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DARKHEART
Eco-Consultancy

STATUTORY ECOLOGICAL IMPACT ASSESSMENT

Proposed Residential Subdivision of Lot 124 DP 1097510, Belle O'Connor St, South West Rocks.

Prepared For:

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NOTE:

This report is presented on an objective basis to fulfil the stated legislative obligations, consideration and requirements in order to satisfy the client's instructions to undertake the appropriate studies and assessments. It is not directly intended to advocate the proponent's ambitions or interests, but is to provide information required in the determination of development consent by the decision-making authority for the subject proposal.

To the best of our knowledge, the proposal described in this assessment accurately represents the proponent's intentions when the report was completed and submitted. However, it is recognised and all users must acknowledge that conditions of approval at time of consent, post development application modification of the proposal's design, and the influence of unanticipated future events may modify the outcomes described in this document. Completion of this report has depended on information and documents such as surveys, plans, etc provided by the proponent. While checks were made to ensure such information was current at the time, this consultant did not independently verify the accuracy or completeness of these information sources.

The ecological information contained within this report has been gathered from field survey, literature review and assessment based on recognised scientific principles, techniques and recommendations, in a proper and scientific manner to ensure thoroughness and representativeness. The opinions expressed and conclusions drawn from this report are intended to be objective, based on the survey results and this consultant's knowledge, supported with justification from collated scientific information, references/citations or specialist advice.

Furthermore, it is clarified that all information and conclusions presented in this report apply to the subject land at the time of the assessment, and the subject proposal *only*.

This report recognises the fact, and intended users must acknowledge also, that all ecological assessments are subject to limitations such as:

- Information deficits (eg lack of scientific research into some species and availability of information)
- Influences on fauna detectability eg season in which survey is undertaken
- Influences on species occurrence eg stage of lifecycle, migratory, etc
- Time, resource and financial constraints.

All users should take into account the above information when making decisions on the basis of the findings and conclusions of this report.

For and on behalf of DARKHEART *Eco-Consultancy*,

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SUMMARY

1. Background Information:

This report presents the results of a Seven Part Test, SEPP 44 – *Koala Habitat Protection* and *Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environmental Significance* assessments of the land identified as Lot 124 DP 1097510, Belle O Conner St, South West Rocks. This survey and assessment forms part of an Environmental Assessment for a development application under Part 3A of the *Environmental Planning and Assessment Act 1979* to the Dept of Planning (DoP), NSW.

The site (the development footprint) falls on the northern footslope to midslope of a ridgeline which runs roughly east-west along the southern boundary. A spur off this ridgeline separates proposed Lots 614-22 from the remainder. The slope grades gently to moderately steep to the north to northeast. Soils are derived from granitic parent material. The total property has been subject to grazing, with extensive clearing and underscrubbing of the mid to lower portions, leaving a ribbon of residual forest in the south to southwest on the crest.

The proposal forms the final stage in addition to the currently approved sections of the larger residential development known as Seascape Grove. The proposal is to establish a further 54 residential Lots in the residual 2(a) zone, 2 residual Lots, and APZs on some Lots extending upslope into the fringes of the adjacent 7(d) zone. The proposal will remove about 39 scattered trees and an isolated patch (about 300m^2) of immature trees from the agricultural woodland (over about 3.03ha), as well as remove about 1.27ha of ornamental gardens around the existing house, and 1.33ha of treeless pasture north of the existing house. Lots will adjoin an approved road, with a new ring road to service Lots in the mid-west. The remainder of the 7(d) zone (generally including about 4.18ha of forest) will be allowed to regenerate post-development, with about 1.077ha actively regenerated under a Vegetation Management Plan.

2. Flora Results:

Two terrestrial vegetation community and one minute area of artificial aquatic vegetation were identified on site according to floristic formation and association, as follows:

a) **Dry Sclerophyll Forest:** Formed a ribbon on the upper slope to crest in the 7(d) zone. Predominantly even-aged, however has a high level of senescent trees. Scribbly Gum and Blackbutt are the dominant species. The sparse to moderately dense understorey consists of young eucalypts in the taller layer, with a lower understorey of Jackson Bay Pines and Black Oaks. The shrub layer is sparse with Hopbush being most common. The ground layer is generally a sparse covering of Bladey Grass, Wiry Panic and Bracken Fern in the upper 7(d) zone, grading to very low pasture grasses in the ecotone.

b) **Agricultural Woodland:** Occurs over the footprint of the new Lots and up the mid to upper slope. This community has been derived from the adjacent forest via long term clearing, underscrubbing, grazing, cultivation, etc. The sparse to clumpy canopy consists of the same species but generally younger regrowth (especially along the western boundary). The understorey and shrub layer is all but absent, and the groundcover is dominated by very low pastoral grasses (Carpet Grass and Couch) , with some herbs and ferns in more recently converted sections.

c) **Dam**: A small dam has been breached over at least a year ago and is drying out. True aquatic vegetation is all but extinct with a few Cyperaceae species making a last stand in the centre, and Carpet Grass and various weeds dominating the remainder.

The study site/area does not contain an Endangered Ecological Community or Population.

The study area demonstrates signs of a range of at times significant disturbances. These disturbances are considered highly likely to have resulted in substantial habitat changes (eg to microclimates, soil characteristics, etc) that may have effectively precluded threatened flora species from occurring on the site. As a result of these factors and the lack of proximate records, the study site (and also the study area) is considered to have minimal potential to support a threatened flora species. No threatened species were recorded on site despite thorough searches. Consequently, no threatened plants were recorded or considered likely potential occurrences.

3. Habitat Evaluation:

The habitat evaluation is summarised below:

Table S1: Habitat evaluation summary

HABITAT ATTRIBUTE/ TYPE	SITE/STUDY AREA	POTENTIAL THREATENED SPECIES OCCURRENCES
Aquatic/wetland habitat	Small dam recently drained. At time of survey, some common frogs breeding in remaining small pool about 2m wide and <20cm deep, with no significant aquatic vegetation and highly likely to dry up within a relatively short period (ie shorter than the period required for breeding of most species). Minimal breeding and foraging habitat in dam which is isolated from other potential habitat.	No dependant species likely to occur.
Marine/estuarine habitats eg estuarine, rocky foreshores, open beaches, open ocean.	Absent	Migratory and threatened seabirds eg Little Tern, White-Breasted Sea-Eagle, Sooty Oystercatcher, etc; marine mammals, reptiles, etc.
Caves, Cliffs, Overhangs, etc	Some exposed rock in the 7(d) zone but no significant formations or areas of good rock cover with cracks, etc. Constructed wall around water tanks offers some good crevices for reptiles and small species. No caves, etc, suitable for bat roosts.	Only common species considered likely to use the artificial habitat of the rock wall. Snake abundance likely to be low due to high risk of contact with humans, and limited prey and refugia. Significant limitation on occurrence of dependant bat species unless range widely from roosts, dens, nests, etc, located elsewhere.
Logs	Absent from site. Some small (<10-15cm diameter) in the 7(d) forest. No suitable hollows observed. Limited potential for foraging.	No suitable dens for Spotted-Tail Quoll. Marginal foraging substrate for Brushtailed Phascogale, Common Planigale (latter limited by lack of groundcover however)
Groundcover	Ranges from sparse to very low (grazed pasture). Unsuitable for refuge or foraging except for common macropods	No dependant species likely to occur.
Leaf Litter	Varies from non-existent to only shallow.	Limited potential for common species only
Shrub Layer/ Undergrowth	Sparse to patchy in parts of the forest. Poor to marginal for passerine birds.	Limited potential for common passerine birds which offer prey for other species eg Square-Tailed Kite.
Wattles, Callistemons and Banksias	Absent on site, uncommon in 7(d). Few Wattles, 1 Banksia and few Callistemons - Better resources in locality for dependant species - qualifies area as marginal.	Very low quality potential foraging habitat for Squirrel Gliders.
Fruiting Species	Absent	No dependant species likely to occur.
Tree flowering periods	Mostly Summer-Autumn species. Limited abundance on site but hundreds in 7(d) zone, and very large extent in locality. Located in high proximity to high human presence.	Good potential but seasonal forage for Squirrel Glider, Grey Headed Flying Fox, Yellow-Bellied Glider plus passerine birds and insects.
Tree Hollows	About 5 trees contain small hollows within development envelope, with at least 60 more trees with >243 hollows in the 7(d) zone. Full range of apertures on property but mostly small to medium (<5-10cm).	Overall, excellent potential dens, etc, for range of hollow-obligates eg Stephens Banded Snake, Pale Headed Snake, Squirrel Glider, Yangochiropteran bats, Eastern Pygmy Possum Very limited for large species eg forest owls, Glossy Black Cockatoo, Quoll.

4. Wildlife Corridors and Habitat Linkages:

The site/property's forest is continuous with similar forest to the east and south (which is closely interconnected to Hat Head National Park in both directions). Linkage to the north/northeast is limited/severed by the pasture land and future residential development. Linkage to the west is at least constrained by intensive residential development for all but flying species.

According to DECCW modelling and mapping the site itself does not fall within a regional or subregional corridor or contain key habitat.

5. Fauna Results:

The survey period coincided with poor weather conditions and this was acknowledged as a limitation on both the range of techniques which could be effectively used, and the survey results, with only a sample of expected diversity recorded. This limitation was countered by an exhaustive literature review of >30 other ecological studies in the South West Rocks area to determine species occurrence.

Most significantly, a Squirrel Glider was captured in the 7(d) zone which verified the consultant's expected presence of this species based on a plethora of records in South West Rocks. Previous survey of the remainder of the property recorded the following threatened species: Grey Headed Flying Fox, East Coast Freetail Bat, Little and Eastern Bent-Wing Bat. No migratory species listed under the EPBCA 1999 were recorded.

6. Potential Impacts of the Development:

A comprehensive review was undertaken of the potential ecological impacts the proposed development may have, with specific focus on the threatened species recorded or those considered to have potential to occur.

Potential impacts were identified and divided into primary and secondary impacts as follows:

(a) **Primary Impacts**:

- ***Habitat Modification***: In total, it is estimated that approximately 3.03ha of agricultural woodland, 1.27ha of ornamental gardens and 1.33ha of treeless pasture will be modified. This will include removal of about 39 scattered and a <300m^2 patch of regrowth native canopy trees, including 5 hollow-bearing trees.

- ***Habitat loss***: The dam will be filled resulting in effective loss of aquatic habitat on the site.

The remainder of forest in 7(d) zone will be allowed to regenerate, with slashing allowed only in the woodland to maintain APZs.

(b) **Secondary Impacts***:*

The following are impacts generally associated with rural development:

1) *Weed invasion*: Given the area affected, current levels of exotics in the woodland, management of APZs, and relative hostility of the surrounding vegetation to most exotic species, and proposed bush regeneration works, this is not considered a significant threat.

2) *Introduction of feral/introduced animals*: Feral/introduced species are likely on the site include foxes and feral cats. In addition, adjacent residences to the southeast and west may host domestic dogs and cats which may roam bushland in the area. While the proposed development may marginally increase the number of domestic dogs, cats and perhaps feral species to occur, overall this incremental increase is not considered likely to be significant given their current occurrence on site and in the general area, etc.

3) *Artificial lighting*: Lighting may potentially discourage sensitive nocturnal native species/individuals from foraging near areas of development or emerging from hollows. Conversely artificial lighting may be beneficial to some eg some Yangochiropteran bats have been recorded foraging on localised aggregation of insects. Given the nature of the proposal, the limited extent of likely light spillage, and observations of known and potential occurrences in similar situations, this is not considered likely to be a substantial impact.

4) *Noise disturbance*: None of the fauna identified on the site are considered likely to be significantly affected by noise, especially given the current level of noise generated by residences, operation of machinery and traffic on and adjacent to the site, and records of all the species in urban remnants and fringes. Furthermore, the subject threatened fauna have been detected in close proximity to residential dwellings and such estates are not typically high-noise environments.

5) *Increased human presence*: Given the nature of the proposal and the extent of the habitat, current levels of human presence, most of the relevant threatened species are unlikely to be significantly affected, especially given recordings of the subject species in similar circumstances elsewhere.

6) *Bushfire risk and alteration to regimes*: The proposal may have the potential to modify the remaining forest via an altered bushfire regime ie increased burning by owners of Lot 800. However, given the recommendations of this report in conjunction with supporting legislation, this is not considered likely to result in a significant modification of the site's vegetation.

7) *Disease*: The proposed development is not considered likely to introduce/increase the presence of any diseases such as Psittacine Circoviral Disease or Chytridiomycosis. Furthermore, Koalas were not considered a potential occurrence on site thus the proposal will not increase the risk of stress-induced diseases to Koalas in the general area.

8) *Incremental vegetation removal*: Given that the habitat on site has known/potential values for several threatened fauna species, appropriate recommendations are provided to support existing statutory controls.

9) *Erosion and Sedimentation*: Construction of the development will increase the risk of erosion and sedimentation. Given standard erosion and sediment control measures will be required to be implemented during the construction of dwellings and driveways, the contribution of the proposal to these processes is unlikely to be substantial.

10) *Edge Effects*: Urban expansion adjacent to currently intact vegetation can have the following effects which are generally referred to as edge effects:
    - Increased ingress of feral species such as cats and dogs.
    - Ingress of weeds into areas not previously found.
    - Alterations to microclimate ie drying, altered humidity levels, increases light penetration, etc.
    - Increased exposure to wind.
    - Increased predation, competition and assemblage modifications.

    The minor extent of habitat affected and the currently disturbed nature of this habitat (hence limited vulnerability) indicates this is unlikely to be a significant impact from edge effects. Two areas of degraded vegetation totalling about 1.077ha are to be regenerated as an offset, and other measures are proposed to curtail other impacts.

7. Recommendations and Ameliorative Measures:

7.1 Primary Recommendations:

The following major recommendations are made to reduce or avoid potential impacts on threatened fauna either known or considered potential occurrences on the study site. These are integral to the basis of later assessment and conclusions as it is assumed these recommendations will largely be implemented in some form eg title covenants.

1. **Informed Development Design:**

To minimise the extent of required clearing, all trees within the development footprint were surveyed. This allowed retention of nearly 20 trees within the footprint (with one additional clump around the former dam and 3 trees in the woodland), and minimised the impacts of establishing an APZ via utilising the currently disturbed sections of the woodland.

2. Pre-Clearing Strategy and Survey:

All non-hollow bearing trees are to removed at least 24hrs before removal of hollow-bearing trees to encourage arboreal mammals to abandon the hollow.

A protocol is detailed including trapping the night before clearing, with stag watches to potentially detect any key bat roosts.

3. Hollow-Bearing Tree Removal Protocol:

Hollow bearing trees must be removed via application of a protocol that minimises risk of direct mortality of resident fauna. Any injured fauna are to be taken in care at the proponent's expense. Rehabilitated and rescued animals are to be released into the remaining habitat in the 7(d) zone.

4. Retained Tree Protection:

The following tree/habitat protection measures will be required to be undertaken to protect the retained habitat/trees during construction. These include:

- All trees/habitat to be retained or removed should be clearly mapped on a site plan (ie a clearing plan) and marked on site (eg with a specific coloured flagging tape or fencing off) to ensure construction activities do not result in accidental damage or removal.

- All practical measures possible are to be undertaken to protect retained trees/habitat to maintain long term health eg fencing off temporary fencing during the length of the construction period. Appropriate guards approved by an arborist are to be installed to prevent physical damage to the trunk where setback via fencing is not practical/possible, and other additional measures (eg mulch placed over roots) are to be implemented to protect the

health of the tree. Appropriate measures approved by an arborist are to be taken when roots must be trimmed during any excavation works.

- Machinery and vehicles should avoid being used or parked directly adjacent to trees which are to be retained to avoid soil compaction. If unavoidable, soil compaction and tree protection measures will be required.

- Specific instruction to staff/contractors on what trees and habitat is to be retained, their significance and measures to be undertaken to avoid damage to them. Contracts are to contain clauses for penalty for non-compliance.

- No disposal of cement wastes, construction material or washdown near the retained vegetation.

- Mixing of imported soils with site soils outside the development/dwelling footprint should be avoided to minimise risk of disease and pathogenic fungus transfer.

Contract conditions with contractors are to provide for compliance mechanisms (eg financial penalties) for breeching of the above eg accidental tree removal (including of replacement plantings), and to compensatory measures eg replacement plantings.

5. Re-Use of Fallen Timber:

All hollow-bearing limbs and tree sections, as well as the main trunk sections of other trees, are to be transported to suitable portions (where machine access is safe by OH&S requirements, and avoids damage to existing habitat) of the 7(d) zone. These are to be stacked in small piles or laid out strategically in this area to provide habitat (refugia and foraging substrate) for native species.

6. Offset and Long Term Management of Lot 800

To offset some of the impacts associated with the development, the proponent offers to regenerate the most modified sections of the 7(d) zone. The southwest regeneration area is 3800m^2, and the southeast area is approximately 6970m^2 (total of 10 770m^2). A specific plan is to be prepared detailing regeneration measures, the responsible authority, and long term arrangements.

Aside from a development envelope containing a dwelling and APZ, plus the APZs and access for bushfire protection to the adjoining residential Lots, all of the remaining area of Lot 800 is to be allowed to naturally regenerate ie is not to be continued to be maintained. Provisions under the *Native Vegetation Act 2003* will additionally prevent any significant loss of forest from this Lot.

Grazing stock are to be permanently prohibited from this Lot via title covenant to assist natural

7. Next Boxes and Habitat Enhancement:

Nest boxes are to be erected in the 7(d) zone to offset loss of tree hollows (minimum ratio of 1:1). Suitable hollow limbs are to be recycled as artificial hollows mounted in the trees. Suitable sections of fallen trees are to be transported to accessible sections of the 7(d) zone and deposited for fauna habitat.

7.2 Secondary Recommendations

The following are provided for optional consideration by the determining authority as conditions of consent. The conclusions of this assessment do not assume that these recommendations are adopted as conditions of consent, but it is desired that the proponent at least be advised to consider adopting them to minimise overall impact and maintain biodiversity as per the principles of Ecologically Sustainable Development:

1. *General Landscaping*: Gardens and any other areas which are to be planted for aesthetics should generally include native potential forage species such as eucalypts, banksias, acacias and grevilleas to attract and support fauna. This will not only offer more habitat for species capable of facilitating such areas, but also increase the aesthetics of the area. Use of garden chemicals should be limited a much as possible.

2. *Artificial Lighting*: To ensure anthropogenic impacts are minimised, it is recommended that artificial lighting generally be kept to a minimum and be of a localised and low luminosity, with light directed to the ground and not into trees/vegetation.

3. *Predator Management*: All stray cats and dogs should be reported by residents to Council as applicable under the provisions of the *Companion Animals Act 1997*. Any pet cats and dogs should be restricted to the development envelopes. Cats should be confined to enclosures or indoors during the night. Pets should not to be allowed to roam through the regeneration area or bushland in the general area.

Residents are to report sightings of foxes, feral cats and wild dogs to the Rural Lands Protection Board and DECCW, and through on-going liaison with the RLPB, DECCW and adjacent landowners, undertake a regular coordinated pest control program to allow suppression of feral species populations in the area, and eliminate reservoir populations

4. *Bushfire Regime*: Any hazard reduction burning should require a Bush Fire Hazard Reduction Certificate under the RFA 1997. Any burning regime should not exceed the minimum time frame recommended in the RFS *Environmental Code*.

8. EPBCA 1999 – *Matters of National Environmental Significance* Assessment:

The provisions of the EPBCA 1999 require determination of whether the proposal has, will or is likely to have a significant impact on a "*matter of national environmental significance"*. These matters are listed and addressed as follows:

i) **World Heritage Properties**: The site is not listed as a World Heritage area nor does the proposal affect any such area.

ii) **Ramsar Wetlands of International Significance**: No Ramsar wetland occurs on the site, nor does the proposal affect a Ramsar Wetland.

iii) **EPBCA 1999 listed Threatened Species and Communities**: No EPBCA listed threatened flora species or community, etc, were found on the site, nor considered a significant likelihood of occurrence. No EPBCA listed threatened fauna species were detected by the survey, though the Grey-Headed Flying Fox and Spotted-Tail Quoll are considered potential occurrences utilising the site as part of a much larger foraging rage. Assessment under the MNES guidelines determined the impacts of the proposal were not considered likely to be a sufficient order of magnitude to be considered significant.

iv) **Migratory Species Protected under International Agreements**: No EPBCA listed migratory species were recorded during the survey but a number of other species are considered at least a fair potential occurrences at some stage on the property overall. Assessment under the MNES guidelines determined the impacts of the proposal were not considered likely to be a sufficient order of magnitude to be considered significant.

v) **Nuclear Actions**: The proposal is not a nuclear action.

vi) **The Commonwealth Marine Environment (CME)**: The site is not within the CME nor does it affect such.

vii) **National Heritage**: The site is not on the National Heritage list.

The proposal was not considered to require referral to the Department of Environment, Water, Heritage and Arts (DEWHA) for approval under the EPBCA 1999.

9. Seven Part Tests Assessment:

In addition to the threatened species recorded on the property (Squirrel Glider, Little & Eastern Bent Wing Bats, East Coast Freetail Bat, Grey Headed Flying Fox), a significant number of other threatened species have also been recorded in the locality. Some other regionally recorded threatened species were considered likely to occur in the locality based on existence of potential habitat and regional records in such habitat. These were all evaluated for their likelihood of occurrence on the site/property, the potential for impact upon them, and if the impacts were likely to be significant enough to require a Seven Part Test assessment. Of the species evaluated, the following were considered to require Seven Part Test evaluation to assess the significance of potential impacts:

- **Mammals**: Grey-Headed Flying Fox, Squirrel Glider, Greater Broad-Nosed Bat, Yellow-Bellied Sheathtail Bat, Hoary Bat, Eastern False Pipistrelle, Beccari's Freetail Bat, Brushtailed Phascogale, Spotted-Tail Quoll, Koala.

- **Birds**: Glossy Black Cockatoo, Square-Tailed Kite, Barking Owl, Masked Owl, Powerful Owl, Little Lorikeet, Little Eagle, Varied Sittella.

The 7 Part Tests are summarised below.

Given the ecology of most of the subject threatened species, the habitat on site/directly adjacent to the site (on the remainder of the property) and the extent of known/potential habitat in the general area; the range of the known/potential local population of all of the subject species would extend well beyond the confines of the study area.

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

The proposed development may see up to approximately 3.03ha of agricultural woodland habitat potentially removed/modified under the proposal from the site, as well as about 1.27ha of ornamental plantings, and 1.33ha of treeless pasture north of the existing house. This will remove 39 scattered trees and an isolated clump <300m^2, including some 5 hollow-bearing trees which have potential as roosts sites for the Yangochiropteran bats, Squirrel Glider and Brushtailed Phascogale. About 23 primary preferred Koala browse species will also be removed.

This habitat loss/modification will result in a reduction of the property's carrying capacity for all the subject species. However, given the very limited quality of the habitat affected, the extent of more optimum habitat in the 7(d) zone (>4ha of forest), and mobility and ranges of the majority of the subject species, this would represent a very minor reduction in marginal potential habitat available in the area, as well as locally and regionally.

For the Squirrel Glider which has the smallest range, the habitat reduction proposed represents a contraction of the marginal fringe towards the core area, hence is also considered relatively insignificant. This is due to the retention of the overwhelming majority of known or potential habitat (and key habitat components such as >200 tree hollows) together with links to surrounding land; and the retention of most of the key habitat components ie tree hollows are most abundant in the 7(d) zone.

Thus given the site/property's disturbance history, current modified state and records of all of the subject species in/adjacent to urban and rural/rural-residential habitats elsewhere: the remaining habitat on the property should retain sufficient current carrying capacity for all of the subject species to maintain population viability. Other threats to the subject species or their habitat (ie domestic pets, road kill, fire) should not be significantly increased by the proposal beyond current threat status given statutory controls.

Overall following consideration of the above, the proposal is not considered likely to result in an impact that may significantly affect the lifecycle of the local population of any of the subject species to the point of increasing extinction risk, especially given the extent of alternative known/potential (and generally better quality) foraging and/or roosting/nesting habitat available to the local population of the subject species on the property and interlinked to adjacent habitat.

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

No relevant populations are currently listed under the TSCA.

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

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

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

No EECs occur on site or in the study area, hence this question is not relevant.

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

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

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

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

The proposal will remove/modify about 4.3ha of agricultural woodland and ornamental gardens (plus about 1.33ha of treeless pasture north of the existing dwelling) including about 39 scattered trees and an isolated clump <300m^2 on the property, which lies on the fringe of about 4.18ha of forest and 1.7ha of woodland remaining on the property's southern boundary. For the majority of the subject species, the currently highly modified habitat requiring removal as part of the proposal provides only marginal habitat on the fringe of the core area and/or a minute fraction of their range, and the majority of habitat on the property will be retained and mostly allowed to regenerate.

All the subject species are generally at least relatively highly mobile (provided suitable habitat exists eg canopy cover), thus the relatively minor area of habitat loss will not impose any barrier to movement as current linkages to the south and west will remain.

The affected areas of habitat comprises known or potential foraging habitat and/or potential denning/roosting habitat in tree hollows for most of the potential or known occurrence species. While its loss/modification is a negative incremental and cumulative impact to the carrying capacity of the property, as about 5.9ha of forest and woodland (comprising the highest quality habitat) on the property will remain (and mostly allowed or assisted to regenerate), the affected area is not crucial to the long term survival of any threatened species population.

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

No relevant areas of critical habitat have been declared, as yet, under Part 3 of the TSCA.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The *Recovery Plan for the Barking Owl* outlines the loss of native vegetation/habitat as a key threatening process for the Barking Owl. While the proposal will remove native vegetation, the extent of clearance is relatively minute compared to remaining habitat in the area and its home range, and will not significantly impact on the species. Hence only via strict definition is the proposal inconsistent with objectives of the plan.

A draft *Recovery Plan for Forest Owls* has been exhibited for the Masked and Powerful Owl. As for the Barking Owl, the proposal will remove a minute area of potential foraging habitat and only via strict definition is the proposal inconsistent with objectives of the plan.

The draft Recovery Plan for Koalas specifies actions considered to be key threats to Koalas. This plan specifies "*Habitat loss and Fragmentation*" and "*Habitat Degradation*" as "*the most important threats to Koalas throughout their range*". The proposal is thus inconsistent with this plan as it will remove >20 potential browse species and contribute to these threats. Dogs and traffic are also key threats, and the proposal will incrementally add to these impacts. While negative, as no Koala population has an association with the site, the conflict with the objectives of the recovery plan is relatively limited.

At present no recovery/threat abatement plan is in place for the other species. The proposal may remove about 4.3ha agricultural woodland including 39 scattered trees and an isolated clump <300m^2 (and 5 hollow-bearing trees), which by strict interpretation could be considered as adding to the main threatening process affecting these species (habitat loss), and hence is inconsistent with the recovery of the species. However, given the relatively marginal quality of the habitat to be affected, the minor area of habitat to be removed, the extent of habitat to be retained on the property, and the abundance of similar habitat on adjacent land and in the direct locality; the loss is considered to be insignificant to the long term recovery of these species.

Overall the proposed development is considered unlikely to have a substantial affect on the long-term recovery of any of the subject species.

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

The TSCA defines a "*threatening process*" as "*a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities*".

"*Clearing of native vegetation*" has been listed as a Key Threatening Process and is a recognised threat to a number of species, communities and populations listed under the TSCA 1995 (NSWSC 2001d). Loss of habitat via development for residential and urban land use is also recognised as a threatening process for all of the subject species (Smith *et al* 1995, NPWS 2003d, DEC 2006b, etc). The proposed development will contribute to this process via the removal/modification of habitat to establish development envelopes and potentially during the clearing of boundary lines. However the majority of the property's forest vegetation will be retained post-development with protection under statutory instruments.

Human-induced climate change is a Key Threatening Process that the proposed development will contribute to via removal of up to 4.3ha of treed vegetation (not including 1.33ha of treeless pasture) with scattered trees, and possible burning of this material; and/or establishment of a residential development utilising fossil fuels for energy.

"Predation by foxes and feral cats" are other Key Threatening Processes likely to be currently existing on the site, which impose a risk to potential prey, and several potentially occurring threatened species. The increase in human presence on site may see greater controls on these pests. Considering that any potential pet cats and dogs will largely be retained in close vicinity of the dwellings, and that the threat posed by domestic cats and dogs is already high (given the abundance of both species on land to the west) the increase in this threat induced by the proposal is not considered likely to be substantial.

Inappropriate fire regimes are also a threatening process eg by increasing risk of wildfire by poor management; prescription burning of too much habitat at one time (or key areas at a particular time eg breeding season). The proposal may result in a

modified fire regime due to increased frequency of hazard reduction burning to protect assets. This report recommends that future fire regimes consider the ecological constraints of the site. In addition, threatened species have been recorded on the site thus any burning for the purpose of hazard reduction should require a Bush Fire Hazard Reduction Certificate (BFHRC) under the RFA 1997 which may include measures to protect the habitats of the threatened species. Thus the potential for an altered fire regime to reduce the site's carrying capacity for the threatened species should be controlled by the legislation and recommendations discussed above.

A number of other Key Threatening Processes may also be incrementally increased by the proposal via edge effects, eg:

- *Invasion of native plant communities by exotic perennial grasses.*
- *Invasion and establishment of exotic vines and scramblers.*
- *Invasion of native plant communities by Lantana camara.*

These Key Threatening Processes may be exacerbated by the proposal due to edge effects as a result of clearing easements.

10. Conclusion:

This survey and assessment has found that while the site is generally evident of a substantial disturbance history, it has retained some significant ecological values. This conclusion is made that, on the provision of the final design and implementation of the proposed development is according to the recommendations and ameliorative measures proposed in this assessment (for the express purpose of ensuring such an outcome is significantly reduced if not unlikely), and that statutory provisions are effectively enforced, the proposed development is not considered likely to significantly adversely affect any threatened species, endangered population or EEC.

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TABLES AND FIGURES

INTRODUCTION

This firm has been requested to undertake an ecological survey, Seven Part Tests and EPBCA – Matters of National Environmental Significance Assessments of the land identified as Lot 124 DP 1097510, Belle O Conner St, South West Rocks. This survey and assessment forms part of an Environmental Assessment for a development application under Part 3A of the *Environmental Planning and Assessment Act 1979* to the Dept of Planning (DoP), NSW.

The proposal forms the final stage (1C) in addition to the currently approved sections of the larger residential development known as Seascape Grove (ERM 2006a, 2006b, Umwelt 2004). The Department of Planning (DoP) has issued Director General's Requirements (DGRs) for the Environmental Assessment of the proposed staged subdivision of the site into 54 residential Lots and 2 residual Lots. This assessment addresses the *Ecological Impact*s requirements section of the DGRs ie a flora and fauna survey, and an assessment of the proposal under Section 5A of the *Environmental Planning and Assessment Act 1979*, as amended by the *Threatened Species Conservation (TSCA) Act 1995* which in turn has been amended by the *Threatened Species Conservation Legislation Amendments Act 2002* (Seven Part Test for Significance). In addition, an assessment of Matters of National Environmental Significance under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBCA) Act 1999* has also been provided to satisfy other statutory requirements.

The survey and assessment was performed in consideration of the draft *Threatened Species Survey and Assessment – Guidelines for Developments and Activities* (DEC 2004), *Guidelines for Threatened Species Assessmen*t (DEC/DPI 2005) and the *Threatened Species Assessment Guidelines – Assessment of Significance* (DECC 2007). The assessment has also been undertaken in accordance with the *Ecological Consultants Association of NSW – Code of Ethics* (2002) available at www.ecansw.org.au.

1.0 BACKGROUND INFORMATION

1.1 LOCATION AND ACCESS

South West Rocks is located approximately 37 kilometres northeast of Kempsey on the South West Rocks Road, falling into the Kempsey Shire Council (KSC) Local Government Area (LGA).

Seascape Grove is located at the southeastern end of the village of South West Rocks, south of the golf course. The subdivision is accessed via Gregory St onto Belle O Connor Street. Figure 1shows the general location of the study site which lies at the southern end of the existing subdivision.

1.2 PROPOSED DEVELOPMENT

1.2.1 General

The proposal is a 54 Lot residential subdivision (plus two future development allotments on Lot 700 and 800) in the residual 2(a) Residential zone within the northern corner of the site, and along the fringes of the 7(d) Scenic Protection zone within the south-west corner of the site (King and Campbell 2009). Proposed Lot 800 is also to include all the 7(d) land.

The subject land forms the peripheral strip of 2(a1) zoned land on the south to southwestern end of the property, abutting the 7(d) zone which encompasses the ridgeline and adjacent water towers (ERM 2006, Umwelt 2004). Another separate area (dominated by pasture, hence not assessed in this

assessment) occurs in the north. These Lots form Precinct E1, E2, F1 and F2 of Seascape Grove (see figure 2), comprising Stage 1(C) of the total development.

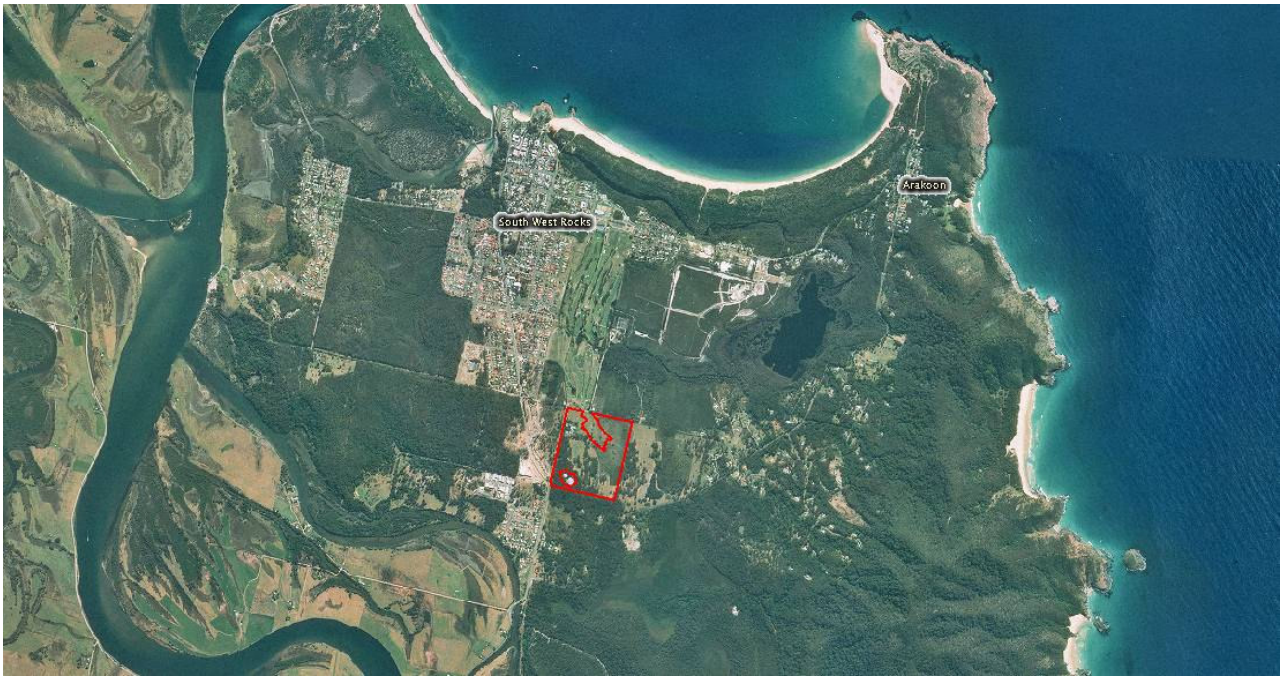
Burrawong Rd will provide access to these Lots. This road will be constructed under previous approvals.

1.2.2 Offset

To offset tree/habitat loss within the development footprint, it is proposed to regenerate 1.077ha of currently degraded 7(d) area upslope of the development envelope (see figure 8). Regeneration is to be achieved by:

- De-stocking.
- Cessation of all agricultural management practises in the regeneration areas.
- Exclusion fencing to prevent vehicle and stock access with wildlife friendly fencing.
- Weeding programs to assist natural regeneration.
- Provision of nest boxes to increase hollow abundance.
- Placement of fallen hollow-bearing trees as hollow logs for refugia and foraging substrate.

Figure 1: Location of the study site
Source: www.maps.nsw.gov.au © 2009).



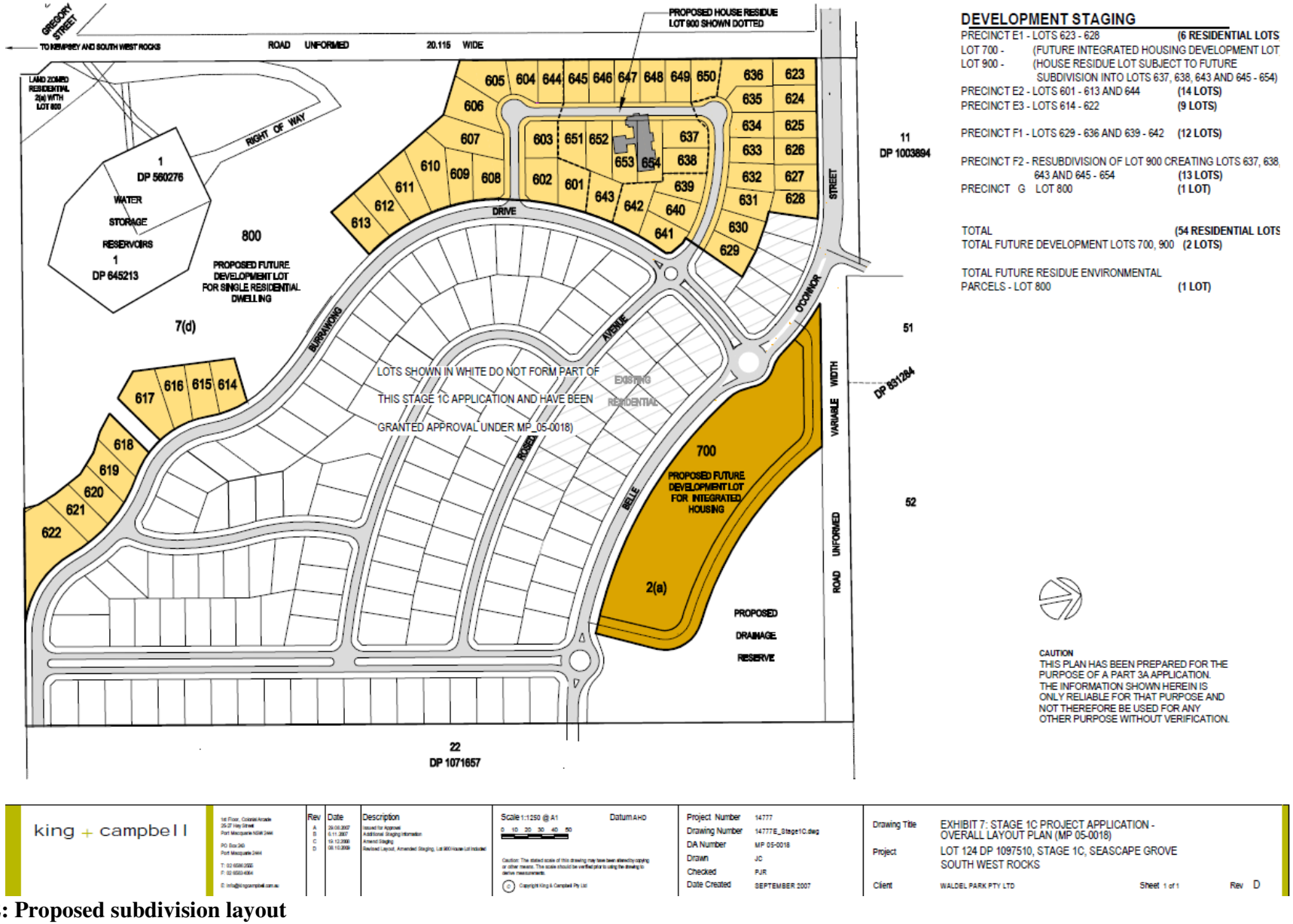


Figure 2: Proposed subdivision layout
(Source: King and Campbell 2009)

1.3 CLIMATE AND WEATHER

1.3.1 Climate of the Bioregion

The climate of the north coast of the North Coast Bioregion from just north of Newcastle to the Queensland border is generally warm temperate. The main influence is the latitudinal position of subtropical anticyclone centres which more easterly across Australia.

In Summer, warm moisture-laden east to south east winds predominate, sometimes bringing rain, with the heaviest in the form of thunderstorms or depressions from subtropical cyclones moving south. In Winter, the northern movement of the anticyclones leads to a dominance of usually dry west to south winds, often leading to fine sunny days and cool nights. Rainfall is usually associated with cold fronts and the coldest temperatures.

Rainfall tends to be distributed more in Summer in the north of the region, to relatively evenly distributed in the south. Annual rainfall is most influenced by distance from the coast and topographic position, with a general decrease from east to west. Annual rainfall in the coastal Macleay area is around 1457mm pa (http://northern.cma.nsw.gov.au/pdf/coastalmacleayrc.pdf.), falling predominantly in Summer and Autumn.

Temperature over the region primarily varies with altitude, decreasing about 5^{o} per 300m rise, and about 2-3^{o}C from north to south in areas of similar altitude. The average annual temperature on the coast is typically 16-20^{o}C, while the annual range is 18-22^{o}C (Australian Bureau of Meteorology, cited in Hager and Benson 1994).

1.3.2 Weather Conditions During Survey

The main survey was conducted between the 5-9th of November 2007. This period coincided with a low pressure trough bringing light to heavy rain over most of the survey period. Most days were overcast with limited sunny breaks mainly toward the end of the week. Temperatures however were warm ranging from about 18-28^{o}C with high levels of humidity. Wind was very limited.

1.4 TOPOGRAPHY, GEOLOGY AND SOILS

1.4.1 Topography

Refer to the topographic map in figure 1.

The study site falls on the northern footslope to midslope of a ridgeline which runs roughly east-west along the southern boundary. A spur off this ridgeline separates Lots 614-22 from the remainder. The slope grades gently to the north to northeast. The area encompassed by Lots 601-654 is largely flat with drainage tending north to northeast.

1.4.2 Geology and Soils

The Macksville and Nambucca Soil Landscape maps (DLWC 2000, Eddie 2000) map the site as occurring on granitic parent material. Derived soils consist of well drained Brown or Yellow Kurosols (red podsolic soils) and Dermosols. Localised outcropping is common on the mid to upper slopes of the parent material.

1.5 LANDUSE AND DISTURBANCE HISTORY

1.5.1 Pastoralism

The total property has undergone increased pastoral improvement activity over the last 10yrs (pers. obs), as notable by review of aerial photos from 1997-2007, with immature regrowth and lower stratums of vegetation removed via slashing and underscrubbing. Open areas have also been maintained by regular slashing to form low pasture. The end result is that the vegetation over most of the property has been converted to parkland with only a ribbon of intact forest retained along the upper slope around the water tanks. Horses are grazed on the property, with cattle also noted at times (pers. obs.).

1.5.2 Fire

The property evidenced very little signs of a fire. The majority of the site appears not to have been burnt for at least 10yrs, however fuel loading is low to negligible in most areas due to management or the natural sparseness of vegetation (eg in the 7(d) zone).

1.5.3 Weeds and Exotic Species

Overall, aside from pastoral species, exotic plant species are not particularly common. Some minor lantana infestations occur in the upper 7(d) zone.

1.5.4 Existing Dwellings

A large dwelling with associated guest house/managers dwelling, tennis court, pool, sheds, and gardens occurs in the northwest corner of the site.

1.6 ADJACENT DEVELOPMENTS AND ACTIVITIES

The general area is subject to a variety of land uses from rural, rural-residential to urban and recreational.

Residential development links directly to the west. Several rural-residential dwellings lie to the south, with a newly approved residential subdivision on the corner of Gregory St and Arakoon Rd (ERM 2007b, Connell Wagner 2005b). Rural land lies to the east (under common ownership) and to the northeast. The South West Rocks Golf Course adjoins to the north. Major residential subdivisions have been recently proposed to the far north-northeast (Connell Wagner 2008, 2005a) adjoining Saltwater Lagoon.

Two Council-owned water supply reservoirs are located within on separate Lots (Lot 1 DP 560726 and Lot 1 DP 645213) within the 7(d) zone on the ridgeline in the southwest

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1.7 PREVIOUS AND RELEVANT STUDIES

1.7.1 Previous On-Site Ecological Assessments

1.7.1.1 Umwelt 2004

Umwelt (2004) assessed the entirety of Lot 21 for 210 residential Lots (the currently approved portions of the Seascape Grove subdivision).

1.7.1.1.1 Flora

The flora survey consisted of 6 walking transects (approximately 150m long) over the approximately 30ha site, and a single 400m^2 quadrat in the modified woodland only. This effort meets the minimum recommended for the size of the site as per DEC (2004) guidelines.

No threatened flora species were recorded. It is noted that the site's Scribbly Gum has been incorrectly identified as the Southern Scribbly Gum (*E. racemosa*). The species present is the Northern Scribbly Gum (*E. signata* - Harden 1991).

1.7.1.1.2 Fauna

The fauna survey was conducted from 19-21st May, hence not in the optimum period of Spring-Summer (DEC 2004).

Fauna survey methods consisted of:

- Herpetofauna habitat searches
- Spotlighting via walking and slow moving vehicle.
- Scat and scratches identification.
- Yangochiropteran bat call recording (45 minutes periods) for an unspecified total.
- Spot Assessment Technique assessment for Koala activity levels (no specification of sampling regime eg grid based system or all trees inspected).

No trapping or hair tubing was undertaken and inadequate explanation is provided other than for terrestrial species, which conflicts with the DEC (2004) requirements. While it is accepted that terrestrial Elliot A and wire cage trapping were redundant due to lack of habitat and hence minimal potential for target species to occur, the failure to conduct an arboreal trapping/tube survey is considered a major shortcoming of the assessment given this consultant has recorded Squirrel Gliders and Brushtailed Phascogales in habitat identical to this situation in South West Rocks (Darkheart 2004f, Berrigan 2000a, 2000b, 2000c, 2002a), and other areas (Berrigan 2003a); and Umwelt (2004) consider these species as unlikely to occur. Hollow-bearing trees are also common in the remaining stands of vegetation which these species are highly likely to utilise.

Owl (and presumedly Bush-Stone Curlew and mammal though not specified) call playback was not undertaken due to proximity to residences. This is not considered acceptable given the property is 30ha and hence more than sufficient area was available to minimise disturbance to residents and dogs, several of the target species have been recorded in the locality, and potential habitat occurs on site (ie Powerful Owl and Koala – DECCW 2009a, Bionet 2009, Macleay Argus 2002, Darkheart 2006f).

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Umwelt recorded the following threatened species on-site:

- Eastern Bent-Wing Bat (Vulnerable –TSCA)
- Little Bent-Wing Bat (V-TSCA)
- East-Coast Freetail Bat (V-TSCA)
- Grey-Headed Flying Fox (V-TSCA, EPBCA)

A review of potential occurrences derived from a search of the DEC Atlas of Wildlife (2004) was undertaken. This list is considered inadequate as per DEC (2004) standards as it does not consider any other public records (eg Birds Australia Atlas of Birds); review any available literature (eg Hat Head National Park Management Plan); or consider species not yet recorded in the locality (to public knowledge) but whose range includes the area *and* for which potentially suitable habitat may occur on site eg Masked Owl. The evaluation of likelihood to occur is also considered very poor eg Brushtailed Phascogales and Squirrel Gliders are not considered potential occurrences despite being recorded <1km from the site (eg Darkheart 2004f, Berrigan 2000a, 2000b, 2000c, 2002a, 2003a, O'Neil and Williams 2003, Smith 1995, DECCW Atlas of Wildlife 2009a, Bionet 2009), suggesting limited knowledge of the species' ecology.

Umwelt also fails to comply with the DEC (2004) requirements to consider impacts on potential habitat, not just potential or known occurrences of threatened species eg the site is Potential Koala Habitat, hence the Koala should have been assessed in the 8 Part Tests, even though the survey results suggest the site is not Core Koala Habitat (ie as it offers potential value as linkage or habitat a future recovering population could expand into).

The impact assessment is very brief and provides minimal scientific justification for its conclusion.

1.7.1.2 ERM 2006b

ERM were engaged to provide a 7 Part Assessment for stormwater treatment infrastructure and a bushfire perimeter road on Lot 22 comprising a 25m strip adjacent to the study area assessed by Umwelt (2006).

ERM considered the subject area to have minimal habitat values, and recorded no threatened species.

A number of botanical misidentifications are noted in this report eg the *Grevillea* spp referred to is actually the physically similar Crinklebush (*Lomatia silaifolia*).

1.7.1.3 ERM 2007a

ERM were engaged to conduct a habitat assessment of the 7(d) *Scenic Protection Zone* south of the residential area on Seascape Grove. This assessment provided supporting information to the Umwelt (2004) assessment in regard to the relatively higher ecological values for threatened species (such as Squirrel Gliders) of this area, relative to the proposed residential area. Umwelt (2004) justified their conclusion that no significant impact was likely due to the presence of sufficient alternative resources on the land adjacent to the subject site.

ERM demonstrated that the 7(d) zone, which is less modified in structure, has relatively higher habitat values in terms of hollow abundance and diversity, vegetation structure, and terrestrial habitat components (exfoliating rocky outcrops and hollow-logs). ERM however also reiterate the error in opinion that Squirrel Gliders and Phascogales are not likely to use the modified woodland.

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1.7.3 Other Ecological Assessments

This firm has undertaken the following assessments undertaken in the South West Rocks area:

- Berrigan, J.A. (2004). *Threatened Species, EPBCA Act and SEPP 44 Assessment for Proposed Rural-Residential Dwelling on Lot 3 Palm Grove, Arakoon***.** Unpublished report to Mid Coast Environmental Services. Darkheart Eco-Consultancy, Port Macquarie.

- Berrigan, J.A. (2003). *Threatened Species, EPBCA Act and SEPP 44 Assessment for Proposed Residential Subdivision on Lot 1 DP 871437, Frank Cooper St, South West Rocks.* Unpublished report to Covey and Associates. Darkheart Eco-Consultancy, Port Macquarie.

- Berrigan, J. A. (2002). *Flora and Fauna Investigations on Lot 42 DP 8788 , Gregory St, South West Rocks*. Memorandum to Hopkins Consultants. Darkheart Eco-Consultancy, Port Macquarie.

- Berrigan, J.A. (2000). *Threatened Species and SEPP 44 - Koala Habitat Assessment For Proposed Residential Subdivision Of Lot 229 DP 754396, Spencers Creek Rd, South West Rocks*. Unpublished report to Hadlow Design Services. Darkheart Eco-Consultancy, Port Macquarie.

- Berrigan, J.A. (2000). *Threatened Species and SEPP 44 - Koala Habitat Assessment For Proposed Residential Subdivision Of Lot 224 DP 754396, Spencers Creek Rd, South West Rocks*. Unpublished report to Hadlow Design Services. Darkheart Eco-Consultancy, Port Macquarie.

- Berrigan, J.A. (2000). *Threatened Species and SEPP 44 - Koala Habitat Assessment For Proposed 12 Lot Residential Subdivision Of Lot 17 and part Lot 16 DP 868688, Arakoon, South West Rocks*. Unpublished report to REALM. Darkheart Eco-Consultancy, Port Macquarie.

- Berrigan, J.A. (2000).*Threatened Species Management Plan for Lot 961, DP 1009907, Spencers Creek Rd, South West Rocks*. Unpublished report to Cavanaghs Bus Company, Kempsey. Darkheart Eco-Consultancy, Port Macquarie.

- Berrigan, J.A. (1999). *Consideration of Potential Impacts on Threatened Species for a Modified Proposal to Establish a Dwelling on Lot 2, DP 718544, Off Gilbert Cory and Bel O'Connor St, South West Rocks*. Letter to Kempsey Shire Council on behalf of Mr J. and Mrs M. Holmes. Darkheart Eco-Consultancy, Port Macquarie.

- Berrigan, J.A. (1998). *Proposed Tourist Facility, Lot 1, D.P. 853056, DA T4-98-62, Arakoon, South West Rocks.* Unpublished report to Glen Petersen Architect, Kingscliffe. Darkheart Eco-Consultancy, Port Macquarie.

- Berrigan, J.A. (1998). *Eight Point Test, EPBCA Act and SEPP 44 Koala Habitat Assessment for Proposed Residential Subdivision, Lot 2 DP 7185, Cabbage Tree Lane, South West Rocks*. Unpublished report for Mr and Mrs J. Holmes. Darkheart Eco-Consultancy, Port Macquarie.

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- Berrigan, J.A. (1998). *Eight Point Test and SEPP 44 Koala Habitat Assessment for Proposed Residential Dwelling on Lot 11, Gap Beach Rd, Arakoon*. Unpublished report to Hadlow Design Services. Darkheart Eco-Consultancy, Port Macquarie.

- Berrigan, J. A. (1997). *Threatened Fauna Assessment for Proposed Retail Complex on Lot 231, DP 753396, Gregory St, South West Rocks*. Unpublished report to Hadlow Design Services. Darkheart Eco-Consultancy, Port Macquarie.

- Berrigan, J. A. (1997). *Flora and Fauna Assessment for Residential Subdivision on Lots 226, 227 and 228, DP 754396, Gregory St, South West Rocks*. Unpublished report to Hadlow Design Services. Darkheart Eco-Consultancy, Port Macquarie.

- Darkheart Eco-Consultancy (2006). *Commonwealth EPBCA Act 1999, NSW Threatened Species Conservation Act, NSW Fisheries Management (Amendments) Act 1997and SEPP 44 - Koala Habitat Assessments of Proposed Eco-Tourism Facility (Meriki Sanctuary) on Portions 73, 77, 78, 79, & 80 DP752409, Rainbow Reach*. Unpublished report to Dutton Consulting. Darkheart Eco-Consultancy, Laurieton.

