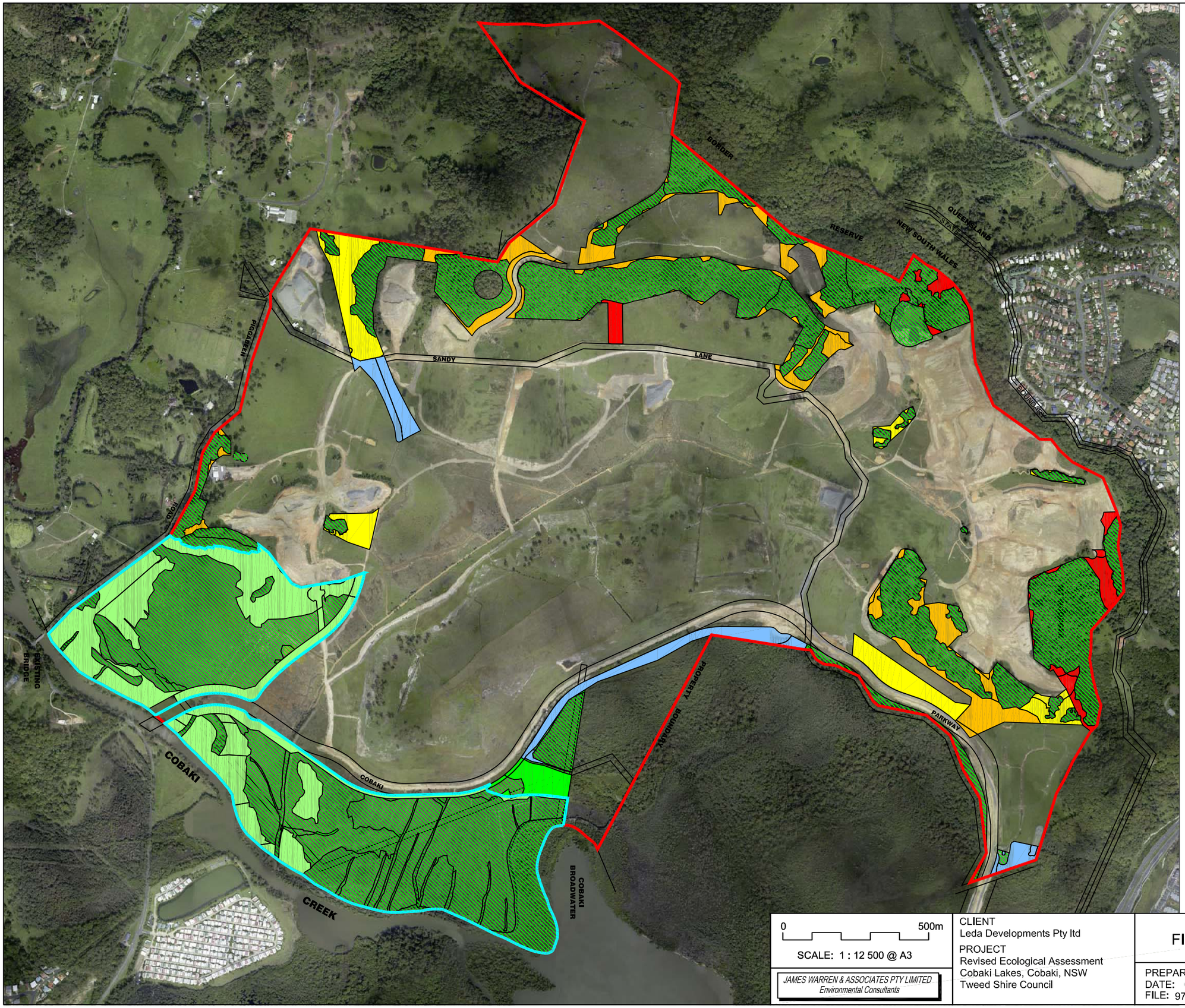

N

LEGEND

ENDANGERED ECOLOGICAL COMMUNITIES (EEC) OFFSET AREAS

- Lowland Rainforest
- Lowland Rainforest on Floodplain
- Swamp Sclerophyll Forest on Floodplain
- Freshwater Wetland
- Swamp Sheoak Floodplain Forest / Saltmarsh

OTHER

- Mixed Sclerophyll Forest
- Retained Vegetation
- Salt Marsh Rehabilitation Area
- Site Outline

SOURCE:
EEC's - James Warren & Associates Pty Ltd
Impact Area - SMEC
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
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Revised Ecological Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 28

PREPARED: BW
DATE: 05 April 2013
FILE: 97038_EA_Base.dwg

TITLE
ENDANGERED ECOLOGICAL COMMUNITIES OFFSET AREAS

a. Revised Site Regeneration and Rehabilitation Plan (JWA 2013a); and

b. Revised Saltmarsh Rehabilitation Plan (JWA 2013b).

2. In instances where appropriate offset areas are not available on the Subject site, Leda Manorstead Pty Ltd is currently carrying out negotiations with OEH with a view to securing appropriate off-site offsets.

TABLE 7
PROPOSED EEC OFFSETS ON THE SUBJECT SITE

EEC Offset Areas	Area of existing EEC (ha)	Area of EEC to be removed/ modified (ha)	Proposed Onsite Offset (ha)	Total Area at completion of development (ha)	Net gain/loss (ha)
Swamp sclerophyll forest on coastal floodplain	3.80	3.80	6.77	6.77	+2.97
Lowland rainforest on floodplain	1.75	0.01	9.59	11.32	+9.58
Lowland rainforest	9.24	0.10	3.71	12.86	+3.61
Freshwater wetlands	35.39	24.12	2.00	13.27	-22.12
Coastal saltmarsh	54.63	9.69	20.00[1]	89.22[2]	+34.59
Swamp oak floodplain forest	4.52	0.73	5.88[1]	9.67	+5.15

Swamp sclerophyll forest on coastal floodplain

Amelioration for the removal of the degraded Swamp sclerophyll forest on coastal floodplain will be provided through revegetation works on the Subject site. The Revised Site Regeneration and Revegetation Plan (JWA 2013a) includes measures to offset the loss of this EEC from the Subject site.

In total, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site (**FIGURE 28**) to offset the loss of 3.8 hectares. The proposed offsets will result in a net gain of 2.97ha of this EEC on the Subject site.

The Revised Site Regeneration and Revegetation Plan (JWA 2013a) includes specific performance criteria as well as detailed maintenance and monitoring programs and it is therefore considered that the compensatory Swamp sclerophyll forest on coastal floodplain will be more likely to persist in the long-term compared to the existing communities.

Lowland rainforest on floodplain

Amelioration for the removal of a very small area of Lowland rainforest on floodplain (i.e. 0.01ha) will be provided through revegetation works on the Subject site. The

[1] The revegetation of Saltmarsh and Swamp oak floodplain forest will occur in areas of the Saltmarsh Rehabilitation Area with exact locations based on topography. Swamp oak forest will be revegetated in areas of higher elevation and saltmarsh in lower lying areas. These areas will be determined at the completion of bulk earthworks.
[2] This includes approximately 64.28ha of natural regeneration of Coastal Saltmarsh in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2013).

Revised Site Regeneration and Revegetation Plan (JWA 2013a) includes measures to offset the loss of this EEC from the Subject site. Furthermore, retained patches of this EEC will be buffered from the proposed development and embellished to increase the overall extent of isolated patches and reduce existing anthropogenic impacts. The Revised Site Regeneration and Revegetation Plan (JWA 2013a) includes specific performance criteria as well as a detailed maintenance and monitoring program to ensure the persistence of this EEC in the long-term.

In total, 9.59 hectares of Lowland rainforest on floodplain will be regenerated/revegetated on the Subject site (**FIGURE 28**) to offset the loss of 0.01 hectares. The proposed offsets will result in a net gain of 9.58ha of this EEC on the Subject site. Retained Lowland rainforest on floodplain communities will be provided with a 10m vegetated buffer as a minimum.

Lowland rainforest

Amelioration for the removal of a very small area of Lowland rainforest (i.e. 0.1ha) will be provided through revegetation works on the Subject site. The Revised Site Regeneration and Revegetation Plan (JWA 2013a) includes measures to offset any loss of this EEC from the Subject site. Furthermore, retained patches of this EEC will be buffered from the proposed development and embellished to increase the overall extent of isolated patches and reduce existing anthropogenic impacts. The Revised Site Regeneration and Revegetation Plan (JWA 2013a) includes specific performance criteria as well as a detailed maintenance and monitoring program to ensure the persistence of this EEC in the long-term.

In total, 3.71 hectares of Lowland rainforest will be regenerated/revegetated on the Subject site (**FIGURE 28**) to offset the loss of 0.1 hectares. The proposed offsets will result in a net gain of 3.61ha of this EEC on the Subject site. Retained Lowland rainforest communities will be provided with a 10m vegetated buffer as a minimum.

Freshwater wetlands

Offsets for the removal of highly degraded Freshwater wetland vegetation from the Subject site will include the following:

1. Recreation of approximately 2ha of high quality wetland habitats. These compensatory Freshwater wetlands will be offline from the stormwater treatment train and will also be specifically designed to provide core (breeding) habitat for the Wallum froglet. Revegetation and management of Freshwater wetlands will occur in accordance with a Freshwater Wetland Compensatory Habitat Management Plan (SMEC 2012); and

2. Additionally, Leda Manorstead Pty Ltd is currently in negotiations with OEH with a view to securing appropriate off-site offsets.

In total, 2 hectares of Freshwater wetlands will be regenerated/revegetated on the Subject site (**FIGURE 28**) to partly offset the loss of 24.12 hectares.

Swamp oak floodplain forest

The removal of approximately 0.73 hectares of the Swamp oak floodplain forest community from the Subject site will be ameliorated by regenerating and revegetating compensatory Swamp oak communities on the Subject site. Areas within and adjacent to the existing Saltmarsh communities on the Subject site are currently comprised of a mixture of exotic grasses and will be restored to Saltmarsh and Swamp oak communities in accordance with the Revised Saltmarsh Restoration Plan (JWA 2013b). Removal of cattle from the area and subsequent relinquishment of existing use rights is considered an integral component of the rehabilitation process.

