Table 4.3 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Large-footed Myotis *Myotis macropus* DECCW	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. Distribution limits: N-Border Ranges National Park. S-South of Eden.	Suitable foraging, roosting & breeding habitat present. 6 records within 10km, with the closest record at less than 2km the SW in 1993. Potential to occur. If present, open water dams, riparian corridors and quality hollow-bearing trees proximate to these should be retained.	V	-
Greater Broad-nosed Bat *Scoteanax rueppellii* DECCW	Inhabits areas containing moist river & creek systems especially tree lined creeks. Distribution Limit: N-Border Ranges National Park. S-Pambula.	Sub-optimal foraging, roosting & breeding habitat present. 5 records within 10km, none within 5km. Low potential to occur and offer constraint to development.	V	-
Cumberland Plain Land Snail *Meridolum corneovirens* DECCW	Inhabits remnant eucalypt woodland of the Cumberland Plan. Shelters under logs, debris, clumps of grass, around base of trees and burrowing into loose soil. Distribution Limit: Cumberland Plain of Sydney Basin Region.	No suitable habitat present.	E	-
Macquarie Perch *Macquaria australasica* EPBC	Occurs in south east Australia at moderate to high altitudes in rivers and reservoirs. Historical records show the species was widespread and abundant in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers and their tributaries. Allen (1989) states that introduced populations are present in Nepean River and water supply dams in the Sydney area. Occurs in lakes and flowing streams, usually in deep holes.	Suitable habitat present within the Bargo & Nepean Rivers in the lower reaches of the site. Potential to occur but not likely to offer any constraints to the development area however there should be consideration to water quality drainage into these rivers.	V	E

Table 4.3 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Australian Greyling *Prototroctes maraena* EPBC	Clear, moderate to fast flowing water in the upper reaches of rivers (sometimes to altitudes above 1000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (eg. weirs, waterfalls).	Suitable habitat present within the Bargo & Nepean Rivers in the lower reaches of the site. Low potential to occur but not likely to offer any constraints to the development area.	Part 2, Section 19 – Protected Fish	V

DECCW	- Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife* database
EPBC	- Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
TBE	- Denotes additional species not listed within 10km searches but considered by *Travers bushfire & ecology* to have potential habitat based on regional knowledge and other records
NOTE:	- 'records' refer to those provided by the *Atlas of NSW Wildlife* database. Updated 1:100,000 database mapsheet requests to DECCW are undertaken every 3 months as recommended. - 'close proximity' refers to distances within 2km from the subject site.

4.10 Summary of potential threatened fauna constraints

If development is generally restricted to the expansive open areas of 'Pasture with Scattered Trees' community there is not expected to be any significant fauna constraints. Some threatened fauna including Glossy Black-Cockatoo, Little Lorikeet, Turquoise Parrot, Brown Treecreeper, owls or microchiropteran bats have potential to be utilising suitable hollows within this community. For most of these species the nearby open forest habitats are likely more suitable and utilisation of hollows would be at the nearby outer fringes of cleared pastures.

Where fauna survey reveals the use of hollows by a threatened species the protection of these hollows would be required with suitable buffers and linkage to natural habitats required with sizes varying according to the species. A 50m buffer at most would be expected for the nesting of owls. Therefore in such circumstances the constraint would be limited to the hollow location and not likely impede on large areas of open developable land.

Proposed development extending into the natural open forest areas will significantly increase the potential for impacts on threatened species habitat. Such impacts will again depend on the species and presence of critical nesting / breeding locations within. It is generally customary for such large proposed development sites to retain significant areas of such connective natural forests for local fauna traffic and which likely contribute to threatened species habitat.