- Darkheart Eco-Consultancy (2005). *Commonwealth EPBCA Act 1999, NSW Threatened Species Act and SEPP 44 - Koala Habitat Assessments of Proposed Subdivision Of Lot 5 DP 22502, Gregory Street, South West Rocks*. Unpublished report to Mr Robert Martin. Darkheart Eco-Consultancy, Laurieton.

- Darkheart Eco-Consultancy (2004). *Flora and Fauna Survey for Proposed Western Distributor Rd, South West Rocks.* Unpublished report to King and Campbell Pty Ltd. Darkheart Eco-Consultancy, Port Macquarie.

- Darkheart Eco-Consultancy (2004). *Threatened Species, EPBCA Act and SEPP 44 Assessments for Proposed Residential Development on Former Oil Terminal Site, Phillip Drive, South West Rocks*. Unpublished report to Hopkins Consultants Pty Ltd, Darkheart Eco-Consultancy, Port Macquarie

This firm also has access to the following assessments undertaken by other consultants in the South West Rocks area:

- Australian Wetlands Pty Ltd (2005). *Boyters Lane Playing Fields: Plan of Management*. Unpublished report prepared for Kempsey Shire Council. Australian Wetlands Pty Ltd, Bryon Bay.

- Bray, D. (1999). *Threatened Species and SEPP 44 Assessment for Proposed Subdivision and Industrial Development on Lot 961 (part Lot 96 DP 754396), off Spencers Creek Rd, South West Rocks*. David Bray Flora and Fauna Surveys, Port Macquarie.

- Connell Wagner Pty Ltd (2008). South West Rocks LES – Detailed Wallum Froglet Investigations on *Lot 19 DP 882848, Lot 52 DP 831284, Lot 94 DP 792945 and Lot 509 DP 850963*. Unpublished report to Kempsey Shire Council. Connell Wagner Pty Ltd, Callaghan.

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- Connell Wagner Pty Ltd (2005a). *Flora and Fauna Report – South West Rocks LES for Saltwater Developments on Lot 29 DP 110040, Lots 51 and 52 DP 831284, Lot 94 DP 792945 and Lot 509 DP 850963*. Unpublished report to Kempsey Shire Council. Connell Wagner Pty Ltd, Callaghan.

- Connell Wagner (2005b). *Preliminary Ecological Investigation 'Rosarii' 334-356 Gregory Street South West Rocks*. Prepared by Connell Wagner Pty Ltd for Nambucca Heads Development Co. NSW.

- ERM Mitchell McCotter (2007b). *Ecological Assessment for Residential Subdivision of Lot 2 in DP 581117, Gregory St, South West Rocks*. Unpublished report to Macleay Valley Properties Group Pty Ltd. ERM, Port Macquarie

- Kendall and Kendall (2003). *Saltwater Creek Catchment Flora and Fauna Study South, West Rocks*. Kendall and Kendall Pty Ltd.

- Phillips and Hopkins (2009a). *Comprehensive Koala Plan of Management for Eastern Portion of Kempsey Shire LGA (draft) - Volume 1: Resource Study.* Unpublished report to Kempsey Shire Council. Biolink Ecological Consultants, Uki.

- Phillips and Hopkins (2009b). *Comprehensive Koala Plan of Management for Eastern Portion of Kempsey Shire LGA (draft) - Volume 2: The CKPoM (Working Provisions).* Unpublished report to Kempsey Shire Council. Biolink Ecological Consultants, Uki.

- Mackay, K. and Bray, D. (1995). *Fauna Impact Assessment for Lot 8, DP 813532, Arakoon Rd, for Blyth, Hadlow and Assoc*. Unpublished report to Blyth and Hadlow. Kel Mackay Flora and Fauna Surveys, Port Macquarie.

- Mackay, K. and Bray, D. (1995). *Fauna Impact Assessment for Proposed Subdivision on Portions 135, 136 and 137, Parish of Arakoon, for Blyth, Hadlow and Assoc.* Unpublished report to Blyth and Hadlow. Kel Mackay Flora and Fauna Surveys, Port Macquarie

- Salter, B.J. (1997). *Report on Part 1- SEPP 44 Assessment and Part 2 - Section 5A (EP&A Act) Assessment of Lot 2252 DP 616771 for Proposed Subdivision into 41 Lots, Gregory St South West Rocks*. Unpublished report to Blyth and Hadlow. North Coast Forestry and Environmental Consultants, Kendall.

- Sandpiper Environmental (2005). *Boyters Lane Playing Fields and Wetland Management Plan: Fauna Component*. Unpublished report prepared for Australian Wetlands Pty Ltd. Sandpiper Environmental, Alstonville.

- O'Neill, M. and Williams, J. (2003). *Species Impact Statement for Proposed Residential Subdivision on Lot 223 DP 754396 and Lot 511 DP 1048157*. Prepared for Machro Pty Ltd and Eric Norman Developments. Northern NSW Forestry Services, Casino.

- Whelans InSites (2008). *Ecological and Impact Assessment Report for Lot 52 DP 831284 and Lot 84 DP 792945, Belle O'Connor St, South West Rocks.* Whelans InSites, Sydney.

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Most of these studies have collectively recorded numerous threatened species in the South West Rocks area, especially Squirrel Gliders and Phascogales. The most significant study is Darkheart (2004f) which was the move extensive (studying a total of approximately 72ha of habitat in western South West Rocks), and determined indicative densities of Squirrel Gliders which have not been determined in any other local studies.

PART A: FLORA AND FAUNA SURVEY

2.0 SURVEY METHODS

2.1 GENERAL INFORMATION

Following an initial inspection to determine the threatened species potentially occurring and the appropriate survey techniques, the main survey was conducted from the 5-9th of November 2007. In addition, the available relevant literature and the Department of Environment, Climate Change and Water (DECCW) Atlas of Wildlife (http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas) and Rare or Threatened Plants databases (www.plantnet.rbgsyd.nsw.gov.au/search) were consulted for records of threatened species on the Grafton, Bare Point, Bulahdelah, Camden Haven, Kempsey, Korogoro, Coffs Harbour, Dorrigo, Nambucca and Macksville (the mid-north coast region) 1:100 000 topographical maps. The Bionet (www.bionet.nsw.gov.au) website was also searched for records in proximity to the site.

As per DECC (2007) definitions, the **study site** is defined as the land subject to the development proposal ie the 2(a) area). This was further reduced to the south and southwest areas due to lack of any notable habitat in the northern areas (highly maintained pasture/lawns). The **study area** consisted of the study site and the adjacent land within 100m of the site which may be subject to indirect impacts (generally the 7(d) area). The **locality** is defined as land within a 10km radius of the study site.

2.2 FLORA

2.2.1 Threatened Flora Records

A search of the DECCW Rare or Threatened Plants (ROTAP) database (2007a), Bionet (2007) and available literature (Campbell 1997) indicated that the following threatened flora species occur within 10km of the site:

1. ***Acronychia littoralis*** (Hat Head NP)
2. ***Cynanchum elegans*** (Hat Head NP)

2.2.2 Survey Methods

The flora survey essentially routinely consists of two components:

- Identification, description and mapping of the major vegetation communities and any Endangered Ecological Communities: Section 2.2.2.1.

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- Searches for, identification of, and (if found) mapping of any threatened species and their habitat: Section 2.2.2.2.

2.2.2.1 Vegetation Mapping and Species Identification

The formal flora survey was carried out over the study area over 3 days. This time was dedicated to undertaking plot sampling, threatened species searches and random walking transects as per DEC (2004) guidelines.

The limited extent of the study area allowed for thorough searches of the site's vegetation communities to identify vegetation types and assess the potential for threatened species to occur.

2.2.2.1.1 Field Methodology

2.2.2.1.1.1 General

A combination of random walking transects and plot based surveys were used as this sampling methodology is considered most suitable for the following reasons:

- Provide the most amount of information for a given input.
- Provide a means to sample vegetation boundaries.
- Provide means for assessing floristic diversity and possible presence of threatened species (Forest Fauna Surveys *et al* 1997).

2.2.2.1.1.2 Plot–Based Sampling

The stratification of the site/study area for plot-based sampling was determined using vegetation patterns observed from preliminary viewing of air photos and site inspection. Correspondingly, sample sites (quadrats) were assigned to sample the range of different vegetation types within the study site/area. Floristic data for this assessment was collected for 4 quadrats of fixed size of 400m^2. The location of these quadrats is shown in figure 3.

The following attributes were measured or estimated at each quadrat:

- Australian Map Grid Reference (GDA-94)
- Vegetation structure, including the height and foliage cover of each stratum.
- Location, aspect, elevation and slope.
- Geology and general soil characteristics.
- Topographic position.
- Approximate time since last fire and characterisation of intensity (ground cover burnt, shrubs burnt, tree tops burnt).
- Forms of disturbance other than fire.
- Presence of environmental weed species and severity of infestation.

2.2.2.1.1.3 Walking Transects

In addition to the data collected at each quadrat site, another hour was spent undertaking a random meander walking transect. This was undertaken to check for species not recorded in quadrats, possible presence of threatened species, vegetation boundaries and confirm vegetation attributes over a larger area than the sample quadrat site. Flora transects are shown in figure 3.

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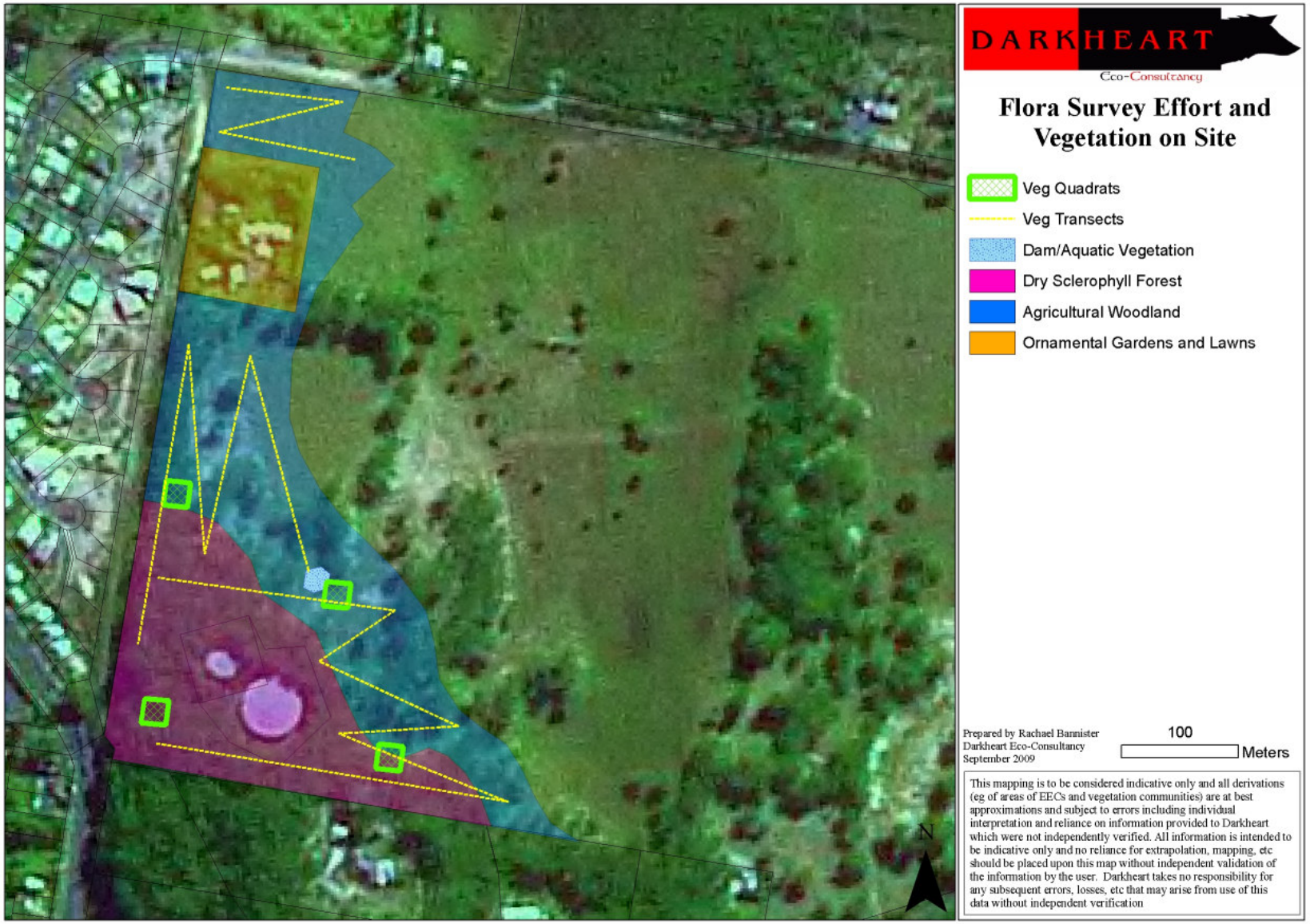
Figure 3: Location of primary vegetation survey quadrats and transects



2.2.2.1.1.4 Opportunistic records

Opportunistic records of plant species while working on the study site/area during other activities (eg trapping) were also recorded. This significantly expanded the species list via acquiring species occurring at lower abundance on the site/area.

2.2.2.1.1.5 Identification and Classification

Species identification was made with the assistance of Bale (1993), Beadle (1982), Harden (1990, 91, 92, 93, 2000), Williams and Harden (1980), Robinson (1994), and Brooker and Kleinig (1999). Plant species were identified to species or subspecies level and nomenclature conforms to that currently recognized by the Royal Botanic Gardens and follows Harden and PlantNET for changes since Harden. Any species unable to be confidently identified is routinely sent to the Royal Botanic Gardens Herbarium for confirmation.

2.2.2.1.2 Air Photo Interpretation and Mapping

The vegetation within the study site/area was ultimately mapped by using a combination of aerial photo interpretation, plot sampling and field truthing. Initially, vegetation types were stratified into types with reference to such diagnostic features as colour, texture, crown architecture, aspect and topographic position. A process of selective field sampling and interpretation adjustment was continued until a satisfactory level of confidence in type recognition was reached. The boundaries of each type, which are generally analogous to the plant communities, were digitised onto a digital orthographic image supplied by the Land and Property Information Centre via Arcview GIS v9.1 software.

2.2.2.1.3 Vegetation Classification

The vegetation communities were described by interpreting data collected during plot-based surveys. Sub-formation names for vegetation types are adapted from the classification proposed by Beadle and Costin (1952) eg 'Dry Sclerophyll Forest' to assist the fauna habitat evaluation and to follow Keith (2004). Structural classification is also used for the community descriptions as per Walker and Hopkins (1984) to allow for comparison with other surveys using this system. Appropriate names from each taxonomic system are provided in the community description. Crown cover classes are defined by the following:

- **Closed or dense**: crowns touching to overlapping (crown separation ratio <0).
- **Mid-dense:** crowns touching or slightly separated (crown separation ratio 0– 0.25).
- **Sparse**: crowns clearly separated (crown separation 0.25–1).
- **Very Sparse:** crowns well separated (crown separation 1–20).
- **Isolated plants:** trees greater than 100 m apart, shrubs about 25m apart (crown separation >20).
- **Isolated clumps**: clump of two to five woody plants 200 metres apart (crown separation >20)

2.2.2.1.4 Vegetation Community Conservation Significance

The conservation significance of the vegetation communities within the subject site was determined by comparing equivalent phytosociological associations and their conservation significance on the North Coast of NSW (Northern Zone NPWS 1999, NSWSC 2004a, 2004b, 2004c, 2004d, 2004e, 2005f, DECCW 2009b, etc). In addition, the condition and continuity of vegetation within the study site relative to larger areas off site was considered when determining significance.

Identification of possible Endangered Ecological Communities was based on the data collected by the survey and review of the relevant listings on the DECCW website (www.environment.nsw.gov.au).

2.2.2.2 Threatened Flora Species Searches and Occurrence Assessment

2.2.2.2.1 Searches

Searches for threatened flora recorded in the Local Government Area (LGA) and/or in regionally similar habitats to that on the site/area (see section 3.2 and Appendix 1) were carried out as detailed above. In addition to general vegetation classification work, a total of 3 dedicated hours was spent on random meander searches for threatened flora on the site/area (ie the site and adjacent sections of the 7(d) zone), with incidental searches during other activities eg vegetation community description and scat searches.

2.2.2.2.2 Potential Occurrence Assessment

Potential occurrence assessment of threatened flora species is provided in section 3.2 and Appendix 1. This section assesses all threatened species listed as threatened under the TSCA 1995 and EPBCA 1999 for their potential to occur on site/study area based on the following factors:

- Presence/absence of literature-cited suitable habitat (vegetation community, climate, altitude, soils, geology, drainage, fire regime, etc).
- Condition and disturbance history of habitat.
- Local and regional records.
- Location of site within known distribution of the species.

2.3 FAUNA

2.3.1 Threatened Fauna Records

The following table lists significant fauna species (excluding marine birds, fish and marine organisms, due to lack of suitable habitat in the study area) have been recorded or reported to occur within 10km of the study site (DECCW Atlas of Wildlife 2009a, Bionet 2009, Darkheart 2007g, 2006f, 2006j, 2006k, 2006f, 2004f, 2004j, 2004x, Berrigan 1997c, 2000a, 2000b, 2000c, 2002a, 2003a, Standing 1990; Mackay and Bray 1995a, 1995b, Bray 1999, Shortlands Wetlands Consultancy 1995, Sandpiper Environmental 2005, Connell Wagner 2008, 2005a, Insites 2008, ERM 2007a, 2007b, Umwelt 2004, personal observations, O'Neil and Williams 2003). Those in bold are dually listed under the EPBCA.

The following species (excluding marine and estuarine birds due to lack of relevance to the proposal) are considered likely to occur in the locality due to suitable habitat and regional records (some have been recorded within 20km):

1. *Mammals:* **Spotted-Tail Quoll, Long-Nosed Potoroo,** Common Planigale, Eastern Chestnut Mouse, Eastern Pygmy Possum, **Dwyer's Bat**.

2. *Birds*: Red-Tailed Black Cockatoo, Gang-Gang Cockatoo, Rose-Crowned Fruit-Dove, Mangrove Honeyeater, Brown Treecreeper, Grey-Crowned Babbler, Hooded Robin, Speckled Warbler, Diamond Firetail, **Regent Honeyeater**, Painted Honeyeater, **Red Goshawk,** Barking Owl, **Painted Snipe**, Bush Stone-Curlew, Little Eagle (pV), White-Browed Woodswallow (pV), Spotted Harrier (pV). Flame Robin (pV), Scarlet Robin (pV).

3. *Frogs:* ***Litoria olongburensis****, L. brevipalmata****, L. aurea****, Mixophyes iteratus***

4. *Reptiles*: Stephens Banded Snake, White-Crowned Snake, Pale Headed Snake, **Three-Toed Snake-Toothed Skink**.

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Table 1: Threatened fauna species recorded in the locality

The following table lists all threatened fauna species recorded in the locality from the cited references.

GROUP	COMMON NAME	SPECIES	LEGAL STATUS	SOURCE	DISTANCE FROM STUDY SITE/GENERAL LOCATION
MAMMALS	Squirrel Glider	*Petaurus norfolcensis*	V-TSCA	Berrigan 2000a, 2000b, 2000c, 2003a, 2002a, Darkheart 2004g, 2007g, 2006k, O'Neil and Williams 2003, Bray 1999, Atlas of Wildlife, Insites, 2008 Connell Wagner 2005a	<500m south of site, <1km east of site, Arakoon area, west South West Rocks, Arakoon, Fishermans Reach, Stuarts Point
	Brushtailed Phascogale	*Phascogale tapoatafa*	V-TSCA	Berrigan 2000a, 2000b, 2000c, 2003a, 2002a, Darkheart 2004g, O'Neil and Williams 2003, Atlas of Wildlife, Connell Wagner 2005a	Hat Head National Park, Arakoon Rd, <500m south of site.
	Koala	*Phascolarctos cinereus*	V-TSCA	Atlas of Wildlife, Standing 1990, Kempsey Argus 2002	3km at Smokey Cape area. Unconfirmed report in western South West Rocks (Darkheart 2004f)
	Little Bent-Wing Bat	*Miniopterus australis*	V-TSCA	Atlas of Wildlife, Umwelt 2004, Darkheart 2006k, 2004f, 2007g, 2006f, InSites 2008, Connell Wagner 2005a	Yarrahappini-Broadwater, western South West Rocks, Rainbow Reach area
	Eastern Bent-Wing Bat	*M. orianae oceanensis*	V-TSCA	Atlas of Wildlife, Umwelt 2004	*possible* recording in industrial estate; west South West Rocks, Yarrahappini-Broadwater, Trial Bay, Rainbow Reach area
	East-Coast Freetail Bat	*Micronomus norfolkensis*	V-TSCA	Atlas of Wildlife, Umwelt 2004, Darkheart 2006k, 2004f, 2007g, Insites 2008	Yarrahappini-Broadwater, Arakoon, Hat Head National Park, Rainbow Reach area
	Beccari's Freetail Bat	*Mormopterus beccarii*	V-TSCA	Darkheart 2004f	*Possible* record in west South West Rocks
	Hoary Bat	*Chalinobus nigrogriseus*	V-TSCA	SWC 1995, Darkheart 2004f. InSites 2008	Yarrahappini-Broadwater, *probable*" call in South West Rocks
	Golden Tipped Bat	*Phoniscus papuensis*	V-TSCA	Atlas of Wildlife	unknown
	Eastern Cave Bat	*Vespadelus troughtoni*	V-TSCA	Atlas of Wildlife	1km south of site
	Eastern Blossom Bat	*Syconycteris australis*	V-TSCA	Atlas of Wildlife	South West Rocks
	Grey Headed Flying Fox	*Pteropus poliocephalus*	V-TSCA, V-EPBCA	Atlas for Wildlife, Darkheart 2004f, 2006k, 2007g, Berrigan 2000a, 2000b, 2000c, 2003a.. InSites 2008, Connell Wagner 2005a	all South West Rocks and Hat Head National Park
	Southern Myotis	*Myotis macropus*	V-TSCA	Darkheart 2007g	Rainbow Reach area
	Northern Long-Eared Bat	*Nyctophilus bifax*	V-TSCA	Atlas of Wildlife	Hat Head National Park
	Yellow-Bellied Sheathtail-Bat	*Saccolaimus flaviventris*	V-TSCA	Atlas of Wildlife, InSites 2008	Southwest of Saltwater Lagoon
	Greater Broad-Nosed Bat	*Scoteanax rueppellii*	V-TSCA	Atlas of Wildlife, Berrigan 2000c	3km
BIRDS	Glossy Black-Cockatoo	*Calyptorhynchus lathamii*	V-TSCA	Berrigan 2000a, 2000b, 2000c, 2003a, 2002a, Darkheart 2004g, 2004f, 2007g, 2006k, 2006f, O'Neil and Williams 2003,Atlas of Wildlife	Smoky Cape, Arakoon, Shark Island, Yarrahappini-Broadwater, Hat Head National Park, west South West Rocks, Pelican Island, Saltwater Lagoon, Fisherman's Reach
	Swift Parrot	*Lathumus discolor*	E-TSCA, E-EPBCA and Migratory	Kempsey Argus 2004	<2km
	Little Lorikeet	*Glossopsitta pusilla*	V-TSCA	Atlas of Wildlife, Bionet	Saltwater Lagoon area
	Powerful Owl	*Ninox strenua*	V-TSCA	Darkheart 2006f, Atlas of Wildlife	Arakoon, Hat Head National Park, Rainbow Reach
	Masked Owl	*Tyto novaehollandiae*	V-TSCA	Atlas of Wildlife, ERM 2007b	South West Rocks Golf Course area
	Grass Owl	*Tyto capensis*	V-TSCA	Atlas of Wildlife	Hat Head National Park, Boyters Lane

	Osprey	*Pandion haliaetus*	V-TSCA, EPBCA-Migratory	Atlas of Wildlife, Berrigan 2000a, 2000b, 2000c, Darkheart 2004g, 2004f, 2006f, Sandpiper Environmental 2005, O'Neil and Williams 2003, EPBCA-website, pers. obs.	Macleay River, Spencers Creek, Shark Island, Fisherman's Reach, Stuarts Point, all South West Rocks, Kinchela, etc
	Square Tailed Kite	*Lophoictinia isura*	V-TSCA	Atlas of Wildlife, Darkheart 2004f, 2006f, Sandpiper Environmental 2005	west South West Rocks, Boyters Lane
	Barred Cuckoo-Shrike	*Coracina lineata*	V-TSCA	Atlas of Wildlife	Shark Island area
	Wompoo Fruit Dove	*Ptilinopus magnificus*	V-TSCA	Atlas of Wildlife	west South West Rocks, Hat Head National Park, Arakoon
	Rose-Crowned Fruit Dove	*Ptilinopus regina*	V-TSCA	Atlas of Wildlife	Saltwater Lagoon - 1km
	Mangrove Honeyeater	*Lichenostomus fasciogularis*	V-TSCA	Atlas of Wildlife	Stewarts Point
	White-Browed Chat	*Epthianura albifrons*	pV-TSCA	Atlas of Wildlife	Western South West Rocks, Jerseyville area
	Varied Sittella	*Daphoenositta chrysoptera*	Prelim V-TSCA	Atlas of Wildlife, Bionet	Hat Head National Park
	Magpie Goose	*Anseranas semipalmata*	V-TSCA	Atlas of Wildlife	Atlas of Wildlife
	Black-Tailed Godwit	*Limosa limosa*	V-TSCA	Atlas of Wildlife, Sandpiper Ecological 2005	Boyters Lane
	Black Bittern	*Dupetor flavicollis*	V-TSCA	Atlas of Wildlife, Darkheart 2006f	
	Australasian Bittern	*Botaurus poiciloptilus*	V-TSCA	Sandpiper Ecological	Boyters Lane
	Terek Sandpiper	*Xenus cinereus*	V-TSCA	Atlas of Wildlife, Darkheart 2006f	Meriki Island
	Sooty Oystercatcher	*H. fuliginosus*	V-TSCA	Atlas of Wildlife, Darkheart 2006f	Trial Bay, Meriki Island
	Pied Oystercatcher	*Haematopus longirostris*	V-TSCA	Atlas of Wildlife, Darkheart 2006f	Meriki Island, Fishermans Reach, Trial Bay
	Masked Booby	*Sula dactylatra*	V-TSCA	Atlas of Wildlife, Bionet	Trial Bay
	Little Tern	*Sterna albifrons*	E-TSCA	Atlas of Wildlife	Shark Island
	Brolga	*Grus rubicunda*		Sandpiper Ecological 2005	Boyters Lane
	Jabiru/Black Necked Stork	*Ephippiorhynchus asiaticus*	E-TSCA	Atlas of Wildlife, Sandpiper Ecological 2005, Darkheart 2006f	Pelican Island, Macleay River, Kinchela, Boyters Lane
	Comb-Crested Jacana	*Irediparra gallinacea*	V-TSCA	Atlas of Wildlife, Sandpiper Ecological 2005	Pelican Island, Boyters Lane
FROGS	Wallum Froglet	*Crinia tinnula*	V-TSCA	Atlas of Wildlife, Berrigan 2003a, 2002a	Yarrahapinni-Broadwater, Trial Bay, Hat Head National Park, swamp forest north of Frank Cooper St, Lot 46 Gregory St.
	Stuttering Frog	*Mixophyes balbus*	E-EPBCA, E-TSCA	SWC 1995	Yarrahapinni-Broadwater

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2.3.2 Fauna Survey Methodology

2.3.2.1 Habitat Evaluation

The site and adjacent 7(d) zone was initially inspected to determine the available potential habitats, and the support value of these habitats for threatened species. Habitats were defined according to parameters such as:

- structural and floristic characteristics of the vegetation eg understorey type and development, crown depth, groundcover density, etc.
- degree and extent of disturbance eg fire, logging, weed invasion, modification to structure and diversity, etc.
- presence of sandbanks, shallow wading areas, overhanging trees, rock walls, roost areas, etc.
- soil type and suitability eg for digging and burrowing.
- presence of water in any form eg dams, creeks, drainage lines, soaks.
- size and abundance of hollows and fallen timber.
- availability of shelter eg rocks, logs, hollows, undergrowth.
- wildlife corridors, refuges and proximate habitat types.
- presence of mistletoe, nectar, gum, seed, sap, etc sources.

In consideration of the threatened species recorded in the locality, available habitats and potentially occurring species, the following survey methods were employed:

- Spotlighting by walking with a 50w/100w focusable hand-held spotlight over the study site.
- Trapping with 30 arboreal Elliot B traps.
- Trapping with 50 Elliot A traps
- Hair sampling via 40 hair tubes (20 terrestrial and 20 arboreal)
- ANABAT call recording of Yangochiropteran bats.
- Torch searches around the dam for frogs.
- Scat, burrow and hollow inspections (where possible).
- Call playback, detection and recording.
- Physical searches of habitat eg debris, etc.
- Opportunistic sighting.

The location of the trapping and hair tubing surveys are shown in figure 4. All field surveying was conducted as per the conditions of the consultant's Animal Research Authority and Section 132c Scientific License (copies available on request).

2.3.2.2 Trapping

2.3.2.2.1 General

Methods such as sand pads, wire cage, harp, mist-net and pitfall trapping were not undertaken due to:

- Lack of suitable habitat for target species (eg Eastern Blossom Bat, Common Planigale)
- The site's extensive disturbance history;
- Extremely limited or unlikely potential for target species to occur;
- High likelihood of other methods detecting target species; and/or
- Conservative use of habitat evaluation.
- Relatively limited extent of habitat loss.
- Adverse weather during the survey period.

The fauna survey was extended to cover habitat beyond the 2(a) zone into the 7(d) zone up to the fenceline on the edge of the ridge to encompass sufficient representative habitat to allow sound

scientifically based deductions and conclusions. As this land falls in the same ownership, permission from another landholder was not required. No survey was undertaken around the dwellings on site.

2.3.2.2.2 Arboreal Elliot B Trapping

Thirty Elliot B traps were mounted on platforms to trees with hollows and/or exuding sap (thus potential forage sources), or on trees adjacent to several of the latter across the length of the linear shaped site/study area where natural forest/woodland occurred. The traps were baited with honey soaked rolled oats and peanut butter and set for 4 nights. Due to the rain which occurred during the survey period, all traps were placed in plastic bags. All traps were mounted on platforms so as to allow drainage out the entrance and contained dry leaf litter for nesting material. The main target species were the Eastern Pygmy Possum, Squirrel Glider and Brushtailed Phascogale. The trunk of Elliot B trap trees were spayed with a honey-water solution from a pressure sprayer as an attractant. A total of 120 trap nights were performed.

2.3.2.2.3 Terrestrial Elliot A Trapping

Fifty Elliot A traps were set along the ridge line as this was the only area not subjected to slashing and thus contained some shrub and ground vegetation, with some fallen timber and rocky outcroppings. Traps were baited with a honey soaked rolled oats and peanut butter mix and set for 3 nights. Traps were placed within plastic bags with dry leaf litter due to inclement weather. The target species was the Common Planigale. A total of 150 trap nights were undertaken.

2.3.2.2.4 Terrestrial and Arboreal Hair Tubes

Twenty arboreal and twenty terrestrial hair tubes/funnels were set over 8 nights. Traps were baited with a honey soaked rolled oats mixture. Arboreal tubes were mounted on platforms to trees with hollows; that were exuding sap (thus potential forage sources); or on trees adjacent to several of the latter across the site. Terrestrial funnels were set along the ridge line due to the reasons outlined in section 2.3.2.2.3. A total of 320 trap nights were performed.

2.3.2.3 Spotlighting/ Torch Searches and Den Watches

Spotlighting and torch searches were conducted for at least 1.5 hours per night for 5 nights. Spotlighting involved observing all habitat components ie understorey/canopy trees for arboreal fauna, the ground and terrestrial strata (eg logs, areas with good leaf litter accumulations, etc) for terrestrial fauna, etc. It was also periodically conducted during call playback (as detailed in 2.3.2.5).

Torch searches were conducted along the poorly formed drainage line and around the dam.

A total of 9hrs was spent on spotlighting/torch search activities.

2.3.2.4 Yangochiropteran Bat Call Detection

Anabat call detection was not able to be undertaken due to the wet weather experienced during the survey and risk of damage to the expensive equipment.

2.3.2.5 Recorded Call Playback

Recorded calls of the following species were routinely played back on site:

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- Koala
- Masked, Barking and Powerful Owls
- Bush-Stone Curlew
- Yellow-Bellied Glider and Squirrel Glider
- Green-Thighed Frog and Green and Golden Bell Frog

Calls were played either through a portable CD player via a 30W PA system from the rear of a utility at a level approximating natural intensities of the species, or a discman connected to a 10W portable amplifier carried by the consultant. The general methodology involved playback of the call simulating a natural pattern, followed by 5-10 minutes of listening; 10-15 minutes spotlighting for owls attracted by the calls (but not responding vocally), within 100m radius of the playback point; and playback of the next call, etc. Calls were generally played at dusk, when such calls are normally heard.

Call playback was conducted for 1 hour per night for 4 nights (4 hours in total), and conducted outside rain periods. While this total effort is below the level of call playback recommended in the draft *Threatened Species Survey and Assessment – Guidelines for Developments and Activities* (ie which requires at least 8 nights of call playback for owls – DEC 2004), this level of surveying was considered adequate given the limited extent and modified state of the habitat on site, as well as the conservative use of habitat evaluation to predict potential occurrence.

2.3.2.6 Herpetofauna and Bird Surveys and Secondary Evidence Searches

Physical habitat searches were undertaken opportunistically during other activities, as well as for several hours which were dedicated merely to this task. This involved lifting up of timber and debris, inspection of dense vegetation and leaf litter for frogs and reptiles, binocular inspection of potential hollows, observation of likely basking sites and searches for scats, tracks and scratches. This time also included searching under preferred forage species for Koala scats; and opportunistically for owl regurgitation pellets. A total of 10 hours was spent on habitat and secondary evidence searches.

Birds were generally surveyed by detecting calls and searching by binoculars at dawn and dusk (when call chorus and peak activity occurs); while walking around the entire site; and opportunistically during other activities. Diurnal species such as the Brown Treecreeper (eastern subspecies), etc, were the main species routinely searched for.

Species identification was assisted by Simpson and Day (1996), Wilson and Knowles (1992), Strahan (1992), Briggs (1996), Robinson (1996), and Schode and Tideman (1990).

2.4 SURVEY LIMITATIONS

All surveys are limited in their ability to fully document all species of flora and fauna likely or actually occurring on a site. Surveys such as these are merely “snapshots” in time, and can only be expected to provide an indicative not absolutely comprehensive representation of a site’s species assemblage (DEC 2004). To counter this limitation, this survey has employed methods recommended in literature and known from personal experience to best detect the target species. Furthermore, qualitative and quantitative evaluation of the habitat present on the site enabled the determination of species potentially likely occur on site.

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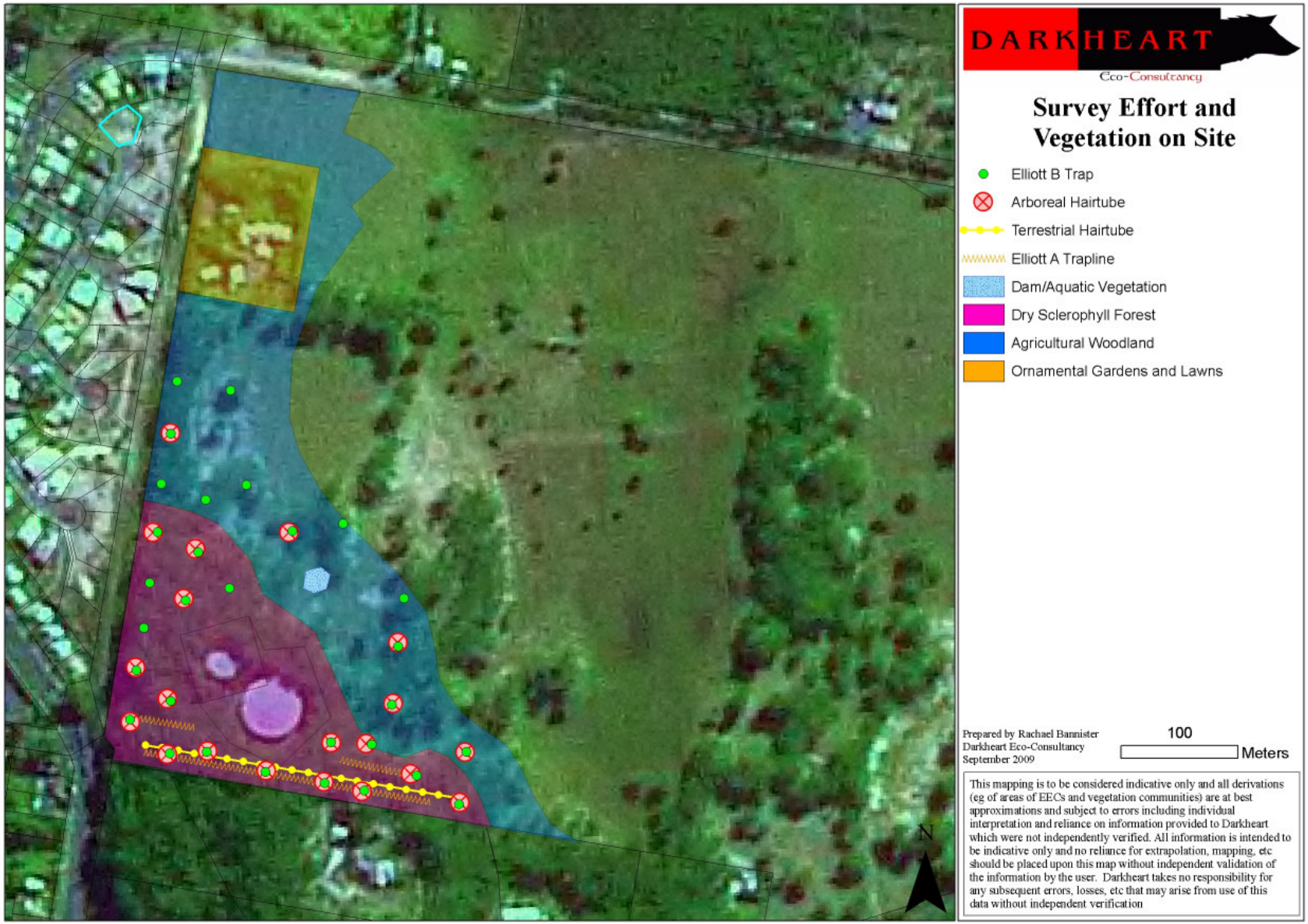
Figure 4: Location of traps and hair tubes



2.4.1 Flora

Flora detection is limited by the lifecycle stage of the plant eg no conspicuous above-ground components of the plant or lack of flowers and leaves. Some plants may thus escape detection by camouflaging in dense vegetation or not being physically visible at the time of the survey (DEC 2004). Identification limitations for species possibly being of conservation significance are routinely dealt with by referring samples to Royal Botanical Gardens Herbarium Identifications Service.

Flora detectability was considered to be potentially limited by slashing disturbances, predominantly for groundcover species (eg native sedges and grasses) in some parts of the 2(a) zone, but overall due to the high accessibility of the site and relatively simplistic assemblage, detection *per se* was considered very high.

2.4.2 Fauna

Fauna detectability is limited by seasonal, behavioural or lifecycle of each species, and even habitat variations (eg flowering periods), which can vary within a year, between years, decades, etc (DEC 2004). Habitat evaluation is used to counter this limitation by assessing the potential occurrence of threatened species based on potentially suitable habitat in the study area and local records.

The survey period fell in Spring which is generally a period of high activity for most fauna (eg Summer seasonal migrants, Koalas, etc – DEC 2004, Churchill 2009, Martin and Lee 1984). However there is limited potential to record Winter migrants (eg Swift Parrot – Smith *et al* 1995, NPWS 2000) and some season specific breeding frogs (Anstis 2002, Robinson 1996, Cogger 2000, DEC 2004) during this period.

Anabat call detection was not able to be physically undertaken due the wet weather experienced during the survey period, thus eliminating the potential to detect threatened Yangochiropteran bats in this survey. Persistent rainfall during the week also hampered the effectiveness of call playback/detection, reptile activity and trapping (DEC 2004). However, these limitations are balanced by conservative habitat evaluation and plethora of studies undertaken in the South West Rocks area in similar to identical habitats to those on site which provide an excellent inventory of local biodiversity and a highly credible means of predicting species occurrence.

3.0 SURVEY RESULTS

3.1 VEGETATION COMMUNITIES

Refer to the site layout in figure 1, study site vegetation map in figure 5, appendix 3 for the species list, and the following photos (see appendix 4 for more site photos).

The study site contains 3 vegetation communities (one natural, one modified, one artificial) which were identified according to structural form and dominant canopy/understorey species (McDonald *et al* 1990, Keith 2004, Beadle and Costin 1952). The identified communities are derived from edaphic (eg slope, moisture, soil type, drainage and aspect) and landuse/disturbance factors. A small dam was also noted to contain some aquatic vegetation.

3.1.1 Very Tall Open/Dry Sclerophyll Forest

Distribution: This community generally occupies the upper slope and crest of the hill in the 7(d) zone, merging over a broad ecotone with the agricultural woodland.

Structure and Species Composition:

(a) Canopy:

Structure and species: Varying slightly with position, the dominant species was Scribbly Gum (*Eucalyptus signata*) and Blackbutt (*E. pilularis*). Common associates included Pink Bloodwood (*Corymbia intermedia*), Tallowwood (*E. microcorys*) and Needlebark Stringybark (*E. planchoniana*).

Canopy height is 20-25m, with about 50-70% canopy cover. Trunk DBH (diameter at breast height) ranges from 40cm-1m; though most trees are 40-80cm (hence it is predominantly even aged).

(b) Understorey:

Structure and Species: Ranges from poorly developed to open, with two stratums. The upper stratum is generally open and consists of younger eucalypts 10-18m tall. The lower stratum (3-8m) is sparse to dense, and essentially consists of a sparse to patchy mix of Jackson Bay Pine (*Callitrus rhomboidea*) and Black Oaks (*Allocasuarina littoralis*).

(c) Shrub layer:

Structure: Generally sparse but persistent; 0.5 to 2m high.

Species: Dominated by Hopbush (*Dodonaea triquetra*) and Flat Pea (*Platylobium formosum*). Some other common species include Dogwood (*Jacksonia scoparia*), Black Oak, mixed juvenile eucalypts (mostly Scribbly Gum), Cheese Tree *(Glochidion ferdinandi*), Maidens Wattle (*Acacia maidenii),* Broad-Leaved Geebung, *Lomatia silaifolia*, Slender Rice Flower (*Pimelea linifolia*), Hard Quandong and *Daviesia squarrosa*.

(d) Ground-layer:

Structure: Sparse with a small dense patch, or very low, depending on species and canopy cover. Height ranging from 0.02-0.5m

Species: Grades from pastoral grasses such as Carpet Grass (*Axonopus affinus*) and Couch (*Cynodon dactylon*) upslope into a sparse cover of Wiry Panic (*Entolasia marginata*), Bladey Grass (*Imperata cylindrica*), Bracken Fern (*Pteridium esculentum*). Spiny-Headed Matrush (*Lomandra longifolia*), Kangaroo Grass (*Themeda australis*) and Basket Grass (*Oplismenus aemulus*).

(e) **Climbers and Scramblers**

Climbers and scramblers were very limited with a few *Smilax australis*, *Smilax glyciphylla*, Wombat Berry (*Eustrephus latifolius*)*, Glycine microphylla, Hardenbergia violacea,* Scrambling Lilly (*Geitonoplesium cymosum*), and Climbing Guinea Flower (*Hibbertia scandens*) noted in more protected areas.

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Comments: Floristic and structural changes throughout this community have been influenced by edaphic factors such as drainage, soil moisture content, soil depth, canopy cover, etc, and disturbances, particularly underscrubbing and pastoralism.

3.1.2 Very Tall Open Woodland/Agricultural Woodland

Distribution: This community generally occupies the 2(a) zone and lower half of the 7(d) zone.

Structure and Species Composition:

(a) Canopy:

Structure and species: Very open, with most trees yet to reach maturity. Consist of similar mix to the adjacent forest from which it has been derived via selective clearing and underscrubbing associated with pastoralism. Height and trunk diameter in similar ranges.

(b) Understorey:

Structure and species: Very poorly defined and open, generally limited to band of trees along the mid-west and some denser clumps of trees (eg around the dam). Generally 4-12m high with trunk DBH<20cm. Consists of a mix of species including young canopy species, Geebung (*Persoonia conjuncta*), Hickory Wattle (*Acacia implexa*), White Sally (*Acacia floribunda*). *Jacksonia scoparia* is an occasional occurrence.

(c) Shrub layer:

Structure and Species: Generally absent but for a few young Acacias (ie Hickory Wattle, Sally Wattle and *Acacia suaveolens*) and Hopbush at bases of trees.

(d) Groundcover:

Structure and Species: Generally reasonably dense except in the more recently disturbed and/or shaded areas. Height ranging <0.3m. Dominated by pastoral grasses such as Carpet Grass and Couch, with common herbs and weeds eg Fireweed (*Senecio madagascariensis*) and Dandelion (*Taraxacum officinale*). In less disturbed sections, Bracken Fern and Gristlefern (*Blechnum indicum*) are common.

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Photo 1: Dry sclerophyll forest upslope of development footprint

Photo 2: Classic agricultural woodland within development footprint

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(**e**) **Climbers and Scramblers**

Absent.

Comments: This community has been derived from dry sclerophyll forest by active management to establish improved pasture species and suppress regrowth.

3.1.3 Ornamental Gardens and Lawns

This "community" is simply the ornamental lawns and gardens around the existing dwelling. No description is given as this community has no conservation or habitat significance.

3.1.4 Aquatic Vegetation

Occurrence and Size:

A small dam occurs under the densest clump of trees within the 2(a) zone. The wall has been breached to drain the dam over at least a year ago, thus only a small pool of ephemeral water may now form during wet periods. The dam has a diameter of approximately 10m, though only an area <2m diameter may contain water. Water depth is approximately 20cm.

Water Quality:

At the time of the survey the water in the dam was of low quality (ie black) as it consisted of rain that fell consistently over the survey period stained with tannins.

Vegetation:

The majority of the dam floor is covered by Carpet Grass with some pioneer shrub species ie wattles and Hopbush. Around the central pool is a small patch of *Juncus* spp with some *Isolepis* spp <20cm high

Comments: This dam is likely to be dry at most times, as evident by colonisation of Carpet Grass and the aquatic vegetation consisting of species which can tolerate ephemeral drying.

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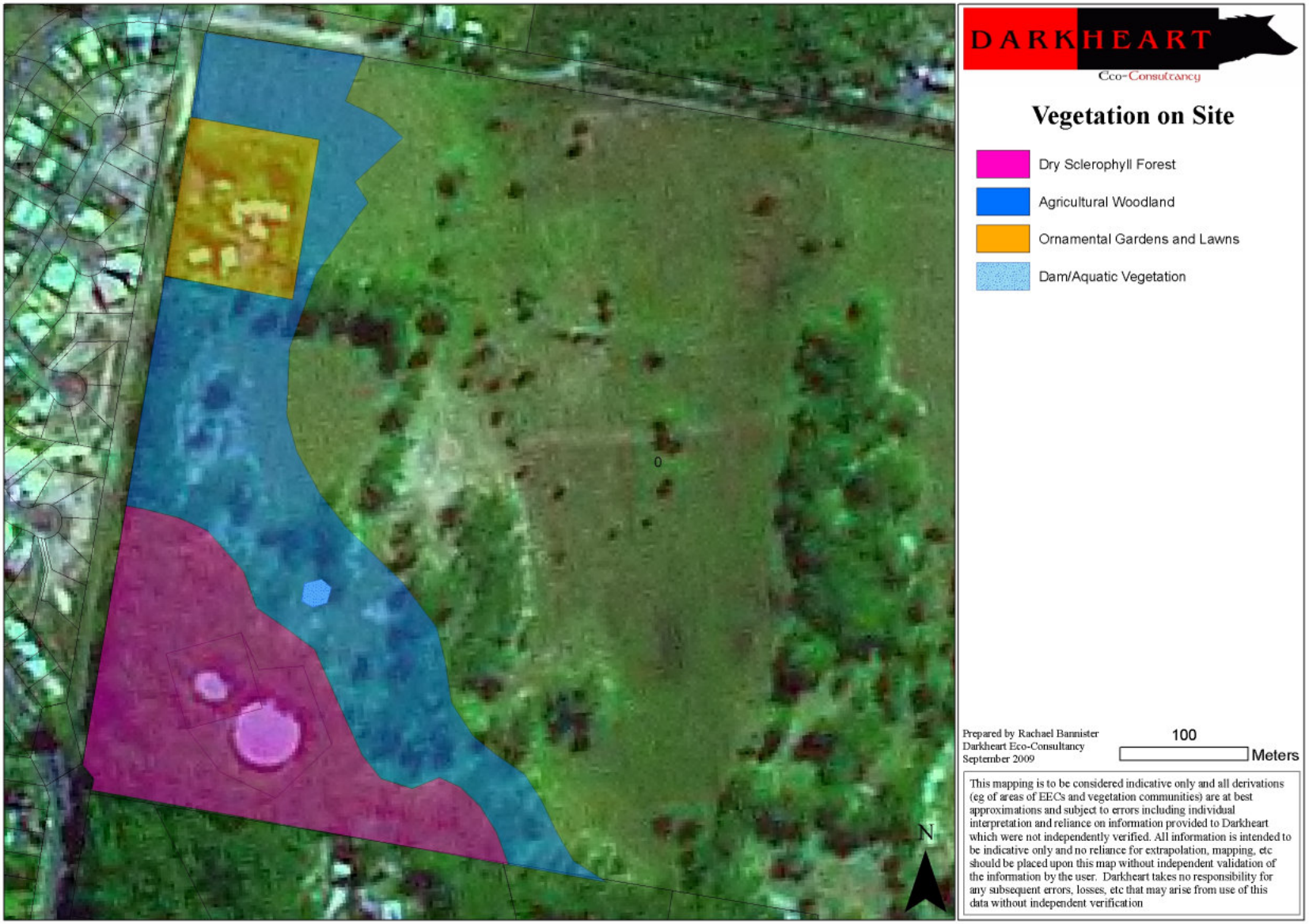
Figure 5: Site vegetation map
(base map provided by King and Campbell Pty Ltd)



3.2 FLORA OF CONSERVATION SIGNIFICANCE

3.2.1 Threatened Species

3.2.1.1 Targeted Searches Results

No threatened flora species were recorded on the site/study area by the survey.

3.2.1.2 Assessment of Threatened Species Occurrence Probability

3.2.1.2.1 Atlas of Wildlife/Bionet/Literature Records

Appendix 1 evaluates the potential site/study area occurrence of threatened flora species recorded or considered potential occurrences in the locality due to records in the North Coast bioregion in habitats similar to that in the locality and on site/study area.

In regards to the potential occurrence of threatened flora, it should be noted that threatened plants often occur in habitats with a precise mix of essential ecological requirements, and not randomly in the landscape or a broad structural form of vegetation (eg dry sclerophyll forest). Such essential requirements may be a complex nexus of position, soil type (which affects fertility, acidity, etc) and climate, but may also include specific (sometimes symbiotic) association with fungi and bacteria (eg Proteaceae), dispersal vectors (eg bats) and disturbance regimes eg *Acacia aprica* will not recruit without a suitable fire regime (Vallee *et al* 2004, Cropper 1993, Brown *et al* 2003). Absence of such essential habitat variables or their modification (eg by disturbance such as frequent fire) can thus reduce or negate a site's potential for such plants to occur. These often poorly understood ecological factors are also a major contributor in the reason that many translocations of threatened plants fail (Vallee *et al* 2004, Cropper 1993, Brown *et al* 2003, Bennet *et al* 2000).

3.2.1.2.2 Conclusion

The study site demonstrates signs of a range of disturbances including extensive and at times very intensive clearing, logging and horticultural activities. The impacts of clearing/logging are clearly evident when comparing vegetation communities on site with more mature and floristically diverse habitats on adjacent land to the south and west. It is considered likely that the disturbances to the site have resulted in habitat changes (eg to microclimates, soil characteristics, etc) that may have effectively precluded threatened flora species from occurring on the site.

The above and survey results appear to suggest that the presence of a population of threatened plants on site is most unlikely due to lack of other proximate populations, disturbance history and/or suitable habitat. Consequently, no threatened plant was considered a significant potential occurrence in Appendix 1, and none are considered in later statutory assessments.

3.2.2 Threatened Communities and Populations

3.2.2.1 Study Area Recorded Endangered Ecological Communities (EECs)

No EECs currently or preliminarily listed under the TSCA or EPBCA were recorded on the site.

3.2.2.2 Other Listed TECs and Endangered Populations

The site and study area does not contain any vegetation community or population listed as threatened under the TSCA 1995 or EPBCA 1999 (www.environment.nsw.gov.au and www.environment.gov.au accessed 7/9/09). The EECs – *Swamp Sclerophyll Forest* and *Freshwater Wetlands on Coastal Floodplains* occurs on nearby land to the far northeast on the floodplain of Saltwater Lagoon (Kendell

and Kendell 2003, Connell Wagner 2005).

3.3 FAUNA HABITAT DESCRIPTION AND EVALUATION

Refer to Appendix 1 for habitat requirements of relative cited threatened fauna.

3.3.1 Potential Habitat/Components For Threatened Species

3.3.1.1 Arboreal Habitat

3.3.1.1.1 Tree Hollows

Tree hollows are considered to be a critical habitat component for many threatened fauna (Gibbons and Lindenmayer 2002, Smith *et al* 1995, Austeco Pty Ltd 1994, NPWS 1999a, 2000a, NSWSC 2007a, etc).

