitat within the study area. The railway easement in the west is known habitat.
Pale Pomaderris *Pomaderris pallida*	This species usually grows in shrub communities surrounded by Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*E. macrorhyncha*) or Callitris spp. woodland. The main distribution is along the Murrumbidgee in the ACT	V, V1	No	Yes	UNLIKELY - no preferred habitat within the study area
Thick-lipped Spider Orchid *Caladenia tesselata*	Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. Flowers appear between September and November (but apparently generally late September or early October in extant southern populations).	E, V1	No	Yes	UNLIKELY - historic Queanbeyan population is presumed extinct
Hoary Sunray *Leucochrysum albicans* var. *tricolor*	Known from the study are and locality. Known to inhabit roadsides and other disturbed areas with the locality including grasslands, Box Gum Woodland and ironbark associations.	E1	Yes	Yes	YES – recorded in the east of the study area
Austral Toadflax *Thesium australe*	Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass. A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	V, V1	No	No	UNLIKELY - no preferred habitat where *Themeda spp*. are dominant

* V – Vulnerable TSC Act, V1 – Vulnerable EPBC Act, E – Endangered TSC Act, E1 – endangered EPBC Act

Table 10 Threatened Fauna Species Previously Recorded in the Locality

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood Of Species Occurring Within Study Area
Golden Sun Moth *Synemon plana*	Occurs in Natural Temperate Grasslands and grassy Box Gum Woodland with *Austrodanthonia* spp or Wallaby Grass, ground cover particularly *A carpoides*. Suitable grassland includes these Wallaby grasses with bare patches between tussocks which are thought to be important display areas for female moths attempting to attract mates. The subject site contains a number of suitable habitats for this species. The adults are only active at the sunniest hours on calm summer days and will only live for a few days following metamorphosis. The females are flightless and the males have limited fling ability making detection difficult. The larvae reside in the root of the wallaby grass tussocks for between 1 and 2 years. Detection of this species outside of the adult emergence is very difficult.	E, CE	Yes, Option 5	Yes	YES - this species was observed during December surveys
Green and Golden Bell Frog *Litoria aurea*	The Green and Golden Bell Frog is a relatively large frog which inhabits a variety of freshwater habitats including marshes, swamps, lagoons, farm dams and ornamental ponds (Cogger 2000). Optimum habitat usually contains macrophyte cover (e.g bull rushes Typha spp. or spikerushes Eleocharis spp.) for diurnal sheltering with nearby grassed areas and an unshaded waterbody free of predatory fish Gambusia holbrooki (White and Pyke 1996). The species is largely aquatic and known to breed from September to early April but most commonly during the summer months (White and Pyke 1996). There is no known population of Green and Golden Bell Frogs occurring on the subject site or study area.	E, V1	No	Yes	UNLIKELY - Currently only one known population in inland NSW

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood Of Species Occurring Within Study Area
Southern Bell Frog *Litoria raniformis*	Thought to now be extinct on the NSW Tablelands, habitat required includes permeant or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice bays. In NSW/ACT *L. raniformis* is thought only to exist in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Very little suitable habitat was observed across the study area. Permanent water, suitable for breeding is not present.	E,V1	No	Yes	UNLIKELY - no recent records for this species within the locality, no suitable habitat.
Yellow-spotted Bell Frog *Litoria castanea*	A mostly aquatic tree frog, with only small finger and toe pads. The Yellow-spotted Bell Frog is distinguished from other members of the group by its fully webbed toes and yellow spots on the groin and the back of the thighs. Elsewhere it is marbled green and gold, with black spots. The Yellow-spotted Bell Frog has not been recorded in the wild since the 1970s. It has two separate highland ranges, on the New England Tableland and on the southern highlands from Lake George to Bombala. There are unconfirmed reports from near Bathurst and Orange. This species, like the other bell frogs require large permanent ponds or slow flowing streams with plenty of emergent vegetation such as bulrushes.	E, E1	No	Yes	NO - has not been recorded in the wild since the 1970's

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood Of Species Occurring Within Study Area
Grassland Earless Dragon *Tympanocryptis pinguicolla*	This small agamid has undergone a large decline in range in recent history and is now only known from the Canberra/Queanbeyan and Monaro lowland temperate Grasslands with limited weed infestation. Although animals have been recorded in areas of introduced tussock forming grasses. Like the other endemic fauna species of local grassland communities the Grassland Earless Dragon appears to prefer more open tussock structure with bare ground between the tussocks, herbs and lose or partially embedded rocks. Another important required habitat feature in tunnels excavated by spiders. These appear to be important refuge and nesting sites.	E, E1	No	Yes	UNLIKELY - this species inhabits Natural Temperate Grasslands which are limited in the study area.
Striped Legless Lizard *Delma impar*	Occurs in the Southern Tablelands, the South Western Slopes and possibly in the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma and Tumut areas. Also occurs in the ACT, Victoria and south-eastern Australia. Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box Gum Woodland. There are no known records of this species within the locality of the subject site. No individuals were recorded during the surveys; however, suitable habitat has been recorded for this species within the locality.	V, V1	NO	Yes	UNLIKELY – primarily occupy Natural Temperate Grasslands as well as derived native grasslands and exotic grasslands. Previous targeted surveys in study area did not identify this species.

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood Of Species Occurring Within Study Area
Pink-tailed Worm-lizard *Aprasia parapulchella*	The Pink-tailed Worm Lizard is only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong. Inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass (Themeda australis). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks Habitat for this species is common across the study area. There are records for this species within the study area.	V, V1	Yes	Yes	YES - this species was observed in the October surveys along the Common Route, Option 1B and Option 5.

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood Of Species Occurring Within Study Area
Little Whip Snake *Suta flagellum*	The Little Whip Snake is a small, slender snake, reaching 45 cm in length. Its most conspicuous feature is the black hour-glass-shaped patch from the back of the nape to between the eyes. Some specimens also have a black snout-band. The body is tan to orange above and creamy below. Each scale is emphasised by its dark edge, giving the animal a "netted" appearance. If disturbed it may hurl itself about, whip-like, and emit a foul smell. The Little Whip Snake is found between Crookwell in the north, Bombala in the south, Tumbarumba to the west and Braidwood to the east. Generally occurring in Natural Temperate Grasslands and grassy woodlands, including those dominated by Snow Gum *Eucalyptus pauciflora* or Yellow Box *E. melliodora*, it will persist in secondary grasslands derived from clearing of woodlands. Found on well-drained hillsides, mostly associated with scattered loose rocks where it forages for frogs and small reptiles.	V	No	No	LIKELY - occupies Box Gum Woodland and Natural Temperate Grasslands preferring steep slopes with loosely embedded rocks.

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood Of Species Occurring Within Study Area
Rosenberg's Goanna *Varanus rosenbergi*	Rosenberg's Goanna occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. This species is found in heath, open forest and woodland, where it forages for carrion, birds, eggs, reptiles and small mammals. Individuals require large home ranges and have an association with termite mounds, which they utilise for nesting. There are records for this species on the Googong Dam foreshores and to the north of the study area near Wickerslack Lane.	V	No	Yes	LIKELY - suitable foraging habitat present.
Swift Parrot *Lathamus discolor*	On the mainland, they occur in areas where eucalypts are flowering profusely or where there are abundant lerp infestations. Favoured feeding trees include winter flowering species such as Mugga Ironbark and White Box. The study area does support intact native woodland communities and therefore is likely to support this species on occasion.	E, E1	No	Yes	LIKELY - study area provides foraging resources.
Gang Gang Cockatoo *Callocephalon fimbriatum*	The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales, It occurs regularly in the Australian Capital Territory. This species generally utilises high altitude forest during summer; it prefers more open eucalypt forest and woodlands, particularly box-ironbark assemblages, during colder months.	V	No	Yes	LIKELY - winter foraging habitat present.

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood Of Species Occurring Within Study Area
Regent Honeyeater *Xanthomyza phrygia*	Inhabit dry and open forest and woodland particular Box-Ironbark woodland and riparian forest of River Sheoak. Inhabit woodlands that support a significantly high abundance and species richness of birds, with large numbers of mature trees, high canopy cover and abundance of mistletoes. The study area supports marginal suitable native woodland communities and given the presence of suitable foraging resources, the study area is likely to occasionally support this species.	E, E1	No	Yes	LIKELY - potential foraging habitat present in the form of Box Gum Woodland
Diamond Firetail *Stagonopleura guttata*	This species is found in grassy eucalypt woodlands, including Box Gum Woodland and Snow Gum Woodland. This species also inhabits natural temperate grasslands, mallee, open forest, riparian area and secondary derived grasslands. This species feeds on ripe and partially ripe grass, herb seeds green leaves and insects. This species has been recorded from the study area a number of times and was detected during the October survey period.	V	Yes	Yes	YES - observed within the study area during October surveys
Hooded Robin *Melanodryas cucullata cucullata*	The Hooded Robin is a large black and white robin. This species is widespread across Australia except for the driest deserts and wetter coastal areas. This species prefers lightly wooded country including open eucalypt woodland, acacia scrub and mallee. It prefers structurally diverse habitats where it hunts insect prey. Territories range from 10 to 30 hectares and breeding occurs from July to November.	V	No	Yes	LIKELY - this species in known to occur in the locality and suitable habitat is present.

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood Of Species Occurring Within Study Area
Speckled Warbler *Pyrrholaemus saggitatus*	The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees.	V	Yes	Yes	YES - this species was observed during the October and December surveys.
Brown Treecreeper (eastern sub-species) *Climacteris picumnus victoriae*	The Brown Treecreeper is Australia's largest treecreeper and also has an inland subspecies. It is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. This species prefers woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species.	V	Yes	Yes	LIKELY - this species was observed during the October surveys.

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood Of Species Occurring Within Study Area
Spot-tailed Quoll *Dasyurus maculatus maculatus*	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and may raid possum and glider dens and prey on roosting birds. Use 'latrine sites', often on flat rocks among boulder fields and rocky cliff-faces; these may be visited by a number of individuals; latrine sites can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Suitable foraging and/or shelter sites were limited across the study area.	V, E1	No	Yes	UNLIKELY - potential habitat was not recorded.
Eastern false Pipistrelle *Falsistrellus tasmaniensis*	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	V	No	Yes	LIKELY - suitable foraging habitat present.

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood Of Species Occurring Within Study Area
Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Breeding or roosting colonies can number from 100 to 150,000 individuals.	V	No	Yes	UNLIKELY - no suitable roost sites available within the study area
Greater Long-eared Bat *Nyctophilus timoriensis*	This species was recently captured within the locality and is a rnage extension for this species. Although the species may have been vagrant, potential habitat does occur within the study area. Inhabits a variety of vegetation types, including mallee, *Allocasuarina leuhmanni* and box eucalypt dominated communities. More common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW. Roosts in tree hollows, crevices, and under loose bark	V, V1	No	Yes	LIKELY - suitable foraging habitat present and recently recorded in locality
Large-footed Myotis *Myotis macropus*	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	V	No	Yes	UNLIKELY - suitable foraging and roosting sites are limited across the study area.

Species	Preferred Habitat in Locality	Status*	Recorded in Survey	Recorded Previously in Locality	Likelihood Of Species Occurring Within Study Area
Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris*	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. It roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; seasonal movements are largely unknown.	V	Pr	Yes	LIKELY - potential habitat present across much of the study area.
Koala *Phascolarctos cinereus*	There is one record of the Koala in the north of the locality from 2007 (DECC 2008). The vegetation on site does not meet the SEPP 44 definition of Potential Koala Habitat or Core Koala Habitat.	V	No	No	UNLIKELY - no preferred habitat within the study area

* V – Vulnerable TSC Act, V1 – Vulnerable EPBC Act, E – Endangered TSC Act, E1 – endangered EPBC Act, CE – critically endangered , Pr – probable call identification

5. Constraints

5.1 Flora and Ecological Communities

Mapping of the survey site revealed that the following areas are likely to be removed along each section of the proposed alignments. The areas in Table 11 are approximate areas as the road design and alignment are not detailed enough to provide more accurate figures. The figures below are areas of threatened species habitat that are likely to be removed as a result of the proposed road development. In some instance the areas in Table 11 may overlap each, depending on threatened species habitat requirements.