4.11 Habitat assessment

A summary of fauna habitats present throughout the site include:

- Vegetated areas of native open forest
- Nectar producing tree species, principally *Eucalyptus, Acacia, Angophora and Corymbia*
- Sap producing tree species, principally *Eucalyptus punctata* and *Corymbia gummifera*
- Sparse to moderate density shrub layers
- Sparse to dense ground covers
- Large, medium and small hollows of varying quality
- Fallen logs, hollow sections and branches
- Sandstone outcrops and overhangs
- Potential for caves and quality crevices along sandstone escarpments
- Loose soil suitable for foraging
- Ephemeral drainages
- Farm dams with limited fringing vegetation
- Sparse to dense litter layers
- Exfoliated bark on trunks and piles at the base of smooth-barked *Eucalyptus* species
- Artificial debris, refuse and structures

4.11.2 Tree hollows

A complete assessment of the location of habitat trees and the size of hollows within each was undertaken within all cleared areas and along the edges of open forest of the subject site.

A total of fifty-eight (58) hollow-bearing trees were observed in these areas containing a total of one hundred and thirteen (113) hollows. Hollow-bearing tree data is provided in Table 4.4 and locations are depicted on Figure 1.

Small hollows (<10cm) provide suitable roosting opportunities for small species such as microbats, medium (10-30cm) hollows provide habitat for gliders and possums and large hollows (>30cm) may be suitable for owl and Cockatoo species.

Table 4.4 – Hollow-bearing tree data

Tag No.	Scientific Name	Common Name	DBH (cm)	Spread (m)	Height (m)	Vigour (%)	Hollows/Comments
HT01	stag	stag	85	1	7	0	1x 30cm+ broken trunk
HT02	*E punctata*	Grey Gum	85	15	25	70	1x 15-20cm trunk, 1x 5-10cm branch
HT03	stag	stag	45	1	10	0	1x 10-15cm trunk, 1x 15-20cm trunk
HT04	*E piperita*	Sydney Peppermint	80	15	12	25	1x 10-15cm broken trunk
HT05	*E punctata*	Grey Gum	75	15	24	70	2x 5-10cm trunk, 2x 10-15cm trunk
HT06	*E punctata*	Grey Gum	100	15	25	50	1x 10-15cm trunk, 2x 5-10cm branch, 1x10-15cm branch, scratch marks
HT07	*E punctata*	Grey Gum	80	10	26	50	1x 5-10cm trunk
HT08	*E punctata*	Grey Gum	100	13	20	50	1x 10-15cm trunk
HT09	*E punctata*	Grey Gum	80	10	22	35	1x 10-15cm trunk
HT10	stag	stag	50	4	10	0	1x 25-30cm broken trunk

Table 4.4 – Hollow-bearing tree data

Tag No.	Scientific Name	Common Name	DBH (cm)	Spread (m)	Height (m)	Vigour (%)	Hollows/Comments
HT11	unknown	unknown	55	3	6	5	1x 30cm+ broken trunk
HT12	stag	stag	50	5	15	0	1x 5-10cm trunk, 1x 10-15cm trunk, 1x 15-20cm trunk, 1x 5-10cm branch, 1x10-15cm branch, 1x 5-10cm split
HT13	stag	stag	50	7	17	0	2x 0-5cm trunk
HT14	*E punctata*	Grey Gum	38	5	17	40	1x 5-10cm branch
HT15	*E sclerophylla*	Hard-leaved Scribbly Gum	60	8	16	50	1x 5-10cm branch
HT16	*E punctata*	Grey Gum	90	15	28	60	1x 10-15cm trunk
HT17	*E punctata*	Grey Gum	38	6	12	20	1x 15-20cm broken trunk
HT18	*E punctata*	Grey Gum	90	12	22	50	1x 20-25cm trunk
HT19	*E punctata*	Grey Gum	55	13	25	55	2x 10-15cm trunk, 1x 5-10cm branch, scratch marks
HT20	*E punctata*	Grey Gum	45	7	17	60	2x 5-10cm branch
HT21	*E sclerophylla*	Hard-leaved Scribbly Gum	70	7	11	25	2x 5-10cm branch
HT22	*C gummifera*	Red Bloodwood	55	8	16	60	1x 20-25cm trunk
HT23	*E fibrosa*	Red Ironbark	60	10	16	35	1x 5-10cm branch, 1x10-15cm branch, 2x 5-10cm cracked bark
HT24	*E punctata*	Grey Gum	90	13	18	60	2x 0-5cm branch, 1x 5-10cm branch
HT25	*E sparsifolia*	Narrow-leaved Stringybark	75	8	18	30	1x 20-25cm trunk, 1x 0-5cm branch, 1x 5-10cm branch, 1x10-15cm branch, Galah nesting
HT26	*E sparsifolia*	Narrow-leaved Stringybark	75	6	15	30	1x 5-10cm broken trunk
HT27	*E punctata*	Grey Gum	85	15	26	75	1x 15-20cm trunk
HT28	*E punctata*	Grey Gum	100	12	21	60	1x 10-15cm trunk
HT29	*E punctata*	Grey Gum	50	10	15	25	1x 5-10cm branch, 1x10-15cm branch
HT30	stag	stag	75	8	20	0	2x 0-5cm branch, 2x 5-10cm branch
HT31	*E fibrosa*	Red Ironbark	70	11	25	65	2x 10-15cm cracked bark
HT32	*E punctata*	Grey Gum	80	15	25	65	2x 10-15cm trunk
HT33	*E punctata*	Grey Gum	45	5	14	55	1x 15-20cm trunk
HT34	*E punctata*	Grey Gum	65,45	15	22	60	2x 5-10cm branch
HT35	*E punctata*	Grey Gum	75	9	19	70	1x 15-20cm trunk
HT36	*E crebra*	Narrow-leaved Ironbark	48	7	17	50	1x 10-15cm trunk
HT37	*E crebra*	Narrow-leaved Ironbark	55	6	18	30	1x 5-10cm branch
HT38	*E sclerophylla*	Hard-leaved Scribbly Gum	60	11	22	60	1x 10-15cm trunk, 1x 15-20cm trunk
HT39	*E beyeriana*	Ironbark	65	8	20	30	1x 10-15cm broken trunk, 1x 20-25cm trunk, 1x 10-15cm branch