ERM (2006b) provided an estimate of hollow abundance in the 7(d) zone. They recorded hollow apertures ranging from small (<5cm), medium (6-10cm), large (11-15cm) and very large (>16cm). Small hollows were most common. Small to medium hollows are preferred by Yangochiropteran bats, Squirrel Gliders and Brushtail Phascogales, while larger hollows are required by Quolls, forest owls and the Glossy Black Cockatoo (Bird Australia 2001, Gibbons *et al* 2002*,* Cameron 2006, Gibbons and Lindenmayer 2002, DECCW 2009b). ERM (2006b) estimated that some 60 hollow-bearing trees with over 245 hollows may occur in the 7(d) area. However, it should be noted however that hollow aperture size is not representative of internal dimensions and ground-based observers have limited ability to ascertain presence of formed cavities (Gibbons and Lindenmayer 2002, pers. obs.), hence the actual abundance of habitable hollows is likely to be somewhat less than estimated by ERM (2006b).

Most fauna (excluding nesting birds) also exhibit denswapping (Gibbons and Lindenmayer 2002, NSWSC 2007a) ie using multiple hollows over the landscape due to predator evasion, parasite build-up, social matrices and varying qualities of the hollows eg presence of water, dimensions (eg capable of supporting a family group or individual). Hence inter and conspecific competition will also influence hollow availability (Gibbons and Lindenmayer 2002, NSWSC 2007a).

Hollows also occur with less frequency in the 2(a) zone (as noted by ERM 2007). Six trees in the development footprint were noted to contain hollows or upturned knobs on the trunk which may contain formed hollows (see table 11).

Overall, hollows on site/property provide potential roosting, shelter and denning opportunities for a range of small to medium-large hollow obligated fauna (based on aperture diameter requirement), including threatened Yangochiropteran bats, the Squirrel Glider, Yellow-Bellied Glider (*Petaurus australis*), Brushtailed Phascogale (*Phascogale tapoatafa*), and Spotted-Tailed Quoll (*Dasyurus maculatus*) (Gibbons and Lindenmayer 2002, Smith *et al* 1995, Austeco Pty Ltd 1994, Birds Australia 2004, Gibbons *et al* 2001). The few larger hollows present in the 7(d) zone may be structurally suitable for forest owls such as Barking Owl (*Ninox connivens*) and Masked Owl (*Tyto novaehollandiae*) or the Glossy Black Cockatoo (Gibbons and Lindenmayer 2002, NSWSC 2007a, Cameron 2006).

3.3.1.1.2 Nectar and Pollen Sources

Table 2 lists the main potential nectar and pollen food sources on site/property:

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Table 2: Flowering periods of canopy and understorey species

SPECIES	FREQUENCY	FLOWERING SEASON
Corymbia intermedia	Uncommon	Late Summer-early Autumn
Eucalyptus planchoniana	Common	Summer
E. signata	Dominant	Summer
E. siderophloia	Very rare	Late Spring-early Summer
E. microcorys	Occasional	Winter-early Summer
E. pilularis	Dominant	Summer (sometimes Winter)

Winter flowering species are particularly critical for arboreal mammals (eg Squirrel Glider and Yellow-Bellied Glider) and nomadic nectarivores (eg Regent Honeyeater, Little Lorikeet, Swift Parrot and Grey Headed Flying Fox) due to the shortage of food resources in this period (Menkhorst *et al* 1999, Eby 2000a, 2000b, Smith *et al* 1995, Smith and Murray 2004, etc). As shown in the table above, the site/property is dominated by Summer flowering species. Tallowwood may be considered a significant flowering resource as it may flower in Winter. Overall though, the site/property has very limited potential to provide year round flowering sources due to the limited abundance and diversity Autumn-Spring flowering species, hence this may result in limited resources during this period.

3.3.1.1.2 Other Habitat Resources

The decorticating bark of Blackbutt and Scribbly Gum is considered to provide a good substrate for invertebrates. The deep fibrous bark of rough-barked species such as Needlebark may also provided good substrate for invertebrates, which in turn may provide potential foraging substrate for arboreal mammals eg Yellow-Bellied Gliders and Squirrel Gliders (Braithwaite *et al* 1984, NPWS 2002b, Quinn 1995), and birds for invertebrate prey.

Pink Bloodwood and Scribbly Gum are potential preferred sap sources for the Yellow-Bellied Glider (Lindenmayer 2002, NPWS 1999, Smith *et al* 1995, NPWS 2003b). The Squirrel Glider and the common Sugar Gliders (*Petaurus breviceps*) also tap eucalypts for sap, with Pink Bloodwood, Scribbly Gum and Grey Ironbark observed to be a very significant sap source at Crottys Lane, Kempsey (Berrigan 1999a), Arakoon (Berrigan 2000b, 2000g, 2000d, 2002e), western South West Rocks (Darkheart 2004f) and Gumma (Berrigan 2002c).

3.3.1.2 Yangochiroptera Bats

3.3.1.2.1 Foraging Opportunities

The site/study area/property offers a range of foraging opportunities for threatened Yangochiropteran bats due to the pattern of vegetation and structure as follows (Churchill 2009, DECCW 2009b, ABS 2009, Smith *et al* 1995, Strahan 2000):

(i) <u>*Supra canopy zone*</u>: The continuous canopy over the dry sclerophyll forest is ideal for aerial intercept species flying over the canopy. Threatened species that could forage in this stratum are: Yellow-Bellied Sheathtail Bat (*Saccolaimus flaviventris*), Eastern Bent-Wing Bat (*Miniopterus schreibersii*), Little Bent-Wing Bat (*M. australis*), Hoary Bat (*Chalinolobus nigrogriseus*), Beccari's Freetail Bat (*Mormopterus beccarii*) and East-Coast Freetail Bat (*Micronomus norfolkensis*).

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(ii) *Sub-canopy zone*: The agricultural woodland which dominates the site/study area lacks any significant understorey and provides potential foraging habitat for more manoeuvrable species or those that prefer more open habitats such as the Hoary Bat, Eastern Bent-Wing Bat, Little Bent-Wing Bat, East Coast Freetail Bat and Greater Broad-Nosed Bat (*Scoteanax rueppellii*).

(iii) *Forest interface*: The dry sclerophyll forest/woodland interface provides suitable structures for species that forage on the interface between forest and open areas, or hovering/gleaning species, such as East-Coast Freetail Bat, Greater Broad-Nosed Bat, Eastern Bent-Wing Bat, Little Bent-Wing Bat and Hoary Bat.

(iv) *Aquatic*: The former dam on site is not considered suitable for foraging by the Southern Myotis as only a very small pool of water may develop due to the excavation of a channel on the dam wall.

3.3.1.2.2 Roosting Opportunities

There are no caves, cliffs, or overhangs on or adjacent to the site/property, which probably precludes species depending on such resources to breed or roost in, unless they are known to forage widely from such habitat components, or utilise alternative roosts (eg tree hollows) during non-breeding stages (and hence not depending on key maternity sites eg the Bent-Wing Bats). The nearest known caves are sea caves north of Smokey Cape (pers. obs.) which are not known major bat roosts (pers. obs).

As detailed previously, tree hollows are relatively common on and especially adjacent to the site with a good number considered structurally suitable for roosting by hollow-obligate bats (depending on a complex interaction of factors such as hollow microclimate, season, sex and life cycle stage of the bat species as well as predation risk and competition with other species – Churchill 2009, Smith *et al* 1995, Anna Lloyd, EcoLocation pers. comm.). Trees with decorticating bark (eg Blackbutt and less so Scribbly Gums) may also provide non-breeding roosting opportunities for species capable of utilising such resources (at least seasonally). Dwellings and sheds on and adjacent to the site may also offer some limited potential as roosts (Churchill 2009, DECCW 2009b, Smith *et al* 1995, Strahan 2000).

3.3.2 Site/Study Area/Property's Habitat Limitations For Threatened Species

The site/study area/property lacked significant habitat or key habitat components for a range of threatened species eg no dense groundcover for the Common Planigale, no rainforest for the Wompoo Fruit-Dove, etc. These limitations are highlighted in the table below.

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Table 3: Limitations of site/study area's habitat for threatened species

HABITAT	STATE OF HABITAT ON SITE/STUDY AREA	THREATENED SPECIES AFFECTED
Groundcover	Poorly developed/absent: • Lack of cover/extensive cover. • Lack of habitat connectivity. • Lack of foraging resources (seeds, shoots, invertebrates).	Common Planigale, Eastern Chestnut Mouse Grass Owl Three-Toed Snake-Toothed Skink Threatened passerines
Leaf Litter	Poorly developed/absent: • Lack of cover. • Lack of foraging resources (fungi, invertebrates).	Long Nosed Potoroo Brushtailed Phascogale Common Planigale Three-Toed Snake-Toothed Skink
Flowering Eucalypts	Limited occurrence/diversity: • Seasonal shortages in nectar flows eg Winter	Grey-Headed Flying-Fox Eastern Blossom Bat Squirrel Glider Yellow-Bellied Glider Little Lorikeet Regent Honeyeater Swift Parrot
Aquatic	No creeks, lakes, or similar habitat. Former dam offers very limited potential: • Very ephemeral area of habitat. Lack of sufficient aquatic vegetation for cover, prey habitat, etc. • Prone to drying out before breeding cycle completed. • Insufficient area or ability to provide sufficient prey or breeding habitat for waterfowl.	Green-Thighed Frog Green and Golden Bell Frog, Wallum Froglet, Wallum Sedge Frog, *Mixophyes* frogs, Southern Myotis, Waterfowl (eg Bitterns, Jabiru) Other frogs (prey).
Fruiting Species	Absent • No forage for dependant species.	Wompoo Fruit Dove Rose-Crowned Fruit-Dove Barred Cuckoo-Shrike Grey-Headed Flying-Fox
Caves, Cliffs, Overhangs	Absent: • Absence of key diurnal, nesting, torpor or colonial roost sites.	Osprey Sooty Owl Eastern Cave Bat, Little and Common Bent Wing Bats etc
Allocasuarina species	Present but only in limited abundance in the forest	Glossy Black Cockatoo
Logs and Stumps	Absent on the site. Stumps and sizeable logs are rare in the 7(d) zone, and have no hollows. Some minor potential to support prey species.	Spotted Tail Quoll Brushtailed Phascogale Common Planigale Three-Toed Snake-Toothed Skink
Rocky Outcrops	Some exposed bedrock but lack significant cracks, etc which are not filled with earth. No large slabs of exfoliated rocks. Constructed rock wall around tanks offers some limited cracks - limited refugia for reptiles and mammals.	Stephens Banded Snake Pale Headed Snake Common Planigale Yangochiropteran bats
Small Terrestrial Prey	Not detected (see Elliot A results), or detected in low abundance and diversity ie Grass Skinks.	forest owls Stephens Banded Snake Pale Headed Snake Spotted Tail Quoll Brushtailed Phascogale

Appendix 1 assesses the potential for locally and regionally recorded threatened species to potentially occur on the study site due to these constraints.

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3.3.3 Potential Habitat for Common Species

The site was found to contain some suitable habitat for a range of common species but was subject to limitations as detailed in the table below.

Table 4: Habitat for commonly occurring species

SPECIES	HABITAT POTENTIAL/LIMITATIONS	SPECIES	LIKELY ABUNDANCE/DIVERSITY ON SITE
Terrestrial Species (ie rodents, common dasyurids)	Overall habitat for these species is limited or absent	Bush Rats, Black Rats, Brown Antechinus, Common Dunnart, House Mouse, etc.	Low
Arboreal fauna	Site offers some hollows, sap and nectar resources, rough barked species which may house invertebrates etc.	Sugar Glider, Possums	Fair to very good
Reptiles	Minimal – lack of any refugia. Better potential upslope in exfoliating granite.	Lace Monitor, Red-Bellied Black Snake etc.	Very low to absent
Aquatic	Very limited in former dam, only present after rainfall	Common Eastern Froglet, Red Backed Toadlet etc	Low to absent

Overall, the site is unlikely to support a high abundance/diversity of non-common modified woodland species which therefore limits the potential for threatened raptors (eg forest owls) and other predators to regularly forage on site.

3.4 WILDLIFE CORRIDORS AND KEY HABITATS

Habitat links are evaluated in this report as links from habitat on-site directly to similar habitat on adjacent land. These would be used by fauna which depend solely or at least partially on the site for all of their lifecycle requirements, and/or dispersal (Lindenmayer and Fisher 2006). Wildlife corridors are the collection of habitat links and interconnected areas of habitat over a broader landscape that facilitates genetic flow and seasonal movements (Lindenmayer and Fisher 2006). Regional corridors are evaluated as per Scotts (2002) definitions and the mapping by the DECCW (DECCW 2009c).

Refer to the aerial photo in figure 6. This photo is considered to represent the current state and distribution of vegetation on and adjacent to the site.

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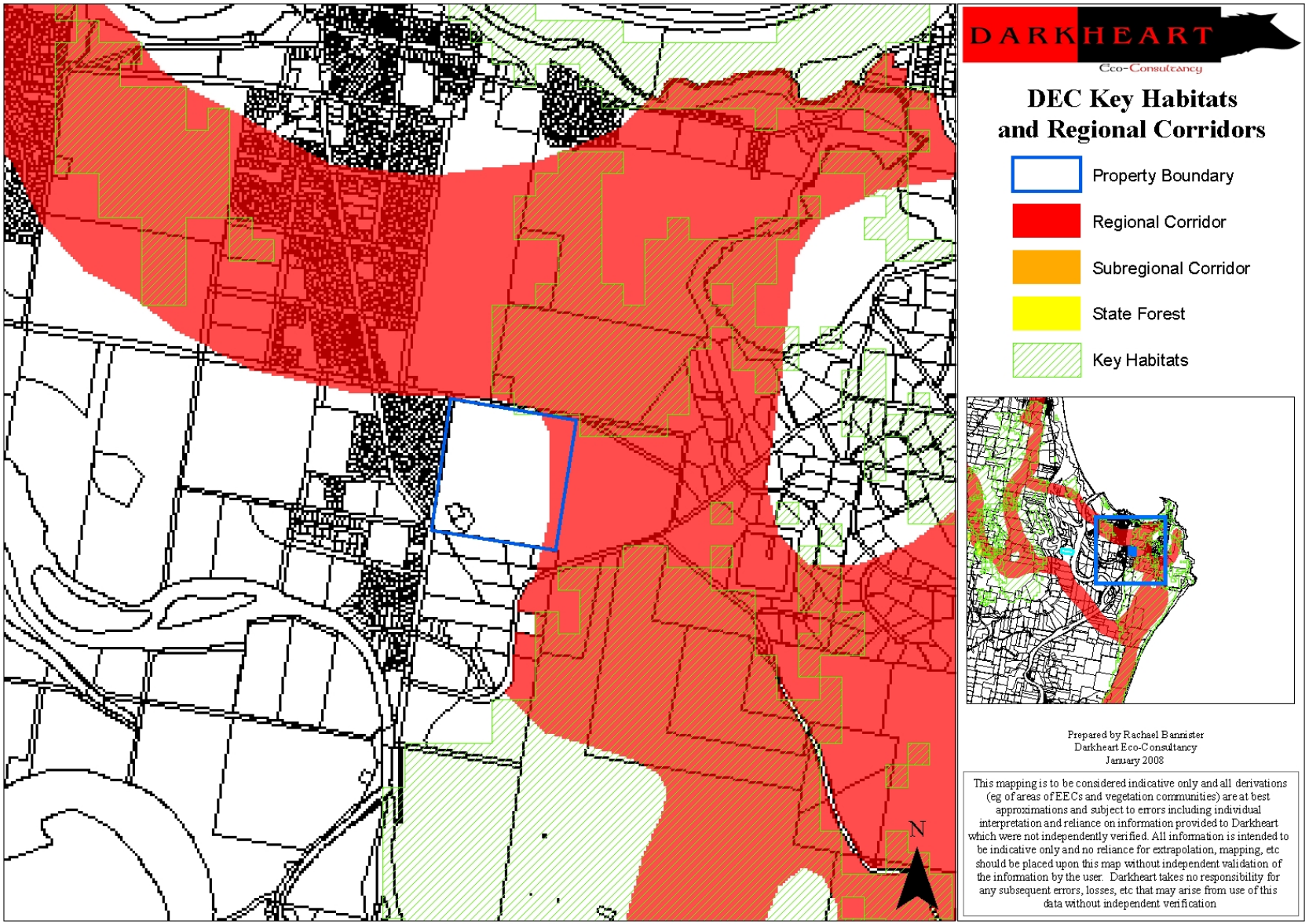
Figure 6: Aerial photo of study area

(© King and Campbell 2007). Note some vegetation patterns have altered since this photo was taken eg western boundary

Figure 7: Regional/Sub-Regional Corridors and Key Habitats
(© DECCW 2009c)



3.4.1 Habitat Links

Refer to the aerial photograph in figure 6. The connectivity of the site/property with surrounding habitat is summarised below:

- *North/Northeast*: No significant linkages due to the extent of previous clearing and pastoralism, followed by golf course and other development on adjoining land. Current tentative linkage via a virtually linear but discontinuous stand of trees along the western boundary will be broken via impending removal for approved stages of the subdivision, and lack of sufficient connectivity to vegetation north of the property.
- *South*: Maintains excellent connectivity to area of increasingly fragmented forest which eventually links to Hat Head National Park to the south and east. Lower stratums limited by underscrubbing, fuel reduction, etc, in many areas, and increasing development.
- *West*: Effectively isolated via relatively recent (<15yrs) residential development from highly significant habitat in western South West Rocks (eg Darkheart 2006f, 2006j, 2004f, 2004j, 2004x, Berrigan, 2000a, 2000b, 2000c, 2002a, O'Neil and Williams 2003).
- *East*: Maintains excellent connectivity with partially fragmented forest, which eventually links to Hat Head National Park. Lower stratums limited by underscrubbing, fuel reduction, etc, in many areas.

This extent of available forested/woodland habitat in the study area indicates the forested southern portions of the site/property and adjacent linkages to the south and east, are likely to be suitable for dispersal by a reasonably wide variety of species including terrestrial fauna (excluding those dependent on well developed groundcover due to the lack of development of this component) to more mobile species capable of traversing cleared or forested habitats. Species present on site/property with large home ranges are also likely to extend their range onto this adjacent habitat, and potentially interbreed with members of other populations in the area due to the connectivity with similar habitat on adjacent land eg dry sclerophyll forest extends to the west and south.

3.4.2 DECCW Wildlife Corridors and Key Habitats

3.4.2.1 General

The DECCW has modelled and mapped corridors at a regional scale throughout northern NSW and the corresponding map for the locality was accessed via the website (www.maps.nationalparks.nsw.gov.au/keyhabs/default.htm), and is shown in figure 7.

3.4.2.2 Regional Corridors and Sub-Regional Corridors

Regional corridors are typically >500m wide and provide a link between major and/or significant areas of habitat in the region. Ideally they are of sufficient size to provide habitat in their own right and at least twice the width of the average home range area of fauna species identified as likely to use the corridor (DECCW 2009c, Scotts 2002). Sub-regional corridors connect larger landscaped features and are of sufficient width to allow movement and dispersal (generally >300m), but may not provide substantial species habitat (DECCW 2009c, Scotts 2002).

Figure 7 shows the eastern margin of the property (but not the site) falls just inside the regional corridor which generally falls over Hat Head National Park in the east and continues north (then northeast) and south along the coast line, with a branch heading west (over residential land) just north of the property. Linkages to the west are very poor due to extensive residential development which has accelerated in the last 20yrs (Darkheart 2004f, 2006k, O'Neil and Williams 2003), hence the functional effectiveness of the corridor in this direction is considered at best severely limited for all but flying species. Habitat to the east is likely to be more suitable as a movement corridor due to its connectivity with habitat in all directions ie the site is fragmented internally and has limited habitat linkage to the northeast and east.

The site/property is not mapped as forming part of any sub-regional corridor.

3.4.2.3 Local Corridors

Local corridors provide connections between remnant patches of habitat and landscape features. Due to their relatively small area and width (they may be <50m) these corridors are subject to edge effects (DECCW 2009c).

As stated in section 3.5.1, the site/property only has substantial connectivity via forest to the south and east which eventually links to Hat Head National Park. Connectivity to the west for non-flying species is effectively severed by residential development, and severely hampered to the north by approved establishing subdivision in the northern end of the property, and pasture and other landuses on adjoining land to the north eg golf course and other approved subdivisions (Connell Wagner 2005).

3.4.2.4 Key Habitats

Key habitats are defined as "*areas of predicted high-conservation value for priority forest fauna assemblages, endemic forest vertebrates or endemic invertebrates*" (Scotts 2002).

As shown in figure 7, the remaining forest on the property is not mapped as Key Habitat, nor is most of the remaining forest to the south, despite records of threatened species such as Squirrel Gliders, Brushtailed Phascogales, Glossy Black Cockatoo, and various bats (Berrigan 2002a).

3.5 FAUNA SURVEY RESULTS

3.5.1 Call Playback, Identification and Recording

3.5.1.1 Birds

Call playback failed to gain a response from any of the target birds (ie Bush-Stone Curlew, Barking, Powerful and Masked Owls). Some common birds were detected by call identification (see table 3).

3.5.1.2 Frogs

Frog calls were heard in the dam after a sufficient level of rain which occurred during the survey. Despite these conditions, only the Common Eastern Froglet was detected which was reasonably expected given the tolerance of this frog for modified habitats (Cogger 2002, Anon 2002, Anstis 2002).

3.5.1.3 Mammals

3.5.1.3.1 Arboreal Mammals

No Yellow-Bellied Gliders responded to either recorded Yellow-Bellied Glider territorial calls or Powerful Owl calls, confirming the failure of many previous local surveys to detect this species (eg Darkheart 2006f, 2006j, 2004f, 2004j, 2004x, 2000a, 2000b, 2000c, 2002a, Parker 1996, O'Neil and Williams 2003, Connell Wagner 2005).

Koala and Squirrel Glider call playback also failed to gain any responses. No response was made to these calls from adjoining land.

3.5.2 Trapping and Hair Tube Results

Elliot B trapping resulted in the capture of a single adult male Squirrel Glider and a single Sugar Glider along the ridge line adjacent to the water tanks. This species is listed as Vulnerable under the TSCA.

Hair tubes and Elliot A trapping failed to record any results.

3.5.3 Spotlighting, Secondary Evidence and Opportunistic Observations

3.5.3.1 Spotlighting and Torch Searches

No threatened species were observed during spotlighting activities. Brushtail Possums were observed on a number of occasions in trees on the site's eastern boundary. A Southern Boobook Owl (*Ninox novaeseelandiae*) and domestic cat were also observed in this area on one occasion.

3.5.3.2 Secondary Evidence

3.5.3.2.1 Scratches

Tracks and scratches were observed on smooth bark species though the intensity of scratching did not indicate high use. Scratches were most likely due to Laced Monitor, possum and glider activity with no Koala scratches detected.

3.5.3.2.2 Bones, Scats and Tracks

No scats, tracks or bones of any threatened species were detected on site. Scats from the Eastern Grey Kangaroo were commonly observed. Scat detection was hindered by the heavy rainfall experienced over the survey period.

3.5.3.2.3 Feeding Signs

(i) ***Sap Sucking - Arboreal Mammals***

Only a handful of small incisions were noted in some Scribbly Gums on the ridgeline. The small size and position on the tree suggested Squirrel Gliders or Sugar Gliders not the Yellow-Bellied Glider were responsible (NPWS 2003c).

(ii) ***Digging and Burrowing***

No burrows were detected during the survey. Some bandicoot diggings were observed around the base of some trees in the 7(d) zone.

(iii) ***Chewed Allocasuarina Cones***:

No chewed cones indicative of foraging by the Glossy Black Cockatoo were found.

3.5.3.3 Opportunistic Observations

3.5.3.3.1 General

Table 3 lists all the species detected by this survey on and directly adjacent to the study site by spotlighting, call detection, opportunistic recordings and habitat inspections. A total of only 9 birds, 4 mammals, 2 reptile and 1 frog were recorded.

3.5.3.3.2 Birds

No threatened or migratory birds under the EPBCA 1999 or TSCA 1995 were recorded during the survey. The recorded species were predominantly woodland species (eg Eastern Rosella, Galah, Willie Wagtail, Laughing Kookaburra, Noisy Miner, etc).

3.5.3.3.3 Reptiles

No reptiles were observed by the survey, though common Grass Skinks were observed in previous visits.

3.5.3.3.4 Mammals

The Eastern Grey Kangaroo was the only mammal opportunistically recorded during the survey.

3.5.3.3.5 Frogs

The Common Eastern Froglet was heard calling as listed previously.

Table 5: Fauna recorded on and/or adjacent to the site
bold indicates threatened species under the TSCA; # indicated threatened species under the EBPCA; * indicates introduced species.

GROUP	COMMON NAME	SCIENTIFIC NAME
BIRDS	Eastern Rosella	*Platycercus eximius*
	Laughing Kookaburra	*Dacelo novaeguineae*
	Willie Wagtail	*Rhipidura leucophrys*
	Grey Fantail	*Rhipidura fuliginosa*
	Galah	*Cacatua roseicapilla*
	Australian Magpie	*Gymnorhina tibicen*
	Australian Raven	*Corvus coronoides*
	Australian Wood Duck	*Chenonetta jubata*
	Rainbow Lorikeet	*Trichoglossus haematodus*
MAMMALS	Eastern Grey Kangaroo	*Macropus giganteus*
	Squirrel Glider	***Petaurus norfolkensis***
	Sugar Glider	*Petaurus breviceps*
REPTILES	Grass Skink	*Lampropholis delicata*
	Laced Monitor	*Varus varius*
FROGS	Common Eastern Froglet	*Crinia signifera*

3.6 DISCUSSION OF FAUNA SURVEY RESULTS

3.6.1 General

Despite the evidence of at times significant habitat modification and unfavourable weather conditions during the survey, the fauna assemblage detected on the site/property is generally consistent with species detected in similar habitats (see 3.7.2) in the Grassy Heads, Stuarts Point and South West Rocks area (Darkheart 2006f, 2006j, 2004f, 2004j, 2004x, 2000a, 2000b, 2000c, 2002a, Parker 1996, O'Neil and Williams 2003).

Arboreal mammal diversity was limited compared to nearby sites though generally typical of the habitat type as evidenced by surveys of similar habitat in the locality (Darkheart 2006f, 2006j, 2004f, 2000a, 2000b, 2000c, 2002a, Parker 1996, O'Neil and Williams 2003). Lack of moist sclerophyll is a limitation on the occurrence of some other species (eg Ringtail Possum), though the Brushtailed Phascogale was expected to be detected given local records in identical habitat within 1km (Darkheart 2004f, 2004j). Small terrestrial mammals were reasonably expected to be at best in low abundance and diversity due to the limited extent of dense groundcover and other refugia (Johnson *et al* 2007, Deacon 1998). The failure to detect any of these species is probably a combination of habitat quality and the poor weather. The very poor diversity of reptiles detected is also considered to be a reflection of these factors.

Bird abundance and diversity was limited as expected given the lack of well developed lower stratums over most of the study area, and lack of specific habitats such as rainforest, wetlands and estuarine habitats. Weather would have also played a major role on activity and detectability, as would the availability of flowering trees. Similarly for the frogs, the lack of a range of habitats precludes most species.

3.6.2 Comparisons With Other Surveys

3.6.2.1 Other Surveys of Seascape Grove

Umwelt (2004) conducted the most extensive survey of the larger portion of the property, with some limited work undertaken by ERM (2006b, 2007).

Umwelt recorded 16 bird, 3 frog (*Limnodynastes peronii* and *L. tasmaniensis*), 10 mammals (7 Yangochiropteran bats including the East-Coast Freetail Bat, Eastern Bent-Wing Bat and Little Bent-Wing Bat; and the Grey Headed Flying Fox) and 1 reptile (*Laced Monitor*) species. The other birds detected were mainly other agricultural woodland species or common wet pasture species ie Straw-Necked Ibis.

ERM (2006b, 2007) did not report recording any fauna.

3.6.2.2 Other Surveys of Similar/Identical Habitat in the Locality

Darkheart (2004f) provides the most comprehensive list of fauna detected in forest and woodland identical to that on site/property. This and other studies by the consultant and others have recorded the following species:

Table 6: Fauna recorded locally in identical habitat to that in study area
Bold indicates listed as threatened under TSCA 1995, * indicates listed as Migratory under EPBCA 1999, # indicates introduced

GROUP	COMMON NAME	SCIENTIFIC NAME
BIRDS	Whistling Kite	*Milvus sphenurus*
	Square-Tailed Kite	***Lophoictinia isura***
	Glossy Black Cockatoo	***Calyptorhynchus lathamii***
	Yellow-Tailed Black Cockatoo	*C. funereus*
	Sulphur-Created Cockatoo#	*Cacatua galerita*
	Galah#	*C. roseicapilla*
	Eastern Rosella	*Platycercus eximius*
	Laughing Kookaburra	*Dacelo novaeguineae*
	Black-Faced Cuckoo Shrike	*Coracina novaehollandiae*
	Grey Fantail	*Rhipidura fuliginosa*
	Rufous Fantail*	*R. rubiginosa*
	Golden Whistler	*Pachycephalia pectoralis*
	Red-Browed Finch	*Neochmia temporalis*
	Eastern Yellow Robin	*Eopsaltria australis*
	Silvereye	*Zosterops lateralis*
	Superb Fairy Wren	*Malurus cynaeus*
	White-Browed Scrubwren	*Sericornis frontalis*
	Leaden Flycatcher	*Myiagra rubecula*
	Restless Flycatcher	*M. inquieta*
	Brown Flycatcher/Jacky Winter	*Microeca flavigaster*
	Brown Thornbill	*Acanthiza pusilla*
	White-Cheeked Honeyeater	*Phlidonyria nigra*
	Lewins Honeyeater	*Meliphaga lewinii*
	Australian Pipit/Richard's Pipit	*Anthus novaeseelandiae*
	White-Throated Treecreeper	*Cormobates leucophaeus*
	Eastern Spinebill	*Acanthorhynchus tenuirostris*
	Spangled Drongo	*Dicrurus bracteatus*
	Brush Wattlebird	*A. chrysoptera*
	Noisy Miner	*Manorina melanocephala*
	White-Throated Warbler/Gerygone	*Gerygone oliveacea*

	Dollarbird	*Eurystomus orientalis*
	Fantailed Cuckoo	*Cuculus flabelliformis*
	Pallid Cuckoo	*C. pallidus*
	Wonga Pigeon	*Leucosarcia melanoleuca*
	Crested Pigeon	*Geophaps lophotes*
	Peaceful Dove	*G. striata*
	White Headed Pigeon	*Columba leucomela*
	Australian Raven	*Corvus coronoides*
	Pied Currawong	*Strepera graculina*
	Magpie	*Gymnorhina tibicen*
	Magpie Lark	*Grallina cyanoleuca*
	Grey Butcherbird	*Cracticus torquatus*
	Forest Kingfisher	*Todiramphus macleayii*
	Southern Boobook	*Ninox novaeseelandiae*
	Tawny Frogmouth	*Podargus strigoides*
	Masked Owl	*Tyto novaehollandiae*
MAMMALS	**Squirrel Glider**	***Petaurus norfolcensis***
	Sugar Glider	*P. breviceps*
	Brushtail Possum	*Trichosurus vulpecula*
	Ringtail Possum	*Pseudocheirus peregrinus*
	Brushtailed Phascogale	***Phascogale tapoatafa***
	Red-Necked Wallaby	*Macropus rufogriseus*
	Eastern Grey Kangaroo	*M. giganteus*
	Short-Beaked Echidna	*Tachyglossus aculeatus*
	Long-Nosed Bandicoot	*Perameles nasuta*
	Northern Brown Bandicoot	*Isoodon macrourus*
	Dog[#]	*Canis familiaris*
	Fox[#]	*Vulpes vulpes*
	Cat [#]	*Felis cattus*
	East-Coast Freetail Bat	***Micronomus norfolkensis***
	Beccari's Freetail Bat ("*possible*" call ID)	***Mormopterus beccarii***
	Hoary Bat	***Chalinolobus nigrogriseus***
	Gould's Wattled Bat	*Chalinolobus gouldii*
	Chocolate Wattled Bat	*C. morio*
	Little Bent-Wing Bat	***Miniopterus australis***
	Eastern Bent-Wing Bat	***Miniopterus orianae oceanensis[#]***
	a Forest Bat	*Vespadelus pumilis*
	a Forest Bat	V. *vulturnus*
	Eastern Broad-Nosed Bat	*Scotorepens orion*
	Undescribed Broad-Nosed Bat	*Scotorepens sp.*
	Greater Broad-Nosed Bat	***S. rueppellii***
	White-Striped Freetail Bat	*Tadarida australis*
	Brown Antechinus	*Antechinus stuartii*
	Dusky Antechinus	*A. swainsonii*
	Swamp Rat	*Rattus lutreolus*
	Bush Rat	*R. fuscipes*
	Common Dunnart	*Sminthopsis murina*
REPTILES	Garden Skink	*Lampropholis guichenoti*
	Common Bearded Dragon	*Pogona barbata*
	Nobby Dragon	*Gemmatophora nobbi*
	Laced Monitor	*Varanus varius*
	Eastern Brown Snake	*Pseudonaja textilis textilis*
	Green Tree Snake	*Dendrelaphis punctulata*
	Red-Bellied Black Snake	*Pseudechis porphyriacus*

FROGS	Common Eastern Froglet	*Crinia signifera*
	Red-Backed Toadlet	*Pseudophryne coriacea*
	Dusky Toadlet	*Uperoleia fusca*
	Green Tree Frog	*Litoria caerulea*
	Striped Marsh Frog	*Limnodynastes peronii*
	Dwarf Tree Frog	*Litoria fallax*
	Bleating Tree Frog	*L. dentata*

Table 4 thus shows that the species recorded on the site/study area are a sub-set of local diversity, and that additional species may occur depending on season, weather, forage availability (eg flowering trees), etc (DEC 2004).

3.6.3 Recorded Threatened Species: Site Occurrence Assessment

The Squirrel Glider was the only threatened species confirmed to occur on the site/study area during this survey. Umwelt (2004) also recorded the Grey Headed Flying Fox, Little Bent-Wing, East Coast Freetail Bat and Eastern Bent-Wing Bats on the larger property that the site is part of. The occurrence and significance of the site to these species is evaluated below.

As mentioned previously a number of other threatened species have been recorded in the locality, and some of these are considered a potential occurrence at least at some time, on the site/study area. This is discussed further in sections 3.7.4, 10.1 and Appendix 1.

3.6.3.1 Squirrel Glider

3.6.3.1.1 Ecological Profile

Inhabits dry sclerophyll forest and woodland (Suckling 1992, Lindenmayer 2002) though it has been recorded in areas bordering wet forest and rainforest (Lindenmayer 2002, Smith *et al* 1995). In NSW, the species has been recorded in a range of communities eg Blackbutt, Forest Red Gum and Red Bloodwood, Coastal Banksia heathland and Grey Gum/Spotted Gum/Grey Ironbark on central coast. On the mid-north coast, it has been recorded in Blackbutt-dominated coastal forest (AMBS 1996, Davey 1984, Quinn 1993); Needlebark-Blackbutt forest, Broad-Leaved Paperbark/Swamp Mahogany/Needlebark woodland (Bray, pers. comm. 1999); Scribbly Gum-Blackbutt dry sclerophyll (Berrigan 2002c, 2000d, 2000e, 2000f, Darkheart 2004c); in open dry sclerophyll forest dominated by *E. siderophloia* with E. *propinqua* and *E. acmenoides* near dry rainforest at Gowings Hill (Berrigan 2003a); dry sclerophyll dominated by White Mahogany associated with Grey Ironbark and Pink Bloodwood (Berrigan 1999a, Darkheart 2004a), though the latter may be an artificial population established by rehabilitated releases. In areas west of the Dividing Range, Squirrel Gliders have been recorded in long linear road reserves, surrounded by cleared agricultural land (Gibbons and Lindenmayer 2002).

Arboreal and hollow-dwelling, this species feeds on eucalypt sap, nectar, pollen, Acacia gum, honeydew, insect exudates, and arthropods (particularly Coleoptera and Lepidoptera larvae), but has also been recorded killing and eating nesting and roosting birds and their eggs (Lindenmayer 2002). Prefers smooth-bark gums due to higher invertebrate diversity and propensity to develop hollows. Areas containing Winter flowering flora, eg eucalypts, Banksia (eg *B. integrifolia* and *B. serrata*), and gum-producing Acacia species are considered by some as likely to be key habitat (Menkhorst *et al* 1988, Quin 1993, Quinn 1995). *Xanthorrhoea* may also be used for nectar.

Hollows occur in live and dead trees, with the entrance size generally preferred to be just big enough to allow the animal and exclude predators (eg Laced Monitor) and competitors (eg Brushtailed Possum) (Gibbons and Lindenmayer 2002). Hollow-bearing trees occur in forest to woodland, though isolated trees have been known to be used (Gibbons and Lindenmayer 2002, Law *et al* 2000). Like the Sugar Glider, the Squirrel Glider is also a den-swapping species (utilising a number of hollows, not just one, within its home range), due to lifecycle

stages, predation, parasite build-up and season (and hence varying insulative properties of hollows) (Lindenmayer 2002, Gibbons and Lindenmayer 2002). The Sugar Glider uses up to 5 hollows in its range, and by inference (Gibbons and Lindenmayer 2002), the Squirrel Glider is likely to use a comparative figure.

The Squirrel Glider has been studied in Limeburners Creek Nature Reserve living in small groups (generally 1 male, at least 2 females plus juveniles) on home ranges of 2-4ha (densities approximately 0.9-1.5 individuals/hectare), which overlap with other groups to form a local population, which also overlaps with Sugar Gliders (Quin 1993). Lindenmayer (2002) provides a range of 3-5ha with a population density of 0.01-0.2/ha. Gilmore and Parnaby (1994) report a home range of 20-30ha in southern areas. A general range of 0.65-8.55ha is generally accepted (Quinn 1995) though home range is likely to be determined by habitat quality, although males move further than females.

Breeding occurs year round depending on food availability (up to two litters p.a.), with high mortality within the first 12 months (Suckling 1992). Juveniles remain in natal range for at least a year, with juvenile males experiencing aggression from dominant males (Quinn 1995). The Squirrel Glider lives in small family groups/colonies of up to 9 individuals, with a polygynous mating system, with males utilising opportunities to mate outside their colonies (depending on factors such as seasonal food availability, habitat distribution, etc) (Lindenmayer (2002).

Squirrel Gliders also often show dominance hierarchies, determined by aggressive interactions (Lindenmayer 2002). Studies have also shown the Squirrel Glider competes successfully for critical resources such as tree hollows with their closely related cousins, the Sugar Gliders (Lindenmayer 2002).

The Squirrel Glider is a gliding mammal, with distances of up to 50m recorded. The closely related Sugar Glider has also been detected running along the ground in habitats where tree distance prevented tree-to-tree glides (Lindenmayer 2002), though this is not considered a preferred method of movement due to predatory risk. Significant predators include foxes, cats, Laced Monitors, large forest owls and the Spotted-Tail Quoll (Lindenmayer 2002).

3.6.3.1.2 Site Occurrence Evaluation

As mentioned previously, a single adult male Squirrel Glider was recorded in the 7(d) zone near the water tanks along the ridge line. This result was highly expected given records in identical and interconnected habitat to the south and local area (eg Darkheart 2004f, O'Neil and Williams 2003, Berrigan 2003a). This capture confirms the presence of the species as predicted by ERM (2006b). As noted by ERM (2006b), the dry sclerophyll forest in this area has a localised concentration of hollow-bearing trees and contains Scribbly Gum and Bloodwood which have been recorded to be preferred sap sources in the area (Darkheart 2004f, Berrigan 2000a, 2000b, etc). Its main limitation is the lack of a diverse understorey containing other forage resource eg banksias and wattles, hence is not likely to be capable of supporting densities recorded in other parts of South West Rocks (Darkheart 2004f).

The species was not detected on the remainder of the study area despite thorough trapping, but this may have been due to factors such as weather, lifecycle stage, and flowering incidence (Smith and Murray 2003, Goldingay *et al* 2006, Goldingay and Sharpe 2004a, 2004b, Melton 2007, Quinn 1995, Sharpe in press, Sharpe and Goldingay 1998). The species is considered highly likely to venture into the spur of trees retained as open space in the earlier approved stage of the subdivision (especially due to the presence of suitable hollow-bearing trees), as evidenced by records in similar woodland within 1km of the site's south (Berrigan 2003a), east (Berrigan 2000c) and west (Darkheart 2006k, 2004f, Berrigan 2000a, 2000b, Bray 1999). It may also use clumps of trees and proximate individuals within the 2(a) zone which contain hollows or offer foraging resources, as part of its larger range.

As noted in section 2.3.1, the species has been recorded at a number of locations in the locality, including habitat interconnected to the site (eg Berrigan 2003a, DECCW Atlas of Wildlife 2009a) or nearby (Darkheart 2004f, Berrigan 2000a, 2000b, 2000c, 2003a); and in the Stuarts Point-Grassy Heads area (Darkheart 2004j,

2006j, 2007g). The species appears to be abundant in dry sclerophyll forest especially where the understorey contains banksias (Darkheart 2004f, Berrigan 2002c), as consistent with other studies (Smith and Murray 2003, Sharpe *in press*, Sharp and Goldingay 1998, Melton 2007, Quin 1995, 1993).

Given the recording of this species on site/study area, the habitat present on site/property (generally comprising about 4.18ha of forest) and in the general area; and the Squirrel Glider's ecology particularly with regards to the cited home range sizes of the species and gliding ability (up to 50m between trees – Lindenmayer 2002, Engel 2004), it is considered that the site and more so the 7(d) zone is overall is capable of supporting at least one colony of this species due to the range of foraging resources and the relative abundance of hollow bearing trees (though carrying capacity is limited by the lack of diversity in the understorey – Smith and Murray 2003). Members of the site/property's population can also readily physically move to connected habitat to the west, southwest and south, and given the known/potential existence of other colonies in these directions, the local population of interbreeding individuals would extend beyond the site/property's extent.

3.6.3.2 Yangochiropteran Bats

3.6.3.2.1 Ecological Profile

(a) Eastern Bent-Wing and Little Bent-Wing Bats:

Similar in appearance, these species are known to share roosting and nursery habitats. Both species mainly roost in caves, mines, culverts, tunnels, buildings etc generally located close to or within dense vegetation, although the Little Bent-Wing Bat has been recording roosting in banana bunches during Winter (Hulm 1994) and both species in tree hollows (Schultz, referred to in AMBS 1996b). Both species are limited by the availability of nursery caves. The Macleay valley has the southernmost population of Little-Bent Wing Bats, which seem to depend on a larger nursery colony of Eastern Bent-Wing Bats to provide environmental conditions (Dwyer 1991, 1968). These nursery caves are protected in Willi Willi National Park, and are the only Little-Bent Wing Bat maternity caves known in NSW (Smith *et al* 1995) as of 1983. Another maternity cave of the Eastern Bent-Wing Bat occurs near Riverton (western tablelands) (Dwyer 1966).

Most roost sites selected by colonies of the Eastern Bent-Wing Bat are typified by their spaciousness and usually ease of access (although some caves, eg the Willi Willi maternity cave, may have restricted entrances). Most roosts in northeast NSW are sufficiently deep to provide portions of complete darkness which these species prefer for roosting (Dwyer 1966, 1968, personal observations). Dwyer (1966, 1968) found that many caves and mines in northeastern NSW not occupied were often very small or had restricted entrances via complicated vertical drops. Small caves are typically not able to provide adequate darkness or humidity, while restricted entrances are unsuitable to these fast-flying and relatively non-manoeuvrable species (Dwyer 1966). Within a roost, bats normally occur in clusters of varying numbers arranged by sex and breeding status (Dwyer 1966, 1968).

These species move and utilise different kinds of roost according to various stages of the lifecycle (Strahan 1995, Dwyer 19966, 1968) ie:

- *Mating roosts*: Consist of a constant male colony visited by transient females (April to mid-June). The main mating cave in the region appears to in the Willi Willi area (Carrai) and Back Creek.
- *Over-Wintering roosts*: Formed from February to July (region dependant) as the colonies appear to widely scatter over the region utilising a range of smaller roosts (possibly as individuals and small Winter colonies in smaller caves, etc, or as sizeable groups of thousands eg Wombeyan), or some larger roosts eg Yessabah, where they may enter short term torpor. Such caves are likely to offer relatively low temperatures that approximate the Winter mean for the area. This patterns continues till they (when the season warms) move to,
- *Acclimatisation roosts*: Several formed en route to maternity colonies, gradually larger with proximity to maternity caves. Used to acclimatise to high humidity levels to be experienced in maternity caves. Utilised till they move to,

- *Maternity/nursery caves*: Peaks around September to November. Where young are born and left when old enough while female forages. For both species, these are located in Willi Willi Nature Reserve, with other nearby caves also serving key functions. Females disperse to mating roosts following this season (usually by March).

Immature bats also utilise specific roosts in the first year after leaving the nursery eg Yessabah. Hulm (1994) considers all such roosts to provide key lifecycle roles, and thus have to be protected.

The Eastern Bent-Wing Bat is considered a habitat generalist, foraging for insects above and below the canopy in well-timbered valleys, containing wet and dry tall forest. This species may migrate large distances to maternity sites, travelling 60-70km a night (females have been recorded moving >160km and juveniles dispersing >300km), utilising its range of roosts according to seasonal needs, age and reproductive status. This species occurs in discrete territorial populations based on maternity colonies whose ranges are often determined by watershed boundaries (Smith *et al* 1995), usually within 300km (Churchill 1998). Movement between territories is unusual, though distances of 1300km have been recorded (Churchill 1998).

The Little Bent-Wing Bat and Eastern Bent-Wing Bat generally forages above and beneath the canopy of tropical rainforest, warm temperate rainforest, tall open forest, riparian forest and dry sclerophyll forest, and in/on the edge of clearings adjacent to forest (Dwyer 1991, Smith *et al* 1995, Berrigan 2001d). Often recorded flying along tracks under canopy or forest edge (eg Berrigan 2001d, 2001e, 1998a, 1998b).

The main cause of mortality is young falling from the roof of nursery caves. Predators include the Green Tree Frog, pythons, feral cat, fox and owls (Dwyer 2000a, 2000b).

(b) East-Coast Freetail Bat:

Specific habitat requirements of the East-Coast Freetail Bat are poorly known. It has been recorded in habitats ranging from rainforest, wet sclerophyll and over riparian areas/streams, to dry sclerophyll and agricultural woodland, with most records in the latter two (Churchill 2009). It mainly roosts in small colonies in tree hollows (often in spouts, and with other species) and under loose bark (Churchill 2009), but has been recorded in various situations such as: roosting under house eaves and metal caps on telegraph poles; roosting in the roof of a school in Illawarra (Robinson 1985); roosting and foraging in Centennial Park in Sydney (Centennial Parklands 2009); and was a small colony was recorded in 1998 roosting in a church roof at Hat Head (Kempsey Argus 1999).

Wing morphology indicates the species is a fast flier with limit mobility (Bullen and MacKenzie 2001, Dwyer 1965, Kutt 1995, Churchill 1998, Rhodes 2002, Reardon *et al* 2008, Law *et al* 1999). It appears to forage above forest or woodland canopy, over and through gaps in forest, and in clearings adjacent to forest (Smith *et al* 1995, Allison 1991, Churchill 1998, 2009). This is evidenced by detections along the edges of the canopy, along forest tracks, and flying over canopy gaps (Makeham 2007, Lloyd *et al* 2006, Churchill 1998, Law *et al* 1999, Strahan 2000, Smith *et al* 1995, Lumsden and Bennet 2005, Law and Chidel 2002, Berrigan 2002c, 2001c, 1998, Darkheart 2004f, 2006e). This consultant has recorded the species foraging on edge of pasture and forest remnants with little or no undergrowth at Valla (Berrigan 1998a, 1998b), and foraging on edge of recently underscrubbed "parkland" and denser dry sclerophyll forest at Arakoon (Berrigan 2000c). Most records are of single individuals, and it is considered likely to occur at low densities over its range (Churchill 1998, 2009).

3.6.3.2.2 Site Occurrence Evaluation

In general, the site and adjacent habitats provide a range of potential foraging structures for the subject species (ie over the canopy in the more wooded areas, amongst the open structured vegetation, and along tracks and the interface between cleared/open areas and wooded areas.

There are no caves, cliffs, or overhangs on or directly adjacent to the site/property, which precludes species depending on such resources to breed or roost in, unless they are known to forage widely from such habitat components, or utilise alternative roosts (eg tree hollows) during non-breeding stages. Hollow bearing trees are abundant in the 7(d) zone (ERM 2006b, pers. obs.) with many of these considered potentially structurally suitable as roosting habitat for hollow-obligate bats (depending on a complex interaction of factors such as hollow microclimate, season, sex and life cycle stage of the bat species as well predation risk and competition with other species – Churchill 1998, 2009, Smith *et al* 1995, Ms Anna Lloyd - Eco-Location, pers. comm.). The trees with decorticating bark (ie Blackbutt and Scribbly Gum) may also provide variable temporary roosting opportunities for species capable of utilising such substrate (NPWS 2000a, Churchill 1998, 2009, Smith *et al* 1995).

Given the ecology of these species, their mobility and the extent of alternative known/potential habitat in the locality (eg Hat Head National Park, etc), the local population of all of the subject species would extend well beyond the confines of the study site/area/property.

3.6.3.3 Grey Headed Flying Fox

3.6.3.3.1 Ecological Profile

The Grey-Headed Flying Fox is an obligate nectarivore and frugivore, generally depending on a continuous nectar flow from *Eucalyptus*, *Melaleuca* and related genera, and fruits mainly from rainforest trees and vines (Eby 2000a, 2000b). In NSW, its diet is mainly flowers of Eucalypt, Melaleucas and Banksias which have more regular flowering patterns, hence the preference for these groups (Eby 2000a). Feeding on introduced flowers and fruits eg orchards mainly occurs during periods of poor native production (Eby 2000a).

The Grey-Headed Flying Fox travels long distances (generally within 20km but sometimes 50km) between roosts and foraging areas. Social roosts/camps are used daily, and locations are generally stable over many years. Roosts vary with function, with many forming an interrelated network. Roost selection is not fully understood. In NSW, they mostly occur next to a watercourse, with the dominant vegetation usually being rainforest, wet sclerophyll, Melaleucas, Casuarinas or mangroves (Eby 2000a). The nearest known roosts are at Arakoon, Clybucca and Yarrahappini (Eby 2002, pers. obs.) which are within range of the site.

Numbers of animals utilising a roost varies with season. In NSW, roosts are classified as occupied continuously (key colonial roosts); occupied annually in certain seasons; or irregularly. During poor seasons, individuals or small groups may occupy temporary roosts often within or close to the food source plants. Spring-Summer roosts are considered maternity sites (Eby 2001a).

The Grey-Headed Flying Fox is highly nomadic following fruiting seasons, with only a small portion being sedentary. Migratory movements are in order of hundreds of kilometres (Eby 2000a, 2000b). It is also a slow breeder, long lived, and has no physiological ability to withstand food shortages. The latter results in a high mortality especially of young if shortages occur during Spring, and also reduced reproductive success (Eby 2000b). Food shortages often force the Grey-Headed Flying Fox to forage in orchards, particularly lactating females (Eby 2000a, Tideman et al 1997).

3.6.3.3.2 Site Occurrence Evaluation

As mentioned previously, the Grey-Headed Flying Fox was observed foraging and flying over the larger property by Umwelt (2004). There are numerous other records of this species within a 10km radius of the site and adjacent to the south (DECCW Atlas for Wildlife 2009a, Bionet 2009, Darkheart 2004f, Berrigan 2003a, personal observations, etc).

The study area provides opportunistic foraging habitat depending on flowering/fruiting incidences. Given the size of the study area/site relative to the range of the species, it has potential only to form a fraction of the wider

foraging range of this species. Due to the lack of key Winter flowering species (eg Tallowwood, Swamp Mahogany, etc), the site/property offers limited potential for support during this key period with most usage likely to occur in Summer when the majority of species on site usually flower. The site/property is not known nor does it have any potential to be roosting habitat.

3.6.4 Other Potentially Occurring Threatened Species

From Appendix 1, the following species are considered potential occurrences (with varying levels of probability) on/in the site/study area/property, generally using it as a small part of a wider range:

Table 7: Threatened species potentially occurring on or near the property.

SPECIES	OCCURRENCE TYPE	OCCURRENCE LIKELIHOOD UNLIKELY = 0 MODERATE = 3 HIGH = 5
Square-Tailed Kite	Minute portion of large foraging territory. Marginal potential nest trees.	At least moderate, foraging on site as minute part of wider range.
Powerful Owl	Minute portion of large foraging territory. Marginal potential nest trees.	Low to fair foraging on site as minute part of wider range.
Masked Owl	Minute portion of large foraging territory. Marginal potential nest trees.	Very low to fair (foraging on site as minute part of wider range.
Barking Owl	Minute portion of large foraging territory. Marginal potential nest trees.	Unlikely to marginally fair foraging on site as minute part of wider range.
Glossy Black Cockatoo	Minute portion of large foraging territory. Marginal potential nest trees.	Low to fair foraging on site as minute part of wider range.
Brushtailed Phascogale	Denning and foraging habitat as part of wider territory from known habitat on adjoining land to the south and west	Moderate to high foraging and denning – **recorded in interconnected habitat**
Spotted-Tail Quoll	Minute portion of large foraging territory. Potential den trees.	Unlikely to marginally fair foraging on site as minute part of wider range.
Grey-Headed Flying Fox	Minute portion of large foraging territory.	**Recorded on adjacent land.** Highly likely to forage on site as minute part of range.
Little and Eastern Bent-Wing Bats	Foraging. Potential non-breeding roosting in tree hollows.	**Recorded on adjacent land.** Highly likely to forage and less so roost on site as minute part of wider range.
Yellow-Bellied Sheathtail Bat	Foraging. Potential breeding/roosting in tree hollows.	Low to fair foraging and roosting on site as minute part of wider range.
Eastern False Pipistrelle	Foraging. Potential breeding/roosting in tree hollows.	Unlikely to marginally fair foraging and roosting on site as minute part of wider range.
Beccari's Freetail Bat	Foraging. Potential breeding/roosting in tree hollows.	Unlikely to marginally fair foraging and roosting on site as minute part of wider range.
Eastern Cave Bat	Foraging.	Low to fair foraging on site as minute part of wider range.
Greater Broad-Nosed Bat	Foraging. Potential breeding/roosting in tree hollows.	At least moderate likelihood of foraging and roosting on site as minute part of wider range.
East Coast Freetail Bat	Foraging. Potential breeding/roosting in tree hollows.	**Recorded on adjacent land.** Highly likely to forage and roost on site as minute part of wider range.
Hoary Bat	Foraging. Potential breeding/roosting in tree hollows.	Low to fair foraging and roosting on site as minute part of wider range.