Table 11 Area (ha) of Ecological Communities Likely to be Removed by Each Alignment Option Proposed for Dunn's Creek Road

Habitat	Common (ha)	Option 1B (ha)	Option 5 (ha)
Box-Gum Woodland TSC	10.4	38.6	29.8
Box-Gum Woodland and Derived Grassland EPBC	2.0	10.9	21.7
Total **EPBC** communities for each option (incl. Common Route)		**12.9 ha**	**23.7 ha**
Total **TSC** communities for each option (incl. Common Route)		**49 ha**	**40.2 ha**

5.1.1 Box Gum Woodland

Both the EPBC Act listed Box Gum Woodland and the TSC Act Box Gum Woodland were identified during the survey period. Within the Common Route, approximately 10.4 hectares of TSC Act listed Box Gum woodland and 2.0 hectares of EPBC listed Box Gum Woodland would be removed as a result of the development. On the preferred route (Option 1B) approximately 38.6 hectares of TSC Act listed Box Gum Woodland and 10.9 hectares of EPBC Act listed Box Gum Woodland would be removed by the proposed action. On Option 5, 29.8 hectares of TSC Act listed Box Gum Woodland and 21.7 hectares of EPBC Listed Box Gum Woodland would be removed by the proposed action (Table 11). The placement of the proposed road along the preferred Option 1B, or along Option 5, would involve dissecting these existing woodlands leaving existing woodland to the north and south of the proposed road. As well as being threatened ecological communities these woodlands represent habitat for a range of threatened species.

5.1.2 Natural Temperate Grasslands

Habitat searches and targeted flora surveys identified areas of potential Natural Temperate Grassland (NTG) in the north west of the study area. Although none of this NTG appears to be occurring in the current alignment route, it does occur further to the north of subject site near the old railway line. The alignment route in the current location is unlikely to remove any NTG within the subject site though if it was moved further to the north in the study area it may remove some NTG. This would require further clarification at the time of alignment studies.

5.1.3 Silky Swainson-pea *Swainsona sericea*

The development of the proposed Dunn's Creek Road along the preferred route will not remove any Natural Temperate Grasslands and would remove 49.2 hectares of Box Gum Woodland. If Option 5 becomes the preferred option then 40.6 hectares of Box Gum woodland would be removed. Box Gum woodland and Natural Temperate Grasslands are known habitat of this species. Of the above area to be removed 10.4 hectares of the Box Gum Woodland occurs along the common route (Table 11)

5.1.4 Hoary Sunray *Leucochrysum albicans* var. *tricolor*

If Option 5 were selected, it would remove at least one individual of this species, however, more may occur in the alignment that were not observed during the survey period. The population of 53 plants observed in the east of the study area would not be removed.

5.1.5 Mountain Swainson-pea *Swainsona recta*

The railway easement in the west of the study area is known habitat for this species. Building a road across the railway easement may indirectly affect known habitat in the south through edge effects, increased weed invasion etc. Although no survey was conducted within this railway easement in the current survey the easement is surveyed regularly to monitor the Mountain Swainson-pea population (ACT Government 1997). In addition, surveys conducted by Kevin Mills and Associates (2007) identified this species south of the alignment route in the railway line easement but despite targeted surveys did not identify this species in the railway line easement to the north of the alignment route.

5.2 Fauna

5.2.1 Pink-tailed Worm-lizard *Aprasia parapulchella*

Table 12 presents the area of Pink-tailed Worm-lizard known and potential habitat within, and surrounding each of the alignment routes.

Table 12 Area (ha) of Known and Potential Pink-tailed Worm-lizard habitat Within the Study Area of Each Alignment Route for Dunn's Creek Road

Habitat	Common	Option 1B	Option 5
Aprasia parapulchella	47	42	59

Potential and known habitat is present for the Pink-tailed Worm Lizard throughout the study area. Targeted surveys recorded 14 live specimens and four sloughs across the study area. The high number of observations during the survey period suggests that the study area is high quality habitat. Rocky outcrops on steep slopes are common in the study area, on the Common Route, Option 1B and Option 5.

The placement of a road through the study area would result in the removal of Pink-tailed Worm-lizard habitat. The Common Route will directly impact on a number of rocky outcrops where the Pink-tailed Worm-lizard was recorded in this survey and has been recorded previously. Seven of the observations were recorded in the subject site of Option 5, five were recorded along both the Common Route and

Option 1B and there is one record located between Option 5 and Option 1B. The surrounding landscape also contains potential Pink-tailed Worm-lizard habitat. The placement of the road on the Common Route would cause habitat loss and create a barrier to movement for this species; this would result in fragmentation of habitat. Direct habitat loss and fragmentation would also result were the road placed along either Option 1B or Option 5.

5.2.2 Striped Legless-lizard

The Striped Legless Lizards is found primarily in Natural Temperate Grasslands and is less commonly observed in Box Gum woodland and derived native grasslands. Potential habitat for this species does occur across the study area though these areas have been previously intensively surveyed by Biosis (2003) and this species was not recorded within the study area despite potential habitat being recorded.

Targeted surveys within south “Tralee” conducted by Biosis (2003) failed to record any individuals of this species. Biosis (2003) concluded that this species presence was unlikely (within Tralee) and if this species were present it would be at very low densities. Although this species was not identified at “Tralee” this species has been recorded form Natural Temperate Grasslands as well as form sites dominated by exotic grasses such as *Phalaris aquatica, Nassella trichotoma* and *Hypochaeris radicata*. This species has also been recorded from secondary grassland (sites which were not traditionally grasslands but have been cleared for grazing and agriculture) (Smith and Robertson 1999). Although some potential habitat for this species may be removed by the proposed road development, previous targeted trapping surveys in the study area suggest that this species is unlikely to occur in the study area.

5.2.3 Little Whip Snake

The Little Whip Snake was not observed during the survey period however much of the site provides suitable habitat for this species. The Natural Temperate Grasslands, Box Gum Woodlands and derive native grasslands are interspersed with rocky outcrops within the study area. This species may inhabit a number of ecological communities within the subject site. Habitat for this species is present along the common route as well as both Option 5 and Option 1B.

5.2.4 Rosenberg’s Goanna

The Rosenberg’s Goanna has a large home range that may include both treed and treeless environments. Although this species was not observed during the survey period the study area does contain potential habitat in the form of Box Gum Woodlands and Dry Forest (DECC 2008b). Option 1b and Option 5 are all likely to provide potential foraging habitat. Although there were very few termite mounds identified during the October and December surveys a more extensive survey is likely to reveal a greater density of termite mounds, especially in the Dry Forest and Box Gum Woodland environments in the east of the study area.

Termite mounds are important features within Rosenberg Goanna habitat as they provide nesting sites for laying eggs. The development of the proposed Dunn’s Creek Road is likely to create a barrier to movement for this species. This species is known to occur on the Googong Dam Foreshores. The study area is likely to form part of a larger habitat area that includes the Googong foreshores and surrounding landscape. The study area is currently well connected to the Googong Dam foreshores. The development of Dunn’s Creek Road will dissect this large area of Rosenberg Goanna potential habitat.

Most of the approximately 80 hectares of land that may be removed for the Dunn's Creek Road development represents potential habitat for this species.

5.2.5 Speckled Warbler

The Speckled Warbler was identified during both the October and December survey periods. On both occasions the Speckled Warblers were observed foraging within close proximity to a drainage line. During the October survey one Speckled Warbler was observed during Bird Survey 10 (BS10) within the drainage line that the Common Route crosses. It is also noted that this species was observed nesting within the drainage line during spring 2008 (anecdotal evidence). The drainage line is vegetated with native and exotic shrubs as well as a predominantly native canopy and ground layer. The drainage line provides breeding a foraging habitat in the vicinity of the proposed road crossing.

The Speckled Warbler was observed during the December survey period near the proposed Option 5 alignment. At least three individuals and up to five, were observed foraging in close proximity to Jerrabomberra Creek. The development of the proposed Option 5 will result in the removal of known habitat of the Speckled Warbler.

Along with the two observations of the Specked Warblers potential habitat for this species was identified in a number of locations across the site. The Speckled Warblers are likely to utilise vegetation along both of the two drainage lines identified above. They are also likely to utilise areas of Box Gum woodland, across the study area. This species occupies woodlands with native understoreys where it nests in dense thickets of native or exotic shrubs. The development of the road in either Option 1B or Option 5 would result in the removal of known and potential habitat.

5.2.6 Hooded Robin

The Hooded Robin was not observed during the survey period however there are known records of this species from the study area. It is also noted that a pair of Hooded Robins nested during spring 2008 in a vegetated gully south of the Common Route (anecdotal evidence). Studies on south "Tralee" by Biosis 2003) have identified the Hooded Robin in the study area. The Hooded Robin is likely to utilise much of the study area for foraging and potentially for breeding. The Box Gum woodland, particularly the EPBC Box Gum Woodland, provides suitable Hooded Robin habitat. The placement of the proposed road along Option 1B and Option 5 would result in the removal and fragmentation of known and potential habitat.

5.2.7 Diamond Firetail

Diamond Firetail habitat is present across the site in the form of Box Gum woodlands and woodlands bordering native grasslands. This species was observed twice during the October survey period and there are a number of existing records for this species within the study area (Biosis 2003, DECC Atlas of NSW Wildlife). The development of the road would remove known and potential habitat of this species and is likely to create a barrier to movement for this species. The development of the road along the Common Route will result in the removal of known habitat of this species. The development along both Option 1B and Option 5 will also create habitat loss and will fragment potential habitat of this species.

5.2.8 Brown Treecreeper

The eastern sub-species of the Brown Treecreeper was observed during the October survey to the south of Option 5. There are also a number of previous records within woodlands in the locality (Thompson and Mullins, 2004, DECC Atlas of NSW Wildlife). The Brown Treecreeper is likely to inhabit the TSC and EPBC Box Gum woodland that covers much of the eastern section of the study area. The removal of vegetation in Option 1B or Option 5 would result in a direct loss of habitat and would result in the fragmentation of known habitat.

5.2.9 Bats

There were no threatened bat species definitely identified during the survey period. The threatened Yellow-bellied Sheathtail Bat was identified as a probable record by Anabat detection. To obtain a definite identification of the Yellow-bellied Sheathtail Bat further survey would need to be conducted possibly involving further Anabat detection and Harp trapping.

The Yellow-bellied Sheathtail Bat, Large footed Myotis, Eastern Bet-wing Bat, Greater Long-eared Bat and Eastern False Pipistrelle have all been recorded within the locality in previous studies (Appendix D). The survey revealed that there were no caves within the study area that are likely to support maternity sites of any of these threatened species. The site survey did observe hollow-bearing trees throughout the study area. These hollow-bearing trees may provide suitable roosting or maternity sites for the above species.

The Yellow-bellied Sheathtail-bat has been recorded within the locality in previous surveys. This wide-ranging species is likely to occupy the study area and may utilise hollow-bearing trees within the study area as maternity sites. The removal of Box Gum woodland within the study area would represent a loss of habitat for this species.

The Eastern Bent-wing Bat's primary maternity sites are caves or similar man made structures, which are not present along Option1B or Option 5. This species may utilise the locality as a foraging resource.