In total, approximately 5.88 hectares of Swamp oak floodplain forest will be revegetated (in areas of the Saltmarsh Revegetation Area with higher elevation) on the Subject site (**FIGURE 28**) to offset the loss of 0.73 hectares. The proposed offsets will result in a net gain of 5.15ha of Swamp oak floodplain forest on the Subject site. Retained Swamp oak floodplain forest communities will be provided with a 10m vegetated buffer as a minimum.

Coastal saltmarsh in the NSW North Coast bioregion

The removal of approximately 9.69 hectares of Saltmarsh communities from the Subject site will be ameliorated by regenerating and revegetating compensatory Saltmarsh communities on the Subject site (**FIGURE 28**). Offsets for the removal of degraded Saltmarsh vegetation from the Subject site will include the following:

1. Large areas adjacent to the existing Saltmarsh communities are currently comprised of a mixture of exotic grasses and will be restored to Saltmarsh communities in accordance with the Revised Saltmarsh Restoration Plan (JWA 2013b).
2. Re-establishment of saltmarsh species will be completed on the batters along the eastern edge of the Cobaki Parkway after construction is complete.
3. The Revised Saltmarsh Restoration Plan (JWA 2013b) also includes the provision of retreat areas for Saltmarsh communities in the event of sea-level rise.
4. Removal of cattle from the area and subsequent relinquishment of existing use rights is considered an integral component of the rehabilitation process.
5. The entire area of the existing Saltmarsh which is to be retained (i.e. 54.63ha) will be rehabilitated in accordance with the Revised Saltmarsh Restoration Plan (JWA 2013b). This will essentially involve restoring a natural tidal regime to the area.

In total, 20 hectares of Saltmarsh vegetation (in lower lying areas of the Saltmarsh Revegetation Area) will be revegetated on the Subject site (**FIGURE 28**) in conjunction with approximately 64.28ha of natural regeneration to offset the loss of 9.69 hectares. The proposed offsets listed above will result in a net gain of 34.59ha of Coastal saltmarsh on the Subject site.

4.2.6.7 Impacts & Amelioration for Threatened Fauna and their habitat

Twelve (12) Threatened fauna species have been recorded from the Subject site including:

- Wallum froglet (*Crinia tinnula*) – Vulnerable (TSC Act 1995);
- Black-necked stork (*Xenorhynchus asiaticus*) – Endangered (TSC Act 1995);
- Powerful owl (*Ninox strenua*) – Vulnerable (TSC Act 1995);
- Masked owl – (*Tyto novaehollandiae*) - Vulnerable (TSC Act 1995);
- Osprey (*Pandion haliaetus*) - Vulnerable (TSC Act 1995);
- Koala (*Phascolarctos cinereus*) - Vulnerable (TSC Act 1995);
- Grey-headed flying-fox (*Pteropus poliocephelus*) - Vulnerable (EPBC Act 1999);
- Little bent-wing bat (*Miniopterus australis*) - Vulnerable (TSC Act 1995);
- Common bent-wing bat (*Miniopterus schreibersii*) - Vulnerable (TSC Act 1995);
- Eastern free-tail bat (*Mormopterus norfolkensis*) - Vulnerable (TSC Act 1995);
- Yellow-bellied sheathtail bat (*Saccolaimus flaviventris*) - Vulnerable (TSC Act 1995); and
- Greater broad-nosed bat (*Scoteanax rueppellii*) - Vulnerable (TSC Act 1995).

Threatened fauna sightings on the Subject site are shown in **FIGURE 29.**

An additional eighteen (18) Threatened species have been recorded during surveys on adjacent land, including:

- Wallum sedge-frog (*Litoria olongburensis*) - Vulnerable (TSC Act 1995) & Endangered (EPBC Act 1999);
- Bush hen (*Amaurornis moluccana*) - Vulnerable (TSC Act 1995);
- Glossy black-cockatoo (*Calyptorhynchus lathami*) - Vulnerable (TSC Act 1995);
- Brolga (*Grus rubicunda*) - Vulnerable (TSC Act 1995);
- Black bittern (*Ixobrychus flavicollis*) - Vulnerable (TSC Act 1995);
- Mangrove honeyeater (*Lichenostomus fasciogularis*) - Vulnerable (TSC Act 1995);
- White-eared monarch (*Monarcha leucotis*) - Vulnerable (TSC Act 1995);
- Wompoo fruit-dove (*Ptilinopus magnificus*) - Vulnerable (TSC Act 1995);
- Rose-crowned fruit-dove (*Ptilinopus regina*) - Vulnerable (TSC Act 1995);
- Superb fruit-dove (*Ptilinopus superbus*) - Vulnerable (TSC Act 1995);
- Collared kingfisher (*Todiramphus chloris*) - Vulnerable (TSC Act 1995);
- Eastern grass owl (*Tyto longimembris*) - Vulnerable (TSC Act 1995);
- Large-footed myotis (*Myotis adversus*) - Vulnerable (TSC Act 1995);
- Eastern long-eared bat (*Nyctophilus bifax*) - Vulnerable (TSC Act 1995);
- Squirrel glider (*Petaurus norfolkensis*) - Vulnerable (TSC Act 1995);
- Common planigale (*Planigale maculata*) - Vulnerable (TSC Act 1995);
- Long-nosed potoroo (*Potorous tridactylus*) - Vulnerable (TSC Act 1995);
- Common blossom bat (*Syconycteris australis*) - Vulnerable (TSC Act 1995).

Threatened fauna sightings adjacent to the Subject site are shown in **FIGURE 30.**

Suitable habitat for Threatened fauna to be removed from the Subject site occurs within existing 2(c) zoned land (i.e. Urban Expansion), land proposed to be rezoned as 2(c), or land that may otherwise be cleared in accordance with existing use rights.

N

LEGEND

- Black-necked stork (*Ephippiorhynchus asiaticus*)
- Osprey (*Pandion haliaetus*) - Old Nest
- Osprey (*Pandion haliaetus*) - New Nest
- Powerful owl (*Ninox strenua*)
- *Grey-headed flying-fox* (*Pteropus poliocephalus*)
- Koala (*Phascolarctos cinereus*)
- Wallum froglet (*Crinia tinnula*) Locations
- Masked owl (*Tyto novaehollandiae*)
- Site Outline

SOURCE:
Fauna - James Warren & Associates Pty Ltd
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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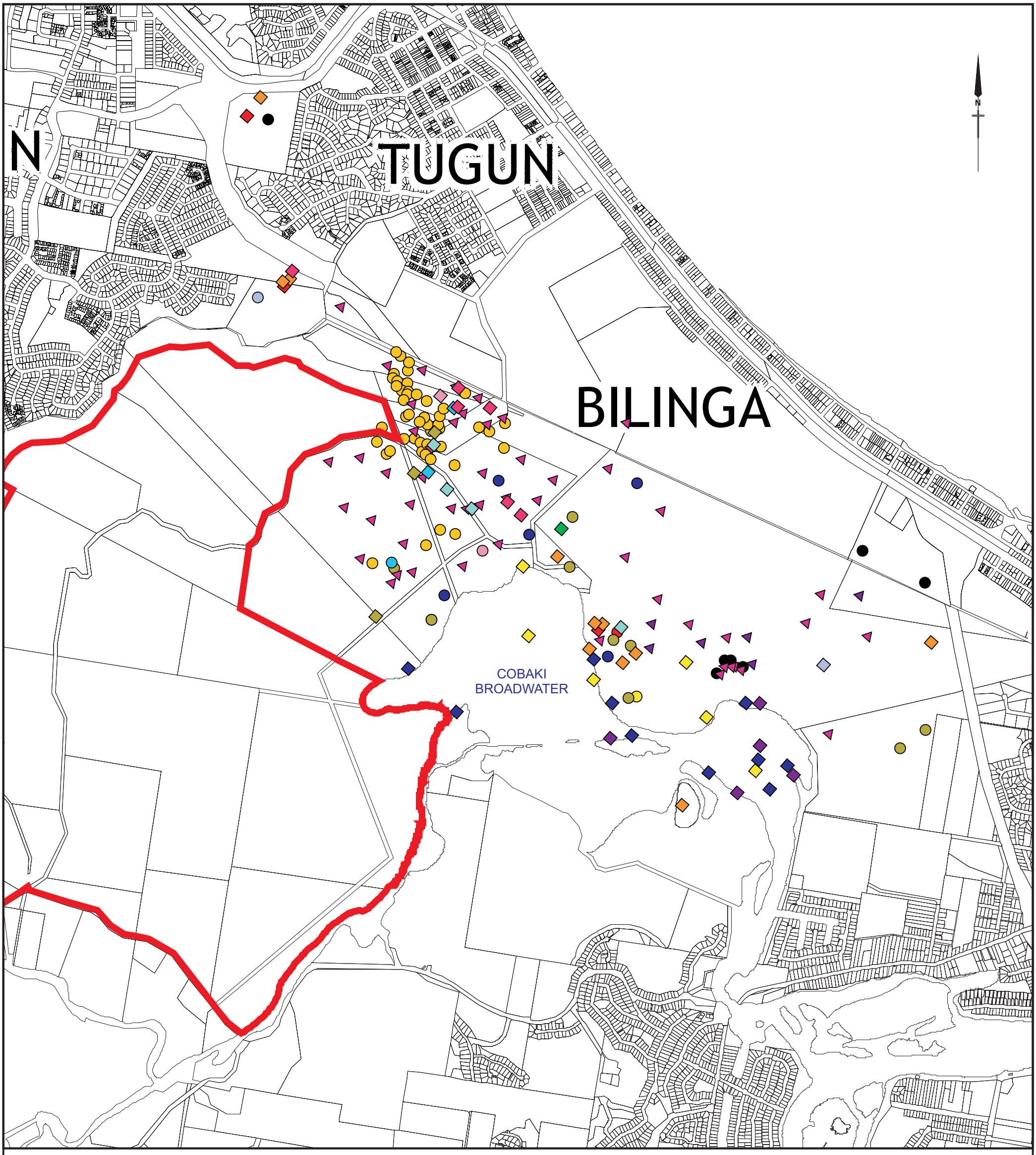
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 29

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
LOCATIONS OF THREATENED FAUNA



Legend

- Black bittern
- Brolga
- Bush hen
- Bush hen (unconfirmed sighting)
- Glossy black cockatoo
- Eastern grass owl
- Mangrove honeyeater
- Masked owl
- Osprey
- Rose-crowned fruit-dove
- Superb fruit-dove (unconfirmed sighting)
- Wallum sedge frog
- Wallum froglet
- Black flying fox
- Common blossom bat
- Common planigale
- Eastern long-eared vat
- Grey-headed flying fox (roost site)*
- Large-footed myotis
- Little bent-wing bat
- Long-nosed potoroo
- Squirrel glider
- Subject Site

Grey-headed flying fox was recorded throughout the area.