Table 4.4 – Hollow-bearing tree data

Tag No.	Scientific Name	Common Name	DBH (cm)	Spread (m)	Height (m)	Vigour (%)	Hollows/Comments
HT40	*E fibrosa*	Red Ironbark	80	12	18	50	1x 15-20cm trunk
HT41	*E punctata*	Grey Gum	80	16	18	45	1x 15-20cm trunk
HT42	*E punctata*	Grey Gum	75	11	17	50	1x 10-15cm broken trunk
HT43	*E parramattensis*	Parramatta Red Gum	80	12	17	40	1x 10-15cm trunk, 1x 15-20cm trunk, 1x 0-5cm branch
HT44	*E punctata*	Grey Gum	90	10	22	50	1x 10-15cm trunk, 1x 15-20cm trunk, 1x 20-25cm trunk, 1x 5-10cm branch, 2x 10-15cm branch
HT45	*E punctata*	Grey Gum	85	12	24	50	1x 10-15cm trunk, 1x 10-15cm branch
HT46	*E punctata*	Grey Gum	90	9	20	40	1x 10-15cm trunk
HT47	*E sclerophylla*	Hard-leaved Scribbly Gum	70	9	18	70	1x 10-15cm trunk
HT48	*E punctata*	Grey Gum	65	11	18	70	2x 5-10cm trunk, 2x 10-15cm trunk
HT49	*E punctata*	Grey Gum	50,40,40	12	21	60	1x 10-15cm trunk, 1x 15-20cm trunk, 2x 5-10cm branch
HT50	*E punctata*	Grey Gum	90	9	22	40	1x 35-40cm broken trunk, 1x 25-30cm trunk, 2x 5-10cm branch
HT51	*E beyeriana*	Ironbark	55	10	18	55	1x 10-15cm trunk
HT52	*E fibrosa*	Red Ironbark	60	9	13	55	1x 10-15cm trunk
HT53	*C gummifera*	Red Bloodwood	30,25	6	14	45	1x 5-10cm trunk
HT54	stag	stag	40	3	13	0	1x 10-15cm trunk
HT55	*E punctata*	Grey Gum	120	12	20	55	1x 10-15cm trunk
HT56	*E punctata*	Grey Gum	100	10	21	60	1x 5-10cm branch
HT57	*E punctata*	Grey Gum	75	8	20	30	2x 20-25cm trunk, 2x 5-10cm branch, 1x 0-5cm branch
HT58	*E fibrosa*	Red Ironbark	70	13	18	60	1x 5-10cm branch, 1x 0-5cm branch