The Eastern False Pipistrelle has been recorded previously within the locality. This species utilises hollow bearing trees for roosting and breeding. This species prefers tall eucalypt forest in moist areas, which are not common within the alignment routes. The development of the road would result in the removal of hollow bearing trees along either of the two alignments. The number of hollow-bearing trees to be removed was not surveyed as the uncertainty of the road alignment and design would not allow for an accurate calculation.

The large-footed Myotis was not recorded during the survey period however it has been recorded in the locality in previous surveys. This species is dependant on a permanent water body where it forages for insect and fish by scraping its feet over the waters surface. This species has been recorded within the locality, however it is primarily a coastal species and less frequently recorded inland along the major inland rivers. The study area does not contain large permanent water bodies where this species is likely to forage. This species is known to utilise hollow bearing trees to roost however it prefers caves, bridges and other man made structures as roost sites.

5.2.10 Golden Sun Moth

The Golden Sun Moth was identified during the December survey period. One individual was observed within native grasslands on the proposed Option 5 alignment route. The observation of a live Golden Sun Moth during the December survey period occurred within the vicinity of the proposed Option 5. Biosis (2003) and Thompson and Mullins (2004) recorded Golden Sun Moths within the study area.

There are also a number of records from within the study area (Figure 4). Potential habitat was identified for this species on the common route, on Option 1B and on Option 5. Although these areas may not be habitat for this species, they do have some potential and cannot be disregarded as habitat at this level of constraints analysis and the unsuitable survey conditions in this survey period. Further survey once the final alignment route has been selected will assist in determining if these areas are actual habitat for this species.

Table 13 Summary of known and potential constraints for the proposed Dunn's Creek Road

Name	Constraint	Location Constraint Type		
		Common Route	Option 1B	Option 5
Endangered Ecological Communities				
Natural Temperate Grassland (EPBC Act)	Potential habitat degradation	Possible habitat degradation by weed infestation, edge effects etc in wider study area.		
White Box, Yellow Box, Blakely's Red Gum Woodland (TSC Act)	Known community loss	**10.4 ha** may be removed or modified.	**38.6 ha** may be removed or modified.	**29.8 ha** may be removed or modified.
	Potential community degradation	Potential community degradation in adjacent existing woodlands caused by fragmenting the existing community and increasing edge effects.	Potential community degradation in adjacent existing woodlands caused by fragmenting the existing community and increasing edge effects.	Potential community degradation in adjacent existing woodlands caused by fragmenting the existing community and increasing edge effects.
White Box, Yellow Box, Blakely's Red Gum	Known community loss	**2.0 ha** may be removed or modified.	**10.9 ha** may be removed or modified.	**21.7 ha** may be removed or modified.

Name	Constraint	Location Constraint Type		
		Common Route	Option 1B	Option 5
Grassy Woodland and Derived Native Grassland	Potential community degradation	Potential community degradation in adjacent existing woodlands caused by fragmenting the existing community and increasing edge effects.	Potential community degradation in adjacent existing woodlands caused by fragmenting the existing community and increasing edge effects.	Potential community degradation in adjacent existing woodlands caused by fragmenting the existing community and increasing edge effects.
Threatened species				
Pink-tailed Worm-Lizard	Known habitat loss	Minimum **1.8 ha** of known habitat to be removed.	Minimum **18.9 ha** of known habitat to be removed.	Minimum **14.4 ha** of known habitat to be removed.
	Known habitat fragmentation	The proposed road would create a barrier to movement creating habitat fragmentation in known habitat.	The proposed road would create a barrier to movement creating habitat fragmentation in known habitat.	The proposed road would create a barrier to movement creating habitat fragmentation in known habitat.
	Potential habitat loss	Further areas of potential habitat may be removed	Further areas of potential habitat may be removed	Further areas of potential habitat may be removed
Golden Sun Moth	Potential habitat loss	Potential habitat may be removed.	Potential habitat may be removed.	Potential habitat may be removed.

Name	Constraint	Location Constraint Type		
		Common Route	Option 1B	Option 5
Speckled Warbler	Known habitat loss	Removal of habitat within and adjacent to the drainage line where this species was observed		Removal of habitat within and adjacent Dunn's Creek, where this species was observed
	Known habitat fragmentation	The proposed road may fragment this known habitat up and downstream of the drainage line		The proposed road may fragment this known habitat up and downstream of the drainage line
	Potential habitat loss	Woodlands across the common route provide potential habitat	Woodlands across Option 1B provide potential habitat	Woodlands across Option 5 provide potential habitat
Hooded Robin	Potential habitat loss	Vegetation within the common route provides potential habitat	Vegetation within Option 1B provides potential habitat	Vegetation within Option 5 provides potential habitat
	Potential habitat fragmentation	Vegetation to the north and south of the common route provide known or potential habitat	Vegetation to the north and south of Option 1B provide potential or known habitat	Vegetation to the north and south of Option 5 provide potential or known habitat
Diamond Firetail	Potential habitat loss	Vegetation within the common route provides potential habitat	Vegetation within Option 1B provides potential habitat	Vegetation within Option 5 provides potential habitat

Name	Constraint	Location Constraint Type		
		Common Route	Option 1B	Option 5
	Potential habitat fragmentation	Vegetation to the north and south of the common route provide known or potential habitat	Vegetation to the north and south of Option 1B provide potential or known habitat	Vegetation to the north and south of Option 5 provide potential or known habitat
Brown Treecreeper	Potential habitat loss		Vegetation within Option 1B provides potential habitat	Vegetation within Option 5 provides potential habitat
	Potential habitat fragmentation	Vegetation to the north and south of the common route provide known or potential habitat	Vegetation to the north and south of Option 1B provide potential or known habitat	Vegetation to the north and south of Option 5 provide potential or known habitat
Striped Legless Lizard	Potential habitat loss	Potential habitat present within the common route though unlikely as a result of previous target surveys in study area	Potential habitat present within Option 1B	Potential habitat present within Option 5
	Potential habitat fragmentation	Potential habitat present within the common route though unlikely as a result of previous target surveys in study area	Small amount of potential habitat present within Option 1B	
Rosenberg's Goanna	Potential habitat loss	Loss of potential foraging habitat	Loss of potential foraging habitat	Loss of potential foraging habitat Loss of potential breeding habitat

Name	Constraint	Location Constraint Type		
		Common Route	Option 1B	Option 5
	Increased incidence of road kill	Potential to occur if road constructed	Potential to occur if road constructed	Potential to occur if road constructed
Little Whip Snake	Potential habitat loss	Potential habitat present within the common route	Potential habitat present within Option 1B	Potential habitat present within Option 5
Silky Swainson-pea	Potential habitat degradation	Known habitat present to south of common route. Increased edge effects, potential weed encroachment etc with road construction and operation.	Unlikely	Unlikely
Hoary Sunray	Potential habitat loss	Potential habitat within Common Route	Present south of Option 1B	Present north of Option 5
Yellow-bellied Sheathtail Bat	Loss of potential habitat	Loss of potential foraging habitat	Loss of potential foraging habitat and potential roost sites	Loss of potential foraging habitat and potential roost sites
Eastern False Pipistrelle	Potential habitat loss	Loss of potential foraging habitat	Loss of potential foraging habitat and potential roost sites	Loss of potential foraging habitat and potential roost sites
Eastern Bent-wing Bat	Potential habitat loss	Loss of potential foraging habitat	Loss of potential foraging habitat	Loss of potential foraging habitat
Greater Long-eared Bat	Potential habitat loss	Loss of potential foraging habitat	Loss of potential foraging habitat	Loss of potential foraging habitat
Swift Parrot	Potential habitat loss	Removal of potential foraging habitat	Removal of potential foraging habitat	Removal of potential foraging habitat

Name	Constraint	Location Constraint Type		
		Common Route	Option 1B	Option 5
Regent Honeyeater	Potential habitat loss	Removal of potential foraging habitat	Removal of potential foraging habitat	Removal of potential foraging habitat

6. Potential Offsetting and Recommendations

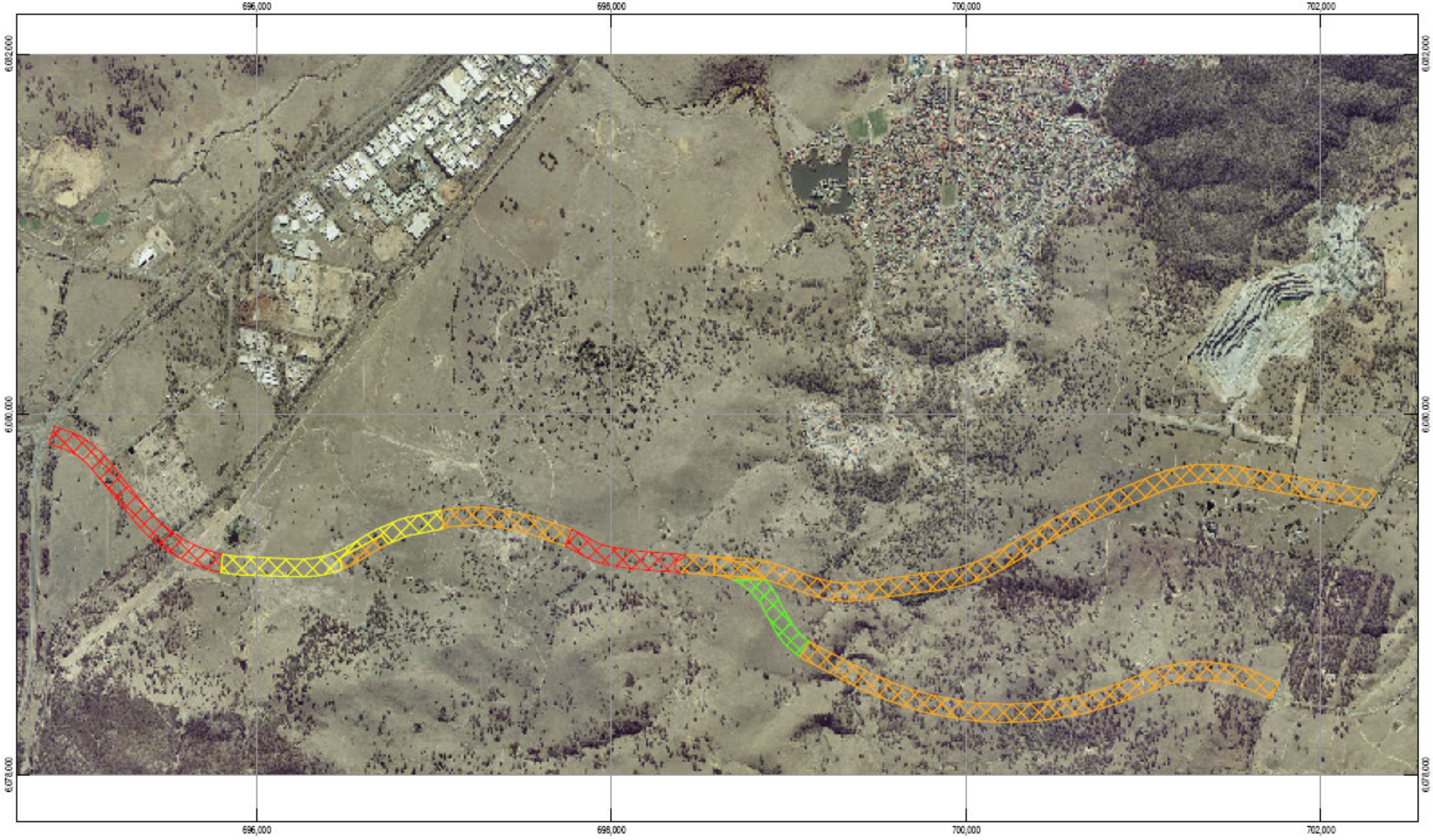
The current study assessed the Common Route, Option 1B and Option 5 using the alignment route and 100 buffer around the proposed alignment route. In order for QCC to gain an understanding of the potential offsets that may be required should the proposed construction occur in each route, a preliminary calculation of biodiversity clearing debits is required. Should the proposed road construction go ahead along a preferred alignment, the biodiversity offsetting process will be required to be undertaken once the alignment route is surveyed and finalised.