0 500m

1 : 20 000

SOURCE: Tugun Bypass Species Impact Statement (Dec 2004) Figures 4.6-4.8

SCALE: 1 : 20 000 @ A3

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Shire of Tweed

FIGURE 30

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Bypass Fauna.cdr

TITLE
LOCATION OF THREATENED FAUNA ADJACENT TO SUBJECT SITE

A summary of impacts for each species recorded on and adjacent to the Subject site is provided in **TABLE 8.**

TABLE 8
POTENTIAL LOSS OF THREATENED FAUNA HABITAT FROM THE PROPOSED DEVELOPMENT

Species	Existing habitat (ha)	Area to be Removed (ha)	Area to be Removed (%)
Wallum froglet	79.12	66.47	84.01%
Black-necked stork	140.60	78.76	56.02%
Powerful owl	69.82	13.09	18.74%
Masked owl	69.82	13.09	18.74%
Osprey*	-	-	-
Koala	42.41	11.89	28.04%
Grey-headed flying-fox	72.26	12.96	17.94%
Little bent-wing bat[1]	72.26	12.96	17.94%
Common bent-wing bat[1]	72.26	12.96	17.94%
Eastern free-tail bat[1]	72.26	12.96	17.94%
Yellow-bellied sheathtail bat[1]	72.26	12.96	17.94%
Greater broad-nosed bat[1]	72.26	12.96	17.94%
Wallum sedge frog	35.39	24.12	68.15%
Bush hen	1.41	0.02	1.42%
Glossy black-cockatoo	48.61	5.42	11.15%
Brolga	140.60	78.76	56.02%
Black bittern	5.66	-	0%
Mangrove honeyeater	5.66	-	0%
White-eared monarch	10.99	0.11	1.00%
Wompoo fruit-dove	10.99	0.11	1.00%
Rose-crowned fruit-dove	10.99	0.11	1.00%
Superb fruit-dove	10.99	0.11	1.00%
Collared kingfisher	5.66	-	0%
Eastern grass owl	2.44	-	0%
Large-footed myotis	2.33	0.80	34.33%
Eastern long-eared bat	10.99	0.11	1.00%
Squirrel glider	52.81	9.55	18.08%
Common planigale	74.93	13.09	17.47%
Long-nosed potoroo[#]	-	-	-
Common blossom bat	3.80	3.80	100%

***** Nesting habitat only
[#] Habitat adjacent to the Subject site only
[1] Forage habitat for these species has been calculated based on more suitable habitat (i.e. forested areas). Other areas of the site (i.e. open areas) may also be utilised for foraging purposes on occasions but have not been included in this calculation

A discussion of amelioration measures to reduce potential impacts on Threatened fauna species is included below.

Wallum froglet

Impacts

The NPWS database (June 2010) contains two hundred and eight (208) records of this species within 10kms of the Subject site. Two hundred and thirty-six (236) records occur within the Tweed LGA. Wallum froglets have been recorded within Paperbark areas, sedgelands and in the main drainage channel and adjacent sedgeland in the east of the property (**FIGURE 31**). This species has also been recorded in a number of locations adjacent to the Subject site (EcoPro 2004) and is very widespread (**FIGURE 30**). The local population is estimated to comprise approximately 10,000 individuals (Hero *et al*. 2001).

Core habitat for this species is considered to be comprised of undisturbed wet heathland and wetland communities adjacent to the Subject site whilst remaining habitats (i.e. adjoining areas of grassland and slashed areas) are considered to provide forage habitat when inundated during wet periods (**FIGURE 29**). Due to a history of disturbance to wetland communities on the Subject site, only 2.5ha of core habitat is considered to occur. However, approximately 79.12 hectares of forage habitat is considered likely to occur on the Subject site during suitable conditions (i.e. localised flooding after periods of heavy rainfall).

The proposed development may result in direct mortality to individuals of this species during construction due to habitat loss and/or being run over by machinery. However, the loss of some individuals and habitat of this widespread species during construction is unlikely to significant impact upon the local population of Wallum froglets. The proposed development will not remove or modify any area considered to provide core habitat for the Wallum froglet (i.e. breeding habitat, refuge habitat).

Approximately 66.47 hectares (84.01%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Additional impacts may include:

- Alteration of water quality in drainage lines due to soil runoff from the construction site.
- Alteration of hydrology of the drainage lines due to construction.
- Contamination or reduction of water quality in drainage lines due to runoff from chemicals or debris (fertilisers, etc).
- Introduction of weed species into core habitat areas.
- Increased competition from disturbance-adapted native, domestic and introduced fauna (such as Cane toads, Noisy miners, foxes, dogs, cats, rats, etc.).

Amelioration

Offsets for the removal of highly degraded Freshwater wetland vegetation from the Subject site will include the following:

N

LEGEND

- Wallum froglet (*Crinia tinnula*) Locations
- Wallum froglet (*Crinia tinnula*) Core Habitat
- Identified Wallum froglet (*Crinia tinnula*) Forage Habitat
- Potential Wallum froglet (*Crinia tinnula*) Forage Habitat (see note)
- Site Outline

Note: Drainage lines and low lying areas in this portion of the site are considered foraging habitat. The exact location and extent of foraging habitat in this area will be the subject of detailed assessment at the DA stage.

SOURCE:
Frogs - James Warren & Associates Pty Ltd
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 31

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
WALLUM FROGLET LOCATIONS & HABITAT

1. Recreation of approximately 2ha of high quality wetland habitats. These compensatory Freshwater wetlands will be offline from the stormwater treatment train and will also be specifically designed to provide core (breeding) habitat for the Wallum froglet. Revegetation and management of Freshwater wetlands will occur in accordance with a Freshwater Wetland Compensatory Habitat Management Plan (SMEC 2012); and
2. Leda Manorstead Pty Ltd is currently in negotiations with OEH with a view to securing appropriate off-site offsets.

Furthermore, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) and these areas are likely to provide suitable forage habitat for this species and offset any loss of forage habitat. In total, 8.77ha of rehabilitation works on the Subject site will result in the creation of suitable forage habitat for the Wallum froglet to partly offset the loss of 66.47ha. The remaining offset will be provided off-site.

A detailed Stormwater Management Plan has been prepared for the Subject site utilising current best-practice management techniques, which will ensure no adverse impacts on the hydrology of the current core habitat.

The construction of core habitat areas on the Subject site will be subject to a detailed Wallum froglet Compensatory Habitat Plan at the development application stage. With the implementation of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Black-necked Stork

Impacts

The NPWS database (June 2010) contains forty-five (45) records of this species within 10kms of the Subject site. Eighty-six (86) records occur within the Tweed LGA. This species has been recorded foraging within the low-lying eastern and south-eastern portions of the Subject site (**FIGURE 29**). The proposed development will not result in significant disturbance to or the removal of habitat for this species within the wetland area located in the south-eastern portion of the site. It is estimated that approximately 140.60 hectares of forage habitat occurs on the Subject site during suitable conditions (i.e. localised flooding after periods of heavy rainfall).

Approximately 78.76 hectares (56.02%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

Approximately 2 hectares of additional Freshwater wetland habitat will be created on the Subject site. Furthermore, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a). In total, 8.77ha of

rehabilitation works on the Subject site will result in the creation of suitable forage habitat for the Black-necked stork to partly offset the loss of 78.76ha.

Additionally, Leda Manorstead Pty Ltd is currently in negotiations with OEH with a view to securing appropriate off-site offsets for the removal of degraded Freshwater wetland vegetation from the Subject site.

Vegetation within the south-eastern portion of the Subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2013b). This area covers 58.68 hectares and currently provides suitable forage habitat for the Black-necked stork and will continue to do so in the long term.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Powerful Owl

Impacts

The NPWS database (June 2010) contains no records of this species within 10kms of the Subject site. Twenty (20) records occur within the Tweed LGA. The Powerful owl was recorded in the north-eastern portion of the Subject site (**FIGURE 29**) in 1994 (Warren *et al*. 1994). A survey completed by Debus (1994) did not confirm the presence of this species. However, Debus indicated that this absence following the breeding season is consistent with the seasonal shift in the use of different parts of the species' large home range.

These owls were again recorded during November 1997 in the Blackbutt Open Forest in the north-eastern portion of the site (Woodward-Clyde 1997). Further spotlighting and call playback surveys of the Subject site (JWA 2000 – 2007) have failed to record this species.

The primary threat to this species and its habitat is the loss and modification of forest and old growth elements, especially trees supporting large nest hollows and areas supporting high densities of prey populations (Debus and Chafer 1994).