4.12 Koala habitat assessment

One Koala food tree species Grey Gum (*Eucalyptus punctata*) as listed on Schedule 2 of State Environmental Planning Policy No. 44 - Koala Habitat Protection was recorded within the subject site. These trees comprised of greater than 15% of the total number of trees within the Grey Gum / Ironbark Open Forest, Grey Gum / Ironbark / Peppermint Gully Forest and Pasture with Scattered Trees vegetation communities and therefore are classified under SEPP 44 as 'Potential Koala Habitat'.

Koalas are typically described to inhabit forest and woodland communities within literature reviewed; this combined with the lack of connectivity throughout the majority of the Pasture with Scattered Trees community suggest that suitable habitat is essentially restricted to the northern and eastern forested portions of the subject site.

A search of the Atlas of NSW Wildlife (DECCW 2010) database found 36 records of Koala habitation within a 10 km radius from the subject site since 1989. The closest 4 records are located approximately 3km to the south-east, south & north-east in 1999, 2004 & 2006. Records do not suggest a strong local presence which likely extends into the subject site

however field fauna surveys will be required to determine if the subject site comprises of 'Core Koala Habitat' as defined under SEPP 44.

Fauna survey should essentially involve target search quadrats for signs of given the presence of suitable habitat and the representation of regional records. Quadrat techniques should be undertaken in association with other methodologies such as spotlighting and call-layback throughout the subject site.

If the site is found to provide evidence of a resident koala population then a Koala Plan of Management will be required under SEPP 44 as part of any future development application. Given that suitable areas and connectivity between Open Forest communities is retained as part of future development applications then this species will not likely offer a constraint to development.

4.13 Riparian constraints

A review of the LEP mapping on the Wollondilly Council website shows a 100m buffer to Nepean River and Bargo River. One watercourse in the south-east has been mapped with a buffer of 10m.

A specific riparian assessment has been prepared by Worley Parsons (2010) which maps the extent of the recognised watercourses onsite.

This Ecological Constraints Report should be read in conjunction with that by Worley Parsons who describe the riparian constraints to the Nepean River, Myrtle Creek and other un-named watercourses arising from these.

Wollondilly Shire Council is required to consider the impact upon threatened species, populations and or endangered ecological communities from any development or activity via the process of a 7 part test of significance. The significance of the assessment is then used to determine the need for a more detailed Species Impact Statement (SIS).

A concept development plan (Insert 1) has been provided for preliminary constraints reporting. A seven part test of significance has not been undertaken as part of this preliminary level. It will be required to be undertaken at a DA submission stage. The following are points to consider relevant to the future seven part test assessment.

5.1 Flora assessment

In summary and following the field habitat assessment it is considered that the subject site provides habitat for the following threatened flora species:

- *Darwinia penduncularis*
- *Epacris purpurascens* var. *purpurascens*
- *Persoonia bargoensis*
- *Persoonia glaucescens*
- *Persoonia hirsuta*
- *Pomaderris brunnea*

Travers bushfire & ecology only located one (1) specimen of *Persoonia bargoensis* (as confirmed by the Royal Botanic Gardens). This specimen occurred near the northern boundary within existing bushland (on the edge of) and is shown on Figure 1.

None of the other five (5) species listed are cryptic in nature such that survey is required to be done at a specific time of the year. The EPBC coordinate search found a number of cryptic species that had potential habitat within 10km of the subject site – *Caladenia tessellata, Cryptostylis hunteriana, Lepidium hyssopifolius, Pterostylis saxicola* and *Thelymitra* sp. 'Kangaloon', however the habitat assessment of this species found that the attributes required for these to occur were not present on site or their geographic distribution ruled them out as having potential to occur.

The Atlas of NSW Wildlife database (DECCW 2010) state one (1) specimen of *Persoonia bargoensis* occurred at grid coordinates 280540E and 6210590N (in 2005) which is within an existing paddock occupied presently by cattle. There is no shrub layer present and the ground layer is predominately exotic or pasture grasses with annual weeds.