These species are subject to later statutory assessment.

3.6.4.1 Factors Affecting Occurrence of Other Regionally Recorded Threatened Species

As noted above and previously in section 2.3.1, a significant number of threatened species have been recorded in the locality, including on land connected to the site/property via continuous forest habitat. A number of these species not recorded by the survey are considered potential occurrences with varying levels of probability (see Appendix 1 and above). A number of other species not yet locally recorded are also considered potential occurrences in the locality due to potential habitat (see Appendix 1).

However, there are a number of factors (which formed part of the determination of whether or not a particular species can be considered a potential occurrence) which may affect the potential occurrence of some of these and other locally recorded species. These factors are:

- *History of extensive, and at times intensive (eg near total clearing of the original communities and subsequent modification via grazing and underscrubbing) disturbances to habitat, resulting in:*
    - State of significant structural and floristic modification of the site vegetation (especially the structure and floristics of the woodland and remaining forest), resulting in:
        - Loss/modification and disturbance of potential and known habitat through clearing and underscrubbing:
            - Gross alteration to structural and floristic diversity leading to simpler communities eg even-aged regrowth, pasture, fire-tolerant species (ie Bladey Grass), colonising species, etc.
            - Displacement of resident species via loss/modification of habitat or invasion by competitors (native and exotic).
            - Impacts on invertebrate diversity and abundance.
            - Increased competition for scarce resources and habitats.
            - Impacts on ecological processes eg development of an understorey, seed establishment, etc.
            - Declining carrying capacity of the area due to habitat simplification.

- *Activity of other threatening processes on the study site is considered to have had a significant effect on the site's habitability and carrying capacity to support these species.*
    - Likely presence of feral cats and foxes known to occur on and in the immediate vicinity of the site. These species have a negative impact on sensitive species such as the Long-Nosed Potoroo, Spotted-Tail Quoll, Brushtailed Phascogale and Common Planigale. Domestic cats and dogs also pose a threat to these species on site due their presence in adjacent residential and rural-residential subdivision to the southeast and east.

    - *Lack of abundance or diversity of prey species* ie small terrestrial species, etc, due to lack/loss of habitat; major interruptions to life cycle stages (eg breeding, torpor, dispersal and recruitment) caused by disturbances; loss of refuge, foraging and nesting habitat; etc, via fire, clearing and underscrubbing. This is particularly evident in the dry sclerophyll forest were Elliot A trapping recorded no catches.

    - *Insufficient time for recovery of habitats and habitat components as result of periodic disturbance (eg logging) or secondary processes eg weed invasion*: Although some habitat components exist (eg sap species and tree hollows), other key resources (eg preferred forage or prey species) are either absent, limited in development or insufficient in abundance, and thus incapable of supporting the corresponding dependent threatened species.

The site and remainder of the property shows evidence of the effects of all these processes and these may be a major influence in the current absence of some species for whom potentially suitable habitat occurs on site, as noted by Umwelt (2004) and ERM (2006b).

PART B: ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

4.0 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

4.1 THREATENED AND PROTECTED FAUNA

A significant number of pelagic seabirds, marine turtles, fish and mammals listed as Threatened and/or Migratory under the EPBCA 1999 (some are also listed as threatened under the TSCA 1995) are known or may occur on rare occasion in the nearby Ocean or Macleay River (eg Green Turtle), or associated estuarine habitats. However, the site and study area do not offer suitable habitat for these species. Furthermore, no aspect of the proposal has potential to impact to any significance upon these species. Consequently, these migratory and threatened marine fish, turtles, mammals and seabirds are not considered in the following assessment due to the lack of significant habitat, occurrence likelihood and/or potential impacts on these groups of species.

4.1.1 Vulnerable and Endangered Species

No EPBCA listed threatened fauna species were recorded during the survey.

A search of the Department of Environment, Water, Heritage and Arts (DEWHA) - Matters of National Environmental Significance (MNES) website was taken to generate a list of threatened species potentially occurring in the locality of the site. These are shown in the following table, with other species previously recorded (Darkheart 2004f, 2006f, O'Neil and Williams 2003, Sandpiper Environmental 2005, Berrigan 2003a, 2000a, 2000b, 2000c) or considered by the consultant as potential occurrences in the locality due to suitable habitat. An evaluation of their likelihood of occurrence on the subject land is also provided from the evaluation table in Appendix 1.

Table 8: EPBCA threatened fauna species potential occurrence assessment

Note: Likelihood of occurrence derived from opinions of consultants in consideration of known ecology of each species (see Appendix 1); and quality of habitat on-site. * indicates listed on DEWHA website search.

GROUP	COMMON NAME	SCIENTIFIC NAME	LISTING STATUS	RECORDED IN LOCALITY (10km radius)	SUITABLE HABITAT ON-SITE	LIKELIHOOD OF OCCURRENCE ON SITE
BIRDS	*Regent Honeyeater	*Xanthomyza phrygia*	E	No	Very marginal generic potential foraging	Unlikely to very low
	Red Goshawk	*Erythrotriorchis radiatus*	V	No	Some marginal generic foraging potential	Unlikely to very low
	*Swift Parrot	*Lathumus discolor*	E	Yes	Site contains no preferred species – marginal opportunistic potential	Unlikely to very low
	*Australian Painted Snipe	*Rostratula australis*	V	N	N	N
MAMMALS	*Long-Nosed Potoroo	*Potorous tridactylus*	V	N	Extremely marginal due to poorly developed understorey and ground layers, fragmentation, etc	Highly unlikely
	*Spotted-Tail Quoll	*Dasyurus maculatus*	E	Recorded at Yarrahappini. Expected to occur in Hat Head National Park.	Site offers some key resources, ie tree hollows, though lacks dense vegetation. Essentially forms cul de sac of potential habitat with high threat risk ie pets, cars.	Unlikely to marginally fair
	*Grey Headed Flying Fox	*Pteropus poliocephalus*	V	Y.	Seasonally suitable for foraging.	Highly likely as recorded adjacent to site where same forage species
	*Dwyer's/Large Pied Bat	*Chalinobus dwyeri*	V	N	Foraging only	Very low
FROGS	*Green and Golden Bell Frog	*Litoria aurea*	V	Y	N	N
	Wallum Sedge Frog	*L. olongburensis*	V	N	N	N
	Stuttering Frog	*Mixophyes balbus*	E	Y	N	N

	*Giant Barred Frog	*M. iteratus*	E	Y	N	N
REPTILES	Burrowing Skink/ Three-Toed Snake-Tooth Skink	*Coeranoscincus reticulatus*	V	N	N	N

4.1.2 Migratory Species

The White-Bellied Sea-Eagle was the only EPBCA listed migratory species which has been recorded during the survey flying over or near the site (Umwelt 2004).

A number of other migratory bird species listed in the EPBCA 1999 have been recorded in the locality, and a search of the MNES website also produced a list of likely occurrences. All of these species plus some species previously recorded (eg Darkheart 2004f, 2006f, Sandpiper Environmental 2005) or considered by the consultant as potential occurrences in the locality and/or LGA in similar habitat to that in the study area are also shown in the following table, with an evaluation made on likelihood of occurrence based on cited ecology. Note this list excludes seabirds, wader, etc as detailed above.

Table 9: EPBCA migratory fauna species potential occurrence assessment
* indicates recorded in LGA and likely to occur in locality in consultant's opinion

COMMON NAME	SCIENTIFIC NAME	PREDICTED TYPE OF OCCURRENCE	RECORDED IN LOCALITY	HABITAT ON STUDY SITE	LIKELY TO OCCUR ON STUDY SITE
White-Bellied Sea-Eagle	*Haliaeetus benghalensis*	Species and/or habitat likely to occur within area	Y	No suitable habitat.	N (recorded as a fly over only)
***Osprey**	*Pandion haliaetus*	-	Y	No suitable habitat.	N
Latham's Snipe	*Gallinago hardwickii*	Species or habitat may occur in area	N	N	N
Painted Snipe	*Rostratula benghalensis (australis)*	Species and/or habitat may occur in area	N	N	N
Cattle Egret	*Egretta ibis*	Species/habitat may occur in area	Y	Very marginal in pasture – very low grazed	May occur on cleared land though foraging limited
Great Egret	*Egretta alba*	Species/habitat may occur in area	Y	N	Very low to unlikely
Swift Parrot	*Lathumus discolor*	Species/habitat may occur in area	Y	Site contains no preferred species – marginal opportunistic potential	Unlikely to very low
Rufous Fantail	*Rhipidura rufifrons*	Breeding or breeding habitat may occur in area	Y	Very marginal in swamp forest	Very low to unlikely
Satin Flycatcher	*Myiagra cyanoleuca*	Breeding or breeding habitat likely in area	Y	Marginal	Very low to unlikely
Black Faced Monarch	*Monarcha melanopsis*	Breeding or breeding habitat may occur in	Y	Marginal	Very low to unlikely

		area			
Spectacled Monarch	*M. trivirgatus*	Breeding or breeding habitat likely in area	Y	Marginal	Very low to unlikely
*Oriental Cuckoo	*Cuculus saturatus*	Species/habitat likely in area	Y	Y	At least fair
Regent Honeyeater	*Xanthomyza phrygia*	Species/habitat likely in area	N	Very marginal potential foraging	Unlikely to very low
Rainbow Bee-Eater	*Merops ornatus*	Species/habitat may occur in area	Y	Y-foraging	At least fair
White-Throated Needletail	*Hirundapus caudacutus*	Species/habitat likely to occur in area	Y	Y	May occur as flyover.
Fork-Tailed Swift	*Apus pacificus*	Species/habitat may occur in area	N	Y	May occur as flyover

4.2 THREATENED FLORA

No EPBCA listed threatened plants were recorded during the survey. Only two species have been recorded in the locality:

1. ***Acronychia littoralis*** (Hat Head NP, Grassy Head)
2. ***Cynanchum elegans*** (Hat Head NP)

The following table assesses the occurrence potential of species derived from the MNES site as potential occurrences in the locality:

Table 10: EPBCA threatened flora species potential occurrence assessment

Note: Likelihood of occurrence derived from opinions of consultant in consideration of local records, known ecology of each species; and quality of habitat on-site. * indicates not recorded on ROTAP database in region as yet

COMMON NAME	SCIENTIFIC NAME	LISTING STATUS	RECORDED IN LOCALITY (10km radius)	SUITABLE HABITAT ON-SITE	LIKELIHOOD OF OCCURRENCE ON SITE
Leafless Tongue Orchid	*Cryptostylis hunteriana*	V	N	N	N
Scented Acronychia	*Acronychia littoralis*	E	Y	N	N
Clear Milkvine	*Marsdenia longilobia*	V	N	N	N
Hairy-Joint Grass	*Arthraxon hispidus*	V	N	N	N
Austral Toadflax	*Thesium australe*	V	N	N	N
White-Flowered Wax Plant	*Cynanchum elegans*	E	Y	N	N

4.3 THREATENED ECOLOGICAL COMMUNITIES

Of the Threatened Ecological Communities currently listed on the DEWHA website, none occur on or near the site (as determined by description and MNES website search).

PART D: IMPACT ASSESSMENT AND RECOMMENDATIONS

5.0 POTENTIAL IMPACTS OF THE DEVELOPMENT

Loss of habitat is the primary threat to the recorded threatened species (Johnson *et al* 2007, Lindenmayer and Fisher 2006, NSWSC 2001d, 2007a, Smith *et al* 1995, Gibbons and Lindenmayer 2002, DECCW 2009b, NPWS 1999b, Watson *et al* 2003, Gilmore and Parnaby 1994, etc). As habitat requirements are species specific, habitat loss in turn has species specific impacts. Additionally, loss of native vegetation does not automatically equate to habitat loss as some species may be advantaged ie the extent of potential habitat may be increased as a result of vegetation loss (eg species which prefer woodland habitats over forest). However, habitat loss rarely occurs in isolation from other impacts such as habitat fragmentation, isolation, degradation, altered species interactions (eg predation), etc, hence impact assessment must consider the cumulative effect of all these impacts on individual threatened species (Johnson *et al* 2007, Lindenmayer and Fisher 2006).

This section gives a general description of impacts likely to be associated with the proposal, with specific evaluation of their consequence for threatened species recorded or which could occur on the site/study area (based on habitat evaluation and local/regional records – see section 3.7.4.1 and Appendix 1) undertaken in the statutory assessments in sections 7 and 8.

5.1 HABITAT REMOVAL/MODIFICATION

5.1.1 Residential Lots

The proposed development has been detailed previously in section 1.2 and illustrated in figure 2. Figure 8 shows the layout with the location of trees to be removed/retained within stage 1C.

As shown in the figure, the footprint falls over the lawns and gardens around the existing dwelling and over the pasture and agricultural woodlands. Approximately 39 scattered trees and an isolated clump <300m^2 are nominated to require removal. Of these trees, 5 contain actual hollows (suggested by observed opening) or significant potential for hollows as shown in table 11, and the following photos:

Figure 8: Lot layout and proposed tree removal
(Source: King and Campbell Pty Ltd 2009)

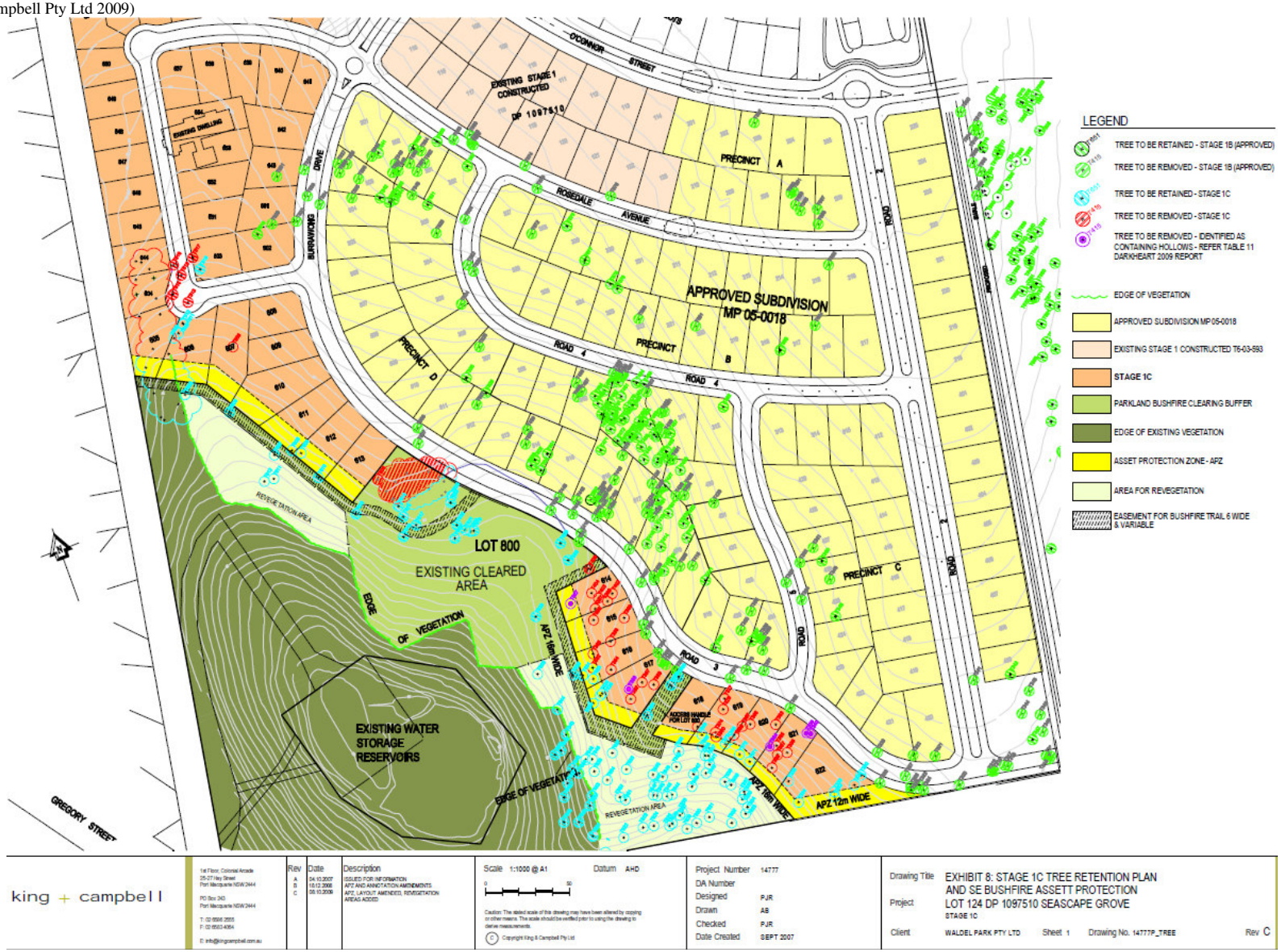


Table 11: Hollow bearing trees to be removed

TREE NUMBER/SPECIES	LOCATION	NO. OF HOLLOWS
627 Blackbutt	Off rear boundary of Lot 614	Contains a fire scar at base, leading into a chimney at least 3m up the trunk. Few remains of beetles suggests potential Microchiropteran roost. This tree could potentially be retained by crown pruning.
383 Blackbutt	Lot 617	At least 2 small hollows in crown limbs potentially suitable for Yangochiropteran bats.
364 Scribbly Gum	Lot 621	Several upturned knobs with one appearing to have a formed hollow. Others potential hollows. Potentially suitable for Brushtailed Phascogale, Squirrel Gliders and Yangochiropteran bats.
339 Pink Bloodwood	Lot 621	Several upturned knobs may have potential hollows. Potentially suitable for Brushtailed Phascogale, Squirrel Gliders and Yangochiropteran bats.
340 Scribbly Gum	Lot 621	Several upturned knobs may have potential hollows. Potentially suitable for Brushtailed Phascogale, Squirrel Gliders and Yangochiropteran bats.

The dam will be re-engineered to allow free drainage but the surrounding trees will be retained. These works will not affect any significant vegetation (as weeds were noted becoming dominant), nor affect any significant habitat (as the wall is breached and the dam no longer holds any significant water).

5.1.2 APZs

APZs will be formally established in the southwest and south within the rear of residential Lots and/or adjacent edge of the 7(d) zone. No canopy loss for APZs is proposed except on Lots 614, 616, and 619 (assumedly these trees may pose a falling threat).

A 6m wide easement is also provided for behind Lots 605-613 in the southwest, and Lots 614-617 in the southwest. These will be maintained by the owner of Lot 800 (King and Campbell 2009).

Photo 3: Tree 627 Blackbutt at rear of Lot 614 with chimney hollow

View east.

View up chimney.

Photo 4: 383 Blackbutt

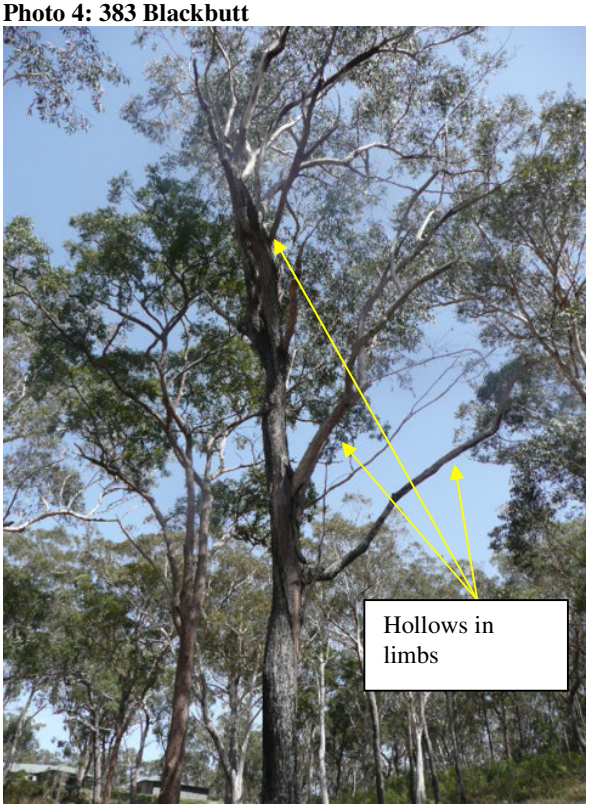


Photo 5: 364 Scribbly Gum

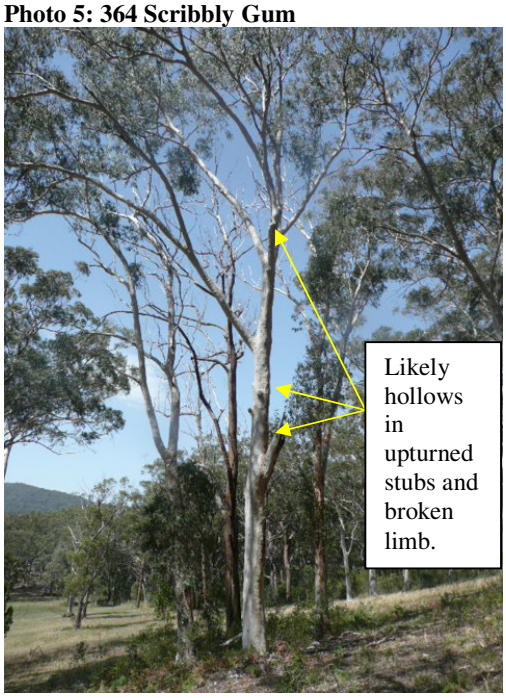


Photo 6: 339 Pink Bloodwood and 340 Scribbly Gum
Potential hollows in upturned stubs in both trees.

5.2 SECONDARY IMPACTS

The following are impacts are generally associated with rural developments and establishment of dwellings:

1) *Weed invasion*: Lawns and gardens are likely to be established eventually around the established dwellings, and it is possible that some plants introduced as garden ornamentals may

escape and become weeds eg via dumping greenwastes over back fences. Sedimentation and flow of nutrients could also potentially increase the occurrence of exotic weed species eg adjacent to roads. Edge effects could also see extension of weeds in some areas ie into the adjacent 7(d) zone. However, competition in marginal habitat and management of APZs should curtail such incursions in the 7(d) zone and hence have little effect on the integrity of vegetation communities. Conversely, any planted fruit trees or flowering trees/shrubs may attract flying foxes or provide more structures for Yangochiropteran bats to forage around, and passerine birds (potential prey species) to forage on.

2) *Vehicle/wildlife collisions*: Burrawong Drive will separate the 7(d) zone habitat upslope from the retained parkland habitat in the open space on a ridge running towards the centre of the approved subdivision, as will the intervening residential Lots. This and associated tree loss in the intervening space will make it difficult for gliders to reach these trees, and at least very difficult for the Phascogale to cross via open ground. Both species may be forced to run across open ground to reach these trees (though given their encapsulation within an urban area, there may be limited drive) hence would be at risk of collision.

3) *Introduction of feral/introduced animals*: Development is often associated with the introduction of non-native species, ie rodents, cats and dogs. The latter two may be kept as pets which may roam bushland, or become feral (eg via dumping of unwanted offspring). Cats are significant predators of native species (eg the Squirrel Glider and Phascogale – Dickman 1996, NSWSC 200a, 2000b, NPWS 2000a, 2001), and domestic dogs are significant threats to species such as the Koala (Connell Wagner 1998b, 2000b, Wilkes and Snowden 1998, DECC 2008, etc).

   The threats induced by these species presently exists due to their presence in the study area and in the general area (eg on adjacent land to the west), and will be incrementally increased as a result of the proposed development. However given the current risk of the threats induced by these species; and that most pets will be largely restricted to residences due to provisions under the *Companion Animals Act 1997*; the incremental increase of these threats should not be a significant addition. Precautionary ameliorative recommendations are given in section 7.

   Other exotic species such as foxes and rodents are not considered likely to be significantly affected by the proposal (in terms of abundance) as the majority of habitat will remain as is.

4) *Artificial lighting*: Artificial lighting will be provided as typical of a residential subdivision. Lighting may potentially discourage particularly nocturnal native species from foraging near areas of development or emerging from hollows (eg Darkheart 2005i), although wallabies, kangaroos, Tawny Frogmouth Owls, and possums have been noted foraging under artificial lighting in the residential areas of Lake Innes, Port Macquarie, for instance (personal observations). Artificial lighting may also be beneficial to some Yangochiropteran bats by creating localised aggregation of insects (personal observations), though others have demonstrated adverse effects to such lighting (Hourigan *et al* 2009, Scanlon and Petit 2008). As the habitat remaining in the study site will generally be located behind residential Lots and away from street lighting, impacts should be reduced compared to the hollow-bearing trees retained in the parkland area of the approved stages of the subdivision.

5) *Noise disturbance*: Noise will be typical of a residential development ie peaks in morning and afternoon, with generally low levels at night. Noise effects on fauna in Australia are relatively poorly studied (Clancy 2001, Berrigan 2001d). Most evidence presented is anecdotal, but suggests most fauna (especially those with some prior exposure) have a fair degree of tolerance and adaptation at least to residential noise, with military training grounds proving to be *de facto*

nature reserves for some species such as the Powerful Owl, Bush Stone Curlew, Squirrel Glider and Brushtailed Phascogale (Anon 1990, Anderson *et al* 2007). For example, this consultant has observed Glossy Black Cockatoos foraging in a tree within 30m of a person chain-sawing firewood (Berrigan 1998d), and Jabirus foraging by an excavator dredging a dam (pers. obs.). Given the Squirrel Glider and Brushtailed Phascogale have been recorded in urban remnants or on the fringes of urban areas (eg Darkheart 2005a, 2005b, 2005i, 2005m, 2004l, Dobson 2002, Goldingay *et al* 2006, Goldingay and Sharpe 2004a, Murray 2006, Smith and Murray 2003), and on military ranges (Anderson *et al* 2007), they are not considered likely to be significantly affected. Similarly, most of the other species under consideration have been recorded in urban situations, and are not likely to be significantly adversely affected.

6) *Increased human presence*: Human presence on the site and in the locality will be increased eventually as a result of the proposal. At present, human occurrence is slowly increasing due to the large approved residential subdivision that the proposal forms a small part of, and existing residential land to the west and rural-residential development to the south. Residential human presence will increase as the total development is completed. However given the history of the site, existing human presence in the area and the ability of the recorded species to utilise even urban areas, all of the relevant threatened species are considered unlikely to be significantly affected, especially given the recording of such species in similar circumstances elsewhere (eg Harrington *et al* 2004, Darkheart 2005d, 2005h, 2004q, 2004o, 2004m, 2004l, Gunninah Consultants 1997, Connell Wagner 2000b, Cooke *et al* 2002, NPWS 2003a, etc). Furthermore, most of the threatened species associated with the site are nocturnal and activities will generally be low to nil during this period. Overall this impact is considered unlikely to be significant.

7) *Bushfire risk and alteration to regimes*: Fire is a natural ecological component of the recorded threatened species and EEC's ecology (Lindenmayer 2002, Smith *et al* 2005, NPWS 2004, Catling 1991, Gill *et al* 1999), however, an inappropriate fire regime can have significant negative effects (NSWSC 2004a, 20004b, 2004c, 2004d, 2004e, 2004f, NPWS 2004, Catling 1991, Gill *et al* 1999), potentially including local extinction.

   Bushfire may be practised in the 7(d) zone for fuel reduction, or potentially be started via vandals. This latter is considered a very low potential outcome however due to the relatively minimal fuel in this zone and very high exposure to neighbour vigilance.

   The *Rural Fires Act 1997* (RFA 1997) has relevant provisions for controlling the fire regime. Burning for the purpose of hazard reduction appears to require a Bush Fire Hazard Reduction Certificate (BFHRC) to be issued by the Rural Fire Service (RFS). This environmental approval is required under the RFA 1997 if the hazard reduction proposed affects native vegetation; poses a potential threat to threatened species, endangered ecological communities, etc; or could result in air or water pollution, or soil erosion (see sections 86, 89, 100C, 100D and 100G of the RFA 1997). A BFHRC requires legal compliance to the specified conditions which will take into account environmental factors such as:

   - Presence of threatened species or EECs.
   - Risk of soil erosion or mass movement.
   - History and minimum fire frequency intervals for specific vegetation types.
   - Location of waterbodies and waterside (riparian) vegetation.

   A BFHRC may include measures to protect significant areas eg limiting fire frequency, specifying exclusion areas eg the wetland. The existence of an EEC and known habitat of several threatened species on the site should require specific environmental protection measures to be specified in any BFHRC applied for the site/property.

The guidelines for hazard reduction also recommend use of low intensity fires for hazard reduction to minimise rate of spread (hence allowing fauna to escape), generation of smoke (which may affect arboreal species), and maximises protection of the canopy. The guidelines also recommend use of spot fires which burn patchily, hence this may result in the creation of a complex mosaic of fire histories. The BFHRC also requires landowners to complete a report post-completion of works, hence provides a means of monitoring and compliance to the BFHRC's conditions.

This statutory instrument thus if implemented effectively should protect the 7(d) area's values from an ecologically unsuitable bushfire regime. The RFA 1997 also requires landowners intending to burn to provide at least 24hrs notice to all neighbours, hence this provides an opportunity for monitoring and control of fires.

The RFS Environmental Code (RFS 2006b) also indicates an appropriate frequency for fuel reduction for the dry sclerophyll, and this should be considered the minimum period between fire events.

Council may consider imposing a title covenant requiring the landowner to contact the RFS for a BHFRC application before burning, or to provide this ecological assessment to the RFS with any enquiry for burning to ensure due process is properly implemented.

Provided prescriptions and control measures give due consideration to ecological constraints, regulated bushfire may have more benefits than detrimental impacts compared to extensive wildfire.

8) *Disease*: This threat is relevant to both Koalas and amphibians. Most Koalas are naturally infected with *Chlamydia* pathogens (Sharp and Phillips 1999, Phillips 1997, DECC 2008). This and other diseases may develop when Koalas are under stress, of which one cause is habitat disturbance. As no evidence of Koala use was detected, the proposal is not considered likely to substantially increase the risk of stress-induced diseases to Koalas in the general area.

   Other diseases such as Psittacine Circoviral Disease and Chytridiomycosis are not considered likely to be introduced to the site as a result of the proposed development.

9) *Incremental vegetation removal*: Despite restrictions, there is a risk that future owners might incrementally remove vegetation (eg applications under the Tree Preservation Order to remove "threatening trees", etc), thus increasing habitat loss. Given that the habitat on site has values for several threatened fauna species, appropriate recommendations are provided in section 7.

10) *Eutrophication and Pollution*: Given statutory provisions, these potential impacts are not considered an issue for the proposal.

11) *Edge Effects*: The change of landuse from agricultural to residential can also have the following effects which are generally referred to as edge effects (Lindenmayer and Fisher 2006, Andrews 1990, Goosem 2002, May and Norton 1996, Catterall 2004, Dickman 1996, NPWS 2001, Kelly *et al* 2003, Cropper 1993, Downy 2003, Brown *et al* 2003):
    - Increased ingress of feral species such as cats and dogs.
    - Ingress of weeds into areas not previously found.
    - Alterations to microclimate ie drying, altered humidity levels, increases light penetration, etc.
    - Increased exposure to wind.

- Increased predation, competition and assemblage modifications.

The relatively minor extent of habitat effected and the currently disturbed nature of this and adjacent habitat indicates that edge effects are unlikely to be significant.

6.0 AMELIORATIVE MEASURES AND RECOMMENDATIONS

6.1 MAJOR RECOMMENDATIONS

The following major recommendations are made to reduce or avoid potential impacts on threatened fauna either known or considered potential occurrences on the study site/area/property. These are integral to the basis of later assessment and conclusions as it is assumed these recommendations will largely be implemented in some form eg title covenants.

6.1.1 Informed Development Design

These recommendations were made during the preliminary design stage of the proposal to maximise retention of key habitat areas and components, as follows:

- Retain maximum numbers of hollow-bearing trees
- Minimise clearing to that absolutely necessary.

To assist with achieving this recommendation, all trees in the development footprint were located via survey (except the western boundary). This allowed development of a layout which achieved the following:

- Potential loss of only 5 hollow-bearing trees, none of which contain medium or large hollows which are rarer in the landscape (Gibbons and Lindenmayer 2002, NSWSC 2007, ERM 2007).
- Tree removal limited to about 39 scattered trees and a 300m^2 clump in northwest.
- Retention of an additional 3 trees and all trees around the former dam by re-design.
- Retention of the 7(d) area in one Lot.

6.1.2 Clearing Strategy, Pre-Clearing Survey and Hollow Bearing Tree Removal

This measure is required to minimise the risk of hollow-obligate fauna (especially Squirrel Gliders) being killed/injured during removal of hollow-bearing trees.

6.1.2.1 Clearing Strategy

When tree removal is to be programmed, all non-hollow bearing trees are to be removed at least 24hrs before removal of hollow-bearing trees. This is to stimulate any resident animals to abandon the den/roost site.

6.1.2.2 Squirrel Glider and Yangochiropteran Bat Pre-Clearing Survey

6.1.2.2.1 General Methods

A pre-clearing survey is to be conducted on the night prior to removal of the hollow-bearing trees to help minimise the risk of injury/mortality of arboreal fauna (especially the Squirrel Glider) potentially utilising the subject trees as den-sites.

The pre-clearing survey will consist of:

- Saturated arboreal Elliot B trapping throughout the study site (particularly on and directly adjacent to the hollow bearing trees) to maximise the likelihood of capturing site-dependant animals on the night before clearing; and

- Stag watches on the hollow-bearing trees to see if key roosts (maternity, nursery, hibernation) are present or to identify hollows subject to usage as Squirrel Glider den sites at the time of the clearing.

The Elliot B traps are to be checked and removed at dawn the following morning prior to the commencement of any clearing work. All hollow-bearing tree felling is to be completed on the day following trapping. If all hollow-bearing trees requiring removal are unable to be fallen the day following trapping, further hollow-bearing tree removal may only commence the day after a second night of trapping.

Any captured fauna are to be kept in a shaded area and released after sunset that evening in the retained vegetation.

6.1.2.2.2 Key Bat Roost

If a tree is found to contain a key bat roost, this tree is not to be removed until the bats complete the key lifecycle stage and move on. This will have to be determined via periodic monitoring (ie stag watching and inspection with a remote infrared camera). Once the bats have moved on, the hollow bearing tree removal protocol will apply.

6.1.2.3 Hollow-Bearing Tree Removal Protocol

The 5 hollow bearing trees likely to require removal are to be removed in a way that will minimise the risk of injury/mortality of denning/roosting fauna (particularly the Squirrel Glider), within the practical and legal limitations of Occupational Health and Safety (OH&S) guidelines/legislative requirements.

6.1.2.3.1 Special Considerations

Potential hollows in limbs on tree #383 are to be lopped by an arborist, and lowered to the ground via ropes. These limbs are to be carried to the 7(d) zone, and gently lowered to the ground with all openings exposed upwards to allow any resident fauna (which has not evacuated during felling) to emerge at dusk.

Tree 627 is to be assessed by a consulting arborist in regards to the practicality of retaining this tree by pruning of dangerous crown limbs. If this is not possible, the top half of this tree (>5m from ground to try and avoid the chimney) should be cut and dropped, and the stump left till dusk for any bats to

naturally exit. The stump may then be removed the following day.

6.1.2.3.2 Felling of Hollow-Bearing Trees with Trunk Hollows

Undertaken with due care, this practice can demonstrably avoid mortality of common and threatened species during felling of hollow-bearing trees, thereby substantially reducing the potential significance of development impacts. The following protocol is to be adopted:

1. As an overriding rule, unless deemed unsafe/impractical in OH&S terms, hollow-bearing trees are to be removed via a method that does not require traditional tree felling methods ie clear-drop chainsaw cut or bulldozer "push-over and crash" methods are not to be utilised due to the violence of tree-ground impact and associated high risk of injury/mortality to fauna (eg via hollow collapse, collision with walls, etc).

2. The preferred option is employment of a suitable excavator with a rotating pincer/saw combination attachment (often used in commercial forestry) is highly preferred. This attachment can readily cut the crown off >10m above ground level, and lower the cut section to the ground intact with minimal ground impact (thereby negating the risk of fauna being crushed by collapsed limbs). This method then allows hollows to be inspected. This method is considered practical for the site as all affected trees are limited in height and are not massive (hence heavy) senescent trees.

3. If this is not available/practical, the following options in decreasing preference, are suggested:
    - Use of a crane to hold the tree section while the base/section is sawn by an arborist, and then lower the tree/section to the ground for inspection. This commences from the largest and highest hollow-bearing crown limb, and progresses until all hollow-bearing sections are removed (remainder of tree removed by routine method). This may require an arborist to scale the tree to make the cuts and appropriate OH&S controls.
    - Use of two excavators, with one pushing the tree over, and the other counterbalancing the tree to allow it to be slowly lowered to the ground.
    - If none of the above is practical, an excavator can cut the roots and slowly push over the tree, counterbalancing the fall rate by pushing down on the root ball to minimise acceleration and final impact (least preferred method).

4. An ecologist or member of FAWNA/WIRES must be present during felling of the hollow bearing trees to monitor clearing, capture any resident animals injured or not evacuating, and undertake appropriate emergency actions if required e.g. transport animal to veterinary treatment (care at proponent's cost) or care by FAWNA/WIRES.

5. Hollows are to be immediately inspected by the wildlife welfare person once the tree is felled (within OH&S guidelines) for injured individuals or abandoned offspring, and appropriate measures undertaken. All rehabilitated animals are to be released in the retained habitat directly on/or adjacent to the site.

6. If hollows cannot be cleared of fauna, and the hollow section cannot be hand carried to the nearby 7(d) zone, the fallen tree/limb must be allowed to sit overnight to allow fauna to passively escape. The hollow-bearing section is to be moved at least 24hrs later to the 7(d) zone as per 6.1.4.

A written report is to be provided to Council following the removal of hollow-bearing trees and the pre-clearing survey detailing all results and actions undertaken.

6.1.3 Retained Tree/Habitat Protection During Construction

The following tree/habitat protection measures will be required to be undertaken to protect the retained habitat/trees during construction. These include:

- All trees/habitat to be retained or removed should be clearly mapped on a site plan (ie a clearing plan) and marked on site (eg with a specific coloured flagging tape or fencing off) to ensure construction activities do not result in accidental damage or removal.

- All practical measures possible are to be undertaken to protect retained trees/habitat to maintain long term health eg fencing off the area with temporary fencing during the length of the construction period. Appropriate guards approved by an arborist are to be installed to prevent physical damage to the trunk where setback via fencing is not practical/possible, and other additional measures (eg mulch placed over roots) are to be implemented to protect the health of the tree. Appropriate measures approved by a consulting arborist are to be taken when roots must be trimmed during any excavation works.

- Machinery and vehicles should avoid being used or parked directly adjacent to trees which are to be retained to avoid soil compaction. If unavoidable, soil compaction and tree protection measures will be required.

- Specific instruction to staff/contractors on what trees and habitat is to be retained, their significance and measures to be undertaken to avoid damage to them. Contracts are to contain clauses for penalty for non-compliance.

- No disposal of cement wastes, construction material or washdown near the retained vegetation.

- Mixing of imported soils with site soils outside the development/dwelling footprint should be avoided to minimise risk of disease and pathogenic fungus transfer.

Contract conditions with contractors are to provide for compliance mechanisms (eg financial penalties) for breeching of the above eg accidental tree removal (including of replacement plantings), and to compensatory measures eg replacement plantings.

6.1.4 Re-Use of Fallen Trees and Hollows

All hollow-bearing limbs (unsuitable for remounting as per section 6.1.6) and tree sections, as well as the main trunk sections of other trees, are to be transported to suitable portions (where machine access is safe by OH&S requirements, and avoids damage to existing habitat) of the 7(d) zone. These are to be stacked in small piles or laid out strategically in this area to provide habitat (refugia and foraging substrate) for native species.

6.1.5 Regeneration Area on Lot 800

To offset some of the impacts associated with the development, the proponent offers to regenerate the most modified sections of the 7(d) zone, as shown in figure 8. The southwest regeneration area (see photo 8 below) is 3800m^2, and the southeast area is approximately 6970m^2 (total of 10 770m^2).

Photo 7: Sample shot of southwest regeneration area

Photo 8: Southeast regeneration area

Regeneration in these areas is proposed by the proponent to consist of:

- De-stocking.
- Cessation of all agricultural management practises in the regeneration areas.

- Exclusion fencing to prevent vehicle and stock access with wildlife friendly fencing.
- Weeding programs to assist natural regeneration.
- Provision of nest boxes to increase hollow abundance.
- Placement of fallen hollow-bearing trees as hollow logs for refugia and foraging substrate.

A specific plan is to be prepared detailing these measures, the responsible authority, and long term arrangements (Mr Paul Rowlandson, King and Campbell Pty Ltd, pers. comm.).

6.1.6 Nest Boxes and Recycled Hollow Limbs

6.1.6.1 General Provisions

In order to ameliorate the loss of at least 5 hollow bearing trees on site, it is recommended that nest boxes/recycled limb hollows be erected on retained trees within the 7(d) area. The boxes/recycled limbs should at least match the number of hollows removed per tree (1:1), and be of varying sizes and designs to suite a suite of target fauna eg Yangochiropteran bat boxes will differ from Squirrel Glider boxes.

A minimum of 20 nest boxes designed to suit Yangochiropteran bats, Squirrel Gliders and Brushtailed Phascogale are to constructed and erected at least 8 weeks before clearing commences to allow adoption by target fauna. Post-tree felling, the total number of hollows in the fallen trees will indicate the final number of replacement nest boxes required.

While it is noted that nest boxes may not be ideally suitable as replacement of natural hollows due to microclimate, limited lifespan, and potential occupancy by ants and feral honeybees (Gibbons and Lindenmayer 2002, Birds Australia 2001, Myers 1994, 1997, Dashper and Myers 2003, Beyer and Goldingay 2006, Harper *et al* 2007, Goldingay and Stevens 2009, Menkhorst 1984), these have been demonstrated to provide refuge to fauna displaced by the loss of hollow-bearing trees or to use habitat where hollows are rare or even absent (Gibbons and Lindenmayer 2002, Birds Australia 2001, Myers 1994, 1997, Dashper and Myers 2003, Soderquist *et al* 1996, Harper *et al* 2007, Goldingay and Stevens 2009, Menkhorst 1984), and could abate associated impacts in the short term and allow time for adjustment. After being erected for 12 months, it is recommended that a qualified ecologist inspect the nest boxes to determine whether they are in use and/or if they have been invaded by ants and/or feral honeybees and require treatment for fauna occupation.

Most of the required nest boxes are to likely to be created from processed materials (marine ply is highly recommended due to its weather resistance) but portions (ie limbs) of fallen hollow-bearing trees may be re-used ie any hollow within a limb which can be effectively cut into a manageable section (ie with effective sealing of each end of the limb via cutting above and below the hollow where the limb is solid wood, or one open end sealed via adding a metal or plastic plate like a cap on a telegraph pole), and then appropriately mounted on a living tree and used as a “recycled” hollow. These recycled hollows may last longer than the nest boxes (pers. obs.) and personal observation have noted these to work for Squirrel Gliders (Darkheart 2007g).

These recycled hollows are to be cut from the fallen trees at least 48hrs after initial removal (as per the protocol above) and erected via the same methodology and restrictions as for nest boxes ie to allow for growth and expansion of the tree.

6.1.8.2 Design and Implementation

The constructed nest boxes are recommended to be made out of at least 20mm thick marine ply to maximise their longevity (ie minimise weathering and termites and fungi activity) and insulative

properties. They are to be predominantly designed to suit Squirrel Gliders and Phascogales, though several should be designed specifically to suit Yangochiropteran bats. The design should not encourage their use by either feral honeybees or Indian Mynas.

The nest boxes may be commercially sourced (eg locally from the Ngurrala Business Enterprise - Phone: 0407 901 066) or manufactured by an agent for the proponent, potentially based on the suggested references below:

- Gibbons, P. and Lindenmayer, D. (2002). Tree Hollows and Wildlife Conservation in Australia. CSIRO Publishing, Collingwood. See Chapter 10.
- Latrobe Valley Field Naturalists Club *et al* (2003). The Bat Roost Box Kit. West Gippsland Catchment Management Authority.
- Birds Australia (undated). Nest boxes for natives. Information Sheet No. 15. Available at www.birdsaustralia.com.au.
- Hollow Log Homes (www.hollowloghomes.com.au)

Nest boxes will be erected following the recommended method on the DECCW website (www.environment.nsw.gov.au) or www.hollowloghomes.com.au to maximise potential longevity and usage, and minimise damage to the tree.

Nest boxes and recycled hollows will probably be mounted via ladder (depending on OH&S requirements), and should be at least 3m above ground to avoid potential interference by children, pets, etc. Orientation should be varied ie mix of aspects to provide for a range of internal nest box climate conditions to suit a range of fauna or their needs per season (Gibbons and Lindenmayer 2002, Birds Australia 2001, Myers 1994, 1997, Dashper and Myers 2003, Soderquist *et al* 1996, Harper *et al* 2007, Goldingay and Stevens 2009, Menkhorst 1984).
As noted above, at least 20 manufactured nest boxes should be erected at least 8 weeks prior to commencement of any clearing to help encourage their usage via allowing adjustment before the hollow-bearing trees are removed. The "hollow logs" excised from fallen hollow-bearing trees are to be erected within 7 days following tree felling to enable their potential re-use post-clearing.

6.1.8.3 Replacement

As a condition of consent, new owners of Lot 800 will be responsible to replacing nest boxes as they succumb to natural attrition.

6.1.7 Long Term Management of Lot 800

Aside from a development envelope containing a dwelling and APZ, plus the APZs and access for bushfire protection to the adjoining residential Lots, all of the remaining area of Lot 800 is to be allowed to naturally regenerate ie is not to be continued to be maintained. Provisions under the *Native Vegetation Act 2003* will additionally prevent any significant loss of forest from this Lot.

Grazing stock are to be permanently prohibited from this Lot via title covenant to assist natural regeneration.

6.2 SECONDARY RECOMMENDATIONS

The following are provided for optional consideration by the determining authority for maintaining biodiversity and abating impacts. It is not assumed that these recommendations are adopted conditions of consent or in the conclusions of this report, but it is desired that proponent (and future residents) at least be advised to consider adopting them eg as conditions of consent.

6.2.1 Pets and Feral Predator Management

No domestic stock are to be kept on Lot 800, which has the capacity to be used for keeping of such, via restrictive title covenant (King and Campbell 2009).

Residents should be encouraged via signage in the 7(d) zone to report all stray cats and dogs to Council as applicable under the provisions of the *Companion Animals Act 1997*. Residents should also be asked via this signage to report sightings of foxes and feral cats to the Rural Lands Protection Board and DECCW for control actions.

Cats are to be confined indoors between sunset and sunrise via restrictive covenant (King and Campbell 2009). This is essential to avoid pet predation of the Phascogale and Squirrel Glider, which are particularly sensitive (NSWSC 2000a, Dickman 1996, Grayson and Galver 2004, May 1997, Smith and Murray 2003, Smith 2002a, Faulding and Smith 2008, Barratt 1997). Any dogs should be restricted to the residential Lots unless on a lead. No pets should are to be allowed to roam through the adjacent bushland in the general area.

6.2.2 General Landscaping

Future residents and any landscaping proposed as part of the development should give due consideration to the establishment of native plants as ornamental species to maintain and/or increase biodiversity and replacement habitat, and minimise water demand. Specifically, such species should include Eucalypts, Grevilleas, Banksias, Melaleucas, Acacias, Allocasuarinas and Callistemons (especially Winter-flowering species which are useful for the Squirrel Glider, honeyeaters and Grey Headed Flying Fox eg *Banksia integrifolia),* and fruiting rainforest species such as Brush Cherry (*Syzygium australe*), figs, *Acronychia littoralis*, etc.

Plantings should preferably not be in parkland style or isolated trees, as this minimises their effectiveness to provide habitat to all but common medium sized species which may in fact become detrimental to the presence of other species eg Currawongs and Indian Mynahs (Catterall 2004). Rather, plantings should to be planned to recreate a natural structure (ie layered). Such plantings thus may consist of at least one or two canopy trees, underlain by a few understorey trees, and finally a number of shrubby species. This multi-layered planting can provide effective aesthetics while supporting passerine birds (who depend on the lower stratums and structural complexity), bats, and canopy species such as arboreal mammals.

Use of and reliance on garden chemicals should be limited a much as possible.

6.2.3 Artificial Lighting

Artificial lighting is considered likely to be typical of residences with lights occurring primarily around the established dwellings. As noted previously, there appears to be varying evidence of artificial residential lighting having significant detrimental effects on fauna with many native (including threatened) species recorded foraging under or near artificial lighting eg Yangochiropteran bats and macropods, unless the light is directly shone onto key habitat areas/components eg tree hollows.

To ensure anthropogenic impacts are minimised, it is recommended that artificial lighting be kept to a minimum and be of a localised and low luminosity, with light directed to the ground and not into vegetation.

6.2.4 Fire Regimes

Any hazard reduction burning of the forested section of Lot 800 must take into consideration the ecological constraints of the site. Proponents must be aware that an excessive fire regime which alters the structure of the site's habitat is a breach of the *Native Vegetation Act 2003*, and offenders are liable for prosecution.

In addition, it is advised that due to the presence of threatened species on site, any burning for the purpose of hazard reduction should require a Bush Fire Hazard Reduction Certificate (BFHRC) under the RFA 1997, which may include measures to protect the potential habitats of these species. Any burning regime should not exceed the minimum time frame recommended in the RFS (2006b) *Environmental Code*. Council may consider issuing a measure which requires owners to consult the RFS prior to conducting any fuel reduction.

6.2.5 Feral Bees and Indian Mynas

Feral bees and Indian Mynas (*Acridotheres tristis*) out-compete native fauna for tree hollows, which are a critical habitat component for many native fauna (Gibbons and Lindenmayer 2002). Feral bees can also invade used hollows and kill native fauna (Gibbons and Lindenmayer 2002). Indian Mynas also predate nestlings (Anon 1990) and hence may be a threat as an edge effect. Both are spreading throughout the country and are having a detrimental on fauna already under pressure from other threats eg habitat loss (Gibbons and Lindenmayer 2002).

Feral bee hives should be exterminated on detection to prevent new hives being established. Indian Mynas should not be encouraged to feed on site (eg by provision of seed, etc by residents), and if detected nesting on-site, they should be reported to the NPWS/DECCW, the Catchment Management Authority, or Council for appropriate action to be undertaken (ie nest destruction and trapping).

6.2.6 Removal of Trees Near Retained Habitat Trees

Trees may intertwine and at times even graft their roots with neighbouring trees, and standard removal via heavy excavation equipment can damage roots of trees to be retained, resulting in risk of fatal infections or general impacts on health and longevity (Page 2006).

This is a potential threat to the hollow-bearing trees proposed to be retained on the site. An arboricultural consultant is recommended to advise and if necessary supervise the proper removal method of such trees to avoid this potential impact. Sawing down of trees and stump grinding is considered likely to be the best method where a potential risk is identified (Page 2006).

6.2.7 Resident Education and Stewardship

The aim of the development design incorporating the above recommendations is to retain as much as possible the present character and ecological values of the site in order to avoid a significant impact.

It thus follows that if the proponent intends to achieve the proposed level of development, the marketing strategy should target those persons most likely to be compatible with the aims of the aforementioned recommendations ie retain the essential character, habitat values and support capacity of the site.

All prospective buyers will have to be advised of the limitations/restrictions, and the obligations imposed upon them. This will ensure buyers are aware of the situation and circumstances, and also

ensure those that choose to purchase are the most desirable to become stewards of the site's conservation values. Part of this process should include an information booklet (including a copy of this assessment for background information) distributed with the title deed to establish resident awareness.

Resident awareness of the site's significance and support for measures undertaken to retain the inhabitant threatened species is considered essential in the long-term retention of the subject site's threatened species eg by fire and weed vigilance. Effective education and awareness of these values, and the measures taken thus far to retain them, is seen as the most viable means of ensuring the long term avoidance of any significant impacts.

PART E: STATUTORY CONSIDERATIONS

7.0 EPBCA 1999 - MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

7.1 GENERAL CONSIDERATION/SUMMARY

The provisions of the EPBCA 1999 require determination of whether the proposal has, will or is likely to have a significant impact on a "*matter of national environmental significance"* (MNES). These matters are listed and addressed as follows:

1. **World Heritage Properties**: The site is not listed as a World Heritage area nor does the proposal affect any such area.

2. **Ramsar Wetlands of International Significance**: No Ramsar wetland occurs on the site, nor does the proposal affect a Ramsar Wetland.

3. **EPBCA listed Threatened Species and Communities**: No EPBCA listed species are likely to be significantly affected (see section 7.2 and Appendix 1).

4. **Migratory Species Protected under International Agreements**: No migratory species is likely to be significantly affected by the proposal (see section 7.3).

5. **Nuclear Actions**: The proposal is not a nuclear action.

6. **The Commonwealth Marine Environment (CME)**: Listed as relevant to the study site though site is not within the CME nor does it affect such.

7. **National Heritage**: The site is not an item of National Heritage.

The proposal thus is not considered to require referral to DEWHA for approval under the EPBCA 1999.

7.2 EPBCA 1999 THREATENED SPECIES

7.2.1 Threatened Flora

No EPBCA 1999 listed flora species were found or are considered likely potential occurrences on the study site, and thus are not considered further.