This species may potentially forage over the majority of the Subject site, however, it is estimated that approximately 69.82 hectares of better quality forage habitat (i.e. more mature forest and woodland communities) occurs on the Subject site. The development will result in the loss of approximately 13.09 hectares of potential habitat for the Powerful owl (approximately 18.74% of available habitat). The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species. This species is able to live in disturbed coastal forest (Debus 1994). Loss of Sclerophyll forest and woodland may reduce the availability of arboreal and terrestrial mammalian prey for this species, however, loss of vegetation from the Subject site will approximate to only 2-3% of the estimated home range of a Powerful owl.

Amelioration

The proposed retention of large areas of intact forest is likely to result in the continued foraging of this species on the Subject site. Furthermore, approximately 61.82ha of revegetation/regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) to offset any loss of remnant bushland and to provide vegetated links across the site (**FIGURE 22**). These areas are likely to provide suitable forage habitat for the Powerful owl in the long-term and offset the loss of 13.09ha of potential forage habitat.

Retention of old growth trees will also provide continued nesting opportunities for this species. Additionally, the installation of nest boxes of a suitable size for owls within retained vegetation (in accordance with the Revised Fauna Management Plan – JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Masked Owl

Impacts

The NPWS database (June 2010) contains two (2) records of this species within 10kms of the Subject site. Twelve (12) records occur within the Tweed LGA. The Masked owl was recorded in the north-eastern portion of the Subject site (**FIGURE 29**) in 1994 (Debus 1994). Further spotlighting and call playback surveys of the Subject site (JWA 2000 – 2007) have failed to record this species. A number of unconfirmed records of this species occurred during survey of adjacent lands to the east (EcoPro 2004) (**FIGURE 30**). This species is typically recorded in dry sclerophyll forest and woodland, but also occasionally forages over open or partly cleared country.

This species may potentially forage over the majority of the Subject site, however, it is estimated that approximately 69.82 hectares of better quality forage habitat occurs on the Subject site comprised of mature dry sclerophyll forests and woodlands. It is noted that this species will also forage over open areas (i.e. grasslands etc.), however, these areas are not considered to form a significant component of the habitat for this species.

The development will result in the loss of approximately 13.09 hectares of potential forage habitat for the Masked owl (approximately 18.74% of available habitat). The majority of this vegetation removal will occur from portions of the site with existing development approvals. This species may also be susceptible to road-strike, as birds often forage along roadsides or use roads to move between foraging sites (Debus and Rose 1994).

Loss of Sclerophyll forest may reduce the availability of arboreal and terrestrial mammalian prey for this species, however, loss of vegetation from the Subject site will approximate to only 2%-3% of the estimated home range of a Masked owl.
This species roosts and breeds primarily in wet sclerophyll forested gullies, favouring large roomy hollows for nesting. Nests have been located in both live and dead eucalypts. Roost sites are also typical in mature eucalypts bearing large hollows. It is considered that the proposed development will not remove any suitable nesting or roosting habitat.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species. As with the Powerful owl, this species is able to live in disturbed coastal forest (Debus 1994). The owls appear to favour a complex local mosaic of dense and sparse tree and ground cover and a high density of old hollow trees. This species will persist in disturbed environments as long as existing and potential nest trees are retained, and suitable areas of forested or woodland areas are conserved so as to conserve prey species (Woodward-Clyde 1997).

Amelioration

The proposed retention of large areas of intact forest is likely to result in the continued foraging of this species on the Subject site. Furthermore, approximately 61.82ha of revegetation/regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) to offset any loss of remnant bushland and to provide vegetated links across the site (**FIGURE 22**). These areas are likely to provide suitable forage habitat for the Masked owl in the long-term and offset the loss of 13.09ha of potential forage habitat.

Retention of old growth trees will also provide nesting opportunities for this species. Additionally, the installation of nest boxes of a suitable size for owls within retained vegetation (in accordance with the Revised Fauna Management Plan – JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Osprey

Impacts

The NPWS database (June 2010) contains three hundred and sixty-nine (369) records of this species within 10kms of the Subject site. Four hundred and four (404) records occur within the Tweed LGA. This species has also been recorded in a number of locations adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**).

It is expected that impacts of the proposed development will be restricted to human disturbance near any nest site. A nest site was recorded in the north-eastern portion of the Subject site (JWA 2000) and was observed to be utilised by a pair of Ospreys until the crown of the nest tree collapsed during a storm in 2005.

A nest site on a power pole was discovered in the south – east of the site (JWA 2006) away from any future development areas (**FIGURE 32**). Two (2) Ospreys were subsequently observed in the nest on several separate occasions (2006 – 2008). A 100m buffer was designated around this nest location (**FIGURE 32**), however, more recent observations on the Subject site (2009 – 2010) have revealed that the nest has collapsed and fallen from the pole.

Amelioration

The Ospreys may attempt to rebuild this nest. However, it is considered that this nest site will not be suitable for use in the long-term. The developer is therefore committed

N

LEGEND

- Lowland Rainforest
- Lowland Rainforest on Floodplain
- Swamp Sclerophyll Forest on Floodplain
- Swamp Oak Floodplain Forest
- Freshwater Wetland (Degraded)
- Saltmarsh
- Threatened Flora Species
- Remnant Bushland
- 20m APZ
- 20 - 40m APZ
- Cross-sections (Refer to Figure 33B)
- Proposed Development Areas
- Site Outline

SOURCE:
Threatened Flora - James Warren & Associates Pty Ltd
EEC's - James Warren & Associates Pty Ltd
Remnant Bushland - James Warren & Associates Pty Ltd
APZ's - Michel Group Services (6400-172.dwg)
Impact Area - Design Forum Architects
(Ref: DA 01.01 E Master Plan.dwg)

0 500m

SCALE: 1 : 12 500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty ltd

PROJECT
Revised Ecological Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 33A

PREPARED: BW
DATE: 05 April 2013
FILE: 97038_EA_Base.dwg

TITLE

ECOLOGICAL BUFFERS

to erecting at least two (2) artificial nesting platforms on the site (**FIGURE 32**). It is well known that these platforms are highly successful.

It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Koala

Impacts

The NPWS database (June 2010) contains ninety-eight (98) records of this species within 10kms of the Subject site. Five hundred and seventy-four (574) records occur within the Tweed LGA.

The site contains a number of tree species listed under Schedule 2 of SEPP 44 – Koala Habitat Protection as Koala feed tree species. These include:

- Tallowwood;
- Swamp mahogany;
- Grey gum;
- Forest red gum; and
- Scribbly gum.

Warren (1994) completed a targeted search on the Subject site for evidence of Koala activity (i.e. scratches and scats). A small number of faecal pellets were recorded and a low density of scratches on Grey gums and Tallowwoods were observed throughout the site.

More recently (December 2007), areas of the site containing preferred Koala food trees (i.e. Swamp mahogany, Forest red gum, Tallowwood, Grey gum) were searched for evidence of Koala activity. Two (2) scientists spent approximately twelve (12) hours on this component of the assessment. A nocturnal survey was also completed including spotlighting and call playback techniques. Approximately eight (8) hours was spent on this component of the assessment. No conclusive evidence of Koala activity (scats) was recorded from the site. Whilst a number of trees contained scratch marks, this is not considered a conclusive method of identifying Koala activity when not accompanied by scats and may be attributable to other more common arboreal species (i.e. Common brushtail possum). One (1) male Koala was heard calling approximately 200-300m north of the south-western corner of the Subject site (**FIGURE 29**).

It is considered that Koalas may utilise the site occasionally as they disperse throughout the locality, however, large areas of more suitable habitat is considered to occur throughout the locality (particularly within intact forested areas to the west) and are likely to be preferred by the local population of Koalas.

It is estimated that approximately 42.41 hectares of potential Koala habitat occurs on the Subject site. Approximately 11.89 hectares (28.04%) of potential forage habitat will be removed from the Subject site all of which will be removed from areas of the site with existing development approvals.

Additional impacts of the proposed development on Koalas include:

- Increased risk of death or injury from vehicle strike;

- Risk of harassment, death or injury from straying dogs;
- Risk of drowning in swimming pools; and
- Opportunities for Koala movement over the site may be restricted.

Amelioration

The majority of vegetation communities which provide suitable habitat for the Koala on the Subject site will be retained (**FIGURE 21**). Furthermore, approximately 61.82ha of revegetation/regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) to offset any loss of remnant bushland and to provide vegetated links across the site. These areas are likely to provide suitable forage habitat for the Koala in the long-term and provide vegetated linkages through the landscape (**FIGURE 22**). It is also worth noting that habitat for the Koala will be retained in perpetuity within the adjacent border reserve.

The following amelioration measures should also be considered:

- Traffic movement controls on local roads and awareness signage are to be incorporated into detailed site design.
- Where feasible, box culverts are to be included in road design where they intersect the areas designated as Open Space. These are drainage structures that can function as fauna movement corridors beneath roads.
- Speed on the majority of roads within the development site will be limited to 50 kilometres per hour. Pedestrian crossings planned for these roads will further reduce actual speed. This should significantly reduce Koala road casualties.
- Landowners should control dogs. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure; and
- Swimming pools should be fenced in a manner to restrict access by Koalas.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Grey-headed flying-fox

Impacts

The NPWS database (June 2010) contains thirty-one (31) records of this species within 10kms of the Subject site. Two hundred and thirty-four (234) records occur within the Tweed LGA. The Grey-headed flying-fox has been recorded foraging in various locations on and adjacent to the Subject site (**FIGURES 29 & 30**). This species is known to roost in rainforest and swamp forest communities. A day-roost site for a small group (15 to 20 individuals) of this species has been recorded from Hidden Valley, to the north-east of the Subject site (**FIGURE 30**).

The Grey-headed flying-fox forages in rainforests, wet and dry sclerophyll forest, mangroves, fruit orchids and fruiting trees in parks and urban areas. The proposed development has the potential to result in the loss of foraging habitat for this species and reduce the foraging efficiency of any individuals foraging in the study area.