Preliminary biodiversity debits and potential offsets have been calculated using the BioMetric Tool (DEC 2005). The BioMetric Tool was used to calculate vegetation debits and offsets based on preliminary estimates of vegetation to be cleared and loss of habitat variables (e.g. hollow bearing trees). It does not take into consideration actual habitat lost for threatened species. The Threatened Species Tool is required to calculate offset ratios and management actions for individual threatened species. This tool is still currently being finalised and is not yet publicly available. However, indicative ratios can be proposed under different scenarios that may occur if the Threatened Species Tool were utilised.

Vegetation quadrats and surveys were undertaken along the common route and the two options in order to be able to allocate vegetation condition categories. Vegetation was only mapped as being in low condition if it meets the definition of low condition under the BioMetric Operation Manual (Gibbons *et al.* 2008) and the Environmental Outcomes Assessment Methodology (DNR 2005). Vegetation is considered to be in low condition if it has:

- Native woody vegetation with an overstorey percent foliage cover <25 percent of the lower value of the over storey percent foliage cover benchmark for that vegetation type;
- Native woody vegetation where <50 percent of vegetation in the ground layer is indigenous species;
- Native grassland where <50 percent of vegetation in the ground layer is indigenous species; and
- Native woody vegetation or grassland is >90 percent is ploughed or fallowed.

The majority of vegetation within the common route and two option routes is in good (moderate) condition (Figure 7).



0 250 500 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N

LEGEND

- Derived native grassland, moderate condition
- Pasture improved, low condition
- WB,YB,BRG Woodland, low condition
- WB,YB,BRG Woodland, moderate condition

GHD

CLIENTS | PEOPLE | PERFORMANCE

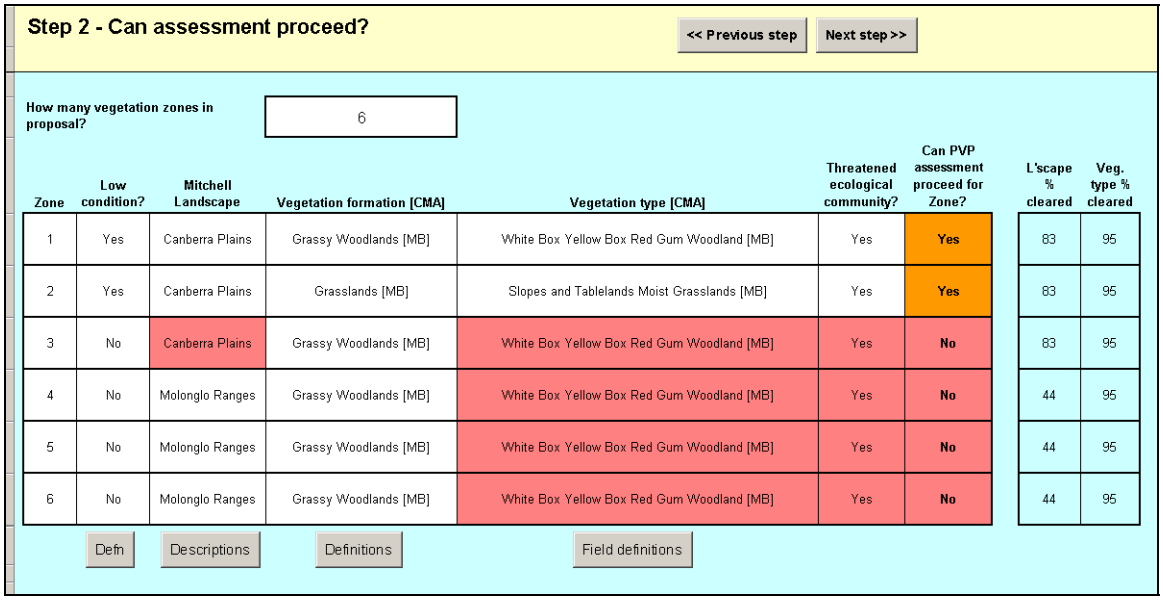
N:\AU\Wagga Wagga\Projects\23\12973\CADD\GIS\ArcView\Wkspace\Report\Biometric_veg.mxd

GHD: Biometric vegetation class areas 2008, Queanbeyan City Council: Alignment Options, Department of Lands: Aerial photography. Created by: R. Robinson

Based on a 100-metre corridor, a total of 79.6 hectares of vegetation would be cleared in Option 1B of which 60.9 ha (76%) is in good condition (i.e. not low condition). Option 5 would remove 75.8 hectares of vegetation of which 57.1 (75%) is in good condition. Total projected clearing figures for each alignment route are:

- Option 1b + Common Route = 60.9[1] hectares;
- Option 5 + Common route = 57.1[2] hectares

When applying the BioMetric tool to the six zones identified, four zones are automatically given a red light at Stage 2, meaning that in its current form (i.e. clearing an endangered ecological community and over cleared landscape in good condition), the proposed road construction cannot proceed (Figure 8).



Step 2 - Can assessment proceed?

<< Previous step | Next step >>

How many vegetation zones in proposal? 6

Zone	Low condition?	Mitchell Landscape	Vegetation formation [CMA]	Vegetation type [CMA]	Threatened ecological community?	Can PVP assessment proceed for Zone?	L'scape % cleared	Veg. type % cleared
1	Yes	Canberra Plains	Grassy Woodlands [MB]	White Box Yellow Box Red Gum Woodland [MB]	Yes	Yes	83	95
2	Yes	Canberra Plains	Grasslands [MB]	Slopes and Tablelands Moist Grasslands [MB]	Yes	Yes	83	95
3	No	Canberra Plains	Grassy Woodlands [MB]	White Box Yellow Box Red Gum Woodland [MB]	Yes	No	83	95
4	No	Molonglo Ranges	Grassy Woodlands [MB]	White Box Yellow Box Red Gum Woodland [MB]	Yes	No	44	95
5	No	Molonglo Ranges	Grassy Woodlands [MB]	White Box Yellow Box Red Gum Woodland [MB]	Yes	No	44	95
6	No	Molonglo Ranges	Grassy Woodlands [MB]	White Box Yellow Box Red Gum Woodland [MB]	Yes	No	44	95

Defn | Descriptions | Definitions | Field definitions

Figure 8 Screen Dump of Red Lights in the BioMetric Tool

If the assessment were allowed to proceed despite the red lights (i.e. bypassing the red lights), offsetting would be required. For the purposes of providing QCC with an indication of potential offsets when clearing a number of different ratios for biodiversity offsetting are outlined in Table 14. Offsets are based on clearing 60.9 hectares of vegetation for Option 1b and 57.1 hectares of vegetation for Option 5.

In the Box Gum Woodland environment, biodiversity offsets are often driven more by the habitat requirements of threatened species than by the clearing of endangered ecological communities (GHD 2007). The highest offset ratio that can be allocated for a threatened species is 20 (using the Threatened Species Tool). Therefore, the following offsets have been modelled based on a loss of all vegetation in each alignment route (including the common route in each option).

[1] This figure excludes 18.7 hectares of pasture improved grassland in the Common route

[2] This figure excludes 18.7 hectares of pasture improved grassland in the Common route

Table 14 Potential Offset Areas Required (Hectares) Under Various Ratios Scenarios

Potential Ratio	Offset Area Required (Hectares)	
	Option 1b + Common Route	Option 5 + Common Route
1:2	121.8	114.2
1:5	304.5	285.5
1:10	609	571
1:15	913.5	856.5
1:20	1218	1142

6.1 Recommendations

This project was commissioned as a constraints analysis and hence no Section 5A assessments of significance (7 part tests) were conducted for threatened species, populations and ecological communities. Although a SIS is highly likely to be required, applications of the assessment of significance will formally confirm this. Close consultation with the Department of Environment and Climate Change should occur to ensure that all requirements for further survey and assessment are met.

Assessment will also be required under the EPBC Act using the administrative guidelines for significance to determine if a referral is required

This ecological study has completed sufficient fieldwork for the following matters to be assessed under the *Environmental Planning and Assessment Act 1979* (EP&A Act):

- Pink-tailed Worm-lizard
- Box-Gum Woodland (TSC Act)
- Box-Gum Woodland (EPBC Act)

The following recommendations are given for further ecological surveys in the study area for species that were not detected during this ecological assessment:

- Golden Sun Moth. Although one individual was observed, and potential habitat occurs in the wider study area, it would be necessary for further surveys to be completed due to the windy weather conditions that occurred during surveys on from 1-2 December 2008. Conditions were windy and this may have prevented detection of the species at other locations within the study area.
- It may be necessary for further surveys to be completed for woodland birds, including species detected during this study (Brown Treecreeper, Speckled Warbler and Diamond Firetail), as well as other species known to occur in the locality (Hooded Robin, Swift Parrot, Gang-gang Cockatoo, Regent Honeyeater), to give more confidence on the assessment of habitat utilisation by these species in the study area.
- All threatened microbat species known to occur in the locality, including Yellow-bellied Sheath-tail Bat, Large footed Myotis, Eastern Bet-wing Bat and Eastern False Pipistrelle. Although four Anabat surveys were completed for this study, it is considered that there is a need for confirmation of the probable detection of Yellow-bellied Sheath-tail Bat from this study, and for further confidence that other threatened microbat species do not occur in the study area.

- Little Whip Snake. Although rock rolling and log rolling was completed for this species, it will be necessary for targeted survey effort in the form of pitfall trapping.
- Targeted surveys for threatened plants. Although this study detected two threatened plants in the study area (Hoary Sunray and Silky Swainson Pea), targeted surveys were not conducted but rather restricted to records during random meanders, and it is possible that species may occur in areas not surveyed. It is also possible that seasonal conditions may have prevented some species from being detected. Targeted flora surveys would give greater confidence that these species do not occur along the final alignment route once it is confirmed.

7. Conclusion

The Dunn's Creek Road study area contains high quality habitat for a number of threatened species and ecological communities listed under both the TSC Act and the EPBC Act. The proposed development, if completed, is likely to remove areas of habitat for threatened flora species and fauna species and threatened ecological communities. There may be other species for which habitat would be removed by the proposed development that were not recorded during the current survey period.

The proposed development is also likely to cause fragmentation and associated degradation of adjacent habitat.

Further detailed study and assessment of the impacts of the proposed development, and their significance under the NSW *EP&A Act 1979*, will be necessary once the preferred alignment has been selected and is highly likely to lead to the need for a Species Impact Statement.

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Appendix A

DECC Correspondence

Your reference : SF070897 OC C0843172
Our reference : Trim 08/26747 File: 07/16360
Contact : Amanda Sullivan, 02 6298 9711
Date : 18 June 2008

Mr Simon Cassidy
Manager Engineering Services
Queanbeyan City Council
PO Box 90
Queanbeyan NSW

Dear Mr Cassidy

RE: Dunns Creek Road Alignment Study

I refer to your letter of 26 May 2008 requesting comments from the Department of Environment and Climate Change (DECC) on the range of studies necessary to support the two options (1b and 5) Queanbeyan Council have outlined for the proposed Dunns Creek Road Alignment study.