7.2.2 Threatened Fauna

7.2.2.1 General Consideration

No EPBCA threatened species were recorded by this survey, but Umwelt (2004) recorded the Grey-Headed Flying-Fox on the property, and hence this species is considered a highly likely seasonal occurrence on site. The Spotted-Tail Quoll is considered a very marginal potential occurrence on or near the site. The Grey-Headed Flying Fox is listed as Vulnerable under the EPBCA, while the Quoll is listed as endangered. These species are dealt with specifically in 7.2.2.2 and 7.2.2.3

Regarding other fauna species, a number of species are known or considered potential occurrences in the locality in terms of potentially suitable habitat. A significant number of others have also been recorded in the region in habitats broadly similar to that occurring in the locality. The following groups of threatened species are not considered further as the proposal has no consequence upon them:

1. **Marine reptiles, fish and mammals** eg Grey Nurse Shark, Great White Shark, Southern Right Whale, Elegant Sea-Snake, Yellow-Bellied Sea-Snake, Loggerhead Turtle, Green Turtle and Leatherback Turtle.

2. **Migratory pelagic/open ocean seabirds** eg Gould's Albatross, Southern Giant Petrel, Blue Petrel, Northern Giant Petrel, Sooty Albatross, Kermadec Petrel, Shy Albatross and Grey-Headed Albatross.

These species were considered likely to be unaffected by the development proposal due to:

- Lack of habitat affected eg pelagic species
- Extremely rare probability of occurrence near site or in locality
- Nesting or foraging habitat not potentially or significantly affected
- No threats to be introduced or enhanced.

The following other threatened species listed under the EPBCA 1999 are potential or known occurrences in the locality or regional database, and are considered for potential impacts, risk and significance in the evaluation table in Appendix 1. These species are dually listed under the NSW TSCA 1995. Species considered are:

1. Birds: Swift, Parrot, Regent Honeyeater, Painted Snipe and Red Goshawk.
2. Mammals: Long-Nosed Potoroo (considered as entire species) and Dwyer's Bat.
3. Frogs: *Litoria olongburensis, L. aurea, Mixophyes balbus, M. iteratus.*

None of these species were considered likely to be significantly affected by the development proposal as:

- Potential habitat does not occur on or near the site.
- Potential habitat is not affected at all or significantly.
- Site has minimal potential to support these species to any significant extent eg key part

of migratory range, breeding habitat, refugia, etc; due to:

i. Extent of habitat modification, ie total clearing to establish orchard.
ii. Insufficient recovery period for regrowth vegetation
iii. Presence of more suitable habitat in the general area, ie to the west of the site.

- Lack of records in locality, Shire and catchment
- No significant habitat loss

7.2.2.2 Vulnerable Species: Grey-Headed Flying Fox

7.2.2.2.1 Factors to be Considered for Vulnerable Species

The guidelines to assessment of significance to this Matter, define an action as likely to have a significant impact on a Vulnerable species if it will:

a) Lead to a long-term decrease in the size of an important population of a species, or:
b) Reduce the area of occupancy of an important population, or:
c) Fragment an existing important population into two or more populations, or:
d) Adversely affect habitat critical to the survival of a species, or:
e) Disrupt the breeding cycle of an important population, or:
f) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or:
g) Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to a Vulnerable species, becoming established in the Vulnerable species' habitat , or:
h) Interferes substantially with the recovery of the species.

An *important population* is one that is necessary for a species' long-term recovery. This includes such populations as:

- Key populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity, and or:
- Populations that are near the limit of the species range:

7.2.2.2.2 Assessment of Significance: Grey-Headed Flying Fox

This section addresses each of the previous points listed.

For the purposes of discussion, the "*important population*" of Grey-Headed Flying Foxes is defined as that population of the species likely to depend on colonial roosts in the locality (eg Arakoon – Eby 2002), or within foraging range of the site.

a) *Lead to a long-term decrease in the size of an important population of a species*, or:

In the context of the species ecology, the site/property provides a relatively minor area of potential foraging habitat. It is not known nor considered suitable as roosting habitat for the species, thus no such areas are affected by the proposal.

The proposal will require the removal of a maximum of approximately 4.3ha of pasture, lawns/gardens and agricultural woodland, containing 39 scattered native trees and a <300m^2 isolated patch on the mid-west, as well as some flowering ornamentals. These trees are potential foraging resources for the Grey-Headed Flying Fox and hence the proposed development will reduce the site/property's current foraging carrying capacity for the species. However, due to the limited loss, extent of habitat in the study area, and the ecology of the species, the resulting reduction is relatively minute. In addition, alternative known/potential habitat occurs extensively in the locality, and the species readily forages

and roosts in human-modified environments eg the Sydney Royal Botanical Gardens (Parry-Jones 2006). Overall, the proposal will not lead to a long-term decrease in the size of an important population.

b) *Reduce the area of occupancy of an important population*, or:

The area of occupancy of the local population of the Grey-Headed Flying Fox would extend well beyond the confines of the site/property (as their ecology indicates an area of occupancy is likely to be tens if not hundreds of thousands of hectares – Eby 2000a, 2000b, Eby and Lunney 2002, Eby 2002). As mentioned previously, establishment of the proposal will require the removal of about 4.3ha of habitat including about 39 scattered native trees and a $<300m^2$ isolated patch on the mid-west boundary which offer forage for the Grey-Headed Flying Fox. This loss is only a minor fraction of the potential habitat remaining in the study area and property. In this context, and in the context of the species' area of occupancy as discussed above, the proposal will reduce only a very small portion of the habitat available to an important population. Furthermore, the species is known to readily use habitat within urban areas indicating usage of highly modified habitat and adjustment to high levels of human presence (eg Smith 2002, Eby 2002, Parry-Jones 2006).

c) *Fragment an existing important population into two or more populations*, or:

The Grey-Headed Flying Fox is highly mobile and known to be capable of crossing human-modified habitat (personal observations, Eby 2002, Parry-Jones 2006, Smith 2002). The proposal will thus offer no barrier to movement and hence will not fragment an existing important population.

d) *Adversely affect habitat critical to the survival of a species*, or:

According to the MNES guidelines, "*critical habitat*" refers to areas critical to the survival of a species or ecological community and may include areas that are necessary for/to:

- Activities such as foraging, breeding, roosting or dispersal.
- Succession.
- Maintain genetic diversity and long term evolutionary development, or
- Reintroduction of populations or recovery of the species/community.

As mentioned previously, the study site/property is not known roosting habitat for the Grey-Headed Flying Fox, nor is any significant extent of potential or known foraging habitat affected by the proposal. Post-development, due to the retention of the larger portion of the potential foraging habitat in the study area and remainder of the property, and the demonstrated tolerance of the species to human presence (eg Eby 2002, Smith 2002, Parry-Jones 2006, Eby and Lunney 2002, Richards 2000), the property will readily retain its essential capacity to support foraging by the Grey-Headed Flying Fox, as part of such locally abundant habitat. Hence the proposal is not considered likely to affect the viability of the important population.

e) *Disrupt the breeding cycle of an important population*, or:

The Grey-Headed Flying Fox is dependant on a sufficient extent of reliable sources of nectar, pollen and fruits for successful reproduction, and uses specific maternity roosts (Eby 2000a, 2000b, Eby 2002, Eby and Lunney 2000). The site is not a known maternity roost (Eby 2002). As some of the potential foraging species present flower in Winter-Summer, the Grey-Headed-Flying Fox has potential to forage while lactating on site as part of a wider area fulfilling these requirements (Eby 2000a, 2000b, Eby 2002, Eby and Lunney 2000, Richards 2000). In this context, the losses potentially imposed by the proposed development are thus unlikely to affect the breeding cycle of any important population of the Grey-Headed Flying Fox.

f) *Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*, or:

As detailed previously, the degree of possible vegetation loss imposed by the proposed development is not significant enough to affect the local Grey-Headed Flying Fox population to the point that it could cause a decline of the species.

g) *Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to a Vulnerable species, becoming established in the Vulnerable species' habitat*, or:

No new species that affects Grey-Headed Flying Fox will be introduced.

h) *Interferes substantially with the recovery of the species*.

Ideally, the goal in threatened species recovery is to increase the abundance and range of the threatened species, so that it is not in risk of becoming extinct. One major means of achieving this is to avoid habitat loss which is the principal cause of threatened species decline (Eby and Lunney 2002, Eby 2000a, 2000b, Richards 2000, Smith 2002, DECC 2007a).

While about 39 scattered native trees and a <300m^2 isolated patch on the mid-west boundary may be lost, overwhelming majority of the current potential of the property to support opportunistic foraging by the Grey-Headed Flying Fox will be retained. Given that the site it not critical to the species, the extent of loss in proportion to the species range, the retention of a large portion of the property's potential foraging resources (protected in the 7(d) zone), and the presence of foraging resources adjacent to the site; the proposal is not considered likely to interfere substantially with the recovery of the species.

7.2.2.2.3. Conclusion

The proposal is not considered likely to have a significant impact on any EPBCA listed Vulnerable species.

7.2.2.3 Endangered Species: Spotted-Tail Quoll

For the Quoll, given its large territories, a population for the purpose of the following assessment is difficult to define. Given the extent of available forest habitat west and south of the site, it is considered the local population is those Quolls that reside generally within at least a 10km range which form an interbreeding set of individuals.

7.2.2.3.1 Factors To Be Considered for Endangered Species

The guidelines to assessment of significance to this Matter, define an action is likely to have a significant impact on an Endangered species, if it will:

b) Lead to a long-term decrease in the size of a population of a species, or:
c) Reduce the area of occupancy of the species, or:
d) Fragment an existing population into two or more populations, or:
e) Adversely affect habitat critical to the survival of a species, or:
f) Disrupt the breeding cycle of a population, or:
g) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or:

h) Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species´ habitat:
i) Interferes substantially with the recovery of the species.

7.2.2.3.2. Assessment of Significance

This section addresses each of the previous points listed.

a) *Lead to a long-term decrease in the size of a population of a species*, or:

The proposal may require the removal of about 4.3ha of pasture, agricultural woodland and lawns/gardens which offer no specific value to this species as it is located beyond the 4.18ha of dry sclerophyll which itself is only considered to have some marginal potential as the fringe of the foraging range of the local individual. No potential den sites will be removed. The loss of this habitat may have some impact on potential prey such as hollow-obligates, but should not significantly affect prey diversity and abundance. The proposal will introduce associated anthropogenic impacts via creation of new residential dwellings ie roads, noise, etc, as well as potentially increase the local population of feral cats which may impact on prey and mortality rates of the Quoll.

However, as all potential habitat and current linkage in the dry sclerophyll will be retained, and given the site's extremely marginal suitability for this species, the net effects of the proposal should not be significantly detrimental to the potential presence of this species.

b) *Reduce the area of occupancy of the species*, or:

The proposal will remove/modify the marginal fringe of low quality potential habitat adjacent to the urban fringe. This loss is only a fraction of a potential territory of a single animal (Belcher 2000, 1994, NPWS 1999a, WWF 2002). Consequently, as the adjacent dry sclerophyll forest will retain its potential value, and most of the habitat used by the local population is not affected by this proposal (due to the area required), it is determined that the proposal only represents a minute contraction of the potential area of occupancy of the important population.

c) *Fragment an existing population into two or more populations*, or:

The Quoll is highly mobile and known to be capable of crossing human-modified habitat (Smith *et al* 1995, Belcher 2000, 1994, NPWS 1999a, WWF 2002). The proposal will offer no barrier to movement to the Spotted Tail Quoll as links have been retained to adjacent habitat. Thus it will not fragment an existing important population.

d) *Adversely affect habitat critical to the survival of a species*, or:

"*Critical habitat*" refers to areas critical to the survival of a species or ecological community may include areas that are necessary for/to:

- Activities such as foraging, breeding, roosting or dispersal.
- Succession.
- Maintain genetic diversity and long term evolutionary development, or
- Reintroduction of populations or recovery of the species/community.

As noted previously, the site/property is also not considered likely to be of any specific significance to the Spotted Tail Quoll due to failure to detect the species by this survey, the low quality of habitat; likely presence of competitors/predators; and it lies near the fringe of a large extent of potential habitat

(Hat Head National Park). Hence its modification is considered very unlikely to have any significant detrimental effect on the viability of the Spotted Tail Quoll.

e) *Disrupt the breeding cycle of a population*, or:

In addition to the majority of habitat being retained on the property, the extent of adjacent habitat with much higher potential to support the Spotted Tail Quoll is not affected by the proposal.

Furthermore, the development is not of significant enough scale to affect an important population of the species, given that such populations would range over hundreds to thousands of hectares owing to the ecology of the species.

f) *Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*, or:

As detailed previously, the area of the site/property and the degree of vegetation/habitat loss is not significant enough to affect the local population of the Spotted Tail Quoll to the point it could cause a decline of the species.

g) *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species´ habitat*, or:

No feral species that may affect the Spotted Tail Quoll is likely to be introduced (since foxes and feral cats are likely to already occur on site/property and in the general area). Domestic species such as cats are potential predators, though as they are pets, are not strictly an "invasive" species.

h) *Interferes substantially with the recovery of the species*.

Ideally, the goal in threatened species recovery is to increase the number and extent of the threatened species, so that it is not at risk of becoming extinct.

The proposal will retain the majority of the current potential of the property to support the potential occurrence of the Spotted Tail Quoll. Given that the site/property it not critical to the species, the proposal is not considered likely to interfere substantially with the recovery of the species.

7.2.2.3.3 Conclusion

While the proposal will see some relatively minute reduction of the potential foraging values of the site/property for this species, the majority of the current potential is considered likely to be retained.

On basis of this and that the site comprises (in a regional context) only a small area of potential foraging habitat, the proposal is considered unlikely to have a significant impact on these species.

7.3 EPBCA 1999 MIGRATORY SPECIES

No EPBCA 1999 listed migratory species were recorded during the survey. However, a number of other migratory species have been recorded in the locality (DECCW 2009a, Birds Australia 2009, Darkheart 2006f, 2004f, Sandpiper Environmental 2005). Of those, the following are considered at least a fair chance of occurrence or directly adjacent to the site:

- Cattle Egret, Rainbow Bee-Eater, White-Throated Needletail and Fork-Tailed Swift.

These species are considered in the following section.

7.3.1 Factors To Be Considered

The guidelines to assessment of significance to this Matter, define an action as likely to have a significant impact on a migratory species, if it will:

a) **Substantially modify (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or;**

b) **Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species, or;**

c) **Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.**

An **important area of habitat** is:

1. Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or:
2. Habitat utilised by a migratory species which is at the limit of the species range, or;
3. Habitat within an area where the species is declining.

7.3.1.1 Assessment of Significance

This section addresses each of the previous points listed.

The site is not considered likely to constitute an *important area of habitat* on the basis of the following:

1. The site/property is not of sufficient extent to support an ecologically significant proportion of the species (at most, only a small group or transient individuals using the broader locality and region as a range). Thus value of the habitat is as a fraction of a significant extent of similar habitat not only in the LGA, but the North Coast Bioregion.

2. While some migratory species occurring in the locality may be at the limits of their range, no such species were recorded on or near the site. Additionally, similar habitat is known to occur both north and south of the LGA.

3. If the site/property were located at the limits of a species whose abundance and range is declining, it would not be considered significant as such habitat is locally abundant in the area, and habitat with greater capability occurs within 10km eg National Parks, SEPP 14 wetlands and conservation reserves, etc.

In regards to point (a): The proposal does not affect important habitat (as detailed above).

In regards to point (b): An invasive species is one that may become established in the habitat, and harm the migratory species by direct competition, modification of habitat, or predation. The proposal will not introduce any invasive species.

In regards to point (c): No disruption of the lifecycle of any migratory bird is likely as:

- Habitat for the species is largely outside the development area.
- Habitat affected is either only marginally suitable, and/or locally abundant.
- No nesting/breeding habitat is affected.
- Key habitat areas are to be retained.

In view of the above, no migratory bird is considered likely to be significantly affected by the proposal.

8.0 SEVEN PART TESTS OF SIGNIFICANCE

8.1 GENERAL

Section 5A of the *Environmental Protection and Assessment Act* (EP&A) *1979,* as amended by the *Threatened Species Conservation Legislation Amendments Act 2002* (Seven Part Test for Significance), lists the factors to be considered in the determination of significant effects of proposed developments on threatened species, populations, communities or their habitats.

The Seven Part Test of Significance is applicable to listed species, populations and communities which are listed under the TSCA 1995 when they are recorded during surveys, or if potential habitat that these species could occupy, occurs on the site of the proposed development, or the proposal will have an effect on adjacent habitats which these entities may or do occupy. The DA is submitted under Part 3a of the EP&A 1979, but the DGRs have specified the 7 Part Tests are to be applied.

No threatened flora species, EECs or populations were detected on the site by the survey, and as detailed in section 3.2.1 and Appendix 1, none are considered likely potential occurrences. Hence no threatened flora, EECs or endangered populations are considered in the Seven Part Tests.

The Squirrel Glider was the only threatened species recorded by this survey on site and hence was automatically subject to the Seven Part Tests.

Previous survey of adjacent land by Umwelt (2004) recorded the following threatened species which are considered highly likely to occur on site due its proximity to these records and connectivity to suitable interconnected habitat. These species were automatically subject to the Seven Part Tests:

- Little Bent-Wing Bat
- East-Coast Freetail Bat
- Eastern Bent-Wing Bat
- Grey Headed Flying Fox

Threatened fauna species recorded in the South West Rocks area, locality or the region and considered to have some potential to occur on the study site or in the locality in broadly similar habitats were listed in section 2.3.1. The likelihood of these species occurring on the study site and their eligibility for consideration under the Seven Part Test is considered in Appendix 1. These species were assessed in terms of records within similar habitats in the bioregion, cited habitat requirements, availability of habitat on the study site/area, and potential impact significance (eg loss of potential or known habitat, loss of critical habitat components, etc). Of these species the following were considered to be potential occurrences on site and hence were considered to require Seven Part Test Assessment:

- **Mammals**: Greater Broad-Nosed Bat, Yellow-Bellied Sheathtail Bat, Beccari's Freetail Bat, Hoary Bat, Eastern False Pipistrelle, Brushtailed Phascogale, Spotted-Tail Quoll, Koala.

- **Birds**: Glossy Black Cockatoo, Square-Tailed Kite, Barking Owl, Masked Owl, Powerful Owl, Little Lorikeet, Little Eagle, Varied Sittella.

The Seven Part Tests for the threatened fauna are summarised below and detailed in Appendix 2.

For the threatened species other than those considered in the Seven Part Tests, it was considered that the proposed development is unlikely to have any significant impact due to some or all of the following factors:

- Absence of suitable habitat either on the study site or within the locality.
- Absence of records in the locality (or even the local region) and survey failure to detect, strongly suggesting these species do not facilitate the study area.
- Degraded condition of the potential habitats and habitat components in the study area which is likely to preclude these species from the study area or on-site eg lack of undergrowth development/diversity, lack of preferred forage species/prey, etc.
- Absence of some critical habitat components within the study area eg understorey containing suitable species, low abundance or diversity of prey species, absence of large hollows.
- Presence of rival/competitive species or predators eg reptiles, common bats and owls.
- Presence of threatening processes and Key Threatening Processes ie foxes, clearing of native vegetation, frequent fire, etc.
- Low probability of potential recovery due to continuation of degrading processes ie slashing and weed infestation
- Presence of alternative and more optimum habitat in adjacent areas ie Nature Reserves, State Forest, etc.

8.2 SEVEN PART TEST SUMMARY

Given the ecology of the subject species, the habitat on the site/property and the extent of known/potential habitat in the general area, the range of the known/potential local population of the subject species would extend well beyond the confines of the site/study area/property, as detailed in Appendix 1 and 2.

The following summarises the findings of the 7 Part Tests (refer to Appendix 2 for full tests):

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

The proposed development may see up to approximately 3.03ha of modified woodland habitat potentially removed/modified via the proposal from the site (about 1.27ha of gardens/ornamentals and 1.33ha of treeless pasture north of the existing house will also be removed but offers no notable habitat). This will remove some 39 scattered native trees and a <300m^2 isolated patch on the mid-west boundary, including some 5 hollow-bearing trees which have generic potential as roosts sites for the Yangochiropteran bats, Squirrel Glider and Brushtailed Phascogale. About 20 trees of species listed under Schedule 2 of SEPP 44 as primary preferred Koala browse species will also be removed.

This habitat loss/modification will result in a reduction of the property's carrying capacity for all the subject species. However, given the limited quality of the habitat affected, the extent of more optimum habitat in the 7(d) zone, and mobility and ranges of the majority of the subject species, this would

represent a very minor reduction in potential habitat available in the area, as well as locally and regionally.

For the Squirrel Glider which has the smallest range of the subject species, the habitat reduction proposed is will have a negative effect, but is also considered relatively insignificant. This is due to the retention of the majority of known or potential habitat together with links to surrounding land; and the retention of most of the key habitat components ie tree hollows are most abundant in the 7(d) zone (ERM 2006b) .

Thus given the site/property's disturbance history, current modified state and records of all of the subject species in/adjacent to urban and rural/rural-residential habitats elsewhere (eg Darkheart 2004b, 2003a, 2006k, 2007d, 2007e, 2006c, 2006i, 2006j, 2005a, 2005b, etc, Smith 2002a, 2000, Faulding and Smith 2008, Smith and Murray 2003, Dobson *et al* in press, Cooke *et al* 2002, etc), and most importantly that all remaining habitat on the property will largely retain the current carrying capacity for all of the subject species, population viability is expected to be retained. Other threats to the subject species or their habitat (ie domestic pets, road kill, fire) should not be significantly increased by the proposal beyond current threat status given statutory and other controls.

Overall following consideration of the above, while it will have some negative effects, the proposal is not considered likely to result in an impact that may significantly affect the lifecycle of the local population of any of the subject species to the point of increasing extinction risk, especially given the extent of alternative known/potential (and generally better quality) foraging and/or roosting/nesting habitat available to the local population of the subject species on the property and interlinked to adjacent habitat.

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

No relevant populations are currently listed under the TSCA.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No EECs occur on site or in the study area, hence this question is not relevant.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The proposal will remove/modify about 4.3ha including about 39 scattered native trees and a <300m^2 isolated patch on the mid-west boundary on the property, which lies on the fringe of about 4.18ha of forest and 1.7ha of woodland remaining on the property's southern boundary. For the majority of the

subject species, the habitat potentially requiring removal as part of the proposal provides only marginal habitat and/or a minute fraction of their range and the majority of habitat on the property will be retained.

All the subject species are generally at least relatively highly mobile (provided suitable habitat exists eg canopy cover), thus the relatively minor area of habitat loss will not impose any barrier to movement as current linkages to the south and west will remain.

The affected areas of habitat for all the subject species comprises known or potential foraging habitat and for some species, offers potential denning/roosting habitat in tree hollows. While its loss/modification is a negative impact to the carrying capacity of the property, as about 5.9ha of forest and woodland on the property will remain (and contains the overwhelming majority of hollows, plus linkages) and be enhanced, the affected area is not crucial to the long term survival of any threatened species population.

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

No relevant areas of critical habitat have been declared, as yet, under Part 3 of the TSCA.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The *Recovery Plan for the Barking Owl* (NPWS 2003e) outlines the loss of native vegetation as a key threatening process for the Barking Owl. While the proposal will remove native vegetation, the extent of clearance is relatively minute compared to remaining habitat in the area and its home range, and will not significantly impact on the species. Hence only via strict definition is the proposal inconsistent with objectives of the plan.

The *Recovery Plan for Forest Owls* (DEC 2006) has been exhibited for the Masked and Powerful Owl. As for the Barking Owl, the proposal will remove a minute area of potential foraging habitat and only via strict definition is the proposal inconsistent with objectives of the plan.

The *Recovery Plan for Koalas* (DECC 2008) specifies actions considered to be key threats to Koalas. This plan specifies habitat loss, fragmentation and degradation as the most important threats to Koalas throughout their range. The proposal is thus by strict definition inconsistent with this plan as it will remove potential browse species and contribute to these threats. Dogs and traffic are also key threats, and the proposal will incrementally add to these impacts. While negative, as no Koala population has an association with the site, the conflict with the objectives of the recovery plan is relatively limited.

At present no recovery/threat abatement plan is in place for the other species. The proposal may remove about 3.03ha of highly modified native habitat including 39 scattered native trees and a <300m^2 isolated patch (and 5 hollow-bearing trees) which by strict interpretation could be considered as adding to the main threatening process affecting these species (habitat loss), and hence is inconsistent with the recovery of the species. However, given the relatively marginal quality of the habitat to be affected, the minor area of habitat to be removed, the extent of habitat to be retained on the property, and the abundance of similar habitat on adjacent land and in the direct locality; the loss is considered to be insignificant to the long term recovery of these species. Active regeneration of 1.077ha of the 5.9ha of retained habitat will also offset the habitat loss to some extent by enhancing the carrying capacity of the retained habitat.

Overall the proposed development is considered unlikely to have a substantial effect on the long-term recovery of any of the subject species.

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

"*Clearing of native vegetation*" has been listed as a Key Threatening Process and is a recognised threat to a number of species, communities and populations listed under the TSCA 1995 (NSWSC 2001d). Loss of habitat via development for residential and urban land use is also recognised as a threatening process for all of the subject species (Smith *et al* 1995, DECCW 2009b, etc). The proposed development will contribute to this process via the removal/modification of habitat to establish development envelopes. However the majority of the property's forest and woodland vegetation will be retained post-development with protection under statutory instruments. Regeneration of 1.077ha of the 5.9ha of retained habitat will also offset the habitat loss to some extent by enhancing the carrying capacity of the retained habitat.

Human-induced climate change is a Key Threatening Process that the proposed development will contribute to via removal of up to 4.3ha of woodland and ornamental garden vegetation and possible burning of this material; and/or establishment of a residential development utilising fossil fuels for energy.

"Predation by foxes and feral cats" are other Key Threatening Processes likely to be currently existing on the site, which impose a risk to potential prey, and several potentially occurring threatened species. The increase in human presence on site may see greater controls on these pests. Considering that any potential pet cats and dogs will largely be retained in close vicinity of the dwellings, and that the threat posed by domestic cats and dogs is already high (given the abundance of both species on land to the west) the increase in this threat induced by the proposal is not considered likely to be substantial.

The proposal will see the loss of about 5 hollow bearing trees. Due to the dependence of a significant proportion of Australian fauna on this habitat component, and historical losses, loss of hollow-bearing trees is listed as a Key Threatening Process (NSWSC 2007a), and is considered a major threat to many threatened species (NSWSC 2007a, Gibbons and Lindenmayer 2002, Fisher and Lindenmayer 2006, Johnson *et al* 2007, DECC 2009b, Smith *et al* 1995). This is to be compensated to some extent by replacement with nest boxes and recycling some hollow limbs. Some 60 other hollow-bearing trees containing >243 hollows occur in the 7(d) zone (ERM 2007a), hence this loss is a minor fraction of available hollows.

Inappropriate fire regimes are also a Key Threatening Process (NSCSC 2000c), and could lead to long term degradation of the 7(d) zone habitat if it were to eventuate. Threatened species have been recorded on the site thus any burning for the purpose of hazard reduction should require a Bush Fire Hazard Reduction Certificate (BFHRC) under the RFA 1997 which should include measures to protect the habitats of the threatened species. Thus the potential for an altered fire regime to reduce the site's carrying capacity for the threatened species should be controlled by the legislation and recommendations discussed above.

A number of other Key Threatening Processes may also be incrementally increased by the proposal via edge effects, eg:

- *Invasion of native plant communities by exotic perennial grasses.*
- *Invasion and establishment of exotic vines and scramblers.*
- *Invasion of native plant communities by Lantana camara.*

- *Invasion of native plant communities by Bitou Bush*

These Key Threatening Processes could be exacerbated by the proposal due to edge effects, but should be abated by the rehabilitation of adjacent portions of the 7(d) zone and appropriate controls.

9.0 CONCLUSION

This survey and assessment has found that while the site and property overall is generally evident of a substantial disturbance history, it has retained some significant ecological values in the retained habitat.

The proposal will see a relatively minute reduction in the foraging capacity of the property overall, and will result in an incremental contraction of habitat extent to the south and southwest; increase some existing threats eg pets; and introduce a higher human presence with its associated impacts eg noise and lighting. However the majority of habitat, including the overwhelming majority of key habitat components, will be retained and overall most of the current connectivity and carrying capacity for all of the known/potentially occurring threatened species should be largely retained.

This conclusion is made on the provision that the final design and implementation of the proposed development is in accordance with the recommendations and ameliorative measures proposed in this assessment (for the express purpose of ensuring ecological impacts are significantly reduced if not avoided), that the proposed development is not considered likely to significantly adversely affect any threatened species, endangered population or EEC.

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APPENDIX 1: *Eligibility for 7-Part Tests*

The following tables are used as a summary to address threatened species (as detailed below) in terms of potential occurrence, and likelihood of being significantly affected by the proposal, and hence requiring formal 7 Part Test assessment. Threatened species have been assessed if it is:

a) Recorded on-site;

b) Not recorded on site, but recorded within a 10km radius (the locality), and may occur to some degree on-site or in the study area (land within 100m of site) due to potential habitat, key habitat component, etc;

c) Not recorded in the locality as yet, but recorded in the bioregion, and thus may occur in the locality, and possibly to some extent, may occur on the site, due to potential habitat.

The "*habitat requirements*" column is derived from the previously listed references. Likelihood of occurrence is based on the probability of occurrence in terms of:

- Habitat extent (eg sufficient to support an individual or the local population; comprises all of home range; forms part of larger territory, etc); quality (ie condition, including an assessment of threats, historical land uses on and off-site, and future pressures); interconnectivity to other habitat; and ability to provide all the species life-cycle requirements (either the site alone, or other habitat within its range);

And:

- Occurrence frequency (ie on-site resident; portion of larger territory; seasonal migrant or transitory opportunist and thus when and how often, etc)

And:

- Usage ie breeding or non-breeding; opportunistic foraging (eg seasonal, migratory or opportunistic); marginal fringe of core range; refuge; roosts; etc.

A scale used by the author to indicate the likelihood of the species to potentially occur in the habitat on the study sites (if they have not been recorded in the locality) is as follows:

- *unlikely* (<1% probability) - no potentially suitable habitat; too disturbed; or habitat is very poor. No or few records in region or records/site very isolated eg by pastoral land, urbanisation, etc.

- *low* (1-10%)- few minor areas of potential habitat; highly modified site/habitat; or few habitat parameters present, but others absent or relatively insignificant (sub-optimum habitat). Usually very few records in locality.

- *fair* (11-25%) - some significant areas of potential habitat, but some habitat parameters limited. Potential for occasional foraging eg from nearby more optimal areas or known habitat. Records at least within 10-15km radius of site.

- *good* (26-50%) - significant abundance of habitat parameters/areas of habitat, and more locally eg adjacent. Potential part of larger territory, but probably unable to support breeding in isolation. Recorded within 10km in similar habitat/environs.

- *Moderate* (51-75%) - quite good potentially suitable habitat on and adjacent to the site, and/or good quality and abundance of some vital habitat parameters. Records within <10km, or adjacent to site, or adjacent to high quality habitat where species likely to occur.

- *high* (>75%) - very good to optimum habitat occurring on or adjacent to the site (support breeding pair or population). Recorded within 5-10km of site in same or similar habitat.

The "*Assessment of Significance*" column is based on consideration of the habitat on-site, likelihood of occurrence, and consideration of the DEC guidelines for assessment under the 7 Part Tests (DEC 2005). Recognising that some species with very large ranges or varying tolerances to habitat modification, some species which may have low potential to occur in the study area and will obviously not be significantly affected by the proposal will not be formally assessed to avoid production of superfluous information. Rather these species are assessed in the final column with justification for this assessment. However, recognising that significance is open to interpretation, the decision on whether a species is formally assessed or not by the 7 Part Tests in this assessment is based on the following rules:

a) If there is *any* justifiable risk, based on consideration, of a significant impact as a result of direct or indirect impacts, a 7 Part Test is required (ie the Principle of Uncertainty is applied).

b) Any threatened species recorded on-site or in the study area, or of at least fair chance of occurrence on-site in terms of potential habitat, is **automatically** selected for the 7 part Tests, unless the proposal has no effect (justification provided).

Table 12 : Eligibility for Seven Part Tests - Flora

SPECIES	HABITAT REQUIREMENT	LIKELIHOOD OF OCCURRENCE	SIGNIFICANCE OF IMPACTS
Acacia courtii	A localised species, found only on Middle and North Brother Mountains. It grows on steep, dry rocky slopes in mixed dry forest on shallow soils, often under a canopy of White Mahogany and Grey Gum. Several populations are known to occur on North Brother South Brother and Middle Brother Mountains. In Dooragan National Park, *A. courtii* occurs on dry locations on the midslopes of the mountain and has been recorded in association with the stringybark forest and white mahogany/ ironbark associations on skeletal soils on western and northern side of the Mountains.	Not recorded on site or in locality. Considered unlikely to occur due to lack of suitable habitat on site and site is well outside known range.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
A. chrysotricha	A small to medium tree restricted to wet sclerophyll and rainforest in steep, narrow gullies on quartzite soil. The nearest records were previously north of Nambucca Heads however new record near Frederickton.	Not recorded on site or in locality. Considered unlikely to occur due to lack of suitable habitat on site.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
A. ruppii	An erect or spreading shrub with smooth grey bark, found in dry sclerophyll forest and shrubland on sand. It is reportedly confined to the Grafton-Coaldale area. Recorded on Grafton database.	Not recorded on site or in locality. Site is located well south of this species known range. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Acalypha eremorum	A new species. This shrub is found in dry rainforest near Lismore. Recorded on Grafton database.	Not recorded on site or in locality. No suitable habitat on the site which is located well south of this species known range. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Acronychia littoralis	An understorey tree found in littoral rainforest on sand. This species has been recorded in littoral rainforest at Big Hill. Recorded on Bare Point, Port Macquarie-Hastings LGA, Kempsey, Nambucca, Macksville LGA and Coffs Harbour databases.	Not recorded on site though has been recorded in locality. No suitable habitat on the site. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Alexfloydia repens	A creeping grass found in moist Casuarina forest and above the king tide zone above mangrove forest in the Coffs Harbour district. It is known from only 10 locations south of Coffs Harbour.	Not recorded on site or in locality. No suitable habitat on site. Site is located south of this species main range. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Allocasuarina defungens	A straggly oak about 2m high with blue-green foliage found in heath on sand (sometimes clay and sandstone soils), and swamp sclerophyll forest margins. This plant has been recorded. Recorded on Port Macquarie-Hastings LGA, Kempsey, Bare Point, Coffs Harbour, Greater Taree City Council LGA, Bulahdelah and Camden Haven databases	Not recorded on site or in locality. No suitable habitat on site. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Allocasuarina simulans	A she-oak found in heath on sand from Nabiac to Forster, with another population in the Grafton LGA. Recorded on Bare Point database.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Amorphospermum whitei	An understorey tree found in littoral and warm temperate rainforest, and also wet sclerophyll forest along riparian zones.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Ancistrachne maidenii	A scrambling perennial with slender, rigid horizontal stems and ascending branches. Grows in dry sclerophyll forest on sandstone-derived soils. Known populations appear to only occur in distinct bands in areas associated with a transitional geology between Hawkesbury and Watagan soil landscapes. Recorded on the Grafton database.	Not recorded on site or in the locality and not on suitable soils/geology. Site located well outside known range. Unlikely to occur on site, thus modification of site considered insignificant.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Angophora inopina	A small to large tree, up to 8 m high, often multi-stemmed, and with persistent shortly fibrous bark throughout. Endemic to the Central Coast region of NSW, the known northern limit is near Karuah with an unconfirmed record of the species near Bulahdelah. It is found in open dry sclerophyll woodland with a dense shrub understorey, on deep white sandy soils over sandstone, often with some gravelly laterite.	Not recorded on site or within the locality, and the site is north of this species known range. Unlikely to occur on site, thus modification of site considered insignificant.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Angophora robur	A small tree found on sandy soils derived from sandstone, and is mainly found northwest of Coffs Harbour and Grafton.	Site contains sandy soils but not derived from correct parent material. Also located south of the species known range. No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Archidendron hendersonii	A tree to 18 m tall, with light-brown bark. It occurs in riverine and lowland subtropical rainforest and littoral rainforest, on a variety of soils including coastal sands and those derived from basalt and metasediments. Recorded on the Dorrigo database.	Not recorded on site or in the locality and not on suitable soils/geology. Unlikely to occur on site, thus modification of site considered insignificant.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Arthraxon hispidus	A grass found in (or is likely to occur in) littoral rainforest, dry rainforest, subtropical rainforest, warm-temperate rainforest, cool-temperate rainforest, wet sclerophyll forest and riparian forests (including gallery rainforests) at no particular altitude. Variable geology and various, mainly richer loams soils are favoured. Recorded on Coffs Harbour database.	Not recorded on site or in locality. The area lacks potential habitat. Site and general area has been subject to an extensive disturbance history. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Arthropteris palisotii	A small fern that grows in rainforest, mainly on tree trunks and north from Comboyne (Harden 1993). Recorded near Comboyne in Port Macquarie-Hastings LGA.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Asperula asthenes	An herb found in damp sites along riverbanks and similar areas, typically from Taree to Bulahdelah, but has been recently found in the Kempsey LGA. Recorded in Bulahdelah, Great Lakes, Greater Taree, Kempsey and Port Macquarie-Hastings (in State Forest near Wilson River) LGA databases.	Not recorded on site or in locality. Not recorded on site or in locality. No suitable habitat on site.. Unlikely to occur. Site and general area has been subject to an extensive disturbance history. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Babingtonia prominens	A shrub discovered in 1997. It is only known from two locations in the Nymboida area. It grows in sclerophyll forest, on steep hillsides, on shallow sandy soil derived from sandstone or granite. Recorded on Grafton database. One population is reserved in Nymboi-Binderay National Park; the other is on private land.	No suitable habitat on site. Not recorded on site or in the locality. Site is outside the range of this species which has a very localised distribution. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Babingtonia silvestris	A shrub found in only 3 localities (Dorrigo National Park, Mt Neville Nature Reserve and a State Forest). It grows on granite and rhyolite rock outcrops in mixed shrublands. Recorded on Dorrigo database.	No suitable habitat on site. Not recorded on site or in the locality. Site is outside the range of this species which has a very localised distribution. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Banksia conferta subsp. conferta	A shrub growing to 4 m, irregular in shape, with bark roughly tessellated and grey in colour. In NSW, restricted to a single population occupying 14 ha, in the Coorabakh National Park, north west of Lansdowne. Found on exposed rocky slopes in well-drained skeletal soil derived from high-quartz conglomerate. It occurs in comparatively low open forest with a dry sclerophyll understorey.	Not recorded in locality, and site is outside the range of this species which has a very localised distribution. Unlikely to occur on site, thus modification of site considered insignificant.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Bertya ingramii	Medium-sized shrub 1 - 2 m tall with a grey to white covering of hairs on the stems. Now known only from two small populations in the Oxley Wild Rivers National Park. Grows among rocks or in thin soils close to cliff-edges in dry woodland with she-oaks, wattles and tea-trees.	Not recorded in locality, and site is outside the range of this species which has a very localised distribution. Unlikely to occur on site, thus modification of site considered insignificant.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Bertya sp. (Chambigne NR, M Fatemi 24)	A monoecious shrub to 2 (rarely 3) m high. Recorded from two disjunct locations. Thought to be restricted to Chambigne Nature Reserve and on the nearby escarpment above Shannon Creek. The species appears to be restricted to dry rocky exposed cliff edges and the foot of cliff lines in shrubby sclerophyll vegetation adjacent to eucalypt-dominated communities. Recorded on the Grafton database.	Not recorded in locality, and site is outside the range of this species which has a very localised distribution. Unlikely to occur on site, thus modification of site considered insignificant.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Bertya sp. Cobar-Coolabah	A shrub to small tree found from Cobar to Coolabah in shallow soils with mallee.	No suitable habitat on site. Not recorded on site or in the locality. Site is located outside the species range. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Boronia hapalophylla	A small straggling shrub up to about 1m tall. This newly discovered species occurs in dry woodland on sandstone hill slopes and ridge tops above Shannon Creek. Recorded in the Coffs Harbour, Grafton and Bare Point databases.	Not recorded in locality, and site is outside the range of this species which has a very localised distribution. Unlikely to occur on site, thus modification of site considered insignificant.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Boronia umbellata	A shrub recorded in "scrub" in the Coffs Harbour locality.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Caesia parviflora var. minor	An inconspicuous herb, usually much less than 20 cm tall. Known to occur between Grafton and Coffs Harbour (with an unconfirmed report in Lake Innes Nature Reserve), however may be more common than currently known, as Pale Grass-lilies are often not identified to variety level. Found in damp places in open forest on sandstone. Recorded on the Bare Point database.	While some very marginally suitable habitat is present, this species was not found. Given lack of local records and disturbance history, and wrong geology, the species is not considered likely to occur on site. Thus significant impact unlikely.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Callistemon linearifolius	A shrub to 4m high with red flowers in Spring-Summer. It typically occurs in dry sclerophyll forest on the central coast and ranges (Georges R. to Hawkesbury R.), but is also recorded from Broken Bago SF in Port Macquarie-Hastings LGA and in Great Lakes LGA.	Not recorded on site or in the locality. The site is located beyond this species range. While structurally suitable habitat in general terms may be present, given the site's disturbance history and the previously mentioned points this species is not considered likely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Calophanoides hygrophiloides	A large herb or small shrub that grows to about 1.5 m in height. Found within the understorey of littoral rainforest, dry rainforest and wet eucalypt forest, usually in well-drained areas. Recorded on the Dorrigo and Grafton databases.	Not recorded in locality, and site is outside the range of this species. Unlikely to occur on site, thus modification of site considered insignificant.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Centranthera cochinchinensis	An upright annual herb 13-55 cm high, with rough-textured branches. Occurs in swampy areas and other moist sites, north from Wooli. Recorded on the Grafton database.	Not recorded in locality, and site is well outside the range of this species. Unlikely to occur on site, thus modification of site considered insignificant.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Chamaesyce psammogeton	An herb that grows on fore dunes and exposed sites on headlands. Recorded on Bare Point, Kempsey, Port Macquarie-Hastings, Nambucca, Coffs Harbour and Bulahdelah LGA databases.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Chiloglottis anaticeps	A terrestrial orchid that typically occurs in tall sclerophyll forest, often along streams or around fringes of low sandstone outcrops in high country west of Wauchope (Harden 1993). Flowers Dec-Feb. Recorded in Werrikimbee NP, Port Macquarie-Hastings LGA and Kempsey LGA databases.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Corybas dowlingii	A tuberous orchid species that grows in clonal colonies, typically grows in gullies in tall open forest on well-drained gravelly soil at elevations of 10-200m (Jones 2004). Flowers from June to August. Currently known from 4 localities including Port Stephens (2 localities), Bulahdelah and Freemans Waterhole south of Newcastle.	No suitable habitat on site. Not recorded on site or in the locality and located outside restricted range. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Corynocarpus rupestris subsp. rupestris	A small tree or large shrub 2 – 5 m tall, known only from Glenugie Peak Flora Reserve, south-east of Grafton. Occurs in dry rainforest on steep basalt boulder slopes.	No suitable habitat on site or in South West Rocks. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Cryptostylis hunteriana (Leafless Tongue Orchid)	A leafless saprophytic terrestrial orchid with a poorly developed root system. This orchid is only detectable during the flowering period of Nov-Feb (Bell 2001). It has been described from isolated records as occurring in a variety of habitats from swamp fringes to bare hillsides in eucalypt forest, with favoured soils being sandy but with records in clay (Bishop 1996). However, the habitats of known populations in Victoria and the NSW central coast were described as being either coastal plains woodland/forest with heathy understorey; heathland; or grasstree plains, all on sandy soils (Bell 2001). Flowering is inconsistent, but has been recorded 18 months to 5 years following fire (Bell 2001). Recorded on Great Lakes (Bulahdelah), Coffs Harbour and Clarence LGA databases.	Dry sclerophyll forest may be generically structurally suitable. However, the extensive disturbance history of the site is likely to have excluded the species. Not recorded on site or in the locality, and limited bioregion records. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Cynanchum elegans	A twiner occurring predominately in dry rainforest, littoral rainforest and the ecotone between dry rainforest and open forest, however it has been found in the Manning Valley and Port Macquarie-Hastings in Open Forest types on specific geologies eg limestone and serpentine respectively (Garry Germon pers. comm. 2004, personal observations). It occurs on a variety of lithology's and soil types. It has been found between the altitudinal ranges of 0 to 600 metres ASL and rainfall >760mm annually (NPWS 1999). Common associated species include Geijera parviflora, Notelaea microcarpa, Banksia integrifolia, Ficus spp., Guioa semiglauca, Melia azedarach, Streblus brunonianus and Pittosporum revolutum. Recorded in Camden Haven, Port Macquarie-Hastings LGA, Grafton, Kempsey, Wingham, and Bulahdelah databases.	No suitable habitat on site. Not recorded on site but recorded in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Cyperus aquatilis	A small annual sedge found in open ephemerally wet sites north of the Evans Head area. Recorded on Grafton database.	Not recorded on site or in locality. No suitable habitat on site. Site is located well outside species known range. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Dendrobium melaleucaphyllum	An epiphyte on *Melaleuca stypheloides*, rainforest trees or rocks in coastal districts north from the Blue Mountains. It has square stems, similar to *D. tetragonum* and it flowers Jul.-Oct.	Not recorded on site or in locality. Given lack of potential host trees, and the site's disturbance history this species is not considered a likely occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Dendrocnide moroides	A shrub to 4 m tall in the nettle family, found in lowland rainforest, especially in gaps or other disturbed sites. Occurs from north QLD, south the Clarence River, where it is considered rare. Recorded on the Grafton database.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Desmodium acanthocladum	A sprawling shrub 1 – 2 m in height and often more than 2 m wide. Found in northern NSW in dry rainforest and fringes of riverine subtropical rainforest, on basalt-derived soils at low elevations. Recorded on the Bare Point database.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Diuris disposita	A terrestrial orchid found in moist grassland within sclerophyll forest only within 3 populations in the Kempsey Area.	Suitable habitat does not occur on the site (grassland not structurally suitable) and the species was not detected by the survey. No local records exist and the species is considered unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
D. pedunculata	A terrestrial orchid found in moist grassland within sclerophyll forest, grassy sclerophyll forest/woodland, grasslands (including pastures), riparian forests (including gallery rainforests), and swamp forests at no particular altitude and with variable geology and soils. Ranges from Port Jackson to Tenterfield and flowers Aug-Sept. Recorded near Werrikimbee NP in Port Macquarie-Hastings LGA, Great Lakes LGA and reported to occur in Kempsey LGA.	Not recorded on site or in the locality. While the vegetation present may provide marginally structurally suitable habitat in general terms, given the site's disturbance history and the previously mentioned points this species is not considered likely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
D. venosa	A terrestrial orchid found in moist grassy sites at approx. 1100m altitudes.	The site is well below the required altitude; hence no suitable habitat occurs on site. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
D. praecox *(The Newcastle Doubletail Orchid)*	A terrestrial orchid in sclerophyll forest of the coast and near coastal districts, previously known only from Ourimbah to Nelson Bay on the Central Coast and flowers July-September. Recorded on Coffs Harbour and Great Lakes LGA database.	At best in broad structural terms marginal potential habitat may exist on-site but it was not found. Due to the disturbance history of the site and the lack of local records this plant is not considered a likely occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
D. sp. aff. chrysantha	A terrestrial orchid previously only known from a single population of 100 plants at Byron Bay (NSWSC 2000b), but also recorded from Christmas Bells Plain at Port Macquarie (DEH 2005). Recorded on Coffs Harbour and Port Macquarie-Hastings LGA databases.	Suitable habitat does not exist on site. It is not considered a likely occurrence due to the above, the disturbance history of the site and lack of local records.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Dillwynia tenuifolia	A shrub up to 1m high found in dry sclerophyll woodland on sandstone, shale or laterite, mainly in the southern portion of the North Coast bioregion, into the central coast and tablelands.	Not potential habitat and due to the disturbance history of the site and the lack of local records this plant is not considered a likely occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Diospyros mabacea	Generally a small tree, though it can grow to 25 m tall. Usually grows as an understorey tree in lowland subtropical rainforest, often close to rivers. Soils are generally basalt-derived or alluvial. Occurs in north-east NSW, recorded on the Coffs Harbour database.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Diploglottis cambelli	A large straight tree to 30 m tall. Confined to the warm subtropical rainforests of the NSW-Queensland border lowlands and adjacent low ranges. Can be found in lowland subtropical rainforest to drier subtropical rainforest with a Brush Box open overstorey, however the majority of known individuals exist within small remnants, along road verges or as remnant trees upon cleared land. Recorded on the Coffs Harbour database.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Dracophyllum macranthum	A weakly woody open shrub 0.6-2 (rarely 3) m tall, occurs in moist eucalypt regrowth forest at elevations of 300 to about 500m, on loamy soils over a substrate of conglomerate rock, and possibly associated sandstones. Known only from Coorabakh National Park and from closely adjacent small populations in Lansdowne State Forest and Comboyne State Forest. Recorded in the Taree and Port Macquarie Hastings Council LGAs.	No suitable habitat on site, below known altitudinal range and soil/geology not considered suitable. Unlikely to occur, no risk of significant impact.	nlikely to occur thus no significant impact likely. Seven Part Test not required.
Eidothea hardeniana	A newly discovered tree up to 40m tall. Known to occur within the Nightcap range in temperate rainforest, usually near creeks. Recorded on the Coffs Harbour database.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Eleocharis tetraquetra	A spikerush found in swampy areas that has been recorded in the Boambee area, south of Coffs Harbour.	The site is beyond the species known range and was not detected by survey. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Elyonurus citreus	A perennial tufted grass that grows to 1m high. Grows in sandy soils (can be found in infertile white sands) near rivers or along the coast in wallum areas or sand dunes. Known to occur north from Grafton. Recorded on the Bare Point database.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Endiandra floydii	A small tree to 15 m tall. Occurs in warm temperate or subtropical rainforest with Brush Box overstorey, and in regrowth rainforest and Camphor Laurel forest. Recorded on the Coffs Harbour database.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Endiandra hayesii	A small crooked tree, up to 35 m tall. Occurs from the Richmond River north to Burleigh Heads in QLD. Grows in sheltered moist gullies in lowland subtropical and warm temperate rainforest on alluvium or basaltic soils. Recorded on the Coffs Harbour database.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Eucalyptus approximans	A small multi-trunked tree 4 - 6 m tall. Occurs in heathy shrubland with thin, nutrient-poor soils at altitudes over 1350 m. Recorded in the Coffs	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Eucalyptus glaucina	A medium-sized tree to 30 m tall. Grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils. Found only on the north coast of NSW in separate districts: near Casino and farther south, from Taree to Broke, west of Maitland. Recorded on the Grafton database.	In broad structural terms, extremely marginal potential habitat may exist on-site but it was not found. Due to the disturbance history of the site and the lack of local records this plant is not considered a likely occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Eucalyptus tetrapleura	A tall ironbark tree found in wet sclerophyll forest on moderately fertile soil, dry sclerophyll forest, grassy sclerophyll forest, riparian forests (including gallery rainforests), at no particular altitude and with variable geology and soils. Recorded on Kempsey, Coffs Harbour and Grafton databases.	No potential habitat and it was not found by the survey and has not been recorded in the locality. Due to this and the disturbance history of the site, this species is not considered a likely occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Galium australe (Tangled Bedstraw)	A very rare straggling or intertwining perennial herb found in a range of habitats in NSW including a valley floor, alluvial soil beside a creek, heathland in a rocky gully, and the top of an escarpment above a creek. In New South Wales it is currently known from 13 locations between Sydney and Eden, with an outlying record to the north from near Byabarra on the north coast. Recorded on Port Macquarie-Hastings LGA database.	At best marginal potential habitat may exist in the study area, but it was not found by the survey, has not been recorded in the locality and the site is located beyond the species range. Due to this and the disturbance history of the site, this species is not considered a likely occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Gingidia montana	A small, erect herb endemic to NSW and is known from only one location within the New England National Park on the Northern Tablelands. Occurs in Snow Gum (Eucalyptus pauciflora) Woodland and at the edge of Antarctic Beech (Nothofagus moorei) forest. Grows within the crevices of basalt or trachyte rocks, mostly on cliff faces.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Glycine clandestine (Broad leaf form) Endangered Population	A wiry, twining climber that differs from the common Glycine clandestina by its broad, oval leaves. Only known from two locations about 200m apart on narrow shelf of a headland immediately south of Scotts Head.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Grammitis stenophylla	A fern often found on mossy wet sandstone walls in rainforest and gallery forest. Recorded on the Dorrigo database.	Not recorded during the survey. The species is considered an unlikely occurrence as the site is outside the species known range and does not contain suitable habitat.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Grevillea banyabba	An open-branched shrub restricted to the Fortis Creek–Coaldale area between Grafton and Whiporie. Most plants are in one population in the Banyabba Nature Reserve. Occurs in shrubby open eucalypt forest growing on low ridges and slopes with poor sandy soil.	In broad structural terms, extremely marginal potential habitat may exist on-site but it was not found. Due to the disturbance history of the site and the lack of local records this plant is not considered a likely occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Grevillea beadleana	A spreading shrub up to 3m high found on granite scarps and exposures, and is confined to the catchments of the Mole and Guy Fawkes River, and possibly Apsley River (generally Northern Tablelands region). Recorded on Grafton database.	Not recorded during the survey. Considered an unlikely occurrence on site due to the lack of suitable habitat, absence of local records and site's location outside known range of the species.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Grevillea caleyi	A spreading shrub usually found in woodland or open forest dominated by *Eucalyptus capitellata, Corymbia gummifera* and *E. sieberi* with an understorey dominated by plants of Proteaceae and Fabaceae families, on lateritised sandstone ridge tops in Central Coast Botanical region, but has also been recorded on North Brother near Laurieton. Recorded on Port Macquarie-Hastings LGA and Camden Haven database.	Not recorded during the survey. Not recorded in the locality. While generically structurally suitable habitat may occur on site, the preferred geology is absent. Hence the species is considered unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Grevillea guthrieana	A spreading shrub known from only two locations – Booral near Bulahdelah and on the Carrai Plateau south west of Kempsey. It grows in sandy loams on creek lines in moist eucalypt forest and also along cliff lines with granitic or sedimentary soils (Plantnet 2004). Recorded on Bulahdelah and Kempsey databases.	Not recorded during the survey. Not recorded in the locality. The site does not contain strictly suitable habitat. Given this and the disturbance history of the site, the species is considered unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
G. quadricuada	A shrub usually found in gravelly loam or in sand as an undershrub in Eucalypt woodland mostly along creeks and drainage lines. It has a northern NSW-Southern Qld distribution. Recorded northwest of Whiporie.	Not recorded during the survey. Not recorded in the locality. The site does not contain strictly suitable habitat. Given this and the disturbance history of the site, the species is considered unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Hakea archaeoides	A woody shrub found on steep, rocky, sheltered slopes and deep gullies in open eucalypt forest. It is restricted to hinterland around Mt Boss, Broken Bago State Forest and Landsdowne. Recorded on Camden Haven and Kempsey LGA databases.	Site does not contain suitable habitat and the species was not detected by the survey or recorded in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Hakea trineura	A woody shrub or small tree up to 7 m high. It is restricted to the hinterland between Kempsey and Taree. Occurs on steep, rocky, sheltered slopes and in deep gullies in open eucalypt forest.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Haloragis exalata *subsp.* ***velutina.***	A shrub found in damp places along watercourses, and this subspecies also occurs in woodland on steep rocky slopes of gorges, particularly in the upper Macleay River (NPWS 2000). Recorded in Kippara SF in Port Macquarie-Hastings LGA and in Kempsey LGA database.	Potentially structurally suitable habitat may occur in the swamp forest. Recorded regionally but not locally. The disturbance of the swamp forest is likely to have excluded the potential for the species to occur. Thus, the species is considered unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Harnieria hygrophiloides.	Was formerly known as *Justica* or *Calaphanoides hygrophiloides*. This is a glabrescent shrub growing in rainforest or adjacent wet sclerophyll only from Brunswick Heads to Hortons Creek in far northeastern NSW. Recorded on Grafton database.	Not recorded during the survey. Not recorded in the locality. Site is well outside species known range. No suitable habitat on site. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Hibbertia hexandra	A tall shrub or small tree, which occurs mainly in heath, open forest and rainforest around Mt. Warning (Harden 1993). A separate population in the Wauchope-Kendall area has plants with smaller leaves that are found in crevices and gullies in rocky terrain (NPWS 2000). Recorded on Camden Haven and Kempsey databases.	Suitable habitat does not exist on site, and the plant was not found, nor is it likely to occur due to the lack of local records and the disturbance history of the site.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Hibbertia superans	A low spreading shrub which occurs on sandstone ridgetops woodlands, often near the shale/sandstone boundary. Appears to prefer open disturbed areas, such as tracksides. Recorded on the Kempsey and Port Macquarie-Hastings databases.	While some marginally generically suitable habitat for this species occurs on site (probably not suitable geology), it was not detected nor has it been recorded locally. Given this the species is not considered a potential occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Hicksbeachia pinnatifolia	A small tree to 10 m tall. Occurs in the coastal areas of north-east NSW from the Nambucca Valley north to south-east Queensland. Found in subtropical rainforest, moist eucalypt forest and Brush Box forest.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Kennedia retrorsa	A vigorous, climbing perennial herb covered with rusty or white hairs. Found in a variety of habitats from mountainsides to riparian zones, from sheltered forest to steep, exposed rocky ridgelines. Chiefly found on Mt Dangar and Goulburn River valley to near Putty, with a record on the Coffs Harbour database.	While some generically suitable habitat may exist on site, this species was not found. Given the disturbance history, restricted distribution of this species, and the location well south of nearest known record, this species is not considered likely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Leucopogon confertus	A small shrub with hairy stems, known only from an early record near Torrington on the New England Tablelands. Possibly occurs in open forest and woodland on rocky granite areas.	Site located well outside known range. Not preferred parent material. Not found and not considered a potential occurrence on site.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Lindernia alsinoides	Diffuse or erect annual herb to 15 cm high. Recorded north from Bulahdelah. Has been recorded in damp paperbark swamps.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Lindsaea brachypoda	A small fern that grows on the ground or on rocks. Found in a few locations north from Minyon Falls in Nightcap National Park, a record exists on the Bare Point database. Occurs in very moist habitats in subtropical or warm-temperate rainforest or palm forest.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Lindsaea incisa	A ground fern found in damp sandy places and open forest. Recorded on Coffs Harbour database.	Marginally structurally suitable habitat occurs on site however it was not recorded. Not considered likely to occur due to the site's disturbance history and location south of the species known range.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Macadamia tetraphylla	A small to medium-sized, usually densely bushy, tree growing up to 18m tall. Found in subtropical rainforest, usually near the coast. Recorded on the Coffs Harbour database, chiefly restricted to the Richmond and Tweed Rivers in NE NSW.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Macrozamia johnsonii.	A cycad known only from a small area in the Dalmorton district in northern coastal NSW. It grows in wet to dry sclerophyll forest, on shallow, rocky, usually steeply sloping and poor soils, and is also occasionally cultivated as an ornamental. Recorded on Grafton database.	Site does not contain the recognised habitat. This, the location of the site well south of this species known range, as well as the disturbance history of the site suggest the species is unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Marsdenia longilobia	A slender climber with clear, watery latex (sap). Occurs in rainforest and moist eucalypt forest adjoining rainforest, at no particular altitude, sometimes in areas with rock outcrops. Found at scattered sites from Barrington Tops to SE Queensland (NPWS 2000). Recorded northeast of Byabarra in the Port Macquarie-Hastings LGA and also recorded on Kempsey, Macksville, Coffs Harbour, Grafton and Bare Point databases.	Suitable habitat does not exist on-site and the plant was not found, nor is it likely to occur due to lack of suitable habitat.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Maundia triglochinoides	An aquatic herbaceous plant found in swamps or shallow fresh water on heavy clay on the north and central NSW coast. Recorded on Port Macquarie-Hastings and Kempsey databases.	No aquatic habitat present on site and no local records. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Melaleuca biconvexa	A paperbark shrub/small tree found in damp places, often near streams, on the coast and adjacent tablelands from Jervis Bay to Port Macquarie. Recorded on Bulahdelah, Kempsey, Port Macquarie-Hastings and Camden Haven databases.	Suitable habitat does not exist on-site and the plant was not found, nor is it likely to occur due to lack of suitable habitat.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Melaleuca groveana	A paperbark shrub/small tree that grows in dry sclerophyll, heath and exposed sites generally at higher elevations, though this consultant has recorded it in dry sclerophyll forest on a basalt ridge about 50m asl at Scotts Head (pers. obs.). Recorded on Bulahdelah, Camden Haven, Port Macquarie-Hastings, Kempsey and Macksville databases.	Suitable habitat does not exist on-site and the plant was not found, nor is it likely to occur due to lack of suitable habitat. Recorded in locality	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Melaleuca tamariscina ssp irbyana	A paperbark shrub or small tree up to 8m high, found in open eucalypt forest on poorly drained sites north from the Casino District. Recorded on Grafton database.	Suitable habitat in marginal form may exist on-site but the plant was not found, nor is it likely to occur due to lack of suitable habitat and the ‘ location south of the species known range.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Melichrus hirsutus	A spreading shrub on sandstone, found near Glenreagh and the upper Clarence Valley. Recorded on Grafton and Bare Part databases.	Not recorded on site or in locality. Site is located outside species known range. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Neoastelia spectabilis	A tufted herb found in rock crevices near waterfalls and seepage lines on rocky slopes within Nothofagus forest 900-1150m alt. Previously only known from New England National Park, but now recorded in the Kempsey and Nambucca LGA.	Suitable habitat does not occur on site and the plant was not found. This and the lack of local records suggest the plant is not a likely potential occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Oberonia titania	An epiphytic orchid that grows in a tight clump in a variety of habitats from subtropical to littoral rainforest, *Melaleuca* swamps, and gorges within dry sclerophyll forest. It occurs north of Kendall. Recorded on Coffs Harbour database	No suitable habitat on site – at best uppermost dry sclerophyll where rocky exfoliations offer marginal generic potential but not found. Disturbance of the site, the lack local records and failure to detect it indicates it is unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Olax angulata	A shrub up to 1m high known only from Minnie Waters on sandy soils and woodland near swamps. Recorded on Bare Part database.	Site is outside known range. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Olearia flocktoniae	A short-lived shrub found in recently disturbed sites in wet sclerophyll and warm temperate rainforest essentially in the Dorrigo area.	The site did not contain potential habitat for this species and it was not found. Given this, the sites disturbance history and lack of proximate records, the species is not considered to be a potential occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Parsonsia dorrigoensis	A climber found in sub-tropical and warm temperate rainforest, and sclerophyll forest often on brown clay soils on the north coast south to the Hastings River. It is associated with Blackbutt, Tallowwood, Brush Box, Crabapple, Lilly Pilly, Tree Heath and Water Gum. It may favour some disturbance, including fire. Recorded on Macksville, Kempsey, Coffs Harbour, Grafton and Camden Haven databases.	The site did not contain potential habitat for this species and it was not found. Given this, the site's disturbance history and lack of proximate records, the species is not considered to be a potential occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Peristeranthus hillii	An epiphytic orchid restricted to coastal and near-coastal environments, particularly remnants of littoral rainforest growing on Aeolian sands and lowland subtropical rainforest on floodplains. Recorded at Sea Acres Nature Reserve (NPWS 1995), and reaching its southern limit in the Port Macquarie-Hastings Shire.	Suitable habitat does not occur on site and the plant was not found. This, the lack of local records and the site's disturbance history suggest the plant is not a likely potential occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Phaius tankervilliae *(recorded on Port Macquarie-Hastings LGA database)* *and* ***P. australis*** *(Bare Point, Coffs Harbour)*	Are orchids that generally grow in *Melaleuca quinquenervia* swamps on the coast or at sea level, as well as littoral rainforest, dunes (including stabilised dunes), riparian forests (including gallery rainforests), swamp forests, swamps (including marshes and intermittent wetlands), mainly at low altitudes. Sandy alluvium is the favoured geology and sandy, damp to humic soils are favoured.	No suitable habitat on site. Not recorded in locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Philotheca myoporoides spp obovatifolia	A shrub found at only one NSW location: Werrikimbee National Park.	Suitable habitat does not occur on site and the species was not recorded. Unlikely to occur given its restricted distribution.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Phyllanthus microcladus	A small shrub to 35 cm tall confined to a few locations in the Tweed, Brunswick, Richmond and Wilson River Valleys with an outlying population near Grafton. Usually found on banks of creeks and rivers, in streamside rainforest.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Plectranthus nitidus	A small shrub that grows 30 - 150 cm tall and has rounded leaves with serrated edges. Grows on rocky cliff-faces and boulders, usually associated with subtropical rainforest and ecotones with	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