The accuracy of the record was stated to be within 1,000m which could mean it does not exist on site however given the relatively precise coordinates stated, the accuracy is likely to be much better than 1000m. The current site assessment did not find any specimens near to the 2005 sighting and there was little to no potential for it to occur in that said location given the presence of cattle.

An assessment of individual threatened species with available habitat present should consider if a proposed development is likely to place a local population at risk of extinction. Furthermore, in the assessment of these species, the seven part test requires consideration to the amount of habitat removed, the impact of isolation and further fragmentation and the importance of habitat removed.

Because of the grazed nature of the majority of the subject site and previous large-scale clearing, the potential habitat and likelihood of occurrence is greatly reduced or considered no potential habitat within those cleared / grazed areas. The remnant forest on the shale geology is limited to the edges of existing vegetation on the flatter slopes and the remnant forest on sandstone geology is limited to the gully vegetation. The gully vegetation is quite extensive to the south-east near the convergence of the Nepean and Bargo River but for most parts is rather inaccessible. The slopes are much greater than 18 degrees meaning there cannot be an asset protection zone for bushfire protection (some slopes near vertical) and are therefore likely to be protected.

The Shale Sandstone Transition Forest vegetation is in good condition with little evidence of grazing and low levels of disturbance except on the very edges for say the first 5-10m. Threatened flora species listed above that occur in shale or sandstone areas have good potential habitat and a variable likelihood of occurrence dependent upon their geographic distribution.

Shale Sandstone Transition Forest is listed under the EPBC Act (nationally recognised EEC). Removal of this vegetation community is likely to trigger a referral to DEWHA for consideration.

The main constraint to future development is existing Shale Sandstone Transition Forest. The removal of the three (3) smaller patches in the northern section of the subject site that are currently isolated and less than 0.25ha is permissible. However there should be no direct removal of the EEC remnants around the perimeter of the subject site. Asset protection zones currently impact on EEC areas and offsetting the losses is likely to be required.

There are no known threatened flora populations within the Wollondilly LGA.

The subject site does not constitute as 'Critical Habitat' as listed by the TSC Act (1995) for any threatened species (flora or fauna) or community.

A seven-part test of significance will also require consideration as to whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There are no approved recovery plans for any of the threatened flora species with potential to occur within the subject site. There are currently plans in preparation (drafts) for the following threatened species with potential habitat within the subject site:

- *Persoonia bargoensis*
- *Persoonia hirsuta*
- *Pomaderris brunnea*

Any proposed development would be considered consistent with the objectives or actions of these draft recovery plans if a suitable area of forested habitat is retained (and possibly restored) with a consideration of connectivity to adjacent resources. Generally this is most likely to be within the Shale Sandstone Transition Forest and upper areas of the Gully Forest vegetation communities.

The initial concept layout plans would require the removal of Shale Sandstone Transition Forest which occurs near the eastern site perimeter. Given this vegetation is a listed Endangered Ecological Community (TSC Act and EPBC Act) any loss of this community would need to be offset.

Travers bushfire & ecology has undertaken a similar assessment within the same LGA and containing some similar vegetation whereby the offset ratio required was 3:1. Thus, in order to remove, as an example, 1.5ha of EEC not classified as low condition under the Biometric Assessment Methodology, would need 4.5ha to be provided as a restoration offset. As the site is not exempt from the Native Vegetation Act 2003, the removal of EEC vegetation will require CMA approval which may require a greater offset ratio.

Alternatively, other avenues for offsetting are currently available such as Biobanking or even negotiation with Council which could allow those sensitive areas of EEC to be removed.