It appears from previous biodiversity and archaeology studies completed for different developments over parts of the proposed routes, there are areas of high biodiversity and archaeological values that require either further investigations or need to be avoided. To ensure that the proposed road alignment identifies all areas of values and assesses the impact of the proposal, DECC recommends that:

1. Murrumbidggee Catchment Management Authority (CMA) be contacted to see if the proposed road needs assessment under the *Native Vegetation Act 2003*

2. That a comprehensive archaeological survey be completed along the entire length of the proposed route/routes.

In addition, subsurface testing of the known Potential Archaeological Deposits (PADs) identified in the Navin Officer report 2003, that will be impacted by the development will need to occur. A licence from DECC will need to be obtained prior to subsurface testing. The archaeological study will need to be consistent with DECCs 'Aboriginal Cultural Heritage Standards and Guidelines' and 'Interim Community Consultation Requirements for Applicants'. The latter outlines the requirements for consultation with members and representatives of Aboriginal communities.

3. A comprehensive fauna and flora report will need to be conducted along the entire route, and/or the two route options of the proposed Dunns Creek Road.

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DECC advises that in preparing a fauna flora study, a biobanking methodology would be an appropriate methodology for a consultant to follow. DECC can advise Council and/ or a consultant on this methodology.

4. Given the areas of high biodiversity along the routes, it is highly likely that a Species Impact Statement (SIS) will need to be prepared.

Please see Appendix 1 attached for specific comments on the proposed Dunns Creek Road alignment.

Should you have any enquiries regarding the information provided above, please contact Amanda Sullivan, Conservation Planning Officer on 6298 9711,

Yours sincerely

M Sheahan

Mark Sheahan
A/Manager Planning and Aboriginal Heritage (South)
Climate Change and Environmental Protection

Appendix B

Flora Lists

Botanical Name	Quadrat/Transect Number											
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	T1	T2	Inc
Acacia dealbata	✓											
Acaena novae-zelandiae	✓	✓	✓	✓	✓	✓		✓				
*Acetosella vulgaris**			✓	✓	✓	✓	✓	✓		✓	✓	
*Aira cupaniana**			✓				✓			✓		
Alternanthera denticulata										✓		
Aristida behriana									✓			
Arthropodium minus										✓		
Asperula conferta	✓	✓	✓		✓	✓						
Asplenium flabellifolium										✓		
*Avena fatua**						✓	✓	✓	✓		✓	
Austrodanthonia sp.											✓	
Austrodanthonia caespitosa	✓			✓	✓						✓	
Austrodanthonia carphoides	✓	✓	✓		✓	✓	✓	✓				
Austrostipa scabra	✓	✓				✓	✓	✓	✓			
Austrostipa sp.				✓	✓				✓		✓	
Bothriochloa macra			✓	✓			✓		✓		✓	
Brachyloma daphnoides								✓			✓	
Pteridium esculentum											✓	
Brassica sp			✓				✓	✓	✓		✓	
*Bromus diandrus**							✓	✓	✓			
*Bromus hordeaceus**					✓				✓		✓	
*Bromus molliformis**			✓	✓	✓	✓	✓	✓	✓	✓	✓	
Bulbine bulbosa										✓		
Bulbine glauca												✓
Bursaria spinosa	✓	✓				✓		✓			✓	

Botanical Name	Quadrat/Transect Number											
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	T1	T2	Inc
*Carthamus lanatus**									✓			
Carex appressa										✓		
Cheilanthes austrotenuifolia	✓										✓	
*Chondrilla juncea**									✓			
Cryptandra amara		✓										
Chamaesyce drummondii					✓							
Cichorium intybus								✓				
Chrysocephalum apiculatum	✓			✓		✓		✓			✓	
Chrysocephalum semipapposum		✓										
*Cirsium vulgare**	✓				✓							
Convolvulus erubescens			✓		✓		✓	✓		✓	✓	
Crassula sp.									✓	✓	✓	
Crassula colorata								✓				
Crassula sp.2							✓	✓				
Crassula decumbens var. decumbens			✓		✓							
*Crataegus monogyna**						✓						
Centipeda cunninghamii										✓		
Cryptandra sp.											✓	
Cryptandra amara	✓											
Cymbonotus lawsonianus					✓							
Cymbopogon refractus										✓		
Cynoglossum australe								✓				
Daucus glochidiatus					✓							
Dianella sp.											✓	
Dodonaea sp.										✓		

Botanical Name	Quadrat/Transect Number											
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	T1	T2	Inc
Echium plantagineum						✓	✓	✓	✓	✓		
Einadia nutans	✓		✓		✓	✓					✓	
Eleocharis sp.										✓		
Elymus scaber	✓	✓	✓			✓						
Enneapogon sp.										✓		
Erodium									✓			
*Erodium botrys**							✓				✓	
Erodium crinitum			✓	✓								
Eucalyptus blakelyi										✓		
Eucalyptus bridgesiana		✓								✓		
Eucalyptus goniocalyx			✓	✓	✓							
Eucalyptus melliodora	✓			✓		✓					✓	
Eucalyptus nortonii	✓											
Eucalyptus pauciflora											✓	
Eucalyptus rossii												✓
Geranium retrorsum					✓	✓		✓				
Geranium solanderi	✓	✓	✓	✓	✓	✓					✓	
Glycine sp.											✓	
Glycine tabacina					✓							
Gonocarpus sp.	✓											
Goodenia sp.					✓							
Hibbertia obtusifolia		✓						✓		✓	✓	
Hibbertia (narrow)										✓		
Hieracium aurantiacum subsp. Carpathicola*												✓
Holcus lanatus											✓	

Botanical Name	Quadrat/Transect Number											
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	T1	T2	Inc
*Hordeum leporinum**							✓		✓			
Hydrocotyle laxiflora	✓	✓			✓	✓						
*Hypericum perforatum**		✓	✓	✓	✓	✓						
Hypochaeris sp.											✓	
Hypochaeris glabra			✓		✓	✓						
*Hypochaeris radicata**							✓	✓				
Indigofera (collected)										✓		
Indigofera australis		✓										
Isolepis sp.										✓		
Juncus sp.			✓									
Juncus usitatus										✓		
Lactuca sp.			✓									
Leptorhynchos squamatus susbp. alpinus		✓			✓	✓				✓		
Lepidium sp.											✓	
*Lepidium africanum**	✓											
*Lolium perenne**												✓
Lomandra bracteate								✓				
Lomandra sp.					✓							
Lomandra filiformis	✓	✓	✓	✓		✓	✓	✓	✓		✓	
Lomandra multiflora	✓			✓		✓		✓				
Lomandra patens			✓		✓	✓				✓		
*Malva parviflora**			✓									
*Marrubium vulgare**			✓									
Melichrus urceolatus	✓	✓				✓		✓				
*Modiola caroliniana**			✓							✓		

Botanical Name	Quadrat/Transect Number											
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	T1	T2	Inc
*Nassella trichotoma**											✓	
*Onopordum acanthium**								✓	✓		✓	
*Oxalis corniculata**					✓			✓				
Oxalis perennans												
*Petrorhagia nanteuilii**			✓	✓	✓	✓		✓		✓		
*Phalaris aquatica**			✓			✓				✓		
Pimelea curviflora								✓				
*Plantago lanceolata**		✓	✓		✓	✓	✓	✓		✓		
Poa sieberiana						✓					✓	
Poa sp.		✓							✓			
*Rosa rubiginosa**			✓	✓		✓				✓	✓	
*Rubus fruticosus**			✓									
Rumex brownii			✓									
*Salvia verbenaca**				✓			✓					
Scleranthus sp.		✓									✓	
*Senecio madagascariensis**	✓											
Senecio prenanthoides					✓							
Senecio quadridentatus		✓	✓		✓	✓						
Solenogyne sp.		✓										
*Sonchus oleraceus**					✓							
Spinosum sp.											✓	
Stackhousia monogyna										✓		
Swainsona sericea						✓						
Themeda australis	✓	✓	✓			✓		✓			✓	
*Trifolium arvense**	✓		✓	✓	✓	✓	✓	✓				

Botanical Name	Quadrat/Transect Number											
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	T1	T2	Inc
*Trifolium campestre**			✓			✓						
*Trifolium glomeratum**			✓	✓		✓	✓		✓			
*Trifolium subterraneum**	✓		✓	✓	✓		✓	✓	✓			
Triptilodiscus pygmaeus										✓		
*Verbascum thapsus**			✓		✓		✓	✓		✓		
Viola betonicifolia								✓				
Viola sp.				✓	✓		✓		✓			
Vittadinia cuneata	✓	✓		✓	✓					✓	✓	
*Vulpia bromoides**				✓					✓			
Wahlenbergia								✓			✓	
Wahlenbergia sp.		✓	✓		✓	✓						
Wahlenbergia stricta	✓											
Wurmbea dioica												✓
Xerochrysum viscosa	✓	✓			✓							

Appendix C

Fauna List

Common Name	*Scientific Name*	Bird Surveys 1-16	Incidentals	Reptile Survey
Birds				
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	✓		
Yellow Thornbill	*Acanthiza nana*	✓		
Brown Thornbill	*Acanthiza pusilla*	✓		
Common Myna*	*Acridotheres tristis*	✓		
Clamorous Reed Warbler	*Acrocephalus stentoreus*		✓	
Chestnut Teal	*Anas castanea*	✓		
Pacific-Black Duck	*Anas superciliosa*	✓		
Red Wattlebird	*Anthochaera carunculata*	✓		
Richards Pipit	*Anthus novaeseelandiae*	✓		
Southern Whiteface	*Aphelocephala leucopsis*	✓		
Wedge-tailed Eagle	*Aquila audax*		✓	
White necked Heron	*Ardea pacifica*	✓		
Dusky Wood Swallow	*Artamus cyanopterus*	✓		
Sulphur-crested Cockatoo	*Cacatua galerita*	✓		
Little Corella	*Cacatua sanguinea*	✓		
Yellow-tailed Black Cockatoo	*Calyptorhynchus banksii*		✓	
Australian Wood Duck	*Chenonetta jubata*	✓		
White-backed swallow	*Cheramoeca leucosternus*		✓	
Speckled Warbler	*Pyrrholaemus sagittatus*	✓		
Brown Song-lark	*Cincloramphus cruralis*	✓		
Rufous Song-lark	*Cincloramphus mathewsi*	✓		
Brown Treecreeper	*Climacteris picumnus victoriae*		✓	
Grey shrike-thrush	*Colluricincla harmonica*	✓		
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	✓		
White-winged Chough	*Corcorax melanorhamphos*	✓		
Australian Raven	*Corvus coronoides*	✓		
A Quail	*Coturnix* sp.		✓	
Laughing Kookaburra	*Dacelo novaeguineae*	✓		
White-faced Heron	*Egretta novaehollandiae*	✓		