	rainforest and open forest up to altitudes of 180m. Recorded on the Dorrigo database.		
Polygala linariifolia	An annual or perennial herb about 20 cm high with a woody taproot and more-or-less upright branches. Found in sandy soils in dry eucalypt forest and woodland with a sparse understorey. Recorded on the Grafton and Bare Point databases.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Pomaderris queenslandica	A shrub 2-3m high, found in moist sclerophyll forest with shrubby understorey and occasionally along creeks. Recorded on Wingham database.	No suitable habitat occurs on the site and the species is not considered likely to occur due to the lack of local records and the failure to detect the species.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Psilotum complanatum	An endangered epiphytic fern found in rainforest, often on other epiphytes such as Elkhorns. This fern reaches its southern limit in the Hastings Valley, and has been recorded in Sea Acres Nature Reserve (NPWS 1995).	Species is unlikely to occur on site due to the absence of suitable habitat. Not recorded on site or in the locality.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Psilotum complanatum	An endangered epiphytic fern found in rainforest, often on other epiphytes such as Elkhorns. This fern reaches its southern limit in the Hastings Valley, and has been recorded in Sea Acres Nature Reserve (NPWS 1995).	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Pultenaea maritima	A prostrate, mat forming shrub with hairy stems. Recorded from Newcastle north to Byron Bay on 16 headlands. Occurs in grasslands, shrublands and heath on exposed coastal headlands.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Quassia sp. Moonee Creek	A shrub found in dry rainforest in a relatively localised area northwest of Coffs Harbour. Recorded on Coffs Harbour, Grafton and Bare Point databases.	No suitable habitat on site. Given this, the lack of local records and the site's location outside the species known distribution it is considered an unlikely occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Rotala tripartita	An annual or short-lived perennial herb up to 40 cm tall. It grows in free-standing water with sedges. Only two known locations, one in Casino and one in South Grafton.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Rutidosis heterogama	A perennial herb, to 30cm high, with yellow everlasting flowers, usually found in heath, often along disturbed roadsides mainly on the coast from Maclean to Hunter Valley, and inland to Torrington. Recorded on Bare Point database.	No potential habitat occurs on site. Lack of local records and failure to detect the species indicate it is unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Sarcochilus dilatatus	A semi-pendant epiphyte found on trees in rainforest in coastal ranges up to 400m asl.	No potential habitat occurs on site. Lack of local records and failure to detect the species indicate it is unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
S. fitzgeraldii	A semi-pendant epilith (rarely an epiphyte) orchid found on rocks or tree bases in subtropical rainforest usually near trees from 500-700m asl.	No potential habitat occurs on site. Lack of local records and failure to detect the species indicate it is unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

S. hartmannii	A semi-erect epilithic or terrestrial herb usually found on volcanic rocks often in shallow soil in dry rainforest, subtropical rainforest, wet sclerophyll forest, dry sclerophyll forest, grassy sclerophyll forest, riparian forests (including gallery rainforests), rocky crevices and scree or exposed sites 500-1000m alt., previously north from the Richmond River, but recently recorded in the Kempsey LGA. Preferred geology is mainly volcanics and various (mainly skeletal and poor) soils are favoured. Recorded on Coffs Harbour, Wingham LGA and Kempsey LGA database.	Not recorded on site or in locality. Due to the site occurring below the altitudinal range of the species no potential habitat occurs, hence the species is unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Senna acclinis	A shrub found in or on the edges of subtropical and dry rainforest. Variable geology and soils are favoured. Recorded in Kerewong SF and Lorne SF in the Port Macquarie-Hastings LGA and also in Bulahdelah, Great Lakes, and Coffs Harbour LGA databases.	No potential habitat on site and not recorded on site or in locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Sophora tomentosa subsp. australis	A coastal shrub that occurs on recent sands on frontal coastal dunes northwards from Port Stephens. Port Macquarie has the largest known population eg Shelley and Nobby's Beaches. Recorded on Kempsey, Port Macquarie-Hastings LGA, and Bare Point databases.	Not recorded on site or in locality. No suitable habitat occurs on site. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Styphelia perileuca	A spreading shrub to 1.5 m tall with bristly branches. Occurs in dry forest on ridges and gentle slopes, on sandy shallow soils over granite and trachyte, and shrublands surrounding swamps. Known only from in and near Cathedral Rock National Park and New England National Park, on the eastern edge of the New England Tablelands of NSW.	While some generically suitable habitat may exist on site, this species was not found. Given the disturbance history, restricted distribution of this species, and the location well outside of nearest known record, this species is not considered likely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Syzygium paniculatum	A type of Lilly Pilly, which has a shrub to small tree habit and grows in subtropical and littoral rainforest on sandy soils or stabilised dunes on the coast. It is also widely cultivated as an ornamental.	Not recorded on site or in locality. No suitable habitat on site. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Tetratheca juncea	A small shrub that grows in sandy, sometimes swampy heath, and also dry sclerophyll forest mainly along the lower end of the region around Bulahdelah.	At best the site may contain marginally structurally suitable habitat. However, the disturbance of history of the site, lack of local records and failure to detect the species indicate it is unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Thesium australe	A parasitic herb commonly associated with Kangaroo Grass, and has been recorded on coastal headlands at Coffs Harbour, Hat Head, Crescent Head, Diamond Head and Perpendicular Point in Kangaroo Grass areas. Recorded on Port Macquarie-Hastings LGA, Kempsey, Bare Point, Coffs Harbour, Korogoro and Camden Haven databases.	Kangaroo grass is present, though the disturbance of the site indicates the species is not a likely occurrence. Not recorded locally.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Tinospora smilacina	A twiner found in dry subtropical rainforest. Recorded on Coffs Harbour and Grafton databases.	No suitable habitat on the site which is located outside the species known range. Therefore, species is not considered a likely occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Tinospora tinosporoides	A woody climber found in wetter subtropical rainforest. Recorded on Coffs Harbour database.	No suitable habitat on the site which is located outside the species known range. Therefore, species is not considered a likely occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Triplarina imbricata *(formerly Baeckea camphorata)*	A shrub occurring mainly in sheltered positions on shady slopes, gorges or creek banks, within about 80km of the coast (Australian Plants Online website). This species is also commonly cultivated. Recorded on Dorrigo database.	Strictly suitable habitat does on not occur on site and lack of proximate records, the disturbance history and failure to detect this species suggest it is not a likely occurrence.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Tylophora woolsii	A twiner found in wet sclerophyll and rainforest in the northern ranges and slopes of NSW from Barrington Tops NP to southern Queensland (NPWS 1999). It has also been recorded within in the Bonville-Archville area and along disturbed roadside verges (NPWS 1999). Associated species include: *Acacia melanoxylon, A. binervata, Caldcluvia, Ehretia, Schizomera, Syncarpia, Eucalyptus microcorys and E. saligna.* Recorded on Coffs Harbour database.	Site does not contain suitable habitat and is located outside the species known range. These factors along with the lack of local records and failure to detect the species indicate it is unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Typhonium sp. aff. brownii	A perennial deciduous tuberous geophyte found on rainforest margins, sheltered gullies and along creek banks. It appears to be confined to the ranges up to 30km west of Woolgoolga and Coffs Harbour.	Not recorded on site or in locality. Site does not contain suitable habitat and is located outside the apparent distribution range of the species. Considered unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Uromyrtus australis	A shrub or small tree growing up to 12 m tall, the trunk often crooked and covered in brown scaly or flaky bark. Occurs in warm temperate rainforest on less fertile soils derived from rhyolite rock. Only known records occur west of Mullumbimby in far north-east NSW, with one record in Coffs Harbour.	No suitable habitat on site. Not recorded on site or in the locality. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Zieria lasiocaulis	A tall shrub to small tree usually found on rocky escarpments and scree slopes, in clearings or along margins of *Nothofagus* rainforest. Previously found only at the headwaters of the Wilson River in Mt Boss State Forest, but recently found in the Kempsey and Port Macquarie-Hastings LGA.	No suitable habitat on site. Not recorded locally or detected by the survey. Unlikely to occur on site.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.
Z. prostrata	A shrub restricted to low coastal heath in the Coffs Harbour area.	Not recorded on site or in locality. Site is outside known range and does not contain suitable habitat. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Seven Part Test not required.

Table 13: Eligibility for Seven Part Tests

NAME	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	SIGNIFICANCE OF IMPACTS
Glossy Black Cockatoo (*Calyptorhynchus lathamii*)	Dry sclerophyll forest and woodland containing Allocasuarina and Casuarina, and large tree hollows. Preferred regional forage species are *A. littoralis* and *A. torulosa*. Requires sufficient extent of forage within home range to support breeding. Breeds Mar-Aug, takes 90 days to hatch and fledge (Lindsey 1992).	A stag on the south-eastern boundary offers some potential as a nest hollow, although internal dimensions could not be determined. Allocasuarinas occur on the site with large crops of seed cones offering a potential foraging resource. Chewed seed cones indicative of foraging by the Glossy Black Cockatoo were observed at a number of locations.	Evidence of foraging by the species on detected on site. **Seven Part Test required**.
Red-Tailed Black Cockatoo (*Calyptorhynchus banksii*)	Ranges broadly across much of northern and western Australia as well as western Victoria. In NSW, one population occurs on the north-western slopes and plains but another small isolated population is found in the coastal north-east. In coastal northeast NSW they have been recorded in dry open forest and areas of mixed rainforest/eucalypt forest. Feeds on forbs, eucalypt seeds and some rainforest fruits.	Some marginally generically suitable habitat is present on the site, however the species was not detected nor has it been recorded locally. Historically recorded in Spring in Belmore River area but not sighted since late 80s. Given this, and apparent restriction of records to far northeast NSW, it is not considered a potential occurrence on site.	Considered unlikely to occur on site. Modification of site of no significance given extent of available habitat within the locality. Seven Part Test not required.
Gang Gang Cockatoo (*Callocephalon fimbriatum*)	Distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. In Summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In Winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Favours old growth attributes for nesting and roosting.	Generically suitable habitat on site but species not found, nor any local records. Given site only forms extreme part of non-breeding range, not considered likely to occur on site.	Considered unlikely to occur on site. Modification of site of no significance given extent of available habitat within the locality. Seven Part Test not required.

Little Lorikeet (*Glossopsitta pusilla*)	Gregarious, usually foraging in small flocks, often with other species of lorikeet feeding primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including, melaleucas and mistletoes. Mostly occurs in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. In south-east Queensland (Smyth *et al*. 2002), were more likely to occupy forest sites with relatively short to intermediate logging rotations (15–23 years) and sites that have had short intervals (2.5– 4 years) between fires.	Recorded within the locality, and site considered to provide a small area of potential foraging habitat during flowering periods. Species must forage well beyond the confines of the site. Hollows provide potential nesting opportunities. Species considered a fair potential occurrence given nearby records.	Loss of a small area of potential foraging habitat considered unlikely to be significant, however a handful of potential nesting trees may be removed and considered a fair chance of occurrence, thus **Seven Part Test required.**
Swift Parrot (*Lathumus discolor*)	Breeds in Tasmania and winters on mainland, from Victoria to southern Queensland. Feeds mostly on pollen and nectar of winter flowering eucalypts and banksias, but also on fruit, seeds, lerps and insect larvae (Schodde and Tideman 1990). Favoured species are *E. robusta*, *Corymbia gummifera*, *E. globulus, E. sideroxylon, E. leucoxylon, E. labens, E. ovata, E. maculata, Banksia serrata* and *B. integrifolia.* In coastal NSW, Swamp Mahogany, Spotted Gum and Bloodwood forests are important foraging habitats and larger trees may be selected. Disperse according to changing local food resources.	No preferred forage species on site. Some species may at best flower out of season coinciding with local occurrence. However the site is not key or critical habitat. No other suitable potential forage on site. Recorded at South West Rocks. Considered to have low to unlikely chance of occurrence on site as very rare incidental/opportunistic seasonal transient forager.	Potential foraging on site will be largely retained. No barriers to access or movements. No risk of significant impact. Minimal potential to occur as not preferred forage species. No risk of significant or even detectable impact hence Seven part test not required to evaluate significance.
Powerful Owl (*Ninox strenua*)	Wet and dry sclerophyll forests. Nests in tree hollows. Requires high diversity and abundance of medium-sized arboreal prey. Very large territory (500-5000ha).	A few very large trees on the southern boundary considered to offer some marginal potential as nest hollows. Prey resources on site likely to include Brushtail Possums and Sugar/Squirrel Gliders, and medium to large woodland birds. Recorded in locality, and <5km west. Overall considered a good chance to occur.	Considered a good chance to occur due to presence of suitable prey and abundance of potential habitat in the locality. Site at most may form minute part of single pair territory. Proposal has no potential to result in a significant impact, however **Seven Part Test required** as a good chance to occur.

Barking Owl (*Ninox connivens*)	Well-forested hills and flats, eucalypt savannah (especially), and riverine woodland in coastal and subcoastal areas. Prefers hunting in more open country for mammals (rabbits, rats, mice, small bats and small marsupials) and birds (small up to Frogmouths and Magpies). Large territories. Nest in hollows.	A few very large trees on the southern boundary considered to offer some marginal potential as nest hollows. Prey resource on site likely to include rodents, gliders and birds. The site is linked to similar/superior areas of habitat. Not recorded in locality. Considered an unlikely to marginally fair potential occurrence given suitable habitat and large range.	No loss of breeding habitat and very small area of potential foraging habitat affected. Site will retain potential to support infrequent foraging as part of larger home range. No barriers to access. No risk of significant impact. However **Seven Part Test required** as a fair chance to occur.
Masked Owl (*Tyto novaehollandiae*)	Eucalypt forest and woodlands with sparse understorey. Nests in tree hollows. Requires high diversity and abundance of prey 200-600g weight. Large territory.	A few very large trees on the southern boundary considered to offer some marginal potential as nest hollows. Site offers a range of potential prey resources. Site is linked to extensive areas of suitable habitat for the species. Recorded in locality, but not found by survey. Considered fair chance of occurrence on site.	As for Powerful Owl. **Seven Part Test required**.
Sooty Owl (*Tyto tenebricosa*)	Rainforest and tall, moist, diverse eucalypt forest. Roosts in dense foliage, tree hollows & caves/overhangs. Nests in hollow in tall forest tree. Requires high diversity and abundance of medium-sized arboreal and/or terrestrial prey. Large territory.	A few very large trees on the southern boundary considered to offer some marginal potential as nest hollows. Site vegetation not preferred structure/type and is not near such vegetation. Potential foraging resources include gliders and possums. Recorded in at far fringe of locality, but not found by survey. Considered unlikely occurrence due to absence of suitable habitat.	Seven Part Test not required as no potential habitat affected and not a potential occurrence.
Eastern Grass Owl (*Tyto capensis*)	Eastern population occurs on coastal floodplains in a variety of wet & dry heath, tall grass, swamps and sedgeland which may have common structure rather than floristics. Records in Port Macquarie area are all near wet sedgelands. Breeds year round. Known to nest near or surrounded by water. Forage near nest site. (summary in Redpath 2002) Dependant on good numbers of rodent prey, with possible nomadic link (NSW NPWS 2000).	No suitable habitat. Recorded in locality. Unlikely occurrence on site.	No risk of any impact as no habitat affected. Seven Part Test not required.
Marbled Frogmouth (*Podargus ocellatus*)	Restricted to rainforest. Sedentary and pairing permanently and holding a small territory. Roost on low branches or amongst leafy vegetation. Nocturnal, feeding on large, hard-shelled insects (ie beetles), grasshoppers and frogs from the ground or tree trunks.	No potential habitat on or adjacent to the site. Not recorded in locality or on site. Unlikely to occur.	No impact on known or potential habitat, hence no significant impact likely. Seven Part Test not required.

Red Goshawk (*Erythrotriorchis radiatus*)	Found in tropical open woodland, taller woodland, open forests, rainforest edges and dense riparian vegetation of coastal and subcoastal drainages. Territorial and utilise same nest. Breeding territories estimated 50-220km^2. Preys on birds, especially Honeyeaters, parrots, kookaburras and slight waterbirds, as well as some mammals, reptiles and large insects. Solitary, secretive, forages from concealed tree perches, by quartering low over canopy or by high transects. Nest is large stick platform in exposed fork of emergent tree. 1-2 eggs laid May-Oct with 90 days to fledging. (Debus 1998)	Recorded in Kempsey Shire historically but recent records south of far north coast of NSW very rare (Birds Australia 2009, DECCW 2009, Bionet 2009). General locality is potentially suitable. Not recorded in locality or by survey. Site may form part of larger territory. Very low to unlikely potential to occur due to sparseness of records – possibly only as extremely rare occurrence.	Potential habitat on site will be largely retained and hence so will potential to support rare occurrence. No risk of significant impact. Seven Part Test not required.
Square-Tailed Kite (*Lophoictinia isura*)	Open forests and woodlands in coastal and subcoastal areas. Forages low over, or in, canopy for eggs, nestlings, passerines, small vertebrates and invertebrates. Large home range (>100km^2). Observed foraging in residential areas of Port Macquarie. Large stick nest in high fork of living tree. Breeds July-December. Lays 2-3 eggs with 1-2 birds fledging after 100days. Appears to be adapting to an abundance of passerines in well-vegetated outer fringes of cities. Probably migrates to northern Australia in winter. (Debus 1998, NSW NPWS 2000)	General area and site considered structurally suitable. Some passerines in forest on site offer potential foraging habitat, but limited by sparse undergrowth. Recorded in locality at South West Rocks. Good chance of occurrence, foraging on site as part of much larger home range.	Only very marginal potential habitat affected. Regeneration of >1ha will increase passerine habitat potentia. Site expected to retain potential support for infrequent foraging occurrence. No barrier to access. No risk of significant impact. However **Seven part test required** as a good chance to occur.
Little Eagle (*Hieraaetus morphnoides*)	Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland, sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. It eats birds, reptiles and mammals, occasionally adding large insects and carrion (Marchant and Higgins 1993; Aumann 2001b; Debus et al. 2007). It is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment (Marchant and Higgins 1993). It occurs as a single population throughout NSW.	Some marginal potential foraging habitat present on site, however no local records exist, and species was not recorded on site. Considered low to fair chance of occurrence on site as fly over, using broader area for foraging as part of very large home range	Modification of habitat on site considered insignificant given extent of home range, minimal prey potential and no nest sites affected. However **Seven part test required** as a fair chance to occur.

Spotted Harrier (C*ircus assimilis*)	Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant and Higgins 1993; Aumann 2001a). It is found mostly commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The species builds a stick nest in a tree and lays eggs in Spring (or sometimes Autumn), with young remaining in the nest for several months. Diet includes terrestrial mammals, birds and reptiles, occasionally large insects and rarely carrion (Marchant and Higgins 1993; Aumann 2001b). Many of the remaining key prey species (e.g. terrestrial grassland birds such as quail, button-quail, pipits, larks and songlarks) require ground cover and are sensitive to habitat degradation from grazing (Marchant and Higgins 1993).	Some marginal generic potential foraging habitat present on site, however no local records exist and species was not recorded on site. Not normally found on coast. Considered very low to unlikely chance of non-breeding occurrence in South West Rocks. More extensive structurally suitable habitat in locality.	Modification of habitat on site considered insignificant, given lack of local records, amount of similar and more structurally suitable habitat available locally. Seven Part Test not required as loss of marginal generic habitat will not have a detectable effect and no significant potential to occur.
Osprey (*Pandion haliaetus*)	Fish (mostly Mullet) and carrion eater. Forages along coastal rivers, lakes, beaches, creeks and inlets. Tall, dead tree for staging or feeding roost. Nests on exposed tree within 2km of water, but rarely adjacent, and with access to Paperbark or Swamp Oak for nest material. Breeds April-Sept. (Clancy, 1991)	Recorded in locality but not on site. No nest on site. No tree considered exceptional potential nest trees. Generic potential foraging in adjacent river. No suitable forage habitat. Occurrence would only be a generic fly over.	No risk of detectable impact as no habitat of any significance on site. Seven Part Test not required to evaluate.
Bush Stone-Curlew (*Burchinus grallaris)*	Nocturnal, sedentary and territorial (when breeding) species generally roosting in open grassy woodlands with few or no shrubs, but with abundant leaf litter and fallen tree debris (ie >10% cover) which is key roosting habitat. Nests in more open areas with very little groundcover (even recorded on mown lawns and golf courses). Nest abandoned if disturbed. Coastally, often associated with Swamp Oak groves, saltmarsh, mangroves, *Melaleuca quinquenervia* woodlands and even golf courses, etc. May travel as far as 3km from roost site to foraging grounds. (NSW NPWS 2003b). Recorded near Kempsey and in Crowdy Bay NP (NPWS Atlas 2004).	Site overall generic potential habitat value given records in urban parklands. However, high exposure to feral predators and pets. Lack of local records and sparse localised records in region suggests unlikely to specifically occur on site.	Majority of potential habitat to be retained, thus site expected to retain potential support. No risk of significant impact. Seven Part Test not required.

Barred Cuckoo Shrike (*Coracina lineata*)	Gregarious rainforest/moist forest (especially creek gullies) species feeding mainly on fruit, especially figs, on tall rainforest trees and shrubs, but also on insects. Nomadic, generally moving with fruiting patterns. (Lindsey 1992) Has been recorded in swamp sclerophyll with rainforest understorey in Port Macquarie (DECCW Atlas of Wildlife).	No suitable habitat occurs on site. Recorded in locality. Considered at best a very low chance of transient occurrence due to absence of preferred habitat.	No preferred habitat on site, thus no significant impact likely. Seven Part Test not required.
Wompoo Fruit Dove (*Ptilinopus magnificus*)	Sub-tropical, littoral, warm temperate and dry rainforest, and wet sclerophyll with rainforest understorey. Preference for large areas of undisturbed forest. Feeds on fruit, usually high in canopy. Locally nomadic following fruit resource. Nests in rainforest, 3-10m above ground. Known to feed on Camphor Laurel and Lantana.	No suitable habitat occurs on site. Recorded in locality at Shark Island. Considered a very low chance of occurrence, at best using site as a stepping stone to more suitable habitat.	No potential habitat on site, thus no significant impact likely. Seven Part Test not required.
Rose-Crowned Fruit Dove (*P. regina*)	Inhabits dense rainforest or vegetation containing fruit bearing trees, feeding on fruit. Recorded in small areas of habitat (2ha). Locally nomadic and migratory, following fruiting patterns, with northward movement in winter.	As for Wompoo Fruit Dove.	As for Wompoo Fruit Dove. Seven Part Test not required.
Regent Honeyeater (*Xanthomyza phrygia*)	Nomadic, may move coastwards in late summer. Inhabits temperate eucalypt woodlands and open forest, including forest edges, woodland remnants on farmland and urban areas. Also uses *Casuarina cunninghamiana* gallery forests. Requires reliable and ample nectar supplies to support semi-permanent (core breeding) habitat. Favoured nectar sources are *E. sideroxylon, E. albens, E. melliodora, E. leucoxylon, E. robusta, E. planchoniana*, and heavy infestations of mistletoe. Also take insects and orchard fruits. Coastal forests of Swamp Mahogany or Spotted Gum an important drought refuge. Preference for large emergent trees. Breeds in pairs or small colonies in open woodland/forest and occasionally more disturbed woodland near housing and farmland, depending on food availability, from August-January. Breeding less likely to occur if nectar flows are low or unreliable, or heavy competition with more aggressive honeyeaters eg Noisy Miner, Red Wattlebirds and Noisy Friarbirds. (Menkhorst *et al* 1999)	No significant infestations of Mistletoe present on site, and few preferred forage species. Recorded regionally but not recorded in locality. Not detected on site by survey. Considered very low to unlikely chance of occurrence as rare transient.	No loss of key or significant habitat. Site will retain generic potential to support rare transient occurrences. No risk of significant impact. Seven Part Test not required.

Painted Honeyeater (*Grantiella picta*)	Dry, mistletoe-laden, open forest and woodland, mostly on inland slopes of Great Dividing Range. Specialist feeder on mistletoe, particularly *Amyema* sp on Acacia and Eucalypts (Garnett, 1993). Breeding areas have high levels of mistletoe infestation. Possibly being displaced by Mistletoebird which feeds on broader range of species (Garnett, 1993). Locally nomadic. Breeds in SE Australia from Oct-Mar, migrates north into Q, NT in winter (Lindsey, 1992). "Cannot effectively be conserved in reserves.." and dependent of private land (Garnett, 1993).	As stated above Mistletoe is present on site but is not abundant. Site considered to be generally unsuitable. Recorded south of Kempsey, but not recorded in locality. Not detected by survey. Considered very low to unlikely chance of occurrence as rare transient.	No loss of key or significant potential habitat. Site will retain potential to support rare transient occurrences. No risk of significant impact. Seven Part Test not required.
Mangrove Honeyeater (*Lichenostomus fasciogularis*)	Similar to Varied Honeyeater. In NE NSW scattered colonies occur in Mangroves, coastal *Casuarina* & *Melaleuca* forest, *Banksia* shrubland, gardens. Forages in small groups in lower foliage or on ground for nectar, fruit, insects, marine invertebrates (eg crabs). Breeds Aug-Dec, with nest low in Mangroves. Record at Stuarts Point. (Lindsey 1992, DEC 2005a)	No preferred habitat on site. Not listed on Bionet (2009) or Atlas of Wildlife (2009a) as local occurrence, however consultant is aware of a record at Stuarts Point. Unlikely occurrence.	Unlikely occurrence and no significant impact likely as no significant type or extent of potential habitat affected. Seven Part Test not required.
Brown Treecreeper (*Climacteris pciumnus*) eastern subspecies	Medium-sized insectivorous bird occupying eucalypt woodlands, particularly open woodland lacking a dense understorey. Sedentary and nests in tree hollows within permanent territories, breeding in pairs or communally in small groups (Noske 1991). Birds forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae (Noske 1979). Distributed through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys, Coffs Harbour and Great Lakes Shire.	Site may contain some very generically potentially suitable habitat for the species in the dry sclerophyll forest, especially potential nesting hollows. Recorded west of Kempsey, but not in locality and not detected on site. Considered unlikely to occur.	Unlikely to occur. No risk of significant impact as dry sclerophyll essentially retained. Seven Part Test not required.
Grey-Crowned Babbler (*Pomatostomus temporalis temporalis*) eastern subspecies	Occupies open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. Builds conspicuous dome-shaped nests and breeds co-operatively in sedentary family groups of 2-13 birds (Davidson and Robinson 1992). Insectivorous and forage in leaf litter and on bark of trees. Occurs on the western slopes and plains but less common at the higher altitudes of the tablelands. Isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (Blakers *et al.* 1984, Schodde & Mason 1999).	As for Brown Treecreeper but not recorded in locality.	As for Brown Treecreeper. Seven Part Test not required.

Diamond Firetail (*Stagonopleura guttata*)	Occupies eucalypt woodlands, forests and mallee where there is a grassy understorey. Build bottle-shaped nests in trees and bushes, and forages on the ground, largely for grass seeds and other plant material, but also for insects (Blakers *et al.* 1984, Read 1994). Distributed through central and eastern NSW, extending north into southern and central Queensland and south through Victoria to the Eyre Peninsula, South Australia. In NSW, the species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas such as the Cumberland Plain of western Sydney and the Hunter, Clarence, Richmond and Snowy River valleys (Blakers *et al.* 1984, Schodde & Mason 1999).	As for Brown Treecreeper but not recorded in locality.	As for Brown Treecreeper. Seven Part Test not required
Speckled Warbler (*Pyrrholaemus sagittata*)	Inhabits mostly inland woodlands (some drier coastal areas) with grassy understorey often on ridges and gullies. Sedentary in pairs or trios, and nests on ground in grass tussocks, dense litter and fallen branches. Forages on ground or understorey for arthropods and seeds within home range of 6-12ha. Remnants <100ha not suitable.	Given the species preference for inland habitats the site is considered to be unsuitable. Recorded in Kempsey LGA, but not in locality and not detected on site. Considered unlikely to occur.	Unlikely to occur. No risk of significant impact. Seven Part Test not required.
White-Browed Woodswallow (*Artamus superciliosus*)	Occurs in eastern, northern and central Australia, in NSW it typically breeds in open forests and woodlands from the inland slopes to the far western plains but during dry years its distribution extends east to open habitats of the tablelands and coast (Higgins *et al.* 2006). Inhabits mostly eucalypt, sheoak and *Acacia* woodland, including mallee, and adjacent open areas including grassland with scattered trees or shrubs. In agricultural landscapes it prefers healthy woodland patches with low disturbance and little grazing (Higgins *et al.* 2006). It eats arthropods, including insects that swarm above vegetation, plus some nectar and small native fruits. It builds a cup-shaped nest of twigs and plant fibres in a fork, crevice or foliage in a tree or shrub (live or dead), vine, creeper, stump or artificial structure.	Site at best contains marginally suitable non-breeding habitat of no specific significance given local extent of such. Not recorded in locality or on site by survey. Unlikely to very low potential to occur as very rare on-breeding transient.	Considered unlikely to occur on site. Modification of site of no significance given best potential habitat will be retained and 1ha enhanced by regeneration, and extent of more structurally suitable available habitat within the locality. Seven Part Test not required.

Varied Sittella (*Daphoenositta chrysoptera*)	Sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west (Higgins and Peter 2002; Barrett *et al.* 2003). It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Site has generic habitat value especially the dry sclerophyll on the southern margins. Not recorded by survey but recorded in locality. Lack of records suggest this territorial species does not have association with site. At best low to fair potential to occur mostly likely as fringe of territory or dispersing, as more optimal habitat with less disturbance and proximity to high human presence within the locality.	Modification of site of no significance given extent of available habitat within the locality and only marginal fringe of best potential habitat affected. **Seven Part Test** required as fair potential to occur, hence as per Precautionary Principle, evaluation undertaken to justify.
Flame Robin (*Petroica phoenicea*)	Found in southeastern Australia. In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in Winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter 2002). There may be two disjunct breeding populations in NSW on the Northern Tablelands and the Central–Southern Tablelands (Barrett *et al.* 2003 and the NSW Wildlife Atlas). Forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank.	Site's dry sclerophyll offers some very generic potential for non-breeding foraging, but not preferred structure. Site only forms minute fraction of similar potential habitat which is locally extensive. Not recorded in locality and not typically on coast well away from hinterland. Very low to unlikely potential to occur.	Considered very low/unlikely to occur on site. Modification of site of no significance given extent of available habitat within the locality, and that best potential habitat will be retained. No risk of significant impact hence Seven Part Test not required.
Scarlet Robin (*Petroica boodang*)	Found in southeastern Australia and southwest Western Australia. In NSW it occupies open forests and woodlands from the coast to the inland slopes (Higgins and Peter 2002). Some dispersing birds may appear in Autumn or Winter on the eastern fringe of the inland plains. It breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. The robin builds an open cup nest of plant fibres and cobwebs, sited in the fork of tree (often a dead branch in a live tree, or in a dead tree or shrub) which is usually more than 2m above the ground (Higgins and Peter 2002; Debus 2006a,b).	As for Flame Robin, site offers some very generic potential for non-breeding foraging, but not preferred structure. Site only forms minute fraction of similar potential habitat which is locally extensive, with best potential habitat to east in National Park. Low to unlikely potential to occur.	Considered low/unlikely to occur on site. Modification of site of no significance given extent of available habitat within the locality. Seven Part Test not required.

White-Fronted Chat (*Epthianura albifrons*)	White-fronted Chats are found predominantly in saltmarsh vegetation although they are also observed in open grasslands and sometimes in low shrubs bordering wetland areas.	While this species has been recorded locally, suitable habitat does not occur on site, thus not considered a potential occurrence on site.	Unlikely to occur. No risk of significant impact. Seven Part Test not required.
Black-Necked Stork/Jabiru (*Ephippiorhynchus asiaticus*)	Wetlands, mudflats, mangroves, floodplains, irrigated fields, farm dams. Forages in shallow water for small vertebrates. Shuns cover, prefers extensive open shallows. Nests in a tree, often above water in a secluded swamp. Eggs laid Aug-Nov in NSW. Adults resident, juveniles dispersive (DEC 2005a, Lindsey 1992).	No suitable habitat. Unlikely to occur. Recorded in locality.	No potential habitat affected. No risk of significant impact hence Seven Part Test not required.
Brolga (*Grus rubicunda*)	Inhabits coastal and inland wetlands, shallow lakes, grassland, saltmarsh, farm and dry open land. Forages for large invertebrates, frogs, fish, seeds, green shoots and bulbs. Breeding occurs predominantly in tropical wetland and large inland swamps and irrigated grasslands at inland and central northern Australia (eg Queensland and Northern Territory), though has been recorded in the northwest and north-eastern corner of NSW and Victoria.	As for Jabiru. Recorded in locality.	As for Jabiru.
Magpie Goose (*Anseranas semipalmata*)	Shallow freshwater in large swamps and dams, with dense rushes, sedges and nearby permanent lagoons, grasslands. Diet of bulbs, roots, seeds of sedges, rushes, rice. Nomadic, migratory, northern species, generally rare vagrant to NSW. Gregarious. Colonial roosting & nesting. Breeding influenced by water level. (NSW NPWS 2000, Lindsey 1992)	As for Jabiru. Recorded in locality.	As for Jabiru.
Black Bittern (*Dupetor flavicollis*)	Coastal waterways, estuaries, swamps with densely wooded edges, Swamp Oak, Mangroves. Secretive, partly nocturnal. Roosts in trees overhanging water or in dense reeds. Critical breeding habitat is mangrove belts (Lindsey 1992). Breeds Dec-Mar, nests in trees over water. (NSW NPWS 2000, DEC 2007b)	As for Jabiru. Recorded in locality.	As for Jabiru.
Australasian Bittern (*Botaurus poiciloptilus*)	Wetlands, preferably with dense sedges, rushes, reeds. Prefers freshwater, but also uses densely vegetated saltmarsh and flooded grasslands. Roosts on the ground, forages in shallow water from a platform of trampled vegetation, nests above water on similar platform. Single or groups to 12. Usually sedentary, but nomadic in response to flood, drought. (DEC 2007b)	As for Jabiru. Recorded in locality.	As for Jabiru.
Little Tern (*Sterna albifrons*)	Summer migrant from Asia. Coastal waters, bays, inlets. Nests in colonies on beaches, shingle pits near mouth of estuaries or coastal lagoons. Sensitive to disturbance. Feeds on wing, taking small fish and invertebrates in estuaries and surf. (DEC 2007b)	As for Jabiru. Recorded in locality.	As for Jabiru.

Masked Booby (*Sula dactylatra*)	Large pelagic seabird which breeds on offshore islands. Feeds on fish.	As for Little Tern.	As for Little Tern. Seven Part Test
Pied Oystercatcher (*Haematopus longirostris*)	Ocean beaches, estuarine sand and mudflats. Forage on exposed sand or mud chiefly for molluscs, but also worms, crabs and small fish. Nest on coastal or estuarine beaches, occasionally in saltmarsh or grassland. Eggs laid Aug-Jan. (NPWS 2000, Smith 1991)	As for Little Tern.	As for Little Tern. Seven Part Test
Sooty Oystercatcher (*H. fuliginosus*)	Mainly forages on rocky foreshores, reefs, wave-cut platforms, coral reefs and stony beaches, occasionally on sandy beaches and estuarine flats. Diet of molluscs, crustaceans. Breeds on off-shore islands or on sand amongst vegetation. (NSW NPWS 2000, Smith 1991).	As for Little Tern.	As for Little Tern. Seven Part Test
Comb-Crested Jacana (*Irediparra gallinacean)*	Deep, permanent freshwater with surface/floating vegetation (eg Water Lily). Sedentary or locally nomadic. Forages on surface. Nest a raft in screened, emergent vegetation. Sensitive to water level changes and to disturbance. Breeds in response to rising water level Sep-Jan (Lindsey 1992).	As for Little Tern.	As for Little Tern. Seven Part Test
Black-Tailed Godwit (*Limosa limosa*)	Non-breeding summer migrant, sporadically occurring in NSW. Occurs on estuarine sand, lagoons and mudflats, also large shallow, muddy inland wetlands with receding water, and wet meadows. Feed in shallow water or soft mud, often in flocks. (Smith 1991, DEC 2005a)	As for Little Tern.	As for Little Tern. Seven Part Test
Terek Sandpiper (*Xenus cinereus)*	Non-breeding Summer migrant, with small numbers reaching southern coasts. Forages on intertidal sand and mudflats, often near mangroves or in tidal creeks. Also ocean beaches, rocky shores. Roosts on/in mangroves, also on beaches. Feed over soft, wet mud. (Smith 1991)	As for Black-Tailed Godwit.	No critical habitat affected. Incremental increase on local waterways insignificant. No risk of significant impact. Seven Part Test not required.
Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*)	Appears to prefer heathland especially dense wet heath and swampy areas usually occupied by Swamp Rat (AMBS,1996). Also recorded from mid-elevation grasslands, open dry and wet sclerophyll woodland. In the Port Macquarie area, associated with heathland with dense shrub layer of *Banksia ericifolia*, *B. serratifolia, Xanthorrhoea* spp, *Dillwynia floribunda, Boronia spp*, *Leptospermum flavescens* and *Melaleuca nodosa.* Requires specific fire regime, greatest density 3-4 years after fire. Omnivorous, seeds, fungi, green stem, arthropods. Home range <0.5ha (NSW NPWS 2000).	Forest on southern end of site has negligible groundcover with corresponding minimal small mammal diversity. Not recorded in locality and unlikely to occur on site.	No potential to occur and no potential habitat affected. Seven Part Test not required.

Long-Nosed Potoroo (*Potorous tridactylus*)	Coastal heath and shrublands; paperbark forest; woodland with dry heathy understorey; high elevation rainforest or moist hardwood forest; moist shrublands with dense or moderately dense understoreys and sedge-dominated groundcover; wet or dry sclerophyll forests where average annual precipitation exceeds 760mm. Requires thick groundcover for refuge, while foraging in open areas on ridges, slopes or gullies, typically on ecotones, and prefers sandy soils for digging. Eats roots, tubers, fungi, fleshy fruits, leaves, insects and other soil invertebrates. Optimum habitat generally considered a mosaic of regenerating dense understorey vegetation as result of patchwork of periodic low to medium intensity fires. Home range of 2-5ha (NPWS 2000).	Dry sclerophyll considered far too open, fragmented and poorly connected to extensive potential habitat in Hat Head National Park. Presence of predators such as foxes and cats also limits the species potential to occur. Recorded in the locality (Yarrahappini) but not by survey on site. Considered unlikely to occur.	Unlikely to occur. No risk of significant impact. Seven Part Test not required.
Koala (*Phascolarctos cinereus*)	Areas where preferred food species occur in sufficient concentrations and diversity.	Recorded in the locality, and at Smokey Cape and possibly Arakoon. Site contains SEPP 44 Potential Koala Habitat but no evidence of Koalas. Considered unlikely potential occurrence due to demonstrated localised distribution and very small population in South West Rocks area.	No substantial chance to occur but as Potential Koala Habitat and potentially could support a Koala if re-introduced, Seven Part Test required as per Precautionary Principle.
Common Planigale (*Planigale maculata*)	Wide variety of habitats. Preference for areas of dense groundcover due to heat/dehydration problems. May prefer ecotones of dry/wet habitats (Denny 1982). Preys on arthropods, small vertebrates, shelters in nest under/in fallen timber or rock (Strahan 1995). Home range about 0.5ha. Breeds Oct-Jan (NSW NPWS 2000).	Dry sclerophyll offers extremely marginal potential habitat due to lack of dense groundcover and limited refugia. Recorded in Kempsey LGA but no in the locality. Considered unlikely to very low chance to occur.	Proposal has no adverse effect on potential habitat upslope of development footprint. Regeneration of >1ha will increase potential habitat, and also cessation of grazing in 7(d) will benefit this species. No potential for detectable impact hence no risk of significant impact. Seven Part Test not required.
Brushtailed Phascogale (*Phascogale tapoatafa*)	Range of forest habitats but prefers drier sclerophyll forest with sparse ground cover. Forages on large rough-barked trees for small fauna, also utilises eucalypt nectar. Rests in tree hollows, stumps, bird nests. Requires tree hollows for nesting. (NPWS, 2000) Breeds May-July. Occupies territory of 20-100ha. Has been recorded in swamp forest.	Site offers key habitat components (hollow trees) and suitable habitat structure. Recorded in the locality in identical habitat and overall considered at least fair chance to occur on site.	At least fair chance to occur. **Seven Part Test required**.
Spotted-Tail Quoll (*Dasyurus maculatus*)	Various forested habitats with preference for dense forests. Requires tree hollows, hollow logs or caves for nesting. Large home range (>500ha) and may move over several kilometres in a few days. Tends to follow drainage lines.	Site offers some potential shelter in hollow logs and trees in higher 7(d) zone. Competitors present on site (ie cats, dogs). Given large home range considered a very marginally fair chance top occur as very rare transient occurrence on fringe of core area to east in National Park. Not detected by survey. Not recorded in locality.	Marginally fair chance to occur hence **Seven Part Test required**.

Yellow-Bellied Glider (*Petaurus australis*)	Moist and dry tall mature eucalypt forest and woodland. Requires mature hollow-bearing trees, winter-flowering eucalypts, suitable sap-feeding eucalypt species and a mosaic of forest types (NPWS 1999). Sap trees utilised include: *E. propinqua, E. tereticornis, E. microcorys, & E. resinifera* (NPWS 2000). Home range of 30-65ha (NPWS 1999).	Not detected on site despite being intensively targeted. Potential foraging habitat present though low abundance of Winter flowering species a major limitation. Recorded in locality (Yarrahappini), but no evidence of use observed on site (incisions) and not detected, considered unlikely to occur.	Unlikely to occur as not recorded in South West Rocks despite extensive surveys. No risk of significant impact. Seven Part Test not required.
Squirrel Glider (*P. norfolcensis*)	Dry, open forest and woodland, and occasionally wet eucalypt and rainforest. Most common in floriferous sub-coastal and coastal forests with winter flowering trees and shrubs and some smooth barked eucalypts. Most commonly recorded along the coastal margin where Banksias dominate the understorey. Home range 0.6-9ha, family groups of 2-10 (NSW NPWS 1999).	**Recorded** on site.	Recorded on site, thus **Seven Part Test required**.
Eastern Pygmy Possum (*Cercartetus nanus*)	Found in rainforest, sclerophyll forest, woodland and tree heath. Predominantly nectarivorous (opportunistically insectivorous and also eats fruits during flowering lulls) feeding on Banksias, Leptospermum, Melaleucas, Eucalypts and Callistemons. Nest in very small hollows, or within bark/leaf nests in tree forks (eg Melaleucas and Banksias), Myrtaceous shrubs, abandoned bird nests or under loose eucalypt bark. Often Winters in torpor.	Dry sclerophyll contains some potential foraging resources and tree hollows are present. Not recorded by survey on site or others in locality in similar and identical habitat. Overall, the lack of local records, limited forage resources, and the failure to detect on site indicate the species is unlikely to occur.	Unlikely to occur. No risk of significant impact as potential to occur retained as all best potential habitat retained. Seven Part Test not required.
Grey-Headed Flying Fox (*Pteropus poliocephalus*)	Nomadic frugivore and nectarivore on rainforest, eucalypt, melaleuca and banksia. Recorded flying up to 45km from roost (generally max. of 20km). Roosts colonially with short term individual or small groups, mostly near watercourses. Spring or Summer roosts are maternity sites. Dependant on winter flowering species eg *E. robusta* and *E. tereticornis.*	Recorded in the locality and adjacent land, but not on site. Potential foraging habitat due to the extent of eucalypts and Bloodwoods available. Overall, considered a certain chance to occur on site when trees flower.	Certain chance to occur. Proposal will remove some potential foraging resources. **Seven Part Test required**.
Eastern Blossom Bat (*Syconycteris australis*)	Found in well timbered habitats. Roosts in rainforest and wet sclerophyll forest. Feeds in heathlands and paperbark swamps up to 4km from roost. Key food species include Banksia, Melaleucas, Callistemons and Bloodwoods.	Only marginal potential foraging resource present in dry sclerophyll. Recorded in the locality. At best very marginally fair chance to forage on site perhaps if seasonable shortage or in transit to preferred habitat. No suitable roosting habitat on site.	At best very marginal fair chance to occur. Proposal only removes some very marginal potential foraging habitat. **Seven Part Test required** as per Precautionary Principle to justify no risk of significant impact.
Greater Broad Nosed Bat (*Nycticeius rueppellii*)	Forages over range of habitats including rainforests and moist forests, but prefers ecotones between riparian forest, woodland and cleared land. Requires sparse understorey and will forage over water. Roosts in tree hollows. Feeds on larger insects, small vertebrates and perhaps other bats.	May forage along tracks, and ecotone of dry sclerophyll and cleared pasture land. Potential roosting habitat is present on site. Recorded in the locality and considered at least a fair chance to occur.	Fair chance of occurrence. Loss of potential hollows and modification of potential foraging habitat. **Seven Part Test re**quired.