It is estimated that approximately 72.26 hectares of forage habitat occurs on the Subject site for this species. Approximately 12.96 hectares (17.94%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Amelioration

Suitable roosting habitat for this species may occur in the rainforest community located on Mt. Woodgee which will be retained. Given the high mobility of this species, the loss of 12.96 hectares of known and potential foraging habitat is not considered significant in relation to the local distribution of potential foraging habitat for this species. The Grey-headed flying-fox is considered likely to continue foraging within retained areas of vegetation on the site.

Furthermore, 6.77ha of Swamp sclerophyll forest, 9.59ha of Lowland rainforest on floodplain, 3.71ha of Lowland rainforest and 12.06ha of Mixed sclerophyll forest will be regenerated/ revegetated on the Subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a). These areas are likely to provide suitable forage habitat for this species and offset the loss of 13.54ha.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Little bent-wing bat & Common bent-wing bat

Impacts

The NPWS database (June 2010) contains thirteen (13) records of the Little bent-wing bat within 10kms of the Subject site. Sixty-one (61) records occur within the Tweed LGA. This species has also been recorded in a number of locations adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**).

The NPWS database (June 2010) contains no records of the Common bent-wing bat within 10kms of the Subject site or within the Tweed LGA.

The Little bent-wing bat and Common bent-wing bat forage on insects in forested habitats, and roost in caves, tunnels or similar structures located nearby. The proposed development will result in the loss of some foraging habitat for these species in the open woodland environments of the site, and reduce the foraging efficiency of any individuals foraging in the study area.

It is estimated that approximately 72.26 hectares of forage habitat occurs on the Subject site for these species. Approximately 12.96 hectares (17.94%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Amelioration

Given the high mobility of these species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species. No roost habitat will be affected by the proposed development and it is considered that this species will continue to forage over the retained vegetation on the Subject site.

Furthermore, approximately 61.82ha of revegetation/regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) to offset any loss of remnant bushland and to provide vegetated links across the site (**FIGURE 22**). These areas are likely to provide suitable forage habitat for these species in the long-term and offset the loss of 12.96ha.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Eastern free-tail bat, Yellow-bellied sheathtail bat & Greater broad-nosed bat

Impacts

The NPWS database (June 2010) contains one (1) record of the Eastern free-tail bat within 10kms of the Subject site. Four (4) records occur within the Tweed LGA.

The NPWS database (June 2010) contains four (4) records of the Yellow-bellied sheathtail bat within 10kms of the Subject site. Five (5) records occur within the Tweed LGA.

The NPWS database (June 2010) contains no records of the Greater broad-nosed bat within 10 km of the Subject site. Two (2) records occur within the Tweed LGA.

It is estimated that approximately 72.26 hectares of forage habitat occurs on the Subject site for these species. Approximately 12.96 hectares (17.94%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Amelioration

Given the high mobility of these species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of suitable habitat. There will be a minor loss of potential roost sites (i.e. hollow-bearing trees) for these species, however, the installation of bat boxes within retained vegetation (in accordance with the Revised Fauna Management Plan – JWA 2013) will increase roosting opportunities for these species. It is considered that these species will continue to utilise retained vegetation for foraging and retained habitat trees for roosting.

Furthermore, approximately 61.82ha of regeneration/regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) to offset any loss of remnant bushland and to provide vegetated links across the site. These areas are likely to provide suitable forage habitat for these species in the long-term and offset the loss of 13.54ha of potential habitat.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Wallum sedge-frog

Impacts

The NPWS database (June 2010) contains twenty-two (22) records of this species within 10kms of the Subject site. Twenty-five (25) records occur within the Tweed LGA.

This species has been recorded from swamp forest communities adjacent to the Subject site on a number of occasions (Warren 1992, Woodward-Clyde 1997, EcoPro 2004) (**FIGURES 29 & 30**). However, extensive searches on the Subject site (JWA 2000 – 2007) have failed to record this species.

The Wallum sedge frog is dependent on low-nutrient wetlands with acidic waters, and often occurs in swamp forests dominated by Broad-leaved paperbark. It is also found along creeks or in marshy or swampy lowlands with emergent vegetation and reeds. The Wallum sedge frog is one of several species that breeds in water of low pH (3.4 to 4.5). Core habitat for this species is considered to be comprised of undisturbed wet heathland and wetland communities on and adjacent to the Subject site. The proposed development will not remove or modify any area considered to provide core habitat for the Wallum sedge frog.

It is estimated that approximately 35.39 hectares of potential forage habitat may occur on the Subject site during suitable conditions (i.e. localised flooding after periods of heavy rainfall), however, this habitat is considered to be marginal at best. No core habitat occurs on the Subject site for this species.

Approximately 24.12 hectares (68.15%) of this potential forage habitat will be removed from the Subject site.

Amelioration

Offsets for the removal of highly degraded Freshwater wetland vegetation from the subject site will include the following:

1. Recreation of approximately 2ha of high quality wetland habitats. These compensatory Freshwater wetlands will be offline from the stormwater treatment train and will also be specifically designed to provide core (breeding) habitat for the Wallum sedge frog. Revegetation and management of Freshwater wetlands will occur in accordance with a Freshwater Wetland Compensatory Habitat Management Plan (SMEC 2012); and
2. Leda Manorstead Pty Ltd is currently in negotiations with OEH with a view to securing appropriate off-site offsets.

Furthermore, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) and these areas are likely to provide suitable forage habitat for this species and partially offset any loss of forage habitat. In total, 8.77ha of rehabilitation works on the Subject site will result in the creation of suitable forage habitat for the Wallum sedge frog.

General mitigation measures aimed at minimising habitat loss and maintaining hydrological regimes of low-lying areas on and adjacent to the Subject site will minimise the impact to this species.

A detailed Stormwater Management Plan has been prepared for the Subject site utilising current best-practice management techniques, which will ensure no adverse impacts on the hydrology of the current core habitat and the proposed rehabilitated freshwater wetland. Furthermore, any stormwater treatment devices and sedimentation ponds will be designed so that they provide limited opportunities for the introduced Mosquito fish (*Gambusia* sp.) to breed and hence provide better habitat for native frogs.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Bush hen

Impacts

The NPWS database (June 2010) contains sixteen (16) records of this species within 10kms of the Subject site. Twenty-seven (27) records occur within the Tweed LGA.

This species has been recorded within Swamp mahogany forest at the northern end of the Cobaki Broadwater (EcoPro 2004) (**FIGURE 30**). Critical habitat features for this species appear to be dense vegetation and proximity to water, although it has been recorded some distance from permanent streams on occasions. Extensive searches on the Subject site (JWA 2000 – 2007) have failed to record this species.

Potential habitat for this species is considered to be comprised of lowland rainforest and swamp forest communities with a dense midstorey/groundcover and standing water. It is estimated that approximately 1.41 hectares of potential habitat occurs on the Subject site for this species, comprised of isolated patches of lowland rainforest.

The proposed development will result in the removal or modification a total of 0.02 hectares (1.42%) of potential habitat for this species, all of which occurs within portions of the site with existing development approvals. Due to their crepuscular and nocturnal nature, this species is most likely to be active around dusk or during the night. This may place any birds at risk of disturbance by street lighting and night-time traffic. Other impacts may include predation by domestic cats.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 6.77 hectares of Swamp sclerophyll forest, 9.59 hectares of Lowland rainforest on floodplain, 3.71 hectares of Lowland rainforest and 2.00 hectares of Freshwater wetland (**FIGURE 28**). These areas may provide suitable habitat for this species in the long-term and will offset the loss of 0.02ha of habitat.

The following additional amelioration measures should be considered:

- Traffic movement controls on local roads and awareness signage are to be incorporated into detailed site design.
- Landowners should control cats. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure.

- Street lights adjacent to retained habitat areas should be capped. Vegetated buffers and/or dense planted screens will also reduce the impacts of lighting.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Glossy black-cockatoo

Impacts

The NPWS database (June 2010) contains one (1) record of this species within 10kms of the Subject site. Fifty-seven (57) records occur within the Tweed LGA.

This species has been recorded from suitable habitat adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the Subject site (JWA 2000 – 2007) have failed to record this species, or evidence of its occurrence (i.e. chewed *Allocasuarina* cones).

Suitable habitat for this species is considered to be comprised of dry and moist sclerophyll forests with an abundance of *Allocasuarina* species. It is estimated that approximately 48.61 hectares of potential forage habitat occurs on the Subject site for this species, however, few areas of dense mature *Allocasuarina* occur on the site.

The proposed development will result in the removal or modification a total of 5.42 hectares (11.15%) of potential habitat for this species. The majority of this vegetation removal will occur from portions of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

The proposed development will retain large areas of intact forest that will provide continued foraging resources for this species on the Subject site. Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the revegetation/regeneration of 61.82ha to offset any loss of vegetation and to provide vegetated links across the site (**FIGURE 28**). These works will utilise *Allocasuarina* species where appropriate to provide suitable forage resources for this species.

Additionally, the installation of nest boxes of a suitable size for cockatoos within retained vegetation (in accordance with the Revised Fauna Management Plan – JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.
With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Brolga

Impacts

The NPWS database (June 2010) contains no records of this species within 10kms of the Subject site or within the Tweed LGA. This species has been recorded from wetlands

adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the Subject site (JWA 2000 – 2007) have failed to record this species.

Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the Subject site. The proposed development will not result in disturbance to or the removal of potential habitat for this species within the wetland area located in the south-eastern portion of the site. It is estimated that approximately 140.60 hectares of forage habitat occurs on the Subject site during suitable conditions (i.e. localised flooding after periods of heavy rainfall).

Approximately 78.76 hectares (56.02%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

The creation of approximately 2 hectares of Freshwater wetland will provide additional suitable habitat for the Brolga on the Subject site. Furthermore, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a). These areas and additional off-site offsets will provide suitable habitat for this species in the long-term and offset the loss of habitat.

Additionally, 64.28 hectares of vegetation within the south-eastern portion of the Subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2013b) (**FIGURE 22**). This area currently provides suitable forage habitat for the Brolga and will continue to do so in the long term.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Black bittern

Impacts

The NPWS database (June 2010) contains two (2) records of this species within 10kms of the Subject site. Ten (10) records occur within the Tweed LGA.