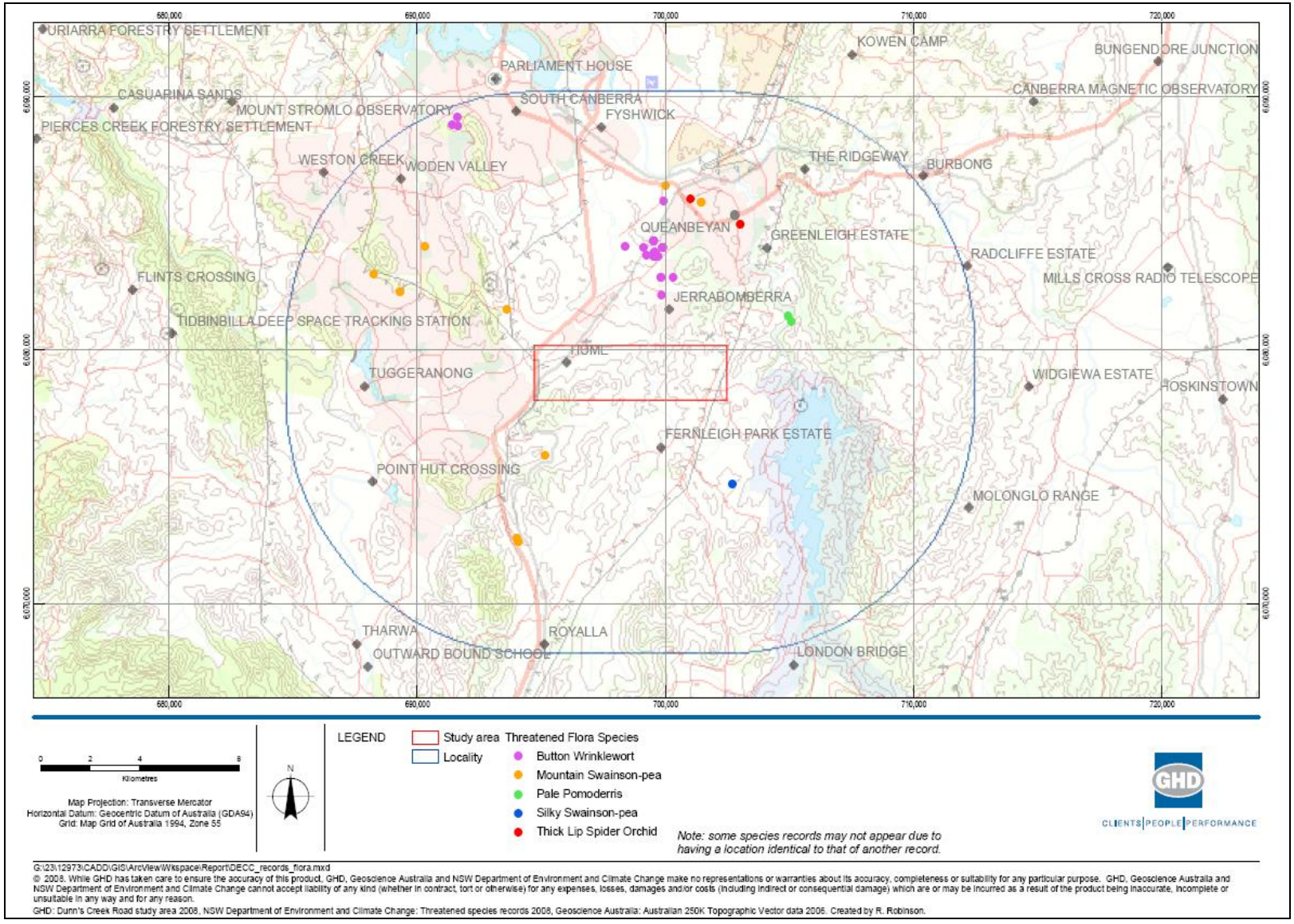
Common Name	*Scientific Name*	Bird Surveys 1-16	Incidentals	Reptile Survey
Galah	*Eolophus roseicapillus*	✓		
Nankeen Kestrel	*Falco cenchroides*	✓		
Eurasian Coot	*Fulica atra*		✓	
Western Gerygone	*Gerygone fusca*	✓		
Magpie-lark	*Grallina cyanoleuca*	✓		
Australian Magpie	*Gymnorhina tibicen*	✓		
Welcome Swallow	*Hirundo neoxena*	✓		
Tree Martin	*Hirundo nigricans*		✓	
A Martin	*Hirundo* sp.		✓	
White-winged Triller	*Lalage sueurii*	✓		
White-plumed Honeyeater	*Lichenostomus chrysops*	✓		
White-eared honeyeater	*Lichenostomus leucotis*	✓		
Superb Fairy-wren	*Malurus cyaneus*	✓		
Noisy Miner	*Manorina melanocephala*	✓		
Brown-headed Honeyeater	*Melithreptus brevirostris*		✓	
Leaden Flycatcher	*Myiagra cyanoleuca*	✓		
Satin Flycatcher	*Myiagra cyanoleuca*		✓	
Red-browed Finch	*Neochmia temporalis*		✓	
Crested Pigeon	*Ocyphaps lophotes*	✓		
Olive-backed Oriole	*Oriolus sagittatus*	✓		
Rufous Whistler	*Pachycephala rufiventris*	✓		
Spotted Pardalote	*Pardalotus punctatus*	✓		
Striated Pardalote	*Pardalotus striatus*	✓		
Red Capped Robin	*Petroica goodenovii*	✓		
Flame Robin	*Petroica phoenicea*	✓		
Little Pied-cormorant	*Phalacrocorax melanoleucos*		✓	
Common Bronzewing	*Phaps chalcoptera*	✓		
Brush Bronzewing	*Phaps elegans*		✓	
Little Friarbird	*Philemon citereogularis*	✓		
Noisy Friarbird	*Philemon corniculatus*	✓		
Eastern Rosella	*Platycercus adscitus eximius*	✓		

Common Name	*Scientific Name*	Bird Surveys 1-16	Incidentals	Reptile Survey
Crimson rosella	*Platycercus elegans*	✓		
Red-rumped Parrot	*Psephotus haematonotus*	✓		
Grey Fantail	*Rhipidura albiscapa*	✓		
Willie Wagtail	*Rhipidura leucophrys*	✓		
White-browed Scrub-wren	*Sericornis frontalis*	✓		
Wee-bill	*Smicrornis brevirostris*		✓	
Diamond Firetail	*Stagonopleura guttata*	✓		
Pied Currawong	*Strepera graculina*	✓		
Grey Currawong	*Strepera versicolor*	✓		
Starling*	*Sturnus vulgaris*	✓		
Australian Grebe	*Tachybaptus novaehollandiae*	✓		
Double-barred Finch	*Taeniopygia bichenovii*	✓		
Masked Lapwing	*Vanellus miles*	✓		
Silver-eye	*Zosterops lateralis*	✓		
Mammals				
Wild Dog	*Canis familiaris*		✓	
Gould's Wattled Bat	*Chalinolobus gouldii*			D
Chocolate Wattled Bat	*Chalinolobus morio*			PR
Hare*	*Lepus europaeus*		✓	
Eastern-grey Kangaroo	*Macropus giganteus*		✓	
Inland Freetail Bat	*Mormopterus planiceps species 3 (spf)*			PR
Southern Freetail Bat	*Mormopterus planiceps species 4 (lpf)*			D
A long-eared Bat	*Nyctophilus* sp.			✓
European Rabbit	*Oryctolagus cuniculus*		✓	
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*			PR
Inland Broadnosed Bat	*Scotorepens balstoni*			PR
White-stripped Mastiff Bat	*Tarda australis*			D
Large Forest Bat	*Vespadelus darlingtoni*			D
Southern Forest Bat	*Vespadelus regulus*			D

Common Name	*Scientific Name*	Bird Surveys 1-16	Incidentals	Reptile Survey
	Vespadelus sp.			✓
Little Forest Bat	*Vespadelus vulturnus*			D
Wombat	*Vombatus ursinus*		✓	
Fox	*Vulpes vulpes*		✓	
Swamp Wallaby	*Wallabia bicolour*		✓	
Reptiles				
Pink-tailed Worm-lizard	*Aprasia parapulchella*			✓
Common Eastern Froglet	*Crinia signifera*		✓	
Robust Ctenotus	*Ctenotus robustus*			✓
Copper-tailed Skink	*Ctenotus taeniolatus*			✓
Eastern-Brown Snake	*Pseudonaja textilis*			✓
Blackish Blind Snake	*Ramphotyphlops nigrescens*			✓
Blue-tongue Lizard	*Tiliqua scincoides*		✓	

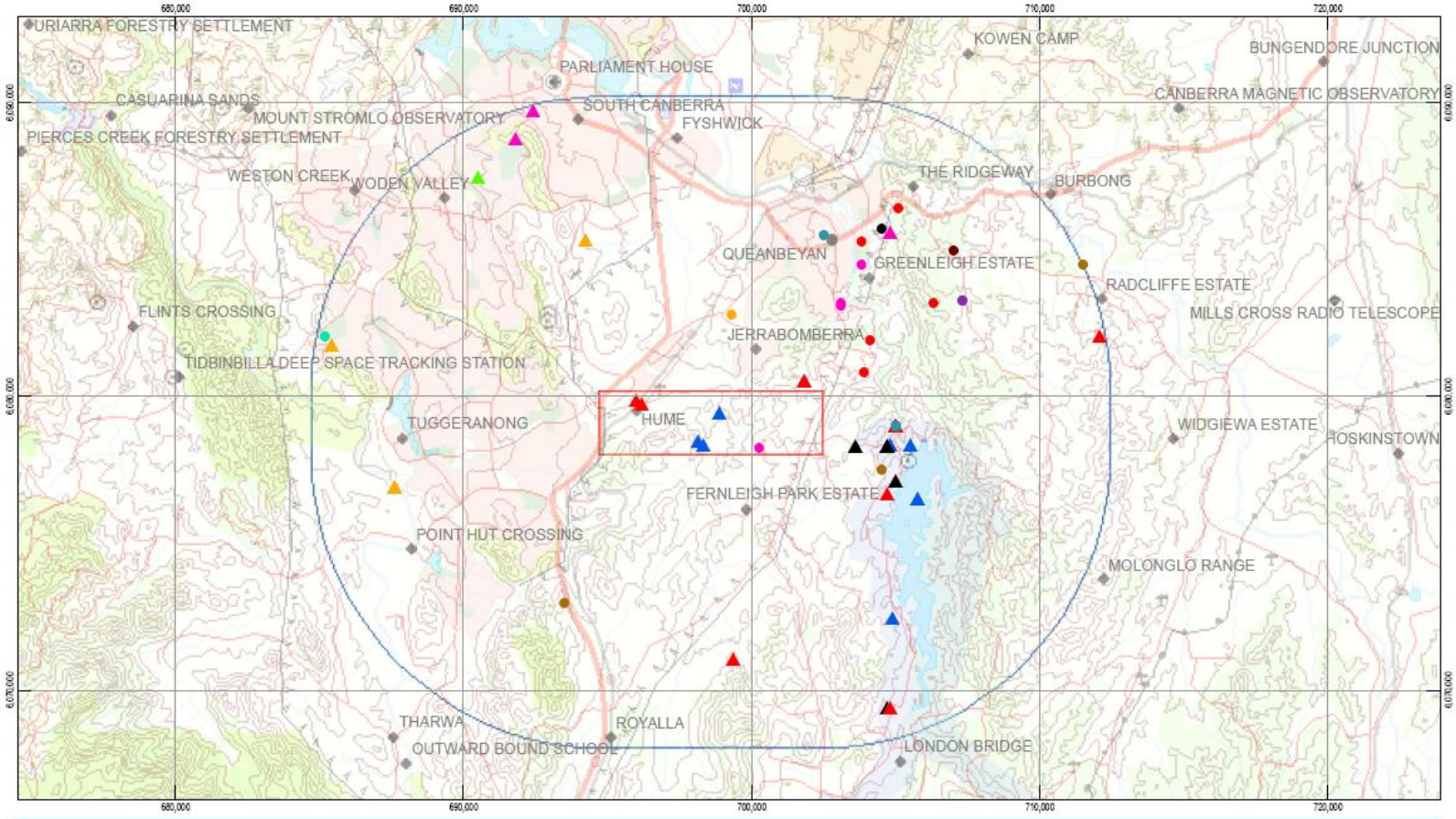
Appendix D

DECC Threatened Species Records



G:\23\12973\CADD\GIS\ArcView\Wkspace\Report\DECC_records_flora.mxd

GHD: Dunn's Creek Road study area 2008, NSW Department of Environment and Climate Change: Threatened species records 2008, Geoscience Australia: Australian 250K Topographic Vector data 2006. Created by R. Robinson.