Eastern Bent-Wing Bat (*Miniopterus orianae oceanensis*)	Habitat generalist - forages above well-forested areas. Roosts in old buildings, caves, mines etc. Dependant on nursery caves and communal roosts.	**Recorded adjacent to site** by Umwelt (2004). Site has suitable foraging potential but limited potential for roosting (not breeding or key lifecycle roosts). Recorded within 10km radius.	Recorded adjacent to site and hence certain occurrence on site. **Seven Part Test required.**
Little Bent-Wing Bat (*M. australis*)	Forages above and below canopy of well-forested areas. Roosts in old buildings, caves, mines etc. Dependant on nursery caves and communal roosts.	As for Eastern Bent-Wing	As for Eastern Bent-Wing. Seven Part Test required.
Southern Myotis (*Myotis macropus*)	Roost in groups of 10-15 in caves, bridges, mines, buildings, tree hollows and dense foliage. Prefers riparian habitat over 500m long with nearby roosting habitat. Key habitats are streams, rivers, creeks, lagoons, lakes and other water bodies. Also captured in mangroves, paperbark swamps and rainforest. Feeds on aquatic insects and small fish, also aerial prey. (Churchill 1998)	No foraging habitat present on site or adjacent. Hollows offer potential roost sites but located well away from any potential foraging habitat suggesting not likely to be used. Recorded in locality. Very low to unlikely to occur on site.	Not considered a significant likely potential occurrence on site. Loss of hollows a negative effect in terms of contraction of this resource, but hollows are known to be common in South West Rocks (Darkheart 2004f, O'Neill and Williams 2003), and common around nearest likely foraging habitat ie Saltwater Lagoon. Hence loss of 5 hollow bearing trees on site, compared to dozens remaining on site alone, is of no detectable significance. Seven Part Test not undertaken as no likely risk of significant impact.
Yellow-Bellied Sheathtail Bat (*Saccolaimus flaviventris*)	Ecology poorly known. Found in almost all habitats, particularly wet and dry sclerophyll forests and woodlands below 500m altitude, and also open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts mainly in tree hollows, but also under bark, under roof eaves and in other artificial structures. Fast flying species, believed to forage above the canopy or closer to the ground in open areas. Insectivorous. May be Summer migrant.	Forest on site offers potential foraging habitat. Potential roosts in hollow-bearing trees. Recorded at Stuarts Point. At least fair chance of occasional occurrence.	Fair chance of occurrence, and loss of potential hollows. **Seven Part Test required.**
Hoary Bat (*Chalinolobus nigrogriseus*)	Occurs in a range of habitats, such as monsoon forest, tall open forest, open woodland, vine thickets, coastal scrub, sand dunes, grasslands, floodplains, watercourses and dams. Roosts in eucalypt tree hollows, as well as rock crevices. Breeding colonies have been recorded in roofs of buildings. Preferred prey is beetles and moths, but also spiders, mantids, crickets, grasshoppers, cicadas, bugs, diving beetles, flies and ants (thus may land and forage).	Site woodland and forest habitats may provide potential foraging and tree hollows offer potential roosting sites. Not recorded on site by survey, but recorded in locality. Considered low to fair chance of occurrence on site.	Fair chance of occurrence, and loss of potential hollows. **Seven Part Test required.**
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	A large vespertilionid which feeds on moths and insects. Known to roost in caves, abandoned buildings, but mostly in trees hollows higher rainfall forested areas. It is suspected that some populations migrate in Winter from higher altitudes to coastal areas, or may simply enter torpor. Prefers tall forests (>20m high) and extensive movements (eg 12km recorded between foraging and roost sites). Recently recorded in Thrumster west of Port Macquarie.	Site's vegetation is considered only marginally potentially suitable as foraging habitat while tree hollows may be suitable for roosting. Not recorded during the survey or in the locality. Overall considered a low to marginally fair potential occurrence.	Greater portion of habitat and at least majority of hollow bearing trees will be retained post development, thus potential to occur should be largely retained. No significant impact likely, however considered a fair chance to occur and habitat lost thus **Seven Part Test required.**

Golden-Tipped Bat (*Phoniscus papuensis*)	Spider eating specialist, capable of hovering and high manoeuvrability. Normally found in rainforest and along rainforest gullies within wet sclerophyll forest (often when lot of vines which suit prey species), but also recorded roosting in wet sclerophyll gullies and foraging in dry sclerophyll on upper slopes. Roosts in abandoned bests of gerygones and scrubwrens, but also found in dense foliage, rooves, and caves.	Site forest is not considered potentially suitable. Recorded in locality but unlikely to occur on site.	No potential to occur, hence no risk of being impacted. Seven Part Tests not required.
Northern Long-Eared Bat (*Nyctophilus bifax*)	In northern NSW, generally restricted to rainforest. Elsewhere, forest dweller preferring wetter habitats (ie rainforest to monsoon forest, riverine paperbark forests) but also found in open woodland, tall open forest and dry sclerophyll woodland. Roosts in tree hollows (especially lactating females) under peeling bark, among epiphytes, in strangler fig roots, dense foliage and dead fronds. Feed on moths, ants and beetles. Tend to forage on edges of tree canopy rather than within foliage. (Churchill 1998)	Dry sclerophyll offers very marginal potential habitat. Overall, site considered to be generally not preferred structure. Potential roosts in tree hollows and marginal potential foraging along forest ecotones. Recorded in locality at Smokey Cape, but not by survey on site and considered very low to low chance of occurrence.	Potential roosting habitat not affected and only small area of very marginal potential foraging habitat in area proposed for development. No critical habitat modified. No barriers to access. Site expected to retain potential support for rare occurrences. No risk of significant impact. Seven Part Test not required.
Eastern Cave Bat (*Vespadelus troughtoni*)	Rare and poorly known bat. Cave dwelling bat roosting in small (5-50) to large (500) groups in sandstone overhang caves, boulder piles, mines, tunnels and sometimes buildings eg under tin roof of a dairy. Tend to roost in well lit portions of caves in avons, domes, cracks and crevices. Forages in tropical mixed woodland, wet and dry sclerophyll along coast, and extending into western slopes and inland areas. Appear to forage over localised area near roosts eg 30ha. Recorded foraging along watercourses and crossing open paddocks. Appears to avoid areas without natural roosts. (Churchill 2009, DECCW 2009b)	Site lacks caves for roosting. Marginal cracks just offsite in exposed granite but full of dirt. Known caves to east near Green Island, proximate to local record. Site habitats may be generically preferred structure. Recorded in locality. Low to fair chance foraging on site as part of local range from sea caves.	Potential foraging habitat on site to be largely retained but **Seven Part Test required** as precaution due to loss of possible known habitat.
East Coast Freetail Bat (*Micronomus norfolkensis*)	Specific habitat requirements of this species are poorly known. Has been recorded in habitats ranging from rainforest to dry sclerophyll and woodland, with most recorded in the latter (State Forests 1994). Roosts in small colonies under tree hollows and under loose bark; has been found under house eaves, in roofs and metal caps on telegraph poles. Recorded roosting in roof in Hat Head village. Probably forages above forest or woodland canopy, and in clearings adjacent to forest. Most records are of single individuals, and it is likely to occur at low densities over its range.	**Recorded adjacent to site by Umwelt** hence a certain occurrence on site. Potential foraging and roosting habitat. Recorded several times in locality.	Certain occurrence on site and loss of known habitat hence **Seven Part Test required.**

Beccari's Freetail Bat (*Mormopterus. beccarii*)	Wide range of habitats from rainforest, floodplains, tall open forest, savannah woodlands, arid shrublands and grasslands. Commonly caught along watercourses, over water and over canopy, typically in areas free of obstructions due to low manoeuvrability. Feeds above canopy in fast flight but agility on ground suggests ability to forage on flightless insects. Roosts in tree hollows, caves, buildings. (Churchill 1998) Very few records in NSW – sporadic and possibly Summer nomadic.	Potential roosts in tree hollows on site. Forest and woodland offer some generically potentially suitable foraging structure. Not detected by survey. "Possible" record in South West Rocks (Darkheart 2004f) and "probable" record at Gumma (Berrigan 2002e) in similar habitat suggests possible non-breeding occurrence. Considered very low to marginally fair chance of occurrence.	Site expected to retain potential support for rare occurrences. No barriers to access. No risk of significant impact. **Seven Part Test required** however on precautionary basis as fair potential to occur.
Dwyer's Bat/Large Eared Pied Bat (*Chalinobus dwyeri*)	Found in moderately wooded habitats such as dry sclerophyll forest, tall open eucalypt forests, woodlands, sub-alpine woodlands, edge of rainforest and wet sclerophyll forest. Roosts in caves, mines and abandoned bottle-shaped mud nests of Fairy Martins. In caves and mines, tend to roost in twilight sections near entrance. Insectivorous but habits poorly known. Fly relatively slowly, direct and manoeuvrable, low to ground or 6-10m above ground. (Churchill 2009, DECCW 2009b).	General foraging preferences of this poorly known species suggests site and locality potentially structurally suitable foraging habitat. No cave, mines, etc on or near site for roosting. Not recorded in locality of site (or LGA, and very few regional records). Not recorded by survey. Considered very low to unlikely chance of occurrence on site.	Site expected to retain potential support for rare occurrences. No barriers to access. No risk of significant impact. Seven Part Test not required.
Three-Toed Snake-Tooth Skink (*Coeranoscincus reticulatus*)	Poorly known ecology. Found in moist layered forest, closed forest and tall open forest (Cogger 1992). Soil type appears important – rich dark or loamy basaltic soils (SFNSW 1994). Also recorded in closed forest on silica dunes, coastal eucalypt woodlands on sand, and in logged forest with tall softwood regrowth. Usually found under leaf litter, moist rotting logs, or loose friable soil.	Extent of disturbance and modification of site and study area suggests potential for this species to occur is negligible. Not recorded locally or by the survey. Overall, considered unlikely to occur due to sparse records and evident disturbance history of site .	Unlikely to occur, Seven Part test not required.
Pale-Headed Snake (*Hoplocephalus bitorquatus*)	Wet and dry sclerophyll, preferring those with *Callitrus* spp, riparian vegetation, and occasionally rainforest. Terrestrial and semi-arboreal predator of small vertebrates (mainly lizards and frogs, small mammals and probably co-habitating bats). Shelters under decorticating bark and within hollows especially close to watercourses.	Dry sclerophyll has some generic structural and floristic suitability, but this species is typically associated with very large areas of intact forest. Not recorded in locality and records predominantly in hinterland. Considered unlikely potential occurrence.	Unlikely to occur. No risk of significant impact. Seven Part Test not required.

Stephen's Banded Snake (*H. stephensii)*	Inhabits variety of habitats including dry rainforest, sub-tropical rainforest, wet and dry sclerophyll, rocky outcrops (especially granite and sandstone) - requires close proximity to variety of vegetation formations. Nocturnal and primarily arboreal - sheltering under decorticating bark, within tree scars, hollows, logs, rock crevices and slabs. Active predator of variety of vertebrates including geckos, skinks, frogs, small mammals, bats, birds	As for Pale Headed Snake.	Unlikely to occur. No risk of significant impact. Seven Part Test not required.
White-Crowned Snake (*Cacophis harriettae*)	Wet sclerophyll, rainforest, moist gullies, moist heathland thickets and well-watered urban areas. Prefers moister, high humidity habitats. Requires cover such as logs, rocks, leaf litter and debris on a suitably moist substrate. Primarily nocturnal, feeding on largely on small lizards. Nearest record is Emerald beach, Coffs Harbour.	Habitat is very dry, in addition to very high level of modification. Not recorded in locality and records predominantly in hinterland. Considered unlikely potential occurrence.	Unlikely to occur. No risk of significant impact. Seven Part Test not required.
Wallum Froglet (*Crinia tinnula)*	Predominantly confined to acidic paperbark swamps of coastal areas (Cogger 1992). Also found in wet heathland and Melaleuca sedgelands. Recorded breeding in flooded pasture adjacent to paperbark swamps.	No suitable habitat on site. Recorded in locality. Unlikely to occur on site.	Unlikely to occur, Seven part Test not required.
Giant Barred Frog (*M. iteratus)*	Moist hardwood forest, Antarctic Beech and rainforest near flowing streams. May also occur in coastal riverine rainforest and riparian vegetation. Forages in areas adjacent to riparian zones. Males call from under leaf litter or rocks by flowing streams. Eggs laid at streamside to await washing into stream by rainfall.	No suitable breeding or foraging habitat on site. Recorded in locality. Not detected by survey. Unlikely to occur.	No significant impact as no suitable habitat affected by proposal. No risk of significant impact. Seven Point Tests not required.
Stuttering Barred Frog *(Mixophyes balbus)*	Generally as for *M. iteratus*.	As for *M. iteratus*. Recorded in locality.	As for *M. iteratus*.
Green and Golden Bell Frog (*Litoria aurea*)	Found in permanent swamps and ponds. Prefers water bodies which are: still; shallow; unshaded; ephemeral; unpolluted; generally isolated; and free of native fish species or Plague Minnow (*Gambusia holbrooki)* and little macro-algae. Requires emergent vegetation, grass tussocks or rocks for shelter. May use disturbed sites opportunistically - may depend on seral stages. Eats insects and other frogs. Summer breeder. (Hero *et al* 2004).	No suitable habitat on site. Recorded in locality but not detected on site by survey. Considered unlikely to occur.	No loss of suitable habitat. No risk of significant impact. Seven Part Test not required.
Green Thighed Frog (*Litoria brevipalmata*)	Poorly known. Found in range of habitats such as warm temperate open forest, rainforest, and forestry dams in dry, open forest; breeding aggregations around oxbow lakes, ditches, flooded paddocks, overflows and grassy semi-permanent ponds. Males call only for few days after spring and early summer rains. Possibly a lowland forest ground-dweller.	Despite broad range of potential habitats the site is not considered to offer any structurally suitable habitat. Not recorded in locality or by survey on site. Considered unlikely chance of occurrence on site.	No loss of suitable habitat. No risk of significant impact. Seven Part Test not required.

Olongburra Sedge Frog (*Litoria olongburensis*)	Apparently restricted to wallum habitats in coastal lowlands and sand islands with tannin-stained acidic freshwater and sandy heath. Generally north from Woolgoolga to Fraser Island. Breeds following heavy rainfall in warmer months, calling from emergent sedges, grasses or ferns. Fish are largely absent from the habitats used. Can disperse into new habitats given suitable corridors. (Hero *et al* 2004).	No suitable habitat on site. Not recorded in locality or on-site. Unlikely to occur.	No loss of suitable habitat. No risk of significant impact. Seven Part Test not required.

APPENDIX 2: SEVEN PART TESTS

A2.1 Preliminary Information

The 7-Part Tests are used to determine whether a proposed development is likely to have a significant effect on a threatened species, Endangered Ecological Communities, Endangered Populations and Critical Habitat listed under schedules of the *Threatened Species Conservation Act 1995*. Considerations must be given to the possible significant impacts a proposed development may have on threatened species, populations, ecological communities and their habitats.

The 7-Parts of Consideration are described by Section 5A of the *Environmental Planning and Assessment Act 1979*, as amended by the *Threatened Species Act 1995* which in turn has been amended by the *Threatened Species Conservation Amendments Act 2002*, are listed in each of the following 7-Part Tests.

From the above table, it is considered that the Seven Part Test is required of the following species (# denotes recorded by survey on site):

- **Mammals**: Grey-Headed Flying Fox, Squirrel Glider#, Little Bent-Wing Bat, Eastern Bent-Wing Bat, Greater Broad-Nosed Bat, East Coast Freetail Bat, Eastern Cave Bat, Yellow-Bellied Sheathtail Bat, Hoary Bat, Beccari's Freetail Bat, Eastern False Pipistrelle, Brushtailed Phascogale, Spotted-Tail Quoll, Koala.

- **Birds**: Glossy Black Cockatoo, Square-Tailed Kite, Powerful Owl, Masked Owl, Barking Owl, Little Lorikeet, Little Eagle and Varied Sittella.

A2.2 Seven Part Tests Structure

To minimise repetition and superfluous information, the responses to the 7 Part Tests are structured as follows:

A.2.2.1 Threatened Species

Part (a) is generally answered per species in a dedicated section if impacts are more acute and require more detailed evaluation. For less affected species, species are grouped together based on broadly common ecology (ie mobile bird species such as the owls or species with similar habitats such as the Yangochiropteran bats) or similar impacts, and subject to a common 7 Part Test response to part (a).

Parts (d) and (f) are answered per species or collectively depending on the nature of impacts. Part (b) deals with Endangered Populations of which none are relevant to the proposed development. Part (c) applies specifically to EECs, hence is not relevant as no EECs occur on site or are affected by the proposal. Part (e) deals with Critical Habitat which is not relevant to the subject proposed development.

A2.3 Seven Part Test Responses

A.2.3.1 Threatened Species

A.2.3.1.1 Species Profiles and Extent of Local Population

SQUIRREL GLIDER *(Petaurus norf*olcensis*)*

ECOLOGICAL PROFILE:

Refer to section 3.7.3.1

HABITAT ON SITE AND EXTENT OF LOCAL POPULATION:

Refer to section 3.7.3.2.

GREY-HEADED FLYING FOX (*Pteropus poliocephalus*)

The Grey-Headed Flying Fox (hereon abbreviated to GHFF) is an obligate nectarivore and frugivore, generally depending on a continuous nectar flow from *Eucalyptus*, *Melaleuca* and related genera, and fruits mainly from rainforest trees and vines (Eby 2000a, 2000b). In NSW, its diet is mainly flowers of Eucalypt, Melaleucas and Banksias which have more regular flowering patterns, hence the preference for these groups (Eby 2000a). Feeding on introduced flowers and fruits eg orchards mainly occurs during periods of poor native production (Eby 2000a).

The GHFF travels long distances (generally within 20km but sometimes 50km) between roosts and foraging areas. Social roosts/camps are used daily, and locations are generally stable over many years. Roosts vary with function, with many forming an interrelated network. Roost selection is not fully understood. In NSW, they mostly occur next to a watercourse, with the dominant vegetation usually being rainforest, wet sclerophyll, Melaleucas, Casuarinas or mangroves (Eby 2000a). A very large important roost occurs near Wingham. Another reportedly occurs near Bowraville. Periodic major roosts occur in the Port Macquarie area in Kooloonbung Creek Nature Reserve and Sea Acres Nature Reserve (personal observations). The latter appear to depend on local food supply.

Numbers of animals utilising a roost varies with season. In NSW, roosts are classified as occupied continuously (key colonial roosts); occupied annually in certain seasons; or irregularly. During poor seasons, individuals or small groups may occupy temporary roosts often within or close to the food source plants. Spring-Summer roosts are considered maternity sites (Eby 2001a).

The GHFF is highly nomadic following fruiting seasons, with only a small portion being sedentary. Migratory movements are in order of hundreds of kilometres (Eby 2000a, 2000b). It is also a slow breeder, long lived, and has no physiological ability to withstand food shortages. The latter results in a high mortality especially of young if shortages occur during Spring, and also reduced reproductive success (Eby 2000b). Food shortages often force GHFF to forage in orchards, particularly lactating females (Eby 2000a, Tideman et al 1997).

HABITAT ON SITE AND EXTENT OF LOCAL POPULATION:

This species was not recorded on site by this survey, although as detailed in section 3.7.3.3, the GHFF was recorded by Umwelt (2004) on land directly adjacent. Given the presence of known forage species on and adjacent to the site and local records, both species are considered moderate to very highly likely to occur on site as seasonal foragers. The site is not considered to offer potential for roosting habitat.

In total the site and study area contains an area of potential foraging habitat for these species, forming a small portion of the locally abundant extent of potential foraging habitat in the area. Given the local extent of habitat and ecology of the species (eg lack of roosts), the local population of these species would extend well beyond the site/study area.

EASTERN CAVE BAT (*Vespadelus troughtoni*)
HOARY BAT (*Chalinolobus nigrogriseus*)
EASTERN FALSE PIPISTRELLE *(Falsistrellus tasmaniensis)*
LITTLE BENT-WING BAT (*Miniopterus australis*)
EASTERN BENT-WING BAT (*M. orianae oceansis*)
EAST COAST FREETAIL BAT (*Micronomus norfolkensis*)
BECCARI'S FREETAIL BAT (*Mormopterus beccarii*)
YELLOW-BELLIED SHEATHTAIL BAT (*Saccolaimus flaviventris*)
GREATER BROAD-NOSED BAT (*Scoteanax rueppellii*)

ECOLOGICAL PROFILE:

(a) Eastern Bent-Wing and Little Bent-Wing Bats:

See section 3.7.3.2 Heron abbreviated as CBWB and LBWB.

(b) East Coast Freetail Bat:

See section 3.7.3.2. Heron abbreviated as ECFB.

(c) Greater Broad-Nosed Bat:

In NSW, this bat occurs in habitats generally below 500m altitude, ranging from woodland to moist and dry eucalypt forest,

and rainforest, with a preference for moist gullies in mature coastal forest or rainforest on the eastern side of the Great Dividing Range (Churchill 1998, Smith *et al* 1995). It mostly roosts and nests in tree hollows in trunks and branches but will use old buildings. It generally forages at a height of 3-6m in rainforest but prefers the edges/ecotones between woodland, cleared land and riparian forest ie along gullies, creeks and small rivers (NPWS 1994b, Hoye and Richards 1995, Richards 1991, Smith *et al* 1995). It requires a sparse understorey to forage on large insects (moths, beetles and chafers) and small vertebrates possibly including other bats.

This consultant has recorded this species foraging on the edge of recently underscrubbed dry sclerophyll forest at Arakoon (Berrigan 2000c) and on the edge of rural-residential land and forest near Harrington (Berrigan 2001f).

(d) Yellow-Bellied Sheathtail Bat:

The ecology of this species is poorly known. Found in almost all habitats, particularly wet and dry sclerophyll forests and woodlands below 500m altitude, and also open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts mainly in tree hollows, but also under bark, under roof eaves and in other artificial structures. Found also in abandoned Sugar Glider nests, and in northern parts of its range cracks in clay and animal burrows.

Fast flying species, believed to forage above the canopy or closer to the ground in open areas. Insectivorous - known to prey on grasshoppers, chafers and shield bugs.

Found in southern half of its range mainly January to June, with a patchy distribution. May migrate to occupy southern area during warmer months. Usually solitary, but found in groups of up to 10 (commonly 2-6) in late Winter to Spring, and may be territorial. Breeds twice early-late Summer (AMBS 1995a, Richards 1991, Smith et al 1995, Churchill 1998).

(e) Eastern Cave Bat

A particularly rare and poorly known bat, with populations in the southern part of its range appearing to be localised (Parnaby 2000). It is a cave dwelling bat roosting in small (5) to large (500) groups in sandstone overhangs, caves, boulder piles, mines, tunnels and sometimes buildings. It tends to roost in well lit portions of caves in avons, domes, cracks and crevices. Typically, it inhabits warm temperate to tropical mixed woodland and wet sclerophyll forest on the coast and dividing range, but extends into drier forest on western slopes and inland areas (Churchill 1998, Parnaby 2000). It hunts below the canopy down to about 2m above the ground for insects such as mosquitoes, flies and moths (Smith *et al* 1995). Heron abbreviated as ECB.

(f) Hoary Bat

The Hoary Bat (hereon referred to as HB) is reportedly a habitat generalist, being found throughout its range in monsoon forest, tall open forest, open woodland, vine thickets, coastal scrub, sand dunes, grasslands, floodplains, along watercourses, swamps and around dams (Churchill 1998). Considered uncommon and likely to occur in low densities in specific areas, with extremely limited distribution in the region, and reaching its southernmost limits in the Macleay. NSW records of this species have been in dry open eucalypt forest dominated by *E. maculata*, *E. moluccana* and *E. siderophloia*, and woodland dominated by *E. signata* and *E. intermedia*. This species has been locally recorded at Clybucca where *E. signata* occurred (ERM Resource Planning 1995); in the Yarrahapinni-Broadwater area; in *E. pilularis* forest near Byron Bay (Smith *et al* 1995); *probably* recorded by echolocation in Blackbutt-dominated forest at Crottys Lane Kempsey (Berrigan 1999); and *confidently* recorded in recently underscrubbed Blackbutt forest in South Kempsey (Berrigan 2001f).

The Hoary Bat is primarily a tree-hollow roosting species, although it has been recorded in rock crevices (Allison 1991b referred to in Smith *et al* 1995, Churchill 1998). It is often one of the first bats on the wing after dusk.

The Hoary Bat prefers moths and beetles, but also recorded feeding on spiders, mantids, earwigs, crickets, grasshoppers, cicadas, bugs, diving beetles, scarabs, click beetles, leaf beetles, weevils, flies, moths and ants. This diet suggests that the species may land and forage.

(g) Beccari's Freetail Bat:

This poorly known bat appears to occupy a broad range of habitats ie rainforest, floodplains, tall open forest savannah woodlands, arid shrublands and grasslands. It is commonly caught along watercourses or over water bodies, or detected in rainforest gaps and dry eucalypt forest/woodlands. It roosts in tree hollows but has also been found in house roofs (commonly found in urban environments within main range) and caves, in colonies of up to 50 animals. It is a fast flyer with low manoeuvrability hence it has a preference for few obstructions. It mainly feeds above the canopy on moths and beetles, but also eats chafers, short-horned grasshoppers, plant-bugs, leaf-hoppers, chafer beetles, weevils and flies. Diet also includes flightless insects, which suggests may land and scurry along ground (Churchill 1998, Hoye 1995, Allison 1991). It apparently breeds from mid Spring to mid-Summer (Allison 1991, Churchill 1998).

This species mainly occurs in northern Australia, and is very infrequently recorded in NSW. The southernmost record appears to be around Herons Creek (Ecopro 1997). Murwillumbah was the previous confirmed record of this species (apart from an unconfirmed record at Alstonville (Parnaby 1992, Hoye 1995 and pers. comm.), at Gumma (Berrigan 2002c), and a tentative call identification at South West Rocks (Darkheart 2004f).

(h) Eastern False Pipistrelle:

This large vespertilionid feeds on moths and insects. It is known to roost in caves, abandoned buildings, but mostly in trees hollows in higher rainfall forested areas. It is suspected that some populations migrate in Winter from higher altitudes to coastal areas, or may simply enter torpor. Prefers wet tall forests (>20m high) (Churchill 1998) and extensive movements (eg 12km recorded between foraging and roost sites).

HABITAT ON SITE AND EXTENT OF LOCAL POPULATION:

The site and adjacent habitat provide a range of potential foraging structures for the subject species ie over the canopy in the more wooded areas, amongst the open structured vegetation, along tracks under the canopy, and along the interface between cleared/open areas and wooded areas.

There are no caves, cliffs, or overhangs on or directly adjacent to the site, which precludes species depending on such resources to breed or roost in, unless they are known to forage widely from such habitat components, or utilise alternative roosts (eg tree hollows) during non-breeding stages. Sea caves occur along the headlands to the east (personal observation), hence the locally recorded ECB may use these as roosts. Hollow bearing trees are abundant in the 7(d) zone with some also occurring in the 2(a) zone on and adjacent to the site. Many of these considered potentially structurally suitable as roosting habitat for hollow-obligate bats (depending on a complex interaction of factors such as hollow microclimate, season, sex and life cycle stage of the bat species as well predation risk and competition with other species – Churchill 1998, 2009, Smith *et al* 1995, Ms Anna Lloyd - Eco-Location, pers. comm.). The trees with decorticating bark (ie Blackbutt and Scribbly Gum) may also provide marginal temporary roosting opportunities for species capable of utilising such substrate (NPWS 2000a, Churchill 1998, 2009, Smith *et al* 1995).

Call recording and identification was not able to be employed due to weather in this survey, however Umwelt (2004) recorded the LBWB, ECFB and EBWB adjacent to the site in similar habitat. The remaining species are all considered potential occurrences given the presence of suitable habitat and local records (DECCW Atlas of Wildlife 2009a, Bionet 2009, Darkheart 2006f, 2004f, 2004j, Berrigan 2000a, 2000b, 2000c, O'Neil and Williams 2003, etc) – many <1km away. Given the ecology of these species, their mobility and the extent of alternative known/potential habitat in the locality (eg Hat Head National Park etc), the local population of all of the subject species would extend well beyond the confines of the study site and area.

SQUARE-TAILED KITE *(Lophoictinia isura)*

ECOLOGICAL PROFILE:

The Square-Tailed Kite (hereon referred to as STK) has an Australian population size of approximately 7000 breeding pairs (low reliability) and stable (low reliability), and it is classed as Least Concern in The Action Plan for Australian Birds (Garnett and Crowley 2000).

It typically inhabits coastal forested and wooded areas primarily within 250km of coast and rarely inland along wooded watercourses and in central Australia (Blakers *et al* 1984, Debus and Czechura 1989). Often associated with ridge and gully forests, STK usually prefers open eucalypt forest and woodland and will forage in open country or partially cleared pastoral country. It is never abundant anywhere, occurring as solitary birds or dispersed pairs. The STK has a marked preference for continuous stands of open forest/woodland. It may forage over mallee, heath and shrubs, and in wooded urban areas particularly if passerine birds present.

The STK is a specialist hunter of passerine birds, especially honeyeaters and nestlings, but also takes eggs, reptiles, rabbits and insects. It prefers to take prey from the outer foliage of the canopy; hunting in the morning and afternoon.
The home range of a pair is reportedly at least 100km^2 with ranges up to 1700km^2 being reported (AMBS 1996, Garnett 1993, State Forests 1995, NPWS 2000).

Nests are constructed in mature, living trees in the fork or large horizontal limb of a tall eucalypt or angophora within forest, often near water. Breeding occurs in July to February (Debus and Czechura 1989). In southeast and southwest Australia, there is a recorded seasonal dispersal of this species north in the Winter and south in the Summer. This is more pronounced in the southwest (State Forests 1995).

In recent years, breeding has been recorded in Kempsey-Wauchope Forestry Management Area and at Port Macquarie, where it is also known to tolerate human activity, even when nesting (Bischoff *et al* 2000). The STK may be adapting to well-

vegetated outer fringes of cities in northern NSW, feeding on the plentiful introduced and native passerine birds there (Debus 1998).

HABITAT ON SITE AND EXTENT OF LOCAL POPULATION:

The Square-Tailed Kite (hereon abbreviated to STK) was not recorded on the site but has been recorded in the locality (<1km). The site and study area offers a relatively small area of potential foraging habitat for the species in the forested habitats, forming a small part of locally extensive potential habitat in the locality. The site and study area possibly has some generic potential for nesting though no aspect of it distinguishes it from being more suitable than other habitat in the locality. A limited abundance of passerine birds were observed, indicating the site could form a relatively marginal part of the large home range of this species. Due to the ecology of the species, the local population would extend well beyond the confines of the site/study area.

BRUSHTAILED PHASCOGALE (*Phascogale tapoatafa*)

ECOLOGY/HABITAT REQUIREMENTS:

The Brushtailed Phascogale (hereon abbreviated to BTP) is predominantly arboreal, requiring tree hollows for nests and shelter; preferring 25-40mm wide openings, territorially marked with scats (Ayers *et al* 1996), in trees with trunk DBH as little as 14cm, but a preference for larger trees eg >40cm DBH (possibly due to trees this age being more likely to develop or contain suitable hollows) (Rhind 1996) and possibly more likely with rough bark (Soderquist *et al* 1996). Large trees offer more microhabitat opportunities which may support a higher abundance and diversity of invertebrates, and appear to be preferentially selected for foraging, which may also reduce the need to cross along the ground and hence reduce predation risk (van der Ree *et al* 2001, Rhind 1998).

The BTP has also been recorded using isolated trees for denning (Rhind 1996), as well as tree stumps (Soderquist 1993b, Trail and Coates 1993) and bird nests (Trail and Coates 1993). It can survive in areas with few hollows (eg paddock trees and immature regrowth forest) and will use alternative nest sites such as the rooves of houses within rural-residential areas and nest boxes even for breeding (Soderquist 1993b, Traill 1995, Law *et al* 2000, Dashper and Myers 2003). It will also cross cleared paddocks with distances of 20-285m recorded by van der Ree *et al* (2001) by females in Victoria.

The BTP uses many different hollows over a short time (ie den-swapping), with males recorded using 27 and females to 38 different hollows in a year (Rhind 1998) due to lifecycle requirements and seasonal variations. For example, nesting females preferred deep cavities with narrow entrances, while non-breeding hollows were less protected from weather and predators (Soderquist 1993a). It has also been recorded sharing non-breeding nests with Sugar Gliders simultaneously (Dashper and Myers 2003, 1997). In areas where hollows are limited, single den site may be used more often which may increase predation risk (Dashper and Myers 2003). It has also been recorded denning in small groups of 4-6 animals even at times of year when mature and normally solitary (Dashper and Myers 2003).

Recorded in a variety of habitats including rainforest, wet sclerophyll, coastal swamp forests, swamp forests, *Leptospermum* heaths, open woodland, eg 30-80% canopy cover dominated by box, stringybark and ironbark (Soderquist 1995; personal observations in eucalypt parkland) and narrow road reserve remnants (van der Ree *et al* 2001), but reportedly prefers open dry sclerophyll forest with a sparse shrub/ground layer varying between scleromorphic shrubs, grasses, low herbs or leaf litter (Soderquist 1995). Also uses forest edges and transitory area between vegetation communities. It forages over the tree trunk and large branches (but rarely uses saplings or branches <10cm diameter), and will feed on the ground and on fallen logs. Foraging occurs over the surface and under bark, with teeth used to prise off material, and forepaws used to reach into crevices (Trail and Coates 1993). Ants, beetles and spiders are common food items (Trail and Coates 1993).

Recorded by the author in White Mahogany dominated dry sclerophyll with sparse groundcover, minimal to dense shrub layer and understorey (Berrigan 1999a, Darkheart 2004a) near Kempsey; at South West Rocks in numerous locations in Blackbutt-Scribbly Gum dry sclerophyll forest (Berrigan 2002d, Berrigan 2000d, 2000e, Darkheart 2004f, O'Neil and Williams 2003); in a 33ha patch of mostly regrowth dry sclerophyll forest tentatively linked to a larger remnant at Minimbah (Berrigan 2003c); and in a 20ha patch of Tallowwood and Grey Ironbark/Cabbage Gum regrowth at Aldavilla with minimal hollows separated from proximate habitat by rural-residential subdivision (Darkheart 2004d)

A primarily (80-90% nocturnal predator (but also forages on the ground), it preys mostly on arthropods and small vertebrates (eg centipedes and spiders) but also eats small mammals (eg Sugar Gliders and House Mice), reptiles and birds (Myers and Dashper 1997, 2003, Soderquist 1994), and may forage for nectar on flowering eucalypts such as ironbarks and boxes (WWF 2002), preferring larger, rough-barked trees of >25cm DBH (Soderquist 1995). It has also been recorded on roadsides feeding on carrion (WWF 2002).

Reportedly solitary with a large home range. Females reportedly generally occupy on average 20-70ha exclusively (with females acting aggressively to other females, and home range size possibly also reflecting the strain of lactation), while males overlap >100ha with both sexes (Traill and Coates 1993, Soderquist and Ealey 1994, Soderquist 1995, 1994), although known to share nest with several others, particularly juveniles which share the maternal nest until they reach sexual maturity (next breeding season). Home range size may be a reflection of habitat quality with very small home ranges recorded in some areas (van der Ree *et al* 2001), as further detailed. There also appears to be a tendency for groups of females to be surrounded by extensive vacant habitat due to their ecology, which reduces their density, as well as breeding and colonising potential (Dashper and Myers 2003). Females appear to be able to survive harsher seasons better than males due to less food requirements (Clutton-Brock 1985).

Mating occurs May-July, followed by the death of the males (usually by the end of July) (Rhind 2002), though September births recorded in Western Australia suggest sperm storage may also occur (Rhind 2003). Nest hollows appear to be selected as large internal cavities (about 9000cm^3) with small entrances to exclude predators (24-55mm diameter entrance) and have been recorded in live and dead trees, and even stumps (where hollows rare). Height of dens has been recorded from ground level to 11m (Soderquist 1993b). Maternal home range of females with young is 4-6ha, occupied exclusively (Cuttle 1982). Births occur after about a 30 day gestation period, with most births in eastern Australia occurring July-August (Dashper and Myers 2003, Soderquist 1993a). Litter size ranges from 1-13, with females attempting to raise as many young as they have teats, though accidental loss and sometimes infanticide reduces numbers. Females have been recorded losing entire litters within the first two weeks, but at the same time, survival of the entire litter to weaning is also common (Soderquist 1993a). Sex ratio may be influenced by season with Rhind (2002) recording more females produced in drought, although Soderquist (1993a) also found 2nd year females produced more males. Young are carried in the pouch while the mother forages and does not return to the nest at this time. Young release the teat at about 48 days and are left in the nest while the mother forages (over 40-60ha if prey is sparse, as typical of the Winter season) in short bouts of <1hr for only a few hours per night. Maternal attendance is frequent in the early stages, and declines as young gain fur and the mother forages for longer periods (presumedly to meet higher lactation demands). Nests are built out of interwoven bark (preferably stringybark or similar material), fur and feathers (but not leaves) for insulation, with a tunnel leading into a chamber (Soderquist 1993b). Young are weaned around 20 weeks and begin foraging outside the nest at this time. Dispersal occurs in early Summer (mid December-early January (162-171 days old), sometimes later in poorer seasons. Mothers appear to abandon their young prior to this period at the earliest around 140 days, though lactation is still heavy to at least 150 days (Soderquist 1993a). Females appear to disperse a short distance adjacent to or replace the mother, though females have also been recorded making larger dispersals, eg 6km (Rhind 2002). Juvenile males disperse much further with studies showing movement of at least 3km away (Cuttle 1982, Soderquist 1995, Soderquist and Ealey 1994, WWF 2002, Rhind 2002). The generally limited dispersal of females may limit colonisation of potentially suitable habitat outside the former maternal range, hence reducing recovery potential of this species from areas where it has been previously displaced (Dashper and Myers 2003). Dispersal may also be delayed during drought seasons (Rhind 2003).

Home range sizes appear to vary with habitat quality and extent, with extensive foraging area required especially by lactating females (van deer Ree *et al* 2001, Soderquist 1993b) as noted previously. Hence larger home ranges are seen to occur in more marginal areas. However, there are recorded instances of very small home ranges in highly productive but limited extent areas, eg van der Ree *et al* (2001) found BTPs using roadside remnants in Victoria using home ranges of 2.3-8ha (females, with average of 5ha; whiles males were >20ha). Home range size in regrowth forest in northern NSW is reported to be around 15ha (Williams, in prep), and O'Neil and Williams (2003) suggested home range in the South West Rocks area may be around 5ha. Rhind (2002) recorded female home ranges of 10ha in rich gully habitats and 17ha in continuous forest (Rhind 1998).

Mortality rates are high, with Phascogales often using vulnerable nest sites (Soderquist 1994). Monitors are a particular threat especially of hollows holding young (Soderquist 1994). Drought and condition also have impacts on breeding success (Rhind 2003). Females may live for a second year, with captive animals living up to 3 years. Second season and even a third breeding season has been recorded (Rhind 2003, Soderquist 1993a). Females also have a high mortality (40-50%) rate during lactation primarily due to predation (predominantly foxes and cats), and less so to accidents (eg road kill or drowning) or other reasons due to poor health/condition (Soderquist 1993a). In addition to high mortality, predation and drought effects, the high risk breeding strategy also predisposes the species to risk of loss of isolated populations that fail to successfully breed in one year.

HABITAT ON SITE/EXTENT OF LOCAL POPULATION:

The site is mainly agricultural woodland and pasture that lies on the fringe of a body of fragmented forest that extends from Hat Head National Park in the west (connectivity broken by roads and rural-residential Lots), running east-west across the southern boundary of the property, and extending to the south to again interconnect with the National Park. Connectivity to the west with known BTP habitat (Darkheart 2004f, Berrigan 2000a, 2000b, O'Neil and Williams 2003) is broken by extensive relatively recent residential development (<15yrs). However, the forest to the south is known to support the species (Berrigan 2003a).

Given the limited extent of suitable habitat in the 7(d) zone suitable for this species, and that it has also been recorded in agricultural woodlands (Darkheart 2005n), the BTP is considered highly likely to occur in the 7(d) zone at least using it as part of a larger home range, with potential periodic foraging forays into parts of the adjacent woodland. Given the abundance of suitable hollows and extent of habitat, breeding may potentially occur in the 7(d) zone but this would depend on foraging capability (Soderquist 1993a, 1993b).

Given the species ecology and the relatively low quality of the habitat on site, it is considered that the site individuals/local population would extend beyond the confines of the site/study area onto adjacent land to the south and east.

SPOTTED-TAIL QUOLL (*Dasyurus maculatus*)

ECOLOGY/HABITAT REQUIREMENTS: The Spotted-Tail Quoll is semi-arboreal, but mostly a ground-dweller in moister sclerophyll forests and rainforests, although also known from woodland, coastal heathlands, rocky areas and semi-agricultural areas (WWF 2002, AMBS 1996b, NPWS 1999). Critical habitat features are not known, with certain areas of apparently suitable habitat not occupied. It has most commonly been found along escarpments, gullies, saddles and riparian zones. The Quoll appears most likely to be found on the most productive sites, irrespective of forest type (eg dense leaf litter, large diameter trees, dense understorey, thick scrub cover and logs). It is often found associated with rocky areas which are important for den sites (WWF 2002).

The Quoll is primarily solitary, and normally nocturnal, resting in caves, rocks, underground burrows, rock crevices, fallen logs and tree hollows (at base of trees and branches several metres above ground), but also leaf litter, grass tussocks and dense brambles of lantana and blackberry – the latter in cleared farmland (Kortner *et al* 2004, WWF 2002, Smith *et al* 1995). Dens do not normally appear to be used on consecutive nights (denswapping) except for lactating females (Kortner *et al* 2004), and animals appear to flee from more unprotected den sites when approached (Kortner *et al* 2004).

Males (maximum about 4.2kg) are significantly larger than females (about 2.15kg) almost twice as heavy, but appear to grow slower (Kortner *et al* 2004). The male may vocalise more frequently during the breeding season. Adults begin breeding at about 2 yrs old with breeding once a year, and mating occurs in April to July, with young becoming independent from August to November (Smith *et al* 1995). Quolls appear to live for about 5yrs (WWF 2002) with high mortality rates (often due to predation by canids and quolls especially of females and juveniles, and starvation again especially of females and juveniles) and turnover (Kortner *et al* 2004).

The Quoll preys opportunistically on birds, reptiles, arthropods and mammals (terrestrial and arboreal) eg rabbits, small macropods, gliders and possums, with about 70% of the diet primarily being medium sized mammals. It generally requires a large extent of intact vegetation to forage in. It has been known to take nestling birds, bats, Ringtail Possums, Yellow-Bellied Gliders and Sugar Gliders from hollows (Belcher 1995). It also scavenges carrion (which makes it vulnerable to automobile collision) and preys on domestic poultry (NPWS 1999, Smith *et al* 1995). Small mammals, reptiles and invertebrates are only a small part of the diet – more so for juveniles.

Home range estimates range from 500-800ha on average (AMBS 1996), but varies with habitat quality, sex and season. Generally, females may range over 600-1000ha, while males may move over 1000-5000ha (WWF 2002), however with varies predominantly with habitat quality (measured in terms of prey abundance and habitat complexity) rather than moisture/habitat types (Claridge *et al* 2005). For instance, Claridge *et al* (2005) recorded males ranging from 621-2561ha for males and 88ha to >653ha for females in dry rainshadow woodland in southern NSW (Claridge *et al* considers these sizes equivalent to home range estimates in other habitat types especially tall wet sclerophyll forest). Home range overlaps of males and females overlaps considerably, but females seldom overlap (Claridge *et al* 2005, Kortner *et al* 2004). Females appear to tolerate juvenile and sub adult offspring within their range for some time, but in areas where resources are more sparse, animals in general appear to defend (ie express territorialism) home ranges. Females also appear to be more sedentary with males having large home ranges or transient (Kortner *et al* 2004). Juvenile females also appear to stay close to their mothers home range with males apparently more likely to disperse (Kortner *et al* 2004).

This species has been recorded foraging over 2-6km in a night, with males shown by Claridge *et al* (2005) to move (in maximum straight line distances) 2529-4430m over a 24 hour to 48hgr period, and females 1865-3085m, with males also moving further over time. Kortner *et al* (2004) recorded males moving 8.1km and females 3.9km on the New England Tablelands.

Latrines are used, but by only by a single female, though several males may also visit. These appear to be important in communicating breeding status of females. Indicated by an accumulation of scats, these latrines are usually located on high points (eg rock piles, large rocks within a stream, or on top of a large log), or within a significant landscape feature eg exposed rock formations (WWF 2002).

The Quoll is also considered likely to be in direct competition with foxes and feral cats (Smith *et al* 1995).

HABITAT ON SITE: The Spotted-Tail Quoll (STQ) was not recorded by the survey, but it been recorded at Yarrahappini, and is likely to occur in Hat Head National Park (Campbell 1997). The 4.18ha of dry sclerophyll in the 7(d) zone on the southern end of the property and interconnected to similar habitat to the south and east, and ultimately the National Park are considered to offer some generic potential habitat values for the species. Hollows in trees which may be structurally suitable for the STQ, are present in the 7(d) zone. Hollows range throughout the spectrum of size ranges which is ideal for potential prey species.

Arboreal prey abundance is likely to be fair with Squirrel Gliders being recorded by this survey, and Ringtail Possums, Sugar Gliders and Brushtail Possums recorded in interconnected vegetation. Terrestrially, foraging potential appears to be limited on both the site and study area. Birds were similarly limited, though this would vary with season eg flowering periods. Other groups such as frogs and reptiles are poorly represented, though the seasonal conditions may have affected detectability. Overall though, the site could support foraging by the Quoll as a minute part of its large territory.

Potential occurrence of the Quoll is significantly reduced by the presence of dogs and cats in residential areas adjacent, and likely presence of foxes. In addition to the fact that the study area habitat forms a spur off a large area of intact habitat to the east and south, the likelihood of the species to occur on the study site/area is overall considered low to marginally fair, with the approximately site/study area at most forming a marginal part of a wider range of at least one Quoll including habitat to the south and east.

POWERFUL OWL (*Ninox strenua*)
BARKING OWL (*Ninox connivens*)
MASKED OWL (*Tyto novaehollandiae*)

POPULATION SIZES/ECOLOGY/HABITAT REQUIREMENTS:

1. Powerful Owl

Australian population is possibly about 7000 breeding birds (stable) classed as Least Concern under The Action Plan for Australian Birds (Garnett and Crowley 2000). The Powerful Owl attains its greatest relative abundance in northeastern NSW (Kavanagh 2000b).

The Powerful Owl (hereon abbreviated to PO) inhabits open *Eucalypt*, *Casuarina* or *Callitris* pine forest and woodland, and may forage along the forest's edge, although it may prefer gullies in coastal forests (below 1500m asl), but is generally found where prey densities and roost densities are sufficiently high. It has also been recorded breeding and foraging successfully within forests and woodlands within metropolitan areas of large cities provided suitable prey species and nesting cavities are available, however, is sensitive to disturbance of nests and thus has lower breeding success (Cooke *et al* 2000). Hence overall, it is regarded as a habitat generalist (Kavanagh 2000b).

The PO preys opportunistically on large arboreal mammals such as the Yellow-Bellied Glider, Sugar/Squirrel Gliders, Common-Ringtail Possum, Greater Glider (high populations of the latter species is often linked with the occurrence of the PO) and even smaller Koalas, supplemented with terrestrial mammals (eg rats, bandicoots and juvenile wallabies), birds (eg galahs, currawongs, rosellas, lorikeets, cockatoos), fruit bats (especially if camps are nearby) and even insects (eg Christmas Beetles and large Ghost Moths), depending on abundance of prey (eg other species may be taken where mammals populations are low, though this is seen as less sustainable) (Debus 1995, Soderquist *et al* 2000, Kavanagh 2000a). Birds tend to be taken in more fragmented habitats where density and abundance of arboreal prey is lower (Kavanagh 2000a). The PO requires the equivalent of a small possum every two nights to maintain physiological demands (Garnett 1993, Schode and Tideman 1990). Hunting may be concentrated in part of the territory for some time, resulting in local declines in abundance and diversity (Kavanagh 1988), but also sees the entire home range being used regularly (Soderquist *et al* 2000).

The PO is sedentary, and solitary or in pairs occupying permanent territories of 300-5000ha (average 800-1000ha), depending on the quality of habitat (Debus 1995, Soderquist *et al* 2000, Kavanagh 2000b). Favoured roosts are on a branch within dense foliage of a tall understorey or sub-storey tree in moist, tall forest, rainforest or open forest. Recorded roost species include Forest Oak (*Allocasuarina torulosa*), Lilly Pilly *(Acmena smithii*), *Leptospermum* spp, *Acacia* spp. and Turpentine (*Syncarpia glomulifera*). The PO has also been recorded roosting in pine plantations near eucalypt forest.

Nests are usually located in large (30 to >150cm DBH, average 77-180cm DBH; with minimum 10cm wide apertures), deep (1-3m) hollows in trunks of trees, or horizontal and sloping spouts, 9-37m above ground (Debus 1995, Kavanagh 1997). These trees are often the largest and oldest tree (150-500 years) within a forest patch (eg an emergent), and are generally located at the head of a minor drainage line or upslope of streams (Soderquist *et al* 2000, Smith *et al* 1995, Gibbons and Lindenmayer 2002).

Breeding mainly occurs in Winter (Kavanagh 2000a), and nest fidelity is usually high, though some pairs have been recorded selecting new sites on average every two years (Kavanagh 2000b). Two eggs are laid per year, with most pairs able to raise at least one young (Kavanagh 2000b). Siblicide is not unknown.

2. The Masked Owl

Southern Australia subspecies estimated to number about 7000 breeding birds (stable), and is classed as Near Threatened under *The Action Plan for Australian Birds* (Garnett and Crowley 2000). The Masked Owl attains its greatest relative abundance in northeastern NSW (Kavanagh 2000b).

The Masked Owl (hereon abbreviated to MO) prefers eucalypt forest and woodland with a sparse understorey, and appears to require partial clearing/open areas or forest edges for foraging, hence it is regarded as habitat generalist (Kavanagh 2000b). They also inhabit more open areas eg farmland. It appears to avoid wetter and denser forest (Kavanagh 2000a) and is least common in forested environments with a denser understorey and/or dense groundcover, including early stages of forest regrowth (Kavanagh 2000b).

The MO is solitary, and sedentary, occupying a large permanent territory about 500-1000ha/5-10km^2 (average 800-1200ha) (Debus 1995, Kavanagh 2000b). It preys closer to the ground than the other owls, and appears to be more of a specialised predator on small terrestrial, scansorial (climbing) and arboreal mammals in the 200-600g range (eg rats, antechinuses, Sugar Gliders, Common Ringtails, bandicoots and rabbits), birds (eg Tawny Frogmouth Owl), domestic poultry and even insects (Garnett 1993, Schode and Tideman 1990, Debus 1995, Mt King 1993, Kavanagh 2000). The Masked Owl appears to predate more on introduced species in highly disturbed environments, and native species in more natural habitats (Kavanagh 2000).

The MO roosts in tree hollows in eucalypts, and also in lilly pillys and some rainforest trees, dense foliage (infrequent), caves and crevices. Nest are located in tree hollows or cliffs. Tree hollow nests are generally in vertical trunk or spout hollows 10-30 high, 0.5-5m deep and 0.5m wide, in or near eucalypt forest or woodland (Debus 1995). Selected trees are usually 100-191cm DBH (Kavanagh 1997).

3. The Barking Owl

The Barking Owl (hereon abbreviated to BO) shows a preference for more open country ie savannah woodland, woodland, as well as forest. It is widespread on the foothills and coastal plain, to the inland slopes and plains, and rare or absent in dense, wet forests on the eastern fall of the Great Dividing Range. It has been recorded roosting in rainforest, but prefers to forage in more open country including farmland. Its preferred habitat is usually dominated by eucalypts and paperbarks (NPWS 2003c), and has even been recorded in remnants of forests and woodland, and in tree copses on farmland, in towns and golf courses. Roosts are normally in dense foliage of large trees (including rainforest species) such as streamside gallery forests, River She-Oak, Casuarinas, Allocasuarinas, eucalypts, Angophoras and Acacias. Roosts are not necessarily hidden (NPWS 2003c).