An unconfirmed sighting of this species occurred near the Cobaki Broadwater adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the Subject site (JWA 2000 – 2007) have failed to record this species.

Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the Subject site, particularly in association with the Cobaki Broadwater. It is estimated that approximately 5.66 hectares of potential habitat for this species occurs on the Subject site. The proposed development will not result in disturbance to or the removal of potential habitat for this species. Overall, impacts on this species are considered to be relatively low.

Amelioration

The creation of approximately 2 hectares of Freshwater wetland will provide additional suitable habitat for the Black bittern on the Subject site in the long-term. Furthermore, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a). These areas and additional off-site offsets may also provide suitable habitat for this species and represent a net gain in available habitat in the long-term.

It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Mangrove honeyeater

Impacts

The NPWS database (June 2010) contains twenty-two (22) records of this species within 10kms of the Subject site. Twenty-three (23) records occur within the Tweed LGA.

This species has been recorded from mangrove and swamp forest communities adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the Subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for this species is considered to be comprised of undisturbed mangrove and wetland communities on and adjacent to the Subject site. Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the Subject site, particularly in association with the Cobaki Broadwater. It is estimated that approximately 5.66 hectares of potential habitat for this species occurs on the Subject site. The proposed development will not result in disturbance to or the removal of potential habitat for this species. Overall, impacts on this species are considered to be relatively low.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 6.77 hectares of Swamp sclerophyll forest (**FIGURE 28**). These areas may also provide suitable habitat for this species and represent a net gain in available habitat in the long-term.

Additionally, 64.28 hectares of vegetation within the south-eastern portion of the Subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2013b) (**FIGURE 28**). This area currently provides stands of mangrove vegetation suitable as forage habitat for the Mangrove honeyeater and will continue to do so in the long term. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

White-eared monarch

Impacts

The NPWS database (June 2010) contains six (6) records of this species within 10kms of the Subject site. Eighty-five (85) records occur within the Tweed LGA.

This species has been recorded from rainforest communities adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the Subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities associated with Mt Woodgee on and adjacent to the Subject site. It is estimated that approximately 10.99 hectares of potential forage habitat occurs on the Subject site for the White-eared monarch. Approximately 0.11 hectares (1.00%) of potential forage habitat will be removed from the Subject site all of which will be removed from areas of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 9.59 hectares of Lowland rainforest on floodplain and 3.71 hectares of Lowland rainforest (**FIGURE 28**). These areas may provide suitable habitat for this species in the long-term and offset the loss of 0.11ha of potential habitat.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Wompoo fruit-dove, Rose-crowned fruit-dove & Superb fruit-dove

Impacts

The NPWS database (June 2010) contains one (1) record of the Wompoo fruit-dove within 10kms of the Subject site. One hundred and fifteen (115) records occur within the Tweed LGA.

The NPWS database (June 2010) contains eight (8) records of the Rose-crowned fruit-dove within 10kms of the Subject site. One hundred and eight (108) records occur within the Tweed LGA.

The NPWS database (June 2010) contains no records of the Superb fruit-dove within 10kms of the Subject site. Two (2) records occur within the Tweed LGA.

The Wompoo fruit-dove and Rose-crowned fruit-dove have been recorded from rainforest and swamp forest communities adjacent to the Subject site, and an unconfirmed sighting of the Superb fruit-dove also occurred (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the Subject site (JWA 2000 – 2007) have failed to record these species.

Suitable habitat for the fruit-doves is considered to be comprised of undisturbed rainforest communities associated with Mt Woodgee on and adjacent to the Subject site. It is estimated that approximately 10.99 hectares of potential forage habitat occurs on the Subject site for these species. Approximately 0.11 hectares (1%) of potential forage habitat will be removed from the Subject site all of which will be removed from areas of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 9.59 hectares of Lowland rainforest on floodplain and 3.71 hectares of Lowland rainforest and 6.77 hectares of Swamp sclerophyll forest (**FIGURE 28**). These areas may provide suitable habitat for the fruit-doves in the long-term and offset the loss of 0.14ha of potential habitat.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Collared kingfisher

Impacts

The NPWS database (June 2010) contains fifty-nine (59) records of the Collared kingfisher within 10kms of the Subject site. Sixty-one (61) records occur within the Tweed LGA.

This species has been recorded from the Cobaki Broadwater adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the Subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for this species is considered to be comprised of undisturbed mangrove communities on and adjacent to the Subject site. Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the Subject site, particularly in association with the Cobaki Broadwater. It is estimated that approximately 5.66 hectares of potential habitat for this species occurs on the Subject site. The proposed development will not result in disturbance to or the removal of potential habitat for this species.

Amelioration

Overall, impacts on this species are considered to be relatively low. Approximately 64.28 hectares of vegetation within the south-eastern portion of the Subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2013b) (**FIGURE 28**). This area currently provides stands of mangrove vegetation suitable as forage habitat for the Collared kingfisher and will continue to do so in the long term. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Eastern grass owl

Impacts

The NPWS database (June 2010) contains three (3) records of this species within 10kms of the Subject site. Twenty-four (24) records occur within the Tweed LGA.

An individual Eastern grass owl was recorded in sedgeland at the southern end of the airport runway, approximately 1.75km to the east of Subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the Subject site (JWA 2000 – 2007) have failed to record this species.

This species has been recorded inhabiting coastal and inland grasslands, coastal heath, agricultural crops and swamp margins (NSW State Forests 1995; Shields 1995). Primary breeding habitat appears to be dense, secluded grass tussock swards, sometimes near water (NSW State Forests 1995). It hunts nocturnally, feeding mainly on rodents. However, birds, insects, frogs and reptiles are also consumed (Shields 1995). Nesting occurs in trodden-down grass under bushes or tussocks.

This species may forage over the low-lying eastern portions of the Subject site. Potential nesting/roost habitat for this species also occurs within the low-lying eastern and south-eastern portions of the Subject site. It is estimated that approximately 2.44 hectares of potential nesting/roost habitat for this species occurs on the Subject site. The proposed development will not result in disturbance to or the removal of potential nesting/roost habitat for this species.

Given the high mobility of this species, the loss of potential foraging habitat on the Subject site is not considered significant in relation to the local distribution of potential foraging habitat for this species.

Increased vehicular traffic on the Subject site may result in the increased risk of vehicular strike. In the vicinity of Ballina in northern NSW, birds are often recorded as road kills along the edge of the Pacific Highway, suggesting that they may use the road verge for foraging (Maciejewski 1996).

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 6.77 hectares of Swamp sclerophyll forest (**FIGURE 28**). These areas may provide suitable habitat for this species and will result in a net gain of suitable habitat in the long-term.

It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Large-footed myotis

Impacts

The NPWS database (June 2010) contains four (4) records of this species within 10kms of the Subject site. Nineteen (19) records occur within the Tweed LGA.

This species has been recorded during surveys adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**). However, numerous surveys on the Subject site (JWA 2000 – 2007) have failed to record this species.

Large-footed myotis generally roost close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish. Potential forage habitat for this species is generally restricted to the adjacent Cobaki Broadwater and the large farm dam in the south-western portion of the site. The proposed development will result in the removal of a small area (0.8ha or 34.33%) of potential forage habitat for this species. However, this will be offset by the construction of drainage channels and revegetation across the site. Overall, impacts on this species are considered to be relatively low.

Amelioration

The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites. Additionally, the installation of bat boxes within retained vegetation (in accordance with the Revised Fauna Management Plan – JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for roosting purposes.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Eastern long-eared bat

Impacts

The NPWS database (June 2010) contains four (4) records of this species within 10kms of the Subject site. Thirty (30) records occur within the Tweed LGA.

This species has been recorded from rainforest communities adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**). However, numerous surveys on the Subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for the Eastern long-eared bat is considered to be comprised of lowland subtropical rainforest and swamp sclerophyll forest. This species roosts in hollows in trees and also in the hanging foliage of palms, in dense clumps of foliage of rainforest trees and under bark. It forages within structurally complex forests. It is estimated that approximately 10.99 hectares of potential forage habitat occurs on the Subject site for this species, comprised of the intact rainforest community associated with Mt Woodgee, and smaller isolated rainforest patches.

Approximately 0.11 hectares (1%) of potential forage habitat will be removed from the Subject site, all of which will be removed from areas of the site with existing development approvals. Given the high mobility of this species, the loss of a small area of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species. The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 9.59 hectares of Lowland rainforest on floodplain, 3.71 hectares of Lowland rainforest, and 6.77 hectares of Swamp sclerophyll forest (**FIGURE 28**). These areas may provide additional suitable habitat for this species in the long-term and offset the loss of 0.11ha of potential habitat.

The installation of bat boxes within retained vegetation (in accordance with the Revised Fauna Management Plan – JWA 2013) may also improve the habitat values of the site for this species and encourage the use of site habitats for roosting purposes.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Squirrel glider

Impacts

The NPWS database (June 2010) contains no records of this species within 10kms of the Subject site. Three (3) records occur within the Tweed LGA.

This species has been recorded from forest communities adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**). However, numerous surveys on the Subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for the Squirrel glider is considered to be comprised of mature dry sclerophyll and wet sclerophyll forests with abundant hollows for refuge and den sites. It is estimated that approximately 52.81 hectares of potential forage habitat occurs on the Subject site for this species.

In total, 9.55 hectares (18.08%) of potential habitat (i.e. remnant bushland with hollow-bearing trees) will be lost from the Subject site. The majority of habitat to be removed occurs within portions of the site with existing development approvals. The loss of potential habitat on the Subject site is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

The Revised Site Regeneration and Revegetation Plan (JWA 2013a) outlines the various measures to ensure that the retained remnant vegetation is adequately managed. Approximately 61.82ha of revegetation/regeneration works will be completed in accordance with this plan (**FIGURE 22**) to offset the loss of 9.55ha of potential habitat and to provide vegetated links across the site.