5.2 Fauna assessment

In summary and following the field habitat assessment it is considered that the subject site provides habitat for the following fauna species:

- Giant Burrowing Frog
- Red-crowned Toadlet
- Littlejohn's Tree Frog
- Green and Golden Bell Frog
- Broad-headed Snake
- Little Eagle
- Square-tailed Kite
- Australian Painted Snipe
- Bush Stone-curlew
- Glossy Black-Cockatoo
- Gang-gang Cockatoo
- Little Lorikeet
- Swift Parrot
- Turquoise Parrot
- Regent Honeyeater
- Barking Owl
- Powerful Owl
- Masked Owl
- Varied Sittella
- Diamond Firetail
- Scarlet Robin
- Hooded Robin
- Speckled Warbler
- Black-chinned Honeyeater
- Brown Treecreeper
- Spotted-tailed Quoll
- Koala
- Eastern Pygmy Possum
- Yellow-bellied Glider
- Brush-tailed Rock-wallaby
- Grey-headed Flying-fox
- Large-footed Myotis
- Eastern Bentwing-bat
- Greater Broad-nosed Bat
- East-coast Freetail Bat
- Eastern Falsistrelle
- Large-eared Pied Bat
- Macquarie Perch
- Australian Greyling

The site offers only sub-optimal or unlikely presence for the majority of these species. The Glossy Black-Cockatoo has already been incidentally recorded during botanical surveys.

An assessment of individual threatened species with available habitat present should consider if a proposed development is likely to place a local population at risk of extinction. Furthermore, in the assessment of these species, the seven part test requires consideration to the amount of habitat removed, the impact of isolation and further fragmentation and the

importance of habitat removed. Refer to Section 4.10 of this report for a preliminary assessment background of threatened fauna species with potential to occur. In essence:

- There is no listed endangered fauna population within the Wollondilly LGA;
- The subject site does not constitute as 'Critical Habitat' as listed by the TSC Act (1995) for any threatened species (flora or fauna) or community; and
- A seven-part test of significance will also require consideration as to whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Draft recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Barking Owl *(Ninox connivens)* (DECC, 2003)
- Brush-tailed Rock-wallaby (*Petrogale penicillata*) (DEC 2005)
- Green and Golden Bell Frog *(Litoria aurea)* (DECC, 2005)
- Koala *(Phascolarctos cinereus)* (DECC, 2003)

Approved recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Bush Stone Curlew (*Burhinus grallarius*) (DECC 2006)
- Large Forest Owls (Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*) (DECC 2006))
- Yellow-bellied Glider (*Petaurus australis*) (DECC 2003)

5.3 Other considerations under the 7-part test

Another ecological consideration of a seven-part test of significance is the potential for 'key threatening processes' listed under the TSC Act (1995). The following threatening processes are considered likely relevant to proposed development within the subject site:-

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands
- Bushrock removal
- Clearing of native vegetation
- Infection of frogs by amphibian *chytrid* causing the disease *chytridiomycosis*
- Infection of native plants by *Phytophthora cinnamomi*
- Invasion and establishment of exotic vines and scramblers
- Invasion of native plant communities by exotic perennial grasses
- Invasion, establishment and spread of *Lantana camara*
- Loss of hollow-bearing trees
- Predation by the Feral Cat (*Felis catus*)
- Removal of dead wood and dead trees

None of these processes are likely to provide a significant constraint within this site provided that the riparian buffers are put in place and there is retention of all good quality EEC and connective natural open forest in the eastern portions. In addition, a Vegetation Management Plan or equivalent would see the management and protection of existing vegetation and habitat in perpetuity.

Isolation and fragmentation issues need to be considered under the 7-part test assessment. Given that basically all vegetation and good habitat is around the fringes of the subject site on constrained areas, future development is unlikely to increase the effects of isolation and fragmentation to cause a '*significant impact*'.

6.1 Legislative conclusions

The following ecological constraints are based on flora survey, database searches and fauna habitat assessment in the absence of fauna survey. Opportunistic observations of fauna were noted during vegetation surveys and assisted in the assessment of potential fauna habitat onsite.

EPA Act and TSC Act

In respect of matters required to be considered under the *Environmental Planning & Assessment Act* (1979) and relating to the species / provisions of the *Threatened Species Conservation Act* (1995);

- One (1) threatened fauna species Glossy Black-Cockatoo (*Calyptorhychus lathami)*, was recorded within the subject site during botanical surveys. No formal fauna survey has been undertaken within the subject site and further threatened fauna species are expected.

- One (1) flora species *Persoonia bargoensis* was recorded within the subject site; and

- One (1) endangered ecological community, *Shale Sandstone Transition Forest* was recorded within the subject site.