0 2 4 8
Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND
Study area
Locality

Threatened Fauna Species
- Brown Treecreeper
- Diamond Firetail
- Eastern Bentwing-bat
- Eastern False Pipistrelle
- Gang-gang Cockatoo
- Golden Sun Moth
- Green and Golden Bell Frog
- Hooded Robin
- Koala
- Large-footed Myotis
- Pink-tailed Worm-lizard
- Regent Honeyeater
- Rosenberg's Goanna
- Southern Bell Frog
- Speckled Warbler
- Spotted-tailed Quoll
- Swift Parrot
- Yellow-spotted Tree frog

Note: some species records may not appear due to having a location identical to that of another record.

GHD
CLIENTS | PEOPLE | PERFORMANCE

G:\23\12973\CADD\GIS\ArcView\Wkspace\Report\DECC_records_fauna.mxd

GHD: Dunn's Creek Road study area 2008, NSW Department of Environment and Climate Change: Threatened species records 2008, Geoscience Australia: Australian 250K Topographic Vector data 2006. Created by R. Robinson.

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	M Suidgeest, R. Robinson	L Maloney		M. Lyons		24/12/2008
2	M Suidgeest, R. Robinson	L Maloney		G Vernon		10/07/2009

Appendix E – Assessment of likelihood of occurrence

An evaluation of the likelihood and extent of impact to threatened and migratory fauna recorded from within the Queanbeyan LGA (TSC Act threatened species); and within a 10 kilometre radius of the subject site (EPBC Act threatened and migratory species). Records are from a search of the Office of Environment and Heritage (OEH) Wildlife Atlas, and the EPBC Environmental Reporting Tool available from the Department of the Environment (DotE) website. Ecology information has been obtained from the Threatened Species Profiles on the NSW OEH website (http://www.environment.nsw.gov.au/threatenedspecies/), the NSW Fisheries Scientific Committee final determinations (http://www.dpi.nsw.gov.au/fisheries/species-protection/fsc/final) and from the Species Profiles and Threats Database on the Commonwealth DotE website (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl).

Likelihood of occurrence in study area

Unlikely: Species, population or ecological community is not likely to occur. Lack of previous recent (<25 years) records and suitable potential habitat limited or not available in the study area.

Likely: Species, population or ecological community could occur and study area is likely to provide suitable habitat. Previous records in the locality and/or suitable potential habitat in the study area.

Present: Species, population or ecological community was recorded during the field investigations.

Status

National: Commonwealth Environment Protection and Biodiversity Conservation Act 1999

NSW: NSW Threatened Species Conservation Act 1995 and Fisheries Management Act 1994

E: Endangered

CE: Critically Endangered

V: Vulnerable

Mi: Migratory

M: Marine.

Flora

Species / Communities	Status		Likelihood of occurrence in study area
	National	NSW	
Ecological communities			
Natural Temperate Grasslands of the Southern Tablelands of NSW and the ACT	E	-	**Likely** – This community occurs up to 1200 m elevation in valleys influenced by cold air drainage and in broad plains (Environment ACT 2005). Grassland with less than 10% cover of trees, shrubs and sedges; dominated by moderately tall (25-50 cm) to tall (50 cm-1.0 m), dense to open tussock grasses including Kangaroo Grass, Snow-grass, River Tussock, Red-grass, Speargrasses and wallaby grasses. Up to 70% of the species present are forbs. This community occurs more commonly in the locality and is known from just south of the common route.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland)	CE	E	**Present -** Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. Commonly co-occurring eucalypts include *Eucalyptus bridgesiana, E. polyanthemos, E. rubida, E. pauciflora, E. cinerea, E. mannifera, E. macrorhyncha, E. microcarpa* and others. The community is present in the study area as both a woodland and derived grassland.
Plants			
Austral Toadflax *Thesium australe*	V	V	**Unlikely -** Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (*Themeda australis*). The species has not been recorded in the locality and is unlikely to occur in the study area as there is no preferred habitat where *Themeda* species are dominant.
Basalt Peppercress *Lepidium hyssopifolium*	E	E	**Unlikely** - In NSW, there is a small population near Bathurst, one population at Bungendore, and one near Crookwell. The species occurs in a variety of habitats including woodland with a grassy understorey and grassland. Appears to respond to disturbance, having appeared after soil disturbance at one site. The species has not been recorded in the locality and the nearest record is in Cooma from 1897.
Button Wrinklewort *Rutidosis leptorrhynchoides*	E	E	**Likely –** Occurs in Box-Gum Woodland, secondary grassland derived from Box Gum Woodland or in Natural Temperate Grassland; and often in the ecotone between the two communities. Grows on soils that are usually shallow, stony red-brown clay loams and tends to occupy areas where there is less competition from herbaceous species. Known to colonise disturbed areas (eg. vehicle tracks, bulldozer scrapings and areas of soil erosion). The species was recorded about 3.2 kilometres north of the study area in 1981 and more recently in 2005, about 4.7 kilometres north. The species is likely to occur in Box-Gum Woodland in the study area.
Hoary Sunray *Leucochrysum albicans* var. *tricolor*	E	-	**Present -** Known from the study area and locality. Known to inhabit roadsides and other disturbed areas with the locality including grasslands, Box-Gum Woodland and ironbark associations. The species was recorded in the east of study area during surveys.

Species / Communities	Status		Likelihood of occurrence in study area
	National	NSW	
Mauve Burr-daisy *Calotis glandulosa*	V	V	**Unlikely** - The distribution of the Mauve Burr-daisy is centred on the Monaro and Kosciuszko regions. Found in montane and subalpine grasslands in the Australian Alps. Found in subalpine grassland (dominated by *Poa* spp.), and montane or natural temperate grassland dominated by Kangaroo Grass (*Themeda australis*) and Snow Gum (*Eucalyptus pauciflora*) Woodlands on the Monaro and Shoalhaven area. Appears to be a coloniser of bare patches, which explains why it often occurs on roadsides. The species has not been recorded in the locality and is unlikely to occur in the study area due to lack of subalpine, montane or natural temperate grassland habitat.
Mountain Swainson-pea *Swainsona recta*	E	E	**Likely -** Before European settlement Small Purple-pea occurred in the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum *Eucalyptus blakelyi*, Yellow Box *E. melliodora*, Candlebark Gum *E. rubida* and Long-leaf Box *E. goniocalyx*. Grows in association with understorey dominants that include Kangaroo Grass *Themeda australis*, Poa tussocks *Poa* spp. and spear-grasses *Austrostipa* spp. The species has previously been recorded in the locality, about 1.6 kilometres west of the study area in the railway easement. The study area is likely to provide preferred habitat in the form of Box-Gum Woodland for the species to occur.
Omeo Storksbill *Pelargonium* sp.	E	E	**Unlikely** - Known from only four locations in NSW, with three on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities. It sometimes colonises exposed lake beds during dry periods. The species has not been recorded in the locality and is unlikely to occur in the study area due to lack of wetland habitat suitable for the species.
Pale Pomaderris *Pomaderris pallida*	-	V	**Unlikely -** This species usually grows in shrub communities surrounded by Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*E. macrorhyncha*) or *Callitris* spp. woodland. The main distribution is along the Murrumbidgee in the ACT. This species has been recorded about 3.3 kilometres north-east of the study area. There is no preferred habitat in the study area for the species to be likely to occur, including associated species it occurs with.
Silky Swainson-pea *Swainsona sericea*	-	V	**Present –** Silky Swainson-pea has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. Its stronghold is on the Monaro. The species is found in Box-Gum Woodland in the Southern Tablelands and South West Slopes. Sometimes found in association with cypress-pines *Callitris* spp. The species was recorded in the Option 5 of the study area during the survey period.
Thick-lipped Spider Orchid *Caladenia tessellata*	V	E	**Unlikely -** Populations in Kiama and Queanbeyan are presumed extinct. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. The species was recorded about 5.4 kilometres north of the study area; however the records are from 1942. The population in Queanbeyan is presumed extinct.

Fauna

Species	Status		Likelihood of occurrence in study area
	National	NSW	
Birds			
Australasian Bittern *Botaurus poiciloptilus*	E	E	**Unlikely -** This species favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleoacharis* spp.). Hides during the day among dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. The species has not been recorded in the locality. The study area does not contain suitable wetland habitat for the species to be likely to occur.
Australian Painted Snipe *Rostratula australis*	V, Mi	E	**Unlikely -** Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground among tall vegetation, such as grasses, tussocks or reeds. Forages nocturnally on mud-flats and in shallow water. The species has not been recorded in the locality. The study area does not contain suitable wetland habitat for the species to be likely to occur.
Black-faced Monarch *Monarcha melanopsis*	Mi	-	**Unlikely** - In New South Wales and the Australian Capital Territory, the species occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Widden Valley, Wollemi National Park, Wombeyan Caves and Canberra. The species mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest. The species also occurs in selectively logged and 20 - 30 years old regrowth rainforest. It is also sometimes found in nearby open eucalypt forests (mainly wet sclerophyll forests), especially in gullies with a dense, shrubby understorey as well as in dry sclerophyll forests and woodlands, often with a patchy understorey. The species especially occurs in 'marginal' habitats during winter or during passage (migration). The species has not been recorded in the locality and is unlikely to occur due to lack of preferred rainforest habitat. It may occur in the locality as a vagrant during winter or migration.
Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*	-	V	**Present -** Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range. The species mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species, and is also found in Mallee and River Red Gum Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses. They are usually not found in woodlands with a dense shrub layer. The species was recorded in Option 1B, Option 5 and the common route.
Cattle Egret *Ardea ibis*	Mi	-	**Unlikely -** The Cattle Egret is found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. Will also forage at garbage dumps, and is often seen with cattle and other stock. The species has not been recorded in the locality. The species is unlikely to inhabit the study area due to a lack of watery habitats.

Species	Status		Likelihood of occurrence in study area
	National	NSW	
Diamond Firetail *Stagonopleura guttata*	-	V	**Present** - Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, Mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects. This species has been recorded from the study area along the common route.
Flame Robin *Petroica phoenicea*	-	V	**Present -** Prefer forests and woodlands up to about 1800 metres above sea level but are often recorded in fragmented landscapes foraging in open farmland adjoining box-gum woodlands. The species was recorded in Box-Gum Woodland in option 5.
Fork-tailed Swift *Apus pacificus*	Mi	-	**Unlikely -** Migratory marine visitor to eastern Australia. It is a highly nomadic and dispersive species which feeds on insects in the air. The species has not been recorded in the locality. The species is unlikely to inhabit the study area due to a lack of suitable habitats.
Gang-gang Cockatoo *Callocephalon fimbriatum*	-	V	**Present -** In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Move to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages. Favours old growth attributes for nesting and roosting. The species has been recorded just south of option 5 and is likely to be a vagrant visitor to the area.
Great Egret *Ardea alba*	Mi	-	**Unlikely -** Reported in a wide range of wetland habitats including swamps and marshes, margins of rivers and lakes, damp or flooded grasslands, pastures or agricultural lands, reservoirs, sewage treatment ponds, and drainage channels. The species has not been recorded in the locality. The species is unlikely to inhabit the study area due to a lack of suitable habitats.
Hooded Robin *Melanodryas cucullata cucullata*	-	V	**Present** - Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and Mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. The species has been recorded at the common route and just south of the common route.
Latham's Snipe *Gallinago hardwickii*	Mi	-	**Unlikely -** Occurs in permanent and ephemeral wetlands. The species usually inhabits open, freshwater wetlands with low, dense vegetation. The species has not been recorded in the locality and is unlikely to inhabit the study area due to a lack of suitable wetland habitats.
Little Eagle *Hieraaetus morphnoides*	-	V	**Likely -** Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. The species has been recorded about three kilometres east of the study area. The study area represents suitable foraging habitat.