The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites. Additionally, the installation of nest boxes within retained vegetation (in accordance with the Revised Fauna Management Plan – JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for denning purposes.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Common planigale

Impacts

The NPWS database (June 2010) contains nine (9) records of this species within 10kms of the Subject site. Thirty-two (32) records occur within the Tweed LGA.

This species has been recorded from a very small area (i.e. about 1 hectare) consisting of Swamp Mahogany-Brushbox Forest adjacent to the Subject site (EcoPro 2004)

(**FIGURE 30**). However, numerous surveys on the Subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for the Common planigale is considered to be comprised of mature rainforest, eucalypt forest and heathland on and adjacent to the Subject site. It is estimated that approximately 74.93 hectares of potential forage habitat occurs on the subject site for these species.

In total, 13.09 hectares (17.47%) of potential habitat will be lost from the Subject site. The majority of habitat to be removed occurs from portions of the site with existing development approval. The loss of potential habitat is not considered significant in relation to the local distribution of habitat for this species.

This species, if present, would be particularly susceptible to predation by cats and dogs. Habitat disturbance associated with construction, especially noise and vibration, may also have a significant impact on this species.

Amelioration

The Revised Site Regeneration and Revegetation Plan (JWA 2013a) outlines the various measures to ensure that the retained remnant vegetation is adequately managed. Approximately 61.82ha of revegetation/regeneration works will be completed in accordance with this plan (**FIGURE 22**) to offset the loss of 13.09ha of habitat and to provide vegetated links across the site.

The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential habitat for this species. Additionally, the installation of nest boxes within retained vegetation (in accordance with the Revised Fauna Management Plan – JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for denning purposes.

Landowners should control cats and dogs. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Long-nosed potoroo

Impacts

The NPWS database (June 2010) contains three (3) records of this species within 10kms of the Subject site. Twelve (12) records occur within the Tweed LGA. It is also worth noting that the Long-nosed potoroo population adjacent to the Subject site has been listed as an Endangered Population.
A small disjunct population of Long-nosed potoroos has been recorded adjacent to the north-eastern corner of the Subject site (Warren 1992, Woodward-Clyde 1997, EcoPro 2004) (**FIGURE 30**). However, numerous surveys on the Subject site (Warren 1992, 1993, Woodward-Clyde 1997, Parker 1999, JWA 2000 – 2007) and within the border reserve to the north and north-west of the Subject site (JWA 2000 – 2007), have failed to record this species.

Suitable habitat for the Long-nosed potoroo is considered to be comprised of heathland and dry and wet sclerophyll forests with a dense understorey adjacent to the north-eastern boundary of the Subject site. A sandy loam soil is also a common feature. The proposed development will not result in disturbance to or the removal of potential habitat for this species. This species has historically been recorded from the north and south of the existing site access road, which has essentially formed two small sub-populations.

Without mitigation, road kills may significantly affect these populations. Predation by domestic cats and dogs is also a potential impact of the development.

Amelioration

The Revised Site Regeneration and Revegetation Plan (JWA 2013a) outlines the various measures to ensure that the retained remnant vegetation is adequately managed. Approximately 61.82ha of revegetation/regeneration will be completed in accordance with this plan (**FIGURE 22**) to offset any loss of vegetation and to provide vegetated links across the site.

Furthermore, a Management Plan has been prepared for the Long-nosed potoroo population at Cobaki Lakes (Warren *et al.* 1994) as is to be adopted as part of the proposed Cobaki Lakes development. The following is a summary of the management strategies to be implemented:

- Ensure that the potoroo population in Cobaki Crown Reserve remains viable;
- To maximise Potoroo population in available and potential habitat;
- Monitoring of predator presence, use of the culverts for fauna access should be carried out by the NPWS and Cobaki Lakes;
- All domestic stock will be removed from known and potential Potoroo habitat;
- All domestic stock will be removed from Potoroo habitat rehabilitation areas;
- Feral animals be monitored and controlled for several years after completion of construction of the road;
- All known and potential Long-nosed potoroo habitat in the Cobaki Crown Reserve will be conserved where possible;
- Selected portions of land occurring on contiguous freehold property will be rehabilitated to eventually form Potoroo habitat;
- All fire be excluded for approximately 15 years;
- In the long term, strategic burning will be necessary. A long term Management Plan (including the use of fire) be established by the future managers (presumably NSW NPWS) for the Crown Wetland and Border Reserve which:
    - accommodates rejuvenation/revitalisation of plant communities;
    - provides food and suitable habitat for the fauna;
- Fauna underpasses should be constructed as an integral part of the Boyd Street access roadworks. Wing fences, steel grates and dense habitat rehabilitation are all strategies which will be utilised in conjunction with the underpasses;
- Other management features will include minimal habitat disturbance, minimal faunal underpass lengths, road signage and vehicle speed reduction;

- Biennial reports on Potoroo and feral animal monitoring activities will be prepared.

With the adoption of these amelioration measures, it is unlikely that the proposed development will result in the extinction of this Endangered Population.

Common blossom bat

Impacts

The NPWS database (June 2010) contains five (5) records of this species within 10kms of the Subject site. Twenty-five (25) records occur within the Tweed LGA.

This species has been recorded during surveys of land adjacent to the Subject site (EcoPro 2004) (**FIGURE 30**). However, numerous surveys on the Subject site (JWA 2000 – 2007) have failed to record this species.

Common blossom-bats often roost in littoral rainforest and feed on flowers in adjacent heathland and paperbark swamps. Potential forage habitat for this species occurs in the low-lying eastern portion of the Subject site. The proposed development will result in the removal or modification a total of 3.80 hectares of Swamp sclerophyll forest on floodplain. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 6.77 hectares of Swamp sclerophyll forest (**FIGURE 28**). These areas and additional off-site offsets may provide additional suitable forage habitat for this species in the long-term and offset the loss of 3.8ha of potential habitat.

It is considered that the proposed development is highly unlikely to result in the local extinction of these species.

4.3 Provide a description of the proposed treatment of any ecological buffers

4.3.1 Introduction

This section will describe the various treatments of ecological buffers on the Subject site and will include details on the interactions of ecological buffers with the following:

1. Threatened flora species;
2. Endangered Ecological Communities;
3. Retained remnant bushland areas;
4. Stormwater treatment areas;
5. Asset Protection Zones; and
6. Environmental restoration and enhancement works.

4.3.2 Proposed buffers

4.3.2.1 Buffers to Threatened flora

The locations of Threatened flora species on the Subject site are shown in **FIGURES 23, 23a, 23b & 23c** and have been described within Section 4.2.5.2 of this report. A large proportion of Threatened species on the Subject site occur within the rainforest communities associated with Mt. Woodgee in the northern portion of the Subject site, or in areas of the subject site otherwise designated for retention (**FIGURES 25, 25a, 25b & 25c**).

A Vegetation Management Plan has been prepared for the Subject site (JWA 2009) and discusses measures to be implemented to protect Threatened flora species during the construction phase. The Mt. Woodgee remnant will be conserved and buffered by a minimum of 10 metres of planted vegetation to ameliorate the potential impacts of adjacent development (in accordance with the Revised Site Regeneration and Revegetation Plan – JWA 2013a). The Revised Site Regeneration and Revegetation Plan will also ensure that a minimum five (5) metre revegetated buffer is marked for all known specimens of Threatened flora to be retained, and the cleared parts of these areas are revegetated with locally endemic flora species.

An indicative cross-section of the interface between development and the locations of retained Threatened flora is shown in **FIGURES 33a & 33b**. These areas will be maintained in their natural condition with minimal disturbance, except where the development is sensitive to, and consistent with, the conservation values of these areas, and undertaken in accordance with an approved management plan.

> Allowable uses: No uses will be allowed within this area.
>
> Landscape and Built Form: Maintenance of existing significant vegetation is the primary aim within this area. Management of these areas may also include the replanting of appropriate native species in accordance with an approved Management Plan.
>
> Lot Reconfiguration: No lot reconfiguration is envisaged within this precinct.

4.3.2.2 Buffers to Endangered Ecological Communities

Retained EEC's on the Subject site will be buffered by a minimum of 5 metres of vegetation where possible to ameliorate potential impacts of adjacent development (in accordance with the Revised Site Regeneration and Revegetation Plan – JWA 2013a). Where necessary (i.e. particularly steep land adjacent to land zoned for development & Cobaki Parkway) a dense screen of vegetation will be planted to minimise edge effects and the interface of the remnant bushland and development will be monitored for weed infestations. A Vegetation Management Plan has been prepared for the Subject site (JWA 2009) and discusses measures to be implemented to protect EEC's during the construction phase.