It should be noted that a specimen of *Persoonia bargoensis* was sighted in 2005 according to the Atlas of NSW Wildlife database (DECCW). Whilst the coordinates of the sighting appear quite accurate giving the impression it was likely to be within 10m, the database states the accuracy is to 1000m. The location of this prior sighting is shown on Figure 1. Given that the sighting is presently grazed by cattle, there is midstorey or shrub layer present, and the ground layer is dominated by pasture grasses and exotic species (annuals), it is unlikely to occur at said location.

EPBC Act

In respect of matters required to be considered under the *Environment Protection and Biodiversity Conservation Act* (1999):

- No formal fauna survey has been undertaken within the subject site;

- One (1) migratory fauna species listed under the EPBC Act (1999) - Cattle Egret (*Ardea ibis*) was recorded within the subject site during botanical surveys.

- One (1) threatened flora species *Persoonia bargoensis* was recorded within the subject site; and

- One (1) endangered ecological community, *Shale Sandstone Transition Forest* was recorded within the subject site.

- No endangered populations were recorded on site or considered likely to occur.

FM Act

One (1) state listed threatened fish species the Macquarie Perch has potential to utilise the Nepean River and Bargo River along the lower eastern limits of the subject site. One (1) additionally protected species listed under this Act - Australian Greyling also has suitable habitat present.

6.2 Constraints conclusions

It is concluded that any proposed development for the subject site landscape would be constrained by the presence of the following ecological features:

- **One (1) large dam** providing variable quality aquatic habitat for a diversity of bird species including waterfowl, waders and migratory species of national significance. These habitats also have potential to be utilised seasonally by listed threatened species. As the dams have connectivity to existing watercourses, they will need to be protected by a minimum natural habitat buffer of 10m for the restoration of fringing vegetation, roosting and foraging habitat.

- **One (1) endangered ecological community** – *Shale Sandstone Transition Forest* was recorded. A *maintain or improve* outcome needs to be achieved for the EEC such that the loss of any medium or high quality vegetation is offset within the site or elsewhere by agreement with Council or potentially DECCW.

  Shale Sandstone Transition Forest is listed as a matter of national environmental significance under the EPBC Act 1979. Impacts on these vegetation types trigger a submission to DEWHA.

  The current area of *Shale Sandstone Transition Forest* on site is 4.87ha. The vegetation is in moderate to very good condition. Vegetation in 'low condition' can generally be removed however any loss of medium or good quality vegetation must be offset through protection and / or restoration measures. Vegetation of a good condition generally needs to be retained insitu. Even though as stated above, vegetation is in moderate through to very good condition, vegetation can be classed as 'low condition' under a Biometric assessment if that remnant is under 0.25ha in size or lacks sufficient cover or native species. There are three (3) small remnants all less than 0.25ha therefore all remnants would be classed as low condition and thus could be removed if required. It is recommended however that hollow-bearing trees identified in these remnants be retained where possible for the protection of roosting habitat for threatened microbat species and common fauna.

  Asset protection zones are to be preferably outside of the EEC to minimise potential offsets and loss of resilient native vegetation.

- **Riparian Buffers** are required for the existing watercourses onsite. These are shown on Figure 1 as assessed by Worley Parsons (2010) with the relevant buffer sizes.

  It is standard DECCW - NSW Office of Water policy that asset protection zones must be outside of any riparian buffer.

- **Threatened fauna species habitat and connectivity** – Comprehensive or preliminary fauna survey has not been undertaken within the subject site. It is expected that potential exists for hollow-dependent threatened species to reside within quality hollows located along the fringes of the 'Pasture with Scattered Trees' vegetation community where neighbouring native open forest areas exist. Fauna survey should attempt to identify most suitable hollows present for each of the hollow-dependent threatened species recorded.

  The eastern native open forest areas contain quality habitats and provide a valued corridor for local fauna along the western slopes of the Bargo and Nepean Rivers which likely includes threatened species. This is emphasised in the Wollondilly LEP, 2009 which shows that the vegetation to the east is of the most valued quality. The retention of these areas will combine well with the proposed riparian corridors for fauna movements to all aspects without compromising current options.