Species	Status		Likelihood of occurrence in study area
	National	NSW	
Rainbow Bee-eater *Merops ornatus*	Mi	-	**Likely-** The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. The species has been recorded about two kilometres east of the study area. The study area represents suitable foraging and breeding habitat.
Regent Honeyeater *Anthochaera phrygia*	E	E	**Likely -** The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. The study area supports marginal suitable native woodland communities and given the presence of suitable foraging resources, the study area is likely to occasionally support this species.
Rufous Fantail *Rhipidura rufifrons*	Mi	-	**Unlikely -** Occurs in wet forests, and less often open forests. The species has not been recorded in the locality and is unlikely to occur in the study area due to a lack of suitable forest habitat.
Satin Flycatcher *Myiagra cyanoleuca*	Mi	-	**Unlikely -** Satin Flycatchers are mainly recorded in eucalypt forests, especially wet sclerophyll forest, often dominated by eucalypts such as Brown Barrel, *Eucalypt fastigata*, Mountain Gum, *E. dalrympleana*, Mountain Grey Gum, Narrow-leaved Peppermint, Messmate or Manna Gum, or occasionally Mountain Ash, *E. regnans*. Such forests usually have a tall shrubby understorey of tall acacias, for example Blackwood, *Acacia melanoxylon*. The species may also occur in woodlands such as Box-Gum Woodland. The species has not been recorded in the locality and is likely to utilise preferred, higher quality habitat outside the study area.
Scarlet Robin *Petroica boodang*	-	V	**Likely -** Primarily a resident in dry forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. The species has been recorded about three kilometres to the east of the study area. The study area provides suitable habitat for the species.
Speckled Warbler *Chthonicola sagittata*	-	V	**Present -** The Speckled Warbler lives in a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The species has been recorded from option 5 and the common route.
Spotted Harrier *Circus assimilis*	-	V	**Likely** - Occurs in grassy open woodland including *Acacia* and Mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. The species has been recorded about three kilometres to the east of the study area but the record is from 1984.

Species	Status		Likelihood of occurrence in study area
	National	NSW	
Superb Parrot *Polytelis swainsonii*	V	V	**Unlikely** - The species inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. May forage up to 10 kilometres from nesting sites, primarily in grassy box woodland. Although suitable habitat is present, this species has not been recorded in the locality. It may be an occasional visitor to the area.
Swift Parrot *Lathamus discolor*	E	E	**Unlikely -** The species occurs in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata,* Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box E*. moluccana* and Blackbutt *E. pilularis*. Although suitable habitat is present, this species has not been recorded in the locality. It may be an occasional visitor to the area.
Varied Sittella *Daphoenositta chrysoptera*	-	V	**Likely -** Occurs in eucalypt woodlands and forests throughout their range. They prefer rough-barked trees e.g. stringybarks and ironbarks The species has been recorded about three kilometres east of the study area. The species may utilise eucalypt woodland in the study area as foraging, roosting and nesting habitat.
White-bellied Sea-Eagle *Haliaeetus leucogaster*	Mi	-	**Unlikely -** Characterised by the presence of large areas of open water (larger rivers, swamps, lakes, and the sea). Birds have been recorded in (or flying over) a variety of terrestrial habitats. Very limited habitat occurs for this species in the study area due to a lack of open water habitats.
White-fronted Chat *Epthianura albifrons*	-	V	**Unlikely -** The White-fronted Chat lives in salt marsh and other damp areas with low vegetation such as swampy farmland and roadside verges. Sometimes occurs on beaches and the edges of lakes. The species has been recorded about three kilometres east of the study area in 1984. There is limited potential habitat in the study area
White-throated Needletail *Hirundapus caudacutus*	Mi	-	**Likely -** This is a highly nomadic and dispersive species, which follows low pressure atmospheric pockets where it feeds on insects. The species is generally found in eastern New South Wales and occasionally in inland NSW. The species may forage above the study area and use trees as roosting habitat.
Mammals			
Koala *Phascolarctos cinereus*	V	V	**Unlikely -** In NSW it mainly occurs on the central and north coasts with some populations in the western region. Inhabits eucalypt woodlands and forests. The species has only been recorded in the wider locality once and the record is from the 1980's. No evidence of the species was detected during surveys.

Species	Status		Likelihood of occurrence in study area
	National	NSW	
Spotted-tailed Quoll *Dasyurus maculatus maculatus (SE mainland population)*	E	V	**Unlikely -** Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. The species has been recorded twice in the locality, most recently three kilometres east of the study area in 1984. The study area provides marginal foraging habitat suitable for the species, and has a paucity of breeding and shelter habitat, including large hollow logs, rock outcrops and suitably-sized hollow-bearing trees. Suitable foraging and/or shelter sites were limited across the study area.
Bats			
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	-	V	**Likely** - Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Hunt in forested and woodland areas, catching moths and other flying insects above the tree tops. There are five records for this species in the locality all to the east. Most of these records are recent and within three kilometres.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	-	V	**Unlikely -** The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 metres. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. The species has not been recorded in the locality and there is limited potential habitat for the species in the study area.
Southern Myotis *Myotis macropus*	-	V	**Unlikely** - Preferred habitat is riparian. Roosts in caves, mines, tree hollows, aqueduct tunnels and under bridges and in dense vegetation in the vicinity of bodies of slow-flowing or still water (including estuaries). The species has not been recorded in the locality. As the species prefers to forage over water and roost in riparian habitat, it is more likely to occupy areas on the Murrumbidgee River to the east and so not likely to occur within the study area.
South-eastern Long-eared Bat *Nyctophilus corbeni*	V	V	**Unlikely -** Occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodlands. Also known to occupy man-made structures such as timber bridges. The species has not been recorded in the locality and is unlikely to inhabit eucalypt woodland in the study area as potential habitat.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	-	V	**Likely -** In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. The species has not been recorded in the locality and is unlikely to inhabit eucalypt woodland in the study area as potential habitat.

Species	Status		Likelihood of occurrence in study area
	National	NSW	
Insects			
Golden Sun Moth *Synemon plana*	CE	E	**Present -** The species occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which groundlayer is dominated by wallaby grasses *Austrodanthonia* spp. Grasslands dominated by wallaby grasses are typically low and open - the bare ground between the tussocks is thought to be an important microhabitat feature for the Golden Sun Moth, as it is typically these areas on which the females are observed displaying to attract males. Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly spear-grasses *Austrostipa* spp. or Kangaroo Grass *Themeda australis*. The species was recorded in the option 1B and option 5 area during surveys in the study area.
Reptiles			
Grassland Earless Dragon *Tympanocryptis pinguicolla*	E	E	**Unlikely** - The only populations now known are in the ACT and adjacent NSW at Queanbeyan, and on the Monaro Basalt Plains between Cooma and south-west of Nimmitabel. Restricted to a small number of Natural Temperate Grassland sites dominated by wallaby grasses (*Nothodanthonia* spp.), spear grasses (*Austrostipa* spp.), Poa Tussock (*Poa sieberiana*), Red Grass (*Bothriochloa macra*), and occasionally Kangaroo Grass (*Themeda australis*). Introduced pasture grasses occur at many of the sites supporting this species, which has also been captured in secondary grassland. Within its habitat, apparently prefers areas with a more open structure, characterised by small patches of bare ground between the grasses and herbs. In addition to tussocks, partially embedded surface rocks, and spider and insect holes are used for shelter. These are important micro-habitat elements within the grassland habitat. Rocks and arthropod holes provide important thermal refuges during temperature extremes.
Little Whip Snake *Suta flagellum*	-	V	**Likely -** The Little Whip Snake is found between Crookwell in the north, Bombala in the south, Tumbarumba to the west and Braidwood to the east. Generally occurring in Natural Temperate Grasslands and grassy woodlands, including those dominated by Snow. Gum *Eucalyptus pauciflora* or Yellow Box *E. melliodora*, it will persist in secondary grasslands derived from clearing of woodlands. Found on well-drained hillsides, mostly associated with scattered loose rocks where it forages for frogs and small reptiles. Occupies Box Gum Woodland and Natural Temperate Grasslands preferring steep slopes with loosely embedded rocks. Although this species has not been recorded in the locality, there is suitable potential habitat in the study area.
Pink-tailed Worm Lizard *Aprasia parapulchella*	V	V	**Present -** Inhabits sloping, open woodland areas with predominantly native grassy groundlayer, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. The species was recorded during surveys in the study area along the common route, Option 1B and Option 5.

Species	Status		Likelihood of occurrence in study area
	National	NSW	
Rosenberg's Goanna *Varanus rosenbergi*	-	V	**Likely -** Rosenberg's Goanna occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. This species is found in heath, open forest and woodland, where it forages for carrion, birds, eggs, reptiles and small mammals. Individuals require large home ranges and have an association with termite mounds, which they utilise for nesting. There are records for this species on the Googong Dam foreshores and to the north of the study area near Wickerslack lane.
Striped Legless Lizard *Delma impar*	V	V	**Unlikely -** The species is found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass *Themeda australis*, spear-grasses *Austrostipa* spp. and poa tussocks *Poa* spp., and occasionally wallaby grasses *Austrodanthonia* spp. Sometimes present in modified grasslands with a significant content of exotic grasses. Sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter. The species was not recorded Dunns Creek Road surveys and has not been recorded in the study area despite targeted surveys in the locality.
Amphibians			
Green and Golden Bell Frog *Litoria aurea*	V	E	**Unlikely** –Inhabits marshes, dams and stream-sides, particularly those containing bulrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia *holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region, occur in highly disturbed areas. The species was recorded about three kilometres east of the study area in 1984. The species is unlikely to inhabit the study area as there is currently only one known population in inland NSW.
Southern Bell Frog *Litoria raniformis*	V	E	**Unlikely -** Currently, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Found in or around permanent or ephemeral Black Box/Lignum / Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. There are no records in the locality. Very little suitable habitat was observed across the study area. Permanent water, suitable for breeding is not present.
Yellow-spotted Bell Frog *Litoria castanea*	E	CE	**Unlikely -** There is only a single known population of the Yellow-Spotted Bell Frog, which occurs on the Southern Tablelands. Historically, this species occurred in two separate highland ranges, on the New England Tableland and on the southern and central highlands from Bathurst / Orange to Bombala. Require large permanent ponds or slow flowing streams with plenty of emergent vegetation such as bulrushes. There are no records in the locality. Very little suitable habitat was observed across the study area. Permanent water, suitable for breeding is not present.

Species	Status		Likelihood of occurrence in study area
	National	NSW	
Fish			
Macquarie Perch *Macquaria australasica*	E	V	**Unlikely -** Habitat for the species is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. They also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods. The species has not been recorded in the LGA. River habitat for the species is not present in the study area and it is unlikely to be impacted.
Murray Cod *Maccullochella peelii*	V	-	**Unlikely -** Occurs in the waterways of the Murray–Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers and billabongs. The species has not been recorded in the LGA. Habitat for the species is unlikely to occur in the study area and it is unlikely to be impacted.
Silver Perch *Bidyanus bidyanus*	CE		**Unlikely -** Only one remaining secure and self-sustaining population occurs in NSW in the central Murray River downstream of Yarrawonga weir, as well as several anabranches and tributaries. The species has not been recorded in the LGA. Habitat for the species is unlikely to occur in the study area and it is unlikely to be impacted.

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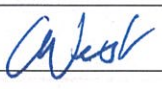
0	G. Pocknee	C. West		C. West		10/07/2015

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