An indicative cross-section of the interface between development and retained EEC's is shown in **FIGURES 33a & 33b**. These areas will be maintained in their natural condition with minimal disturbance, except where the development is sensitive to and consistent

N

LEGEND

- Lowland Rainforest
- Lowland Rainforest on Floodplain
- Swamp Sclerophyll Forest on Floodplain
- Swamp Oak Floodplain Forest
- Freshwater Wetland (Degraded)
- Saltmarsh
- Threatened Flora Species
- Remnant Bushland
- 20m APZ
- 20 - 40m APZ
- Cross-sections (Refer to Figure 33B)
- Proposed Development Areas
- Site Outline

SOURCE:
Threatened Flora - James Warren & Associates Pty Ltd
EEC's - James Warren & Associates Pty Ltd
Remnant Bushland - James Warren & Associates Pty Ltd
APZ's - Michel Group Services (6400-172.dwg)
Impact Area - Design Forum Architects
(Ref: DA 01.01 E Master Plan.dwg)

0 500m

SCALE: 1 : 12 500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty ltd

PROJECT
Revised Ecological Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

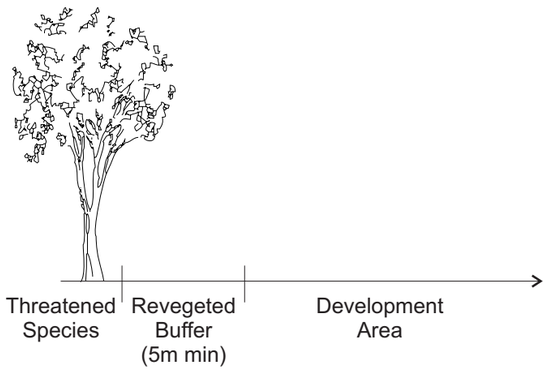
FIGURE 33A

PREPARED: BW
DATE: 05 April 2013
FILE: 97038_EA_Base.dwg

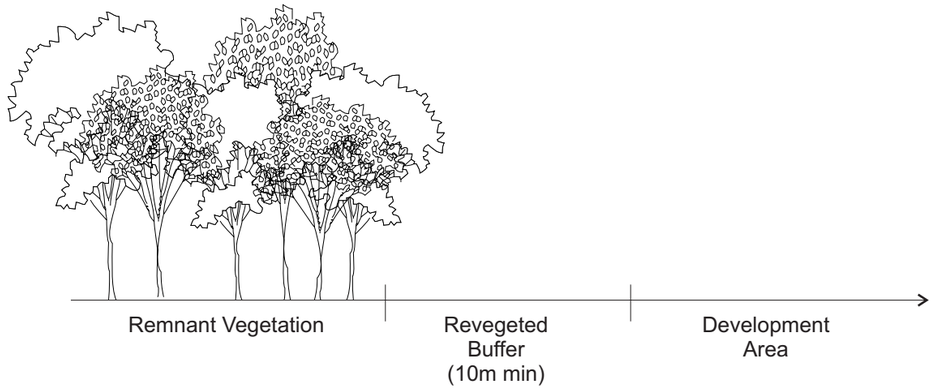
TITLE

ECOLOGICAL BUFFERS

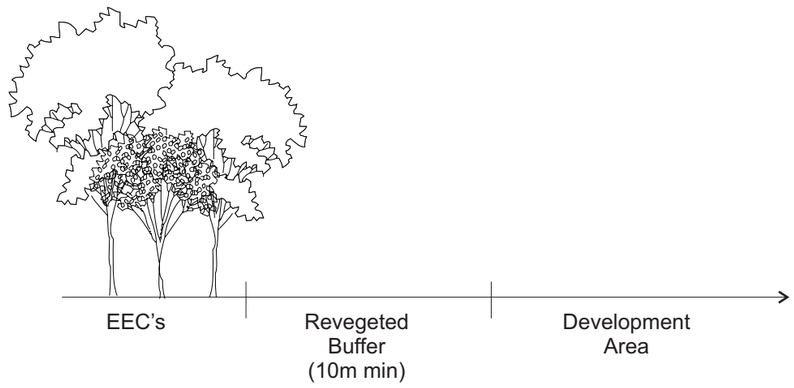
CROSS-SECTION A
BUFFERS TO THREATENED FLORA



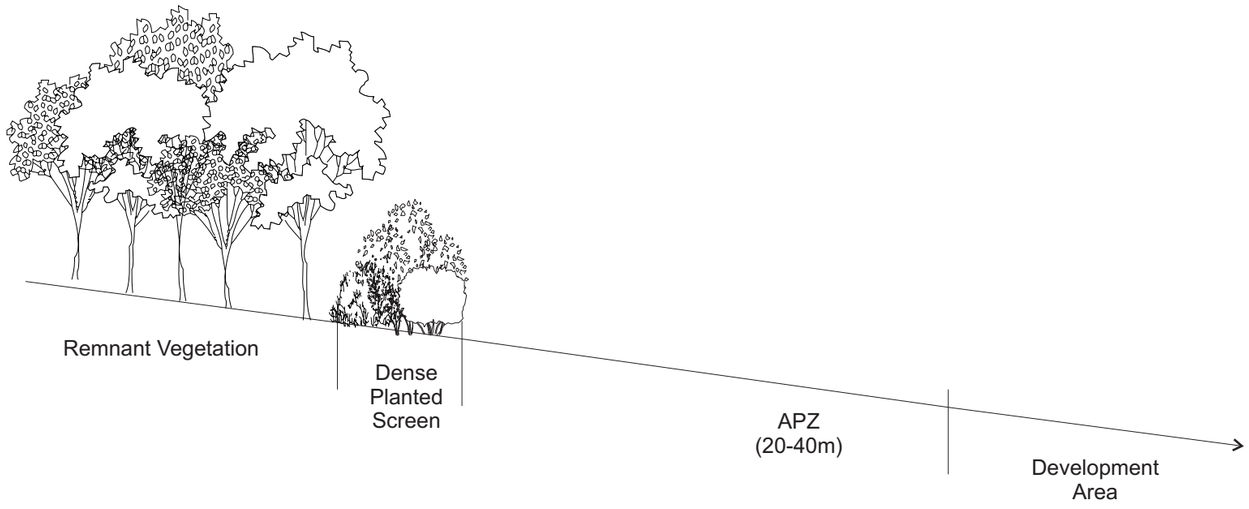
CROSS-SECTION C
BUFFERS TO REMNANT VEGETATION



CROSS-SECTION B
BUFFERS TO EEC'S



CROSS-SECTION D
BUFFERS/APZ'S TO RETAINED VEGETATION



0 10m

1 : 250

SOURCE: JWA Site Investigations

SCALE: 1 : 250 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty Ltd

PROJECT
Revised Ecological Assessment
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 33B

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Cross-sections.cdr

TITLE
ECOLOGICAL BUFFERS - CROSS-SECTIONS

with the conservation values of these areas, and undertaken in accordance with an approved management plan.

Allowable uses: No uses will be allowed within this area.

Landscape and Built Form: Maintenance of existing significant vegetation is the primary aim within this area. Management of these areas may also include the replanting of appropriate native species in accordance with an approved Management Plan.

Lot Reconfiguration: No lot reconfiguration is envisaged within this precinct.

4.3.2.3 Buffers to Remnant Bushland

The concept plan has been designed to retain the majority of remnant bushland on the Subject site (**FIGURE 18**). These areas will be buffered where possible by a minimum of 10 metres of planted vegetation to ameliorate potential impacts of adjacent development (in accordance with the Revised Site Regeneration and Revegetation Plan – JWA 2013a). Where sufficient area is not available to provide a 10m buffer (i.e. particularly steep land adjacent to land zoned for development) a dense screen of vegetation will be planted to minimise edge effects and the interface of the remnant bushland and development will be monitored for weed infestations. A Vegetation Management Plan has been prepared for the Subject site (JWA 2009) and discusses measures to be implemented to protect retained vegetation during the construction phase.

In some instances an Asset Protection Zone (APZ) will be required on the interface between retained Remnant Bushland and the development. The treatment of this interface is discussed in Section 4.3.2.5.

An indicative cross-section of the interface between development and retained remnant bushland is shown in **FIGURES 33a & 33b**. These areas will be maintained in their natural condition with minimal disturbance, except where the development is sensitive to and consistent with the conservation values of these areas, and undertaken in accordance with an approved management plan.

Allowable uses: No uses will be allowed within this area.

Landscape and Built Form: Maintenance of existing significant vegetation is the primary aim within this area. Management of these areas may also include the replanting of appropriate native species in accordance with an approved Management Plan.

Lot Reconfiguration: No lot reconfiguration is envisaged within this precinct.

4.3.2.4 Stormwater treatment areas

A detailed Stormwater Management Plan has been prepared for the Subject site. The conceptual planning of the urban development proposed for Leda Manorstead's land at Cobaki has followed a constraints-based approach, which recognises:

a) The sensitivity of the receiving environment within the Cobaki Broadwater;

b) The large mosquito breeding areas currently on site; and

c) The major opportunity that the careful rehabilitation of the southern areas could provide by way of an ongoing fisheries habitat contribution to the Broadwater.

Starting from the watershed of each sub-catchment, the stormwater treatment train involves the following measures:

a) Compliance with BASIX;

b) Bioretention devices within constructed swales on slopes <5% and Gross Pollutant traps (GPTs);

c) Sedimentation basins;

d) Constructed wetlands with a minimum 30% soft-edge treatment;

e) Diffuse low-flow discharge ($<Q_{3month}$) and stormwater treatment within the rehabilitation areas;

f) High-flow bypass channels to protect the rehabilitation areas; and

g) Discharge of fully treated water to the Cobaki Broadwater.

All stormwater treatment areas occur within land designated as Open Space.

4.3.2.5 Asset Protection Zones

The NSW Rural Fire Services guidelines "Planning for Bushfire Protection 2006" list six (6) key Bushfire Protection Measures which in combination must be addressed in a development assessment context. In relation to Asset Protection Zones (APZ's), Table A2.3 in the guidelines classifies the Tweed local council area as having a Forest Danger Index rating of 80 assumed as a 1:50 year event.

Table A2.5 of the guidelines sets the minimum width of APZ's for residential development based on the adjacent forest type. These minimum APZ widths range from 20m (for situations where the slope towards the vegetation ranges from uphill, to a maximum of 5° downhill) to 45m (for situations where the adjacent forested slope is up to 18° downhill). Requirements for APZ's on the Cobaki Lakes site are shown in **FIGURE 34**.

Asset Protection Zones (APZs) will generally be accommodated within already cleared land unless further clearing is required within existing 2(c) zoned land (i.e. Urban Expansion), land proposed to be rezoned as 2(c), or land that may otherwise be cleared in accordance with existing use rights.

The interface between retained vegetation areas and APZ's will be planted with a dense screen of fire-resistant vegetation to minimise edge effects and will be monitored for weed infestations (in accordance with the Revised Site Regeneration and Revegetation Plan – JWA 2013a). There may also be opportunities for revegetation within APZ's with fire-resistant plant species. An indicative cross-section showing the interaction of APZ's with retained vegetation is shown in **FIGURES 33a & 33b.**