  Existing water bodies such as the large dam on the western boundary are potential habitat areas for threatened microbat and migratory species. Appropriate ecological survey and assessment will need to be undertaken at the detail design/DA stage to determine the ecological value of these areas.

The total area of the subject site is approximately 110 ha. Based on ecological investigations to date, the open pasture area is mostly unconstrained except for the provision of riparian buffers and fringing native vegetation areas some of which contains the EEC - *Shale Sandstone Transition Forest*. The Open pasture area occupies approximately 90 ha. Subject to fauna survey and assessment under the Native Vegetation Act, it is estimated that approximately 85 ha would be suitable for future development. This would preferably be inclusive of perimeter asset protection zones that minimise impacts on any existing Shale Sandstone Transition Forest.

6.3 Recommendations

The following recommendations are made to provide a greater degree of security as to the nature of the sites ecological constraints and to optimise the vegetative cover and hence habitat values of the landscape post potential subdivision of the site. The recommendations are also based on the concept subdivision layout (Attachment 1).

- Undertake comprehensive fauna survey within the subject site for any subsequent development application. Where development is proposed to impact on natural open forest areas fauna survey will include fauna trapping as a minimum along with target survey for threatened species and general diurnal observations and night survey. Further recommendations pertinent to the protection of significant fauna habitat are likely to result from such survey.

- Ecological site management would need to include restoration of native vegetation within the proposed riparian corridors. Restoration works will be needed to restore *Shale Sandstone Transition Forest* vegetation onsite if any is removed or modified by an asset protection zone or other proposed works. It is highly likely that the vegetation could be replaced onsite to create more contiguous and consolidated native vegetation areas such as adjoining Myrtle Creek in the north-eastern portions of the site. It is possible that offset areas may be found at another location off the site as assessed under a Biobanking Statement or in consultation with Council.

- To adopt a vegetation management plan that conserves as much of the existing vegetation as possible, offsets the loss of significant vegetation in the form of wildlife corridors, riparian corridors, retained vegetation and dams for waterbirds.

- Stormwater management of the site will need to achieve a 'maintain or improve' outcome in the management of water quality onsite. A general improvement in water quality would need to be achieved prior to the delivery of water into the Nepean and Bargo Rivers (and Myrtle Creek).

- Given the potential migratory bird and threatened fauna habitat value of the main dam near the western site boundary, fauna survey will need to be undertaken to identify the significance of habitat for threatened and migratory bird species.

- Consider realignment of the proposed lot boundaries to allow conservation or restoration of Shale Sandstone Transition Forest within the north western portion of the site as a 3:1 restoration offset for removal of the same EEC within the eastern portions of the site.

The subdivision layout plans as mapped would require the removal of Shale Sandstone Transition Forest which occurs near the eastern site perimeter. Given this vegetation is a listed Endangered Ecological Community (TSC Act and EPBC Act) any loss of this community would need to be offset. As the site is not exempt from the Native Vegetation Act 2003, the removal of EEC vegetation will require CMA approval which may require 3:1 or greater offset ratio.

Travers bushfire & ecology has undertaken a similar assessment within the same LGA and containing some similar vegetation whereby the offset ratio required was 3:1. Thus, in order to remove, as an example, 1.5ha of EEC not classified as low condition under the Biometric Assessment Methodology, would need 4.5ha to be provided as a restoration offset.

It recommended that if some of the eastern areas of EEC are to be removed for asset protection zones, the most appropriate restoration offset area would be within the north-western portions of the site which abuts a larger patch of fringing Shale Sandstone Transition Forest.

Alternatively, as described in the dot points above, Biobanking methodology or negotiations with Council may be undertaken to come up with a different offset strategy to be located elsewhere.

6.4 Conclusion

From this review large portions of the site are ecologically unconstrained and suitable for development due to the lack of native vegetation and / or watercourses. The constraints in this report have been appropriately reflected in the attached concept plan. Fauna constraints and vegetation management matters relevant to the Native Vegetation Act 2003 will need to be examined at the detailed design/DA stage.

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A1
Attachment 1
Concept Development
Layout