Nesting occurs in hollow trees, mainly eucalypts or paperbarks, usually near watercourses or wetlands. Nest is a large open hollow often vertical or sloping in a trunk or spout of a live or dead tree, 2-35m above ground, with an opening of 20-46cm and depth of 20-300cm. Breeding is in permanent territories, and is strictly seasonal with eggs laid in late Winter or Spring (August-October in NSW). Fledglings are seen with their parents about October to January, and disperse at the end of Summer (NPWS 2003a).

Population densities are not well known for the species, though some studies have recorded breeding pairs spaced <1-10km apart. Large territories (probably at least 200ha, but more likely up to 6000ha) are maintained with territorial calls at dusk and dawn.

Least nocturnal of Australian owls, hunting before dusk for small to medium prey such as birds, large insects and mammals. Tends to eat more birds than other forest owls such as rosellas, starlings and magpies, with a concentration on mammals during breeding and Winter; and often a lot more insects post-breeding in warmer months. Common prey include rabbits, hares, smaller marsupials, possums, Sugar Gliders, Squirrel Gliders, Brushtailed Phascogale, rats mice, and a variety of birds (NPWS 2003c).

HABITAT ON SITE/EXTENT OF LOCAL POPULATION:

This survey failed to record the subject owl species on site, though the PO has been recorded within 5km (Darkheart 2006f).

The approximately 4.18ha of dry sclerophyll forest and less so the woodland in the southern end generically offers a relatively minute area of potential foraging habitat for these species. Potential foraging resources in the study area are likely to include Squirrel Gliders, possums, bandicoots, rodents and birds. The potential for roosting is somewhat limited due to the absence of dense foliage due to the disturbance history and forest types. Some large hollows were noted to occur in the 7(d) zone which were considered generically potentially suitable as nest sites ie large trees with large hollows. Such trees also occur in more protected parts of the area however (eg Berrigan 2000c, Darkheart 2004f), and the proximity to residences may be a deterrent to this activity occurring on site or in the study area

Given the extent of the site/study area and the ecology of these species, the local viable population obviously extends well beyond the confines of the site/study area.

KOALA (*Phascolarctos cinereus*)

HABITAT REQUIREMENTS: Koalas feed primarily but not exclusively on selected species of Eucalypts. In the Hastings and Macleay regions, eucalypt species that are known to be used by Koalas include: Tallowwood, Swamp Mahogany, Forest Red Gum, and Small-Fruited Grey Gum (Standing 1990, Connell Wagner 2000). The first two species occur on the study site.

A Koala food tree is usually identified by a significant number of scats at its base, though such trees may also be used for roosting. Koalas may often be observed during the day resting in a tree in which they either fed on the night before, or will that night. Koalas appear to prefer young leaves rather than mature leaves and nutritional quality of individual trees may also be a factor (Braithwaite, Turner and Kelly 1983, Sarre 1999). Usage may also be determined by site-dependant edaphic factors eg soil type (Sharp and Phillips 1999), which affects the nutrient quality of forage. A gradient in nutrient concentration in soils and foliage is a major determinant of the distribution of arboreal fauna (Sarre 1999, Gibbons and Lindenmayer 2002). Forests consisting of primary browse species associations located on deep, fertile soils on floodplains, in gullies and along watercourses are generally considered preferred habitat. This may be a reflection of the nutritional value of the foliage. The preferred tree size varies according to the site, but is in the range 20-100cm DBH typical of medium to large trees.

Koalas are solitary, and territorial (particularly males), yet live in established, sedentary polygynous breeding aggregates arranged in matrix of overlapping home ranges, whose size varies according to sex (males tend to be larger so that they overlap the ranges of several females), and carrying capacity of the habitat (usually measured in terms of density of primary browse species) (Phillips and Callaghan 1995). These aggregates basically consist of an alpha (dominant) male, with his harem of at least 2-4 females and their offspring (juveniles and/or sub-adult Koalas) of varying stages of maturity and independency (Phillips 1997). Home range size also varies according to quality of the habitat and ranges from a hectare to hundreds of hectares (see Jurskis and Potter 1997).

In the initial stages of independence, a young female Koala usually remains within its mother's home range for about a year, until they establish their own, often overlapping with their mother's, or dispersing to other aggregates. In contrast, a young male is often turned out of the maternal home range (usually around 2 years of age), and becomes nomadic. These males may be forced into marginal habitats, and become more generalist in their dietary intake. Koalas may travel substantial distances and movements of up to 50km have been observed over a period of months.

Within a home range, a few specific trees (*home range trees*) are used by Koalas to mark territories and identify individual Koalas. Such trees are recognisable by heavy scratching and collections of scats close to the tree base, and may also have significant forage value (Phillips and Callaghan 1995, Hume 1989). Such trees are very important as they maintain social cohesion through identification of population members and assist geographical location (Phillips 1997, Sharp and Phillips 1999).

POTENTIAL HABITAT ON SITE: The site and study area contains Scribbly Gums and Tallowwoods which are listed in SEPP 44 as primary preferred forage species. These occur in sufficient abundance to qualify the site as Potential Koala Habitat. This survey and previous survey of most of the remainder of the property however failed to detect Koalas.

Presently, there appears to be only one confirmed Koala breeding aggregate in the South West Rocks area, which is located around the Smokey Cape area (Kempsey Argus 2002, DECC 2007a, Bionet 2009a). An article in the Kempsey Argus (23/7/02) reported the existence of a small colony of Koalas in the Smokey Cape-South Smokey Beach area. Koalas are also reported to occur in Hat Head National Park (Campbell 1997), and this is likely to be this colony given no other records are known for the reserve (DECC 2007a, Bionet 2009). There are also unconfirmed reports of Koalas in western South West Rocks (Darkheart 2004f). Standing (1990) in "*A Study of Koalas in the Macleay Valley*" reports only one unconfirmed koala sighting for the South West Rocks area (in the vicinity of Smoky Cape). This sighting was in 1983, and no further sightings or scats were detected in the area by her field survey in 1989-1990.

The site is about 3km from the known record of Koalas in Smokey Cape, separated by extensive area of other Potential Koala Habitat, Arakoon Rd and rural-residential subdivisions. The unconfirmed record of Koalas in western South West Rocks is almost effectively (as Koalas can move through residential areas – Connell Wagner 2000b, Wilkes and Snowden 1998, NPWS 2003a, etc) isolated from the site via relatively recent residential development. Hence the actual current potential for the Koala to occur on site/study area is at best very low (eg a wandering sub-adult).

Given this, it is readily apparent that site/study area does not contain a local population, but provides potential habitat in which a recovering local population could potentially expand into.

GLOSSY BLACK COCKATOO (*Calyptorhynchus lathamii*)

ECOLOGY/HABITAT REQUIREMENTS:

The Glossy Black Cockatoo has a restricted diet of large-coned Casuarina and Allocasuarina eg *A. littoralis* and *A. torulosa* are the preferred coastal species. Food trees generally have large cone crops (eg >200 cones) and young cones (easier to open and the seeds have higher protein content). Cones are not selected on size but on number of seeds per cone (to maximise foraging effort), thus a tree with a large crop is not necessarily a preferred food tree (Clout 1989). Trees may require at least 10 years of growth before being potentially utilised (Mt King Ecological Surveys 1993).

This species lives in loose groups ranging from 2-20 individuals, occupying a permanent area (range over 100km), following the fruiting pattern of its preferred food tree species. A Winter breeder, perhaps linked to the phenology of its food, it requires nesting hollows, around the mid canopy, in dead limbs or trunks approximately 18cm in diameter with very wide bottoms, usually in dead trees (Schode and Tideman 1990). It appears to have a preference for tracts of undisturbed or minimally disturbed woodland (Smith *et al* 1995).

HABITAT ON STUDY SITE/EXTENT OF LOCAL POPULATION:

This species or chewed seed cones indicative of foraging by the Glossy Black Cockatoo were not recorded on the property. However, this bird has been recorded in numerous occasions in the locality (DECC 2007a, Bionet 2009, 2004f, 2000a, 2000b, 2000c, 2002a, O'Neil and Williams 2003), including habitat within 1km (Darkheart 2004f, Berrigan 2003a).

Overall, the site offers no foraging or nesting potential for this species. A few large trees with large hollows occur in the 7(d) zone and these offer some marginal potential as nest sites (Cameron 2006), though more optimal potential hollows have been observed in other locations (eg Darkheart 2004f). Similarly, forage is limited to rather stringy Black Oaks in a very limited abundance in the uppermost portions of the dry sclerophyll forest. Given the ecology of the species, and the limited extent of foraging habitat, the property may only form a relatively minute fraction of the foraging and breeding range of a viable local population.

LITTLE EAGLE (*Hieraaetus morphnoides*)

HABITAT REQUIREMENTS/ECOLOGY:

From the Preliminary Determination (NSWSC 2009b):

> "2. The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Young fledge in early summer. It eats birds, reptiles and mammals, occasionally adding large insects and carrion (Marchant and Higgins 1993; Aumann 2001b; Debus *et al*. 2007). It was formerly heavily dependent on rabbits, but following the spread of rabbit calicivirus disease, and consequent decline in rabbit numbers by 65-85% in the arid and semi-arid zones (Sharp *et al*. 2002), the eagle is increasingly dependent on native prey. Most of its former native mammalian prey species in inland NSW are extinct (terrestrial mammals of rabbit size or smaller, *e.g*. large rodents, bandicoots, bettongs, juvenile hare-wallabies and nailtail wallabies: Van Dyck and Strahan 2008)."

HABITAT ON SITE AND EXTENT OF LOCAL POPULATION:

This bird has not been recorded locally (DECC 2009a, Bionet 2009), suggesting it is only a low to marginally fair chance of using the wider area as part of its territory.

No nests occur on site, and no aspect of the site distinguishes it from other potential habitat in the locality for being specifically ideal for a potential nest site. The approximately 4.18ha of forest and less so the woodland on site contains some potential prey species, but due to its limited extent and ecology of the species, would obviously only form a minute fraction of the local pair's territory. Occurrence is considered most likely as a passing fly over. Hence the local population would far exceed the site/study area.

LITTLE LORIKEET (*Glossopsitta pusilla*)

HABITAT REQUIREMENTS/ECOLOGY:

From the Preliminary Determination (NSWSC 2009a):

> "2. The distribution of the Little Lorikeet extends from just north of Cairns, around the east coast of Australia, to Adelaide. In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri (Barrett *et al*. 2003).
>
> 3. There is no evidence of regular migration, but Little Lorikeets are generally considered to be nomadic (Higgins 1999), with irregular large or small influxes of individuals occurring at any time of year, apparently related to food availability. However, long term investigation of the breeding population on the north-western slopes indicates, that breeding birds are resident from April to December, and even during their non-resident period, they may return to the nest area for short periods if there is some tree-flowering in the vicinity (Courtney & Debus 2006).
>
> 4. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. In south-east Queensland (Smyth *et al*. 2002), Little Lorikeets were more likely to occupy forest sites with relatively short to intermediate logging rotations (15–23 years) and sites that have had short intervals (2.5– 4 years) between fires.
>
> 5. Little Lorikeets are gregarious, usually foraging in small flocks, often with other species of lorikeet. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including, melaleucas and mistletoes. On the western slopes and tablelands White Box *Eucalyptus albens* and Yellow Box *E. meliodora* are particularly important food sources for pollen and nectar respectively (Courtney & Debus 2006). They are also reported as feeding on fruits, particularly those of mistletoes (Higgins 1999).
>
> 6. The breeding biology of Little Lorikeets is little known, except for long-term observations (43 years) on the north-western slopes by Courtney and Debus (2006). This work, consistent with anecdotal records from around the country, indicates that nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts, especially Manna Gum *Eucalyptus viminalis*, Blakely's Red Gum *E. blakelyi* and Tumbledown Gum *E. dealbata*. Hollow openings are very small, approximately 3 cm in diameter, and are kept open by the activities of the occupants, which use their beaks to bite away living bark from around the opening. When nest hollows are deserted, e.g. after storm-damage to trees, hollows can close over within 14 months (Courtney & Debus 2006). Nest hollows are occasionally located in dead trees, but birds generally desert hollows within two years of tree death. Nest-hollows are used 'traditionally', with the same hollow known to be occupied for at least 29 years (not necessarily by the same individuals) (Courtney & Debus 2006). The breeding season extends from May to September (Higgins 1999) and as long as eucalypt nectar and pollen are available throughout this period, two broods of fledglings can be raised in a season. Clutches are of three to five eggs (Higgins 1999) and broods of three and four young have been recorded, with a single fledgling recorded from one nest (Courtney & Debus 2006). No data are available on generation time in wild birds and the 'low-reliability' estimate of two years (Garnett and Crowley 1998), for the ecologically-similar Swift Parrot (*Lathumus discolor)* would seem a poor surrogate, given that other lorikeet species are known to survive and potentially breed for 20 years (Rainbow Lorikeet *Trichoglossus haematodus*: ABBBS 2008). Little Lorikeets in captivity are known to breed at one year of age (G Phipps, pers. comm. 2008, R Webb, pers. comm. 2008) and this suggests a minimum age for maturation in the wild of one year. A life span of 10 years in the wild is a reasonable estimate for a parrot of this size (W Boles, pers. comm. 2008). An approximation of generation time based on the age of maturity plus half of the length of the reproductive period of the life cycle (IUCN 2006) produces an estimate of generation time of approximately five years."

HABITAT ON SITE AND EXTENT OF LOCAL POPULATION:

This bird has been recorded in the locality (DECCW 2009a, Bionet 2009). The site and general area offers generic foraging habitat for this species on eucalypts and bloodwoods, but has limited Winter-Spring flowering potential, hence site breeding appears unlikely.

The approximately 4.18ha of forest and less so the sparse woodland only has generic potential to form a minute part of the seasonally nomadic range of this species, but offers potential breeding resources in terms of hollow-bearing trees. Potential to occur thus would depend on seasonal flowering incidence and competition with other species (eg Rainbow and Scaly Breasted Lorikeets), with breeding also dependant on abundance of flowering and availability of hollows. This species is considered to have at least a fair chance of occurrence on site, most likely as a non-breeding nomad using the wider area as part of its range. The ecology of this species thus determines that the local population far exceeds the site.

VARIED SITTELLA (*Daphoenositta chrysoptera)*

HABITAT REQUIREMENTS/ECOLOGY:

From the Preliminary Determination (NSWSC 2009d):

> "2. The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west (Higgins and Peter 2002; Barrett *et al.* 2003). It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.
>
> 3. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction in population size on the basis of comparative atlas surveys over the past several decades. The species was reported in 69 one-degree grids in NSW in the first national bird atlas in 1977-81 at mostly moderate to high reporting rates (Blakers *et al.* 1984). It was recorded in 63 one-degree grids in the second national bird atlas in 1998-2002 at mostly low reporting rates, and with gaps in its distribution coinciding with heavily cleared bioregions (Barrett *et al.* 2003). The index of abundance (reporting rate) for this species declined significantly by 44% in NSW in the 20 years between the two atlases, but with no significant change nationally (Barrett *et al.* 2003, 2007). In NSW it declined by more than 20% in every bioregion except the North Coast, Brigalow Belt and Darling Riverine Plains, where there were no significant changes in reporting rates, and the three westernmost bioregions where insufficient records were obtained to assess trends (Barrett *et al.* 2007). This result suggests that a decline of 35% has occurred in NSW over three generations (15 years). The Sittella was not less likely to be detected in Atlas 2 versus Atlas 1 due to the different survey methods (Barrett *et al.* 2003) and therefore comparison of the two atlases is unlikely to be significantly affected by survey bias.
>
> 4. The apparent decline has been attributed to declining habitat cover and quality (*e.g.* Watson *et al.* 2003). The sedentary nature of the Varied Sittella makes cleared agricultural land a potential barrier to movement. Survival and population viability are sensitive to habitat isolation, reduced patch size and habitat simplification, including reductions in tree species diversity, tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter (Watson *et al.* 2001; Seddon *et al.* 2003). The Sittella is also adversely affected by the dominance of Noisy Miners in woodland patches (Olsen *et al.* 2005). Current threats include habitat degradation through small-scale clearing for fencelines and road verges, rural tree decline, loss of paddock trees and connectivity, 'tidying up' on farms, and firewood collection. 'Clearing of native vegetation', 'Loss of hollow-bearing trees', and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes in NSW under the *Threatened Species Conservation Act* 1995."

Noske (1998) undertook a study of this species in northeastern NSW. He found the species occurred in sedentary groups or clans maintaining weakly defended territories around 13-20 ha. He also observed that group size varied seasonally, with density varying in the region from 0.2-0.5/ha. Roosting was noted to be communal with periodic changes in roost sites every few days or so. In the region, the breeding season is long and extends from August to January. Mortality seemed highest during the early breeding season during dispersal. In Noske's survey area, he found most nests built on dead branches of Broad-Leaved Stringybarks (*Eucalyptus caliginosa*). Most clutches (74%) of the species were of three eggs, the remainder being two. Nest success was low (20%; n = 49), with nests containing 2-3 eggs. Noske considered that large territories, feeding of the incubating female, and long periods of incubation, nestling and juvenile dependency, as well as a specialised foraging niche and cryptic prey (hence overall, availability of food) may be limiting for this species, which he suggested by the species has adapted to have helpers to provide young with sufficient food.

HABITAT ON SITE AND EXTENT OF LOCAL POPULATION:

This bird has been recorded in the locality (DECCW 2009a, Bionet 2009). The site and general area offers generic foraging habitat for this species in the open woodland and more so the denser dry sclerophyll in the 7(d) zone. The site has generic breeding potential but presence of Noisy Miners and limited carrying capacity due to the extent of modification and fragmentation may be a significant limitation.

The 4.18ha of forest on site only has generic potential to form part of a larger territory of a breeding pair or clan of this species. However, lack of sightings on site (Umwelt 2004, this survey) or in nearby habitat (Darkheart 2006f, 2006j, 2004f, 2004j, 2004x, 2000a, 2000b, 2000c, 2002a, Parker 1996, O'Neil and Williams 2003, Connell Wagner 2005), as well as the extent of modification of the site's habitat (hence limited carrying capacity) suggests this is most unlikely. The site is thus only considered to offer potential habitat on the fringe of a relatively large area within nearby Hat Head National Park. This and the ecology of this species thus determines that the local population exceeds the site.

A.2.3.1.2 Part (a)

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

The proposed development is a 56 Lot residential subdivision (including two larger residual Lots) that will see removal of 3.03ha of agricultural woodland (comprising about 39 scattered trees and an isolated clump <300m^2), about 1.27ha of gardens, and 1.33ha of treeless pasture north of the existing house, for residential Lots and APZs. The subject development proposal represents the final stages of previously approved residential development on the remainder of the property zoned 2(a) to the north (ERM 2006a), hence impacts are incrementally cumulative the impacts associated with the total proposal.

SQUIRREL GLIDER

Recording of a Squirrel Glider (hereon abbreviated to SG) in the dry sclerophyll forest in the 7(d) zone confirmed the expected presence of this species given local records in identical habitat in South West Rocks (eg Darkheart 2004f, Berrigan 2000a, 2000b, 2000c, 2001a, O'Neil and Williams 2003, etc). The extent of habitat provided by woodland and more so the forest combined with a relative abundance of tree hollows provides habitat suitable for foraging and breeding by at least one colony, with adjacent habitat to the west and south likely and known to support other colonies (eg Berrigan 2003a), in total forming the local population (Smith and Murray 2003, Smith 2002a, 2002b, Faulding and Smith 2008).

The SG is sensitive to the loss of tree hollows (ie nests and shelter), and key food plants, eg Winter-flowering Banksias and gum-producing Acacias (Smith *et al* 1995). Loss of sap species is also likely to be significant. The SG also has a high level of site fidelity, and is unlikely to disperse successfully once habitat is lost (Gibbons and Lindenmayer 2002).

As detailed above, the proposal may modify/remove about 3.03ha of agricultural woodland including about 39 scattered trees and an isolated clump <300m^2. This will remove about 5 hollow bearing trees (and at least 8 potential hollows) as well as foraging habitat provided by flowering trees, decorticating bark, etc. While this is a negative impact on the current carrying capacity of the site, it is unlikely to result in detrimental impacts of sufficient order of magnitude capable of placing the dependant colony/colonies at risk of extinction due to:

- The 4.18ha area of habitat with detected SG activity on the site will be retained, as will the overwhelming majority of existing potential habitat. Just over 1ha of this habitat is also be actively regenerated into structured forest as an offset to the loss of woodland comprising the marginal fringes of the core area of habitat.
- The habitat loss essentially constitutes a contraction of the marginal fringe on the core area of habitat.
- Relative to the abundance of hollows in the 7(d) zone, the loss of 5 hollow bearing trees is not critical on this site,
- Relatively poor quality of habitat to be removed in comparison to that retained ie no understorey, maintained groundcover, very high exposure to predators, etc.

SGs have been detected on a number of occasions in traps located within 20m of existing dwellings (eg Darkheart 2007g, 2004f, 2005a, 2005b), and also within urban remnants (Smith and Murray 2003, Murray 2006, Faulding and Smith 2008, Murray 2006, Melton 2007, Dobson 2002, Goldingay *et al* 2006, Goldingay and Sharpe 2004a, Smith 2002a, 2002b, Darkheart 2005d, 2005o, 2007h). These areas contained outdoor lighting and noise levels typical of residential/rural-residential dwellings. This supports other anecdotal evidence that the species has the capacity and even a willingness to forage within urban, rural and rural-residential development where habitat is retained (Smith and Murray 2003, Murray 2006, Faulding and Smith 2008, Murray 2006, Melton 2007, Dobson 2002, Goldingay *et al* 2006, Goldingay and Sharpe 2004a, Smith 2002a, 2002b, Darkheart 2004l, 2004n, 2004o, 2004q, 2004u, 2005a, 2005d, 2005h, 2006i, pers. obs). Thus the location of dwellings adjacent to the retained habitat in the 7(d) zone should not significantly affect habitat usage.

Establishment of an additional 56 residential Lots will incrementally and cumulatively increase the threat posed by cats. Dependence is placed on owners to comply with restrictions, and Council to employ provisions of the *Companion Animals Act 1998*.

With consideration of the above, the proposed development is not considered likely to result in an impact that may significantly affect the lifecycle of the local SG population to the point of increasing extinction risk, especially given the retention of the overwhelming majority of habitat and the abundance of directly connected potential SG habitat to the south

and west which will remain to support the population.

YANGOCHIROPERAN BATS

As noted above, while no threatened bats were able to be recorded on site due to the wet weather preventing effective survey, previous survey of other portions of the property recorded the LBWB, ECFB and CBWB. The remaining species are all considered potential occurrences given the presence of suitable habitat and local records (DECCW Atlas of Wildlife 2009a, Bionet 2009, Darkheart 2006f, 2006j, 2006k, 2004f, 2004j, 2004x, Berrigan 2000a, 2000b, 2000c, 2002a, 2003a, Parker 1996, SWC 1997, O'Neil and Williams 2003)

The major threat to the life cycle of the LBWB, CBWB and ECB is disturbance of nursery and communal roosting sites, particularly during Winter or reproductive periods. Modification of extensive tracts of foraging habitat by timber harvesting, fire and grazing may also be threatening (Smith e*t al* 1995).

The sensitive habitat components of the GBNB and HB are tree hollows, foraging habitat and riparian corridors (Smith *et al* 1995). Retention of a sufficient density of tree hollows appears to be a key determinant for the species to remain (Smith *et al* 1995). The dominant threats to critical habitat are cited to be extensive development of the coastal zone, particularly for residential and industrial uses, though clearing, grazing and past forestry practices have also reduced the extent of available habitat (Smith *et al* 1995).

The YBSB, ECFB, BFB and EFP are likely to be sensitive to the loss of roosting resources, and habitat modifications which affect their prey or ability to forage over the area (Smith *et al* 1995).

Suitable key roosting or nursery habitat does not exist on the site or in close proximity for the ECB, LBWB or CBWB, though sea caves to the far east (eg near Green Island) may provide this habitat component. Maternity caves are located west of Kempsey, and a key colony roost is known for the LBWB and CBWB at Big Hill (Dwyer 1964, 1965). Hollow bearing trees in the study area are likely to be suitable at least for roosting, and perhaps for breeding of the other bats (Churchill 1998, Smith *et al* 1995, DECCW 2009b, Strahan 2000, Hulm 1997).

The site offers generic potential foraging habitat of varying quality for all the subject species. These foraging habitats include habitat above and below the canopy, and at the fringe of forest habitat and pastoral land. As detailed above, the proposal will modify/remove about 3.03ha of woodland into residential Lots for the APZ. This habitat loss is likely to result in a slight reduction in foraging habitat present on site. Regardless, this impact is unlikely to impact upon the site's carrying capacity given the relatively minor extent of habitat loss, the mostly low quality state of the subject habitat, and the retention of overwhelming majority of the site's potential foraging habitat.

Location of the development envelopes has been selected so as to minimise the loss of hollow bearing trees, with only 6 to be removed. A felling protocol will minimise risk of any roosting bats being injured. As demonstrated by ERM (2006b), a relative abundance of hollows occur in the 7(d) zone, hence roosting potential will be retained. Consequently potential roosts for the main hollow roosting species including the HB, ECFB, BFB, GBNB, EFP and YBSB should not be significantly affected. The site does not contain caves on-site or similar structures, thus breeding or key roosts by dependant bats (ie ECB, LBWB and CBWB) do not occur on the site.

All of the subject species have been recorded in rural, urban and/or rural-residential areas (Churchill 1998, Smith *et al* 1995, Darkheart 2005h, 2004l, 2004p, Berrigan 2003b, 2001d, 1998d) and given consideration to the factors discussed above, the site/study area's potential to support the subject species should largely be retained post development. Consequently, it is considered that the proposal is unlikely to have a significant negative impact on the local population of any of the subject bat species.

GREY-HEADED FLYING FOX AND EASTERN BLOSSOM BAT

The GHFF was not detected on site by the survey, however it is considered a certain occurrence on site/study area as it was recorded by Umwelt (2004) on other portions of the property. The EBB was not recorded on site (though specific survey with harp traps was not undertaken) or by Umwelt (2004) on the remainder of the property.

The GHFF and EEB are sensitive to the loss of key roosting resources, and loss/modification of foraging habitat by forest clearance, degradation, dieback, drought and fire (Eby 2000b, DECCW 2009b, NPWS 2000a, 1999b, Smith *et al* 1995).

The GHFF does not roost on the site, nor is potential roosting habitat present, and hence known/potential roosting habitat will not be affected. Suitable potential roosting habitat does not occur on site for the EBB, and the site only offers very marginal generic potential for foraging as it is not preferred habitat ie heath or scrub (DECCW 2009b, Strahan 2000, Churchill 2009, Law 1993).

As detailed above, the proposal may modify/remove about 39 scattered trees and an isolated clump <300m^2 within 3.03ha of modified woodland, and 1.27ha of ornamental plantings which may offer some potential forage. In the context of the habitat available in the study area, locally, regionally and the species ecology; this represents a very minor contraction in potential foraging habitat. In addition, the majority of the potential foraging habitat in the study area will be retained; therefore while any habitat loss is via definition adverse to the recovery of the species, the extent of habitat remaining is expected to readily see retention of the potential for the GHFF and EBB to occur post-development. Furthermore, there are other higher quality areas of foraging habitat within range of the site/property (the GHFF has been recorded flying up to 50km from roosts, and the EBB up to 4km) such as in Hat Head National Park and on habitat to the south and northeast of the site, and given the ecology of the species, the local populations are not restricted to the site (Strahan 2000, Smith *et al* 1995, Churchill 1998, 2009, Eby 2000a, 2000b, DECCW 2009b).

Hence overall, while the proposal will relatively minutely reduce some of the potential foraging capacity of the site/study area, it is very unlikely to lead to an impact that may significantly affect the lifecycle of a local EBB or GHFF population, to the point of increasing extinction risk.

POWERFUL OWL, MASKED OWL, BARKING OWL, SQUARE TAILED KITE, LITTLE EAGLE.

None of the subject species were recorded on site/study area during the survey. However, potential foraging and nesting/roosting for all the subject species occurs on the site/study area. The site/study area/property would form only a small portion of a much larger home range for a single pair of all the subject species (DECCW 2009b, NSWSC 2009b, Smith et al 1995, DECC 2006, NPWS 2003b).

The major threats to the life cycle of the PO and MO is generally the loss of suitable nesting and roosting hollows, and similar habitat alterations that lead to a reduction in prey density and diversity (Soderquist *et al* 2000, Kavanagh 2000b, Smith *et al* 1995). Habitat loss and degradation is considered the major threat to the BO (NPWS 2003b). The BO is also considered to be threatened by fox predation on fledglings, goanna predation of nests, increased mortality via collision with fences, overhead wires and vehicles; and direct/indirect poisoning from agricultural pest control (NPWS 2003b).

The STK and LE are sensitive to the removal or disturbance of critical habitat components ie tall eucalypts, shrub layers and requires a prey base of sufficient density and consistent availability. Both are also sensitive to pesticide contamination of its lifecycle and feral carnivores that impact upon the availability of passerine birds and other prey (Smith *et al* 1995, DECCW 2009b, NPWS 2000a, 1999a, NSWSC 2009b).

As detailed above, the proposal may modify/remove about 3.03ha of agricultural woodland constituting the fringe of a larger body of more continuous forest, which eventually adjoins Hat Head National Park <1km east. The best foraging area occurs in the forest and woodland in the 7(d) zone where gliders and most birds were recorded. This area will be retained post-development with 1ha encouraged to restore back to structured forest. Thus the current foraging potential will be largely retained. Records of both species in rural, rural-residential and even urban areas ((Kavanagh and Stanton 2000, Hastings Birdwatchers, pers. comm.; Darkheart 2007d, pers. obs.) indicates that indirect impacts of the proposal (ie increased anthropocentric activity) are unlikely to deter foraging or significantly reduce the levels of prey on site due to their demonstrated tolerance and extent of habitat retained. As the majority of the habitat will be retained post-development including all potential nest sites, nesting potential and foraging potential will be essentially be retained.

With consideration of the above, the proposed development is not considered likely to result in an impact that may significantly affect the lifecycle of the local population of any of the subject species to the point of increasing extinction risk, especially given the extent of alternative known/potential foraging and/or roosting/nesting habitat available to the local population of the subject species and their high mobility (eg Hat Head National Park/SRA, etc).

BRUSH TAILED PHASCOGALE AND SPOTTED TAILED QUOLL

Neither the BTP or STQ were recorded on the site/study area during this or previous surveys, though the BTP has been recorded within 1km, in the locality, and at many South West Rocks locations in habitat identical to that on site (Darkheart 2004f, 2004j, Berrigan 2000a, 2000b, 2000c, 2002a, 2003a, O'Neil and Williams 2003). Potential foraging and nesting/den habitat is considered to occur on site and in the 7(d) area, and is locally abundant. The STQ has been recorded at Yarrahapinni and is considered a potential occurrence due to the connectivity of the site with extensive forested habitat in Hat Head National Park and the species large range (DECCW 2009b, Strahan 2000). Due to this habitat connectivity and ecology of these species, the range of the species and hence the local population would extend beyond the confines of the site/property, though breeding of the BTP could occur in tree hollows on the property.

The sensitive habitat components of the STQ are tree hollows and hollow logs required for refuge and nests, and impacts which affect the diversity and abundance of its prey species eg removal of groundcover and understorey eg clearing, logging

and frequent burning (Smith *et al* 1995, WWF 2002, DECCW 2009b). Cats are also a potential predator mainly of young (WWF 2002). The STQ has been recorded in rural-residential and agricultural areas, usually fringing areas of more extensive habitat (eg State Forest), and may be regarded as a pest to poultry (DECCW 2009b). The study area has competitive predators in the form of wild dogs, foxes, cats and laced monitors.

The BTP is generally considered sensitive to the loss of critical nest, shelter and feeding habitat via logging, clearing, urban development and inappropriate fire management (Smith *et al* 1995, NPWS 1999b, DECCW 2009b). Other threats are high predation (eg from natural and exotic predators), accidental drowning in water tanks, and automobile collision (NPWS 1999, WWF 2002).

As detailed above, the proposal may modify/remove about 3.03ha of woodland on the edge of a larger body of fragmented forest which links to Hat Head National Park <1km east. This habitat loss does not include any hollow logs but will remove 5 hollow-bearing trees which may be potentially suitable for the BTP. The retention of the majority of the best habitat (4.18ha of forest) and overwhelming majority of hollows (>200) plus connectivity to adjacent habitat is considered sufficient to maintain the potential presence of these species and the ecological values of the property overall. Hollow logs and some of the crown material is to be redistributed in the 7(d) zone to enhance its habitat values for these species.

Cats and dogs are likely to incrementally increase on site as domestic pets. This may result predation on the BTP (May 1997, Grayson and Calver 2004, NSWSC 2000a, 2000b). However, as a large number of domestic cats and dogs may potentially occur in existing and future development north and west, the potential for the proposal to result in increased competition/predation is low. Compliance with title covenants and enforcement of statutory provisions would help curb this threat.

Overall thus while the proposal will have some negative effects, the order of magnitude is considered unlikely to disrupt the life cycle of the subject species such that a viable population is likely to be placed at risk of extinction.

KOALA

The Koala does not have a demonstrated association with the site, and the only confirmed records of Koalas in the South West Rocks area are around Smokey Cape and the eastern side of Arakoon (Kempsey Argus 2004, Standing 1990, Phillips and Hopkins 2009a). The site forest and woodland qualifies as Potential Koala Habitat, and has to be considered in terms of supporting a potentially recovering local population (DECC 2007).

The main threats to Koalas are loss of habitat, increased mortality from automobile collision, dog attack/predation, fire and disease (Wilkes and Snowden 1998, State Forests 2000, Lunney *et al* 1999, Port Stephens Council 2001, Connell Wagner 2000, DECC 2008, Phillips and Hopkins 2008, Standing 1990).

The proposal will remove 2 Tallowwoods and about 21 Scribbly Gums. This constitutes a marginal reduction of the local abundance of these preferred browse species on the property and locality, however, relative to the extent retained on the property, this loss is insignificant as the potential to support a recovering population will be retained in the 7(d) zone.

The proposal will also incrementally and cumulatively contribute to other threats such as dog attack via keeping of pets, and vehicle collision via increasing traffic on site and on local roads. However, as no population is dependant on the site/property at this time, this is not significant.

Overall thus the potential for the Koala to occur in the retained habitat on the property will be retained in the long term. Hence the proposal has no potential to place a local viable population at risk of extinction.

GLOSSY BLACK COCKATOO

The GBC was not recorded on the property, and is only considered a marginal potential occurrence using the dry sclerophyll for opportunistic foraging forays as part of its very large range.

The GBC is dependant on suitably sized tree hollows for nesting, and is very dependant on the presence of a sufficient number of cone-bearing trees of suitable age and size to possess high quantities of cones, and suitably sized cones to support breeding. Threats thus include clearing for development, logging, inappropriate fire regimes and firewood collection (NPWS 1999b, 2000a, DECCW 2009b, Birds Australia 2007).

The proposal will have relatively minimal impact on this species as no potential nest hollows or any foraging habitat will be removed. The main impact will the increased anthropogenic presence, however as this bird has been recorded in the area and other locations foraging and breeding in urban remnants, on the urban fringe and in rural-residential areas, its potential to occur will be retained.

Given this and the ecology of the species thus, it is readily apparent that the proposal will have no significant impact on this species.

LITTLE LORIKEET

The Little Lorikeet (hereon abbreviated to LL) was not recorded on site by this survey, nor was it recorded by previous survey on the property by Umwelt (2004). This species has been recorded in the locality (DECCW 2009a, Bionet 2009).

The site offers generic potential foraging habitat for this species due to presence of eucalypts and bloodwood (NSWSC 2009a, Readers Digest 1990). Due to the species' ecology and hence its seasonally variable range, the site only forms a minute fraction of this species local range (NSWSC 2009a). However, the site contains numerous potential nest hollows, a limiting and hence critical habitat component, the loss of which is a major threatening process to hollow-obligate species (NSWSC 2007, Gibbons and Lindenmayer 2002, Smith *et al* 1995, DECC 2009b). This species also appears to show fidelity to nest sites, hence loss of known nest sites (selection of which may be due to specific physical characteristics of the hollow – Gibbons and Lindenmayer 2002, NSWSC 2009a, 2007) would have a greater impact that loss of foraging habitat.

Without long term survey during the breeding season, it cannot be determined that the site is known breeding habitat. A range of other common and threatened species would also compete with this species for hollows on site and within the species range, hence in addition to the slow recruitment of this habitat component (Gibbons and Lindenmayer 2002, NSWSC 2007), this evidences the need to maintain an abundance of tree hollows.

At this time, as the site comprises only a minute fraction of the species' seasonally variable and very large range (ie hundreds of square kilometres, depending on flowering occurrences), and that this range would encompass numerous other hollows in addition to that on site (hence by deduction, it is likely to have alternatives to nesting on site, most likely preferred to be in proximity to active foraging habitat): it is determined that although the proposal will incrementally and cumulatively contribute to the major threatening processes causing the decline of this bird (NSWSC 2009a), the order of magnitude of the impacts as a result of the proposal are unlikely to be sufficient to directly significantly risk extinction of a local population.

VARIED SITTELLA

The Varied Sittella (hereon abbreviated to VS) was not recorded on site by this survey, nor was it recorded by previous survey on the property by Umwelt (2004). This species has been recorded in the locality (DECCW 2009a, Bionet 2009).

The dry sclerophyll forest in the southern fringes of the site and less so the modified woodland offers generic potential foraging and nesting habitat for this species. However, given its sedentary and territorial nature, the lack of records by this or the previous survey strongly suggest a local viable population does not depend on the site. The site overall is considered to offer relatively marginal habitat for this species due to the extent of modification and fragmentation, which also affects interconnected forest to the south.

The proposal will see the loss of marginal habitat comprising the outermost fringe of the relatively best habitat on site. No known or significant potential nest sites will be removed, nor will a significant area of potential foraging habitat be removed. The local pet cat population is expected to incrementally and cumulatively increase which will elevate potential predation risk in the retained habitat, unless residents control their cats as per title restrictions and enforcement by Council of statutory provisions.

Overall, the proposal will have a negative effect on the current habitability of the site, but the order of magnitude of this effect is not considered sufficient to place a local population at risk of extinction given:

- A local population has not been demonstrated or appears likely to be associated with the site.
- All of the best potential habitat will be retained, with >1ha regenerated to increase its potential.
- Indirect threats such as cats and anthropogenic disturbance currently exist to the west, and will significantly increase to the north regardless of the development.

A.2.3.2.3 Part (b)

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

No relevant populations are currently listed under the TSCA.

A.2.3.2.4 Part (c)

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
- **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

No EECs occur on site or in the study area, hence this question is not relevant.

A.2.3.2.5 Part (d)

(d) in relation to the habitat of a threatened species, population or ecological community:
- **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,**

The proposed development will see approximately 4.33ha of mostly agricultural woodland and ornamental gardens (and 1.33ha of treeless pasture) modified into a 56 Lot residential estate (including two residual Lots) and APZ. This will removes about 39 scattered trees and an isolated clump <300m^2, including 5 hollow-bearing trees.

YANGOCHIROPTERAN BATS

The loss/modification of approximately 4.3ha of habitat is likely to include potential foraging substrates for all the subject species and potential roost trees for all the subject species (with the exception of the ECB). However, no maternity caves suitable for the CBWB, LBWB or ECB occur on site/property. This habitat loss while negative however only forms a fraction of the potential habitat provided by the remaining forested sections of the property.

All of the subject species are highly mobile, and several are known to move significant distances throughout their lifecycle eg during breeding (eg Dwyer 1968). Given that the proposal does not involve removal of a significant portion of vegetation: in the context of habitat remaining on the site/property and in the direct locality, and the lack of creation of any barriers to their movements, the proposed works are not considered likely to isolate or fragment currently interconnecting or proximate habitat.

These species occupy large areas and the regional distribution of habitat available to the subject species encompasses a large area of potential habitat in Nature Reserves, State Forests, and private land. All the subject species (except perhaps the ECB and EFP) have been recorded in human-modified habitats, or adjacent to large patches of relatively intact forest (Churchill 1998, 2009, Smith *et al* 1995, Berrigan 2001f, Darkheart 2004a, ERM 2003, Umwelt 2004, etc). The vegetation to be removed is unlikely to be considered a significant area in the local or regional context due to the relatively large area of potential habitat elsewhere in the study area and in the locality. Therefore it is considered that site/property is not considered of any specifically critical importance and the potential modification of up to 4.3ha of habitat within an area where suitable habitat is locally abundant is unlikely to have a significant impact on the long-term survival of the species.

GREY-HEADED FLYING FOX AND EASTERN BLOSSOM BAT

The loss/modification of about 39 scattered trees and an isolated clump <300m^2 is highly likely to include potential foraging habitat for the subject species. However no known or potential roosting habitat will be affected. The vast majority of potential foraging habitat will be retained on the property post development.

The GHFF is a flying mammal that migrate hundreds of kilometres annually, and fly 20-50km a night between roosts and foraging areas. They are often observed flying over cleared land and foraging in highly urbanised habitats, demonstrating they have no physical barriers to movement (other than weather or perhaps altitude). Given the minor extent of the site, the

retention of the majority of the habitat on the property and in adjacent forests, and the mobility of the species, the proposal is not considered likely to result in the isolation of known or interconnected habitat for either species. The regional distribution of habitat available to the GHFF encompasses a massive amount of potential habitat in National Parks, conservation areas and private land.

The EBB is also a flying mammal known to move several kilometres from roosting to foraging habitat. Records roosting in urban remnants (JWA 2001) suggest open land and urbanised areas are not significant barriers. Furthermore, the proposal will retain the forest along the southern boundary, thereby retaining direct forested linkages to the south and east, and hence a natural corridor for this species.

The loss of 39 scattered trees and an isolated clump <300m^2 of potential foraging trees from the site/property represents a relatively minute fraction of the potential habitat available locally (eg Hat Head National Park, State Conservation Areas etc) and it is not considered to be a significant area relative to either the local or regional distribution of potential and known habitat of either species.

SQUIRREL GLIDER

The loss/modification of 3.03ha of habitat will include several dozen potential foraging species (both sap and nectar) and 5 hollow-bearing trees. Foraging habitat which may be lost is considered to represent only a minor component of the available resource with the major area of activity (the 7(d) zone where hollows are also abundant) to be retained. In addition, habitat potentially lost represents only a small fraction of the potential habitat within the range of the dependant colony with the majority being retained. Thus, relative to the extent of habitat retained, the superior quality of the retained habitat and the extent of habitat available on adjacent land, the loss is considered insignificant.

The site/property's vegetation links directly to forest on adjacent land to the east and south. Connectivity to the north/northeast is negated by existing cleared land and future residential development, while relatively recent development to the west has effectively isolated a large remnant known to support this and other threatened species from Hat Head National Park (Darkheart 2004f, Berrigan 2000a, 2000b, O'Neil and Williams 2003). The proposal will result in a further incremental and cumulative contraction of the modified fringe of a body of habitat in southwest of the village of South West Rocks. Linkage will be retained to the south and west, hence no fragmentation or isolation of habitat will occur.

The ecology of the subject species, retention of almost all the key areas of habitat (ie 4.18ha of dry sclerophyll) and interconnectivity with adjoining habitat, local abundance of such habitat, and particularly considering the mobility of the SG; indicates that modification of habitat on site, while adverse and incremental to the cumulative loss of habitat in the area, will not significantly impact on the long-term survival of the species in the locality. Land to the south and west provides additional potential habitat in conjunction with the habitat remaining on site; therefore, the removal/modification of potential habitat will not significantly affect the population in the locality.

POWERFUL OWL, MASKED OWL, BARKING OWL, SQUARE-TAILED KITE, LITTLE EAGLE

The 3.03ha of habitat which may potentially be removed under the proposal will reduce the extent of prey support habitat a relatively minute fraction, essentially constituting a contraction on the marginal fringe of the most optimum habitat. It will not remove any known nest sites, and overall should have relatively negligible effects on prey abundance and diversity.

These birds forage over large areas and the have even been recorded in urban areas (eg Cooke *et al* 2000), thus it is reasonable to assume the proposal will form no barrier to these large flying birds. Hence the proposal will not result in isolation of proximate or currently interconnecting habitat.

The site/property may at most comprise a very minor fraction of the home range of the subject species, and the majority of its potential for the species will be retained post development.

BRUSHTAILED PHASCOGALE AND SPOTTED-TAIL QUOLL

Neither the BTP nor the STQ was detected during the survey, though they are considered to have fair potential to occur at least in proximity to the study area at some time due to local records and the extensive area of suitable habitat in the area which is linked to the site. Habitat for the two species is present in the study area in the form of potential den sites and foraging habitat, though the study area itself would at most form a fraction of a much larger range of one to two animals (especially STQ).

The majority of habitat (all 4.18ha of forest) on the property overall will be retained and no effective barrier will be created to forest on adjacent land to the south and west. Both species have a demonstrated ability to move through rural and rural residential land, even persisting in fragmented landscapes within or on the fringes of urbanised areas (Darkheart 2004f, 2004a, 2004b, WWF 2002). Hence, the proposal will not isolate any currently interconnecting or proximate areas of potential habitat for either the BTP or the STQ.

Overall the loss/modification of approximately 3.03ha of highly modified woodland may see a relatively minute reduction in foraging and denning habitat on the marginal fringe of the key area of potential habitat. The site/property's habitat (4.18ha of forest) at most comprises a minor fraction of the home range of the subject species, and the majority of its potential for the species will be retained post development. Given the minor area of potential habitat affected, the retention of the majority of the habitat on the property and the extent of potential habitat occurring in the direct locality, the loss is considered insignificant to the long term viability of local populations of these species.

GLOSSY BLACK COCKATOO

The proposal will not remove any habitat for this species, and the habitat on the property is potentially only marginal foraging and breeding habitat. This species readily flies over agricultural and urban landscapes hence the proposal will not result in any isolation or fragmentation of habitat

LITTLE LORIKEET

This species is considered a potential forager on site depending on flowering incidences, mostly likely during non-breeding seasons. Hollows potentially suitable for nesting are very common on site, especially in the upper 7(d) zone (ERM 2006).

This bird migrates over significant distances following flowering patterns, and given records in urban areas, is not considered to have any obstacles to movement. Consequently, the proposal has no potential to isolate habitat for this species.

The proposal will see loss of 39 scattered trees and an isolated clump <300m^2 over the development envelope. Some potential nest hollows may also be removed as 5 hollow-bearing trees are likely to be removed. Overall, this is a negative effect, but relative to the local abundance of these resources on site and in the locality (ERM 2006, Darkheart 2004f, O'Neil and Williams 2003), is not sufficient to significantly impact on the viability of a population of the species in the locality.

VARIED SITTELLA

This species has been recorded in the locality. It has not been recorded on site, suggesting by its territorial nature, to be unlikely to have an association with the site. The site has limited potential for this species as it has been degraded by pastoralism and underscrubbing, and it not considered of sufficient size to solely support a breeding pair.

While a flying bird, it appears to avoid open ground (NSWSC 2009d) hence movement north is considered limited due to the current scattered trees and golf course, and negligible to the west due to extensive residential subdivision. Movement south and east is far more likely due to connectivity of forest (albeit fragmented). In addition to the impacts of approved subdivision, the proposal will further reduce potential for movement to the north but should have no detectable impact on potential movement east and south. Hence the proposal will not fragment or isolate habitat of this species.

As noted in part (a), the habitat affected by the proposal comprises the marginal fringe of the best area of potential habitat on site. The affected habitat is more suited to Noisy Miners, and regeneration of >1ha of forest will adversely affect the latter, benefiting the VS. Overall, the proposal does not affect habitat important to the maintenance of a local population or species in the locality.

A.2.3.2.6 Part (e)

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

No relevant areas of critical habitat have been declared, as yet, under Part 3 of the TSCA.

A.2.3.2.7 Part (f)

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The *Recovery Plan for the Barking Owl* (NPWS 2003e) outlines the loss of native vegetation as a key threatening process for the Barking Owl. While the proposal will remove native vegetation, the extent of clearance is relatively minute compared to remaining habitat in the area and its home range, and will not significantly impact on the species. Hence only via strict definition is the proposal inconsistent with objectives of the plan.

The *Recovery Plan for Forest Owls* (DEC 2006) has been exhibited for the Masked and Powerful Owl. As for the Barking Owl, the proposal will remove a minute area of potential foraging habitat and only via strict definition is the proposal inconsistent with objectives of the plan.

The *Recovery Plan for Koalas* (DECC 2008) specifies actions considered to be key threats to Koalas. This plan specifies habitat loss, fragmentation and degradation as the most important threats to Koalas throughout their range. The proposal is thus by strict definition inconsistent with this plan as it will remove potential browse species and contribute to these threats. Dogs and traffic are also key threats, and the proposal will incrementally add to these impacts. While negative, as no Koala population has an association with the site, the conflict with the objectives of the recovery plan is relatively limited.

At present no recovery/threat abatement plan is in place for the other species, however priority actions have been identified (DECCW 2009b). For these and all other species, as the proposal will remove or modify habitat, and contribute to secondary impacts, it will not be considered strictly consistent with objectives of a recovery plan, threat abatement plan or priority action now or in the future, as it will contribute to the primary cause of the decline of these entities, and remove habitat in which potentially recovering fauna and flora populations could expand into, as well as reduce current connectivity with adjacent interconnected potential habitat. It will also increase other threats eg automobile collision, weed invasion, etc, which will incrementally and cumulatively place additional pressure on the long-term viability of local populations. This will be offset to some extent by regeneration of about >1ha of the disturbed dry sclerophyll forest.

A.2.3.2.8 Part (g)

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

The TSCA defines a "*threatening process*" as "*a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities*".

"*Clearing of native vegetation*" has been listed as a Key Threatening Process and is a recognised threat to a number of species, communities and populations listed under the TSCA 1995. Loss of habitat via development for residential and urban land use is also recognised as a threatening process for all of the subject species (Smith *et al* 1995, DECC 2008, DECCW 2009b, DEC 2006, Gibbons and Lindenmayer 2002, Lindenmayer and Fisher 2006, Johnson *et al* 2007, Lindenmayer and Fisher 2006, etc). Thus, the proposal will result in a relatively small incremental and cumulative contribution to this threatening process via the removal/modification of native vegetation including potential foraging and denning/roosting habitat.

Most importantly, the proposal will see the loss of about 5 hollow bearing trees, with dozens of potential and actual hollows. Due to the dependence of a significant proportion of Australian fauna on this habitat component, and historical losses, loss of hollow-bearing trees is listed as a Key Threatening Process (NSWSC 2007a), and is considered a major threat to many threatened species (NSWSC 2007a, Gibbons and Lindenmayer 2002, Fisher and Lindenmayer 2006, Johnson *et al* 2007, DECCW 2009b, Smith *et al* 1995). The proposal and approved development on adjoining land to the north will thus incrementally and cumulatively contribute to this process in the short and long term. This is to be compensated to some extent by replacement with nest boxes and recycling some hollow limbs.

Inappropriate fire regimes are also a Key Threatening Process (NSWSC 2000c), and could lead to long term degradation of the 7(d) zone habitat if it were to eventuate. Threatened species have been recorded on the site thus any burning for the purpose of hazard reduction should require a Bush Fire Hazard Reduction Certificate (BFHRC) under the RFA 1997 which should include measures to protect the habitats of the threatened species. Thus the potential for an altered fire regime to reduce the site's carrying capacity for the threatened species should be controlled by the legislation and recommendations discussed above.

Human-induced climate change is a Key Threatening Process that the proposed development will contribute to via removal of up to 4.3ha of treed vegetation and possible burning of this material; and/or establishment of a residential development utilising fossil fuels for energy.

"Predation by foxes and feral cats" are other Key Threatening Processes likely to be currently existing on the site, which impose a risk to potential prey, and several potentially occurring threatened species. These are recommended to be controlled by encouraging residents to report sightings to encourage control actions.

A number of other Key Threatening Processes may also be incrementally increased by the proposal via edge effects, eg:

- *Invasion of native plant communities by exotic perennial grasses.*
- *Invasion and establishment of exotic vines and scramblers.*
- *Invasion of native plant communities by Lantana camara.*
- *Invasion of native plant communities by Bitou Bush*

These Key Threatening Processes could be exacerbated by the proposal due to edge effects, but should be abated by the rehabilitation of adjacent portions of the 7(d) zone and appropriate controls.

APPENDIX 3: Plant Species List

COMMON NAME	SCIENTIFIC NAME
Canopy Trees	
Pink Bloodwood	*Corymbia intermedia*
Tallowwood	*Eucalyptus microcorys*
Scribbly Gum	*E. signata*
Needlebark Stringybark	*E. planchoniana*
Blackbutt	*E. pilularis*
Understorey Trees	
Hickory Wattle	*Acacia implexa*
Port Jackson Pine	*Callitrus rhomboidea*
Corkwood	*Dubosia myopoides*
Cherry Ballart	*Exocarpus cupressiformis*
Black Oak	*Allocasuarina littoralis*
Dogwood	*Jacksonia scoparia*
Hard Quandong	*Elaeocarpus obovatus*
Cheese Tree	*Glochidion ferdinandi*
Weeping Bottlebrush	*Callistemon saligna*
Geebung	*Persoonia conjuncta*
Geebung	*P. levis.*
Shrubs and Young Trees	
Elderberry Pomax	*Polyscias sambucifolia*
Slender Riceflower	*Pimelea linifolia*
a hopbush	*Dodonaea triquetra*
Dogwood	*Jacksonia scoparia*
Narrow-Leaved Palm Lily	*Cordyline stricta*
White Banksia	*B. integrifolia*
-	*Hibbertia aspera*
-	*H. obtusifolia*
-	*Leucopogon ericoides*
Coral Heath	*Epacris pulchella*
a pea	*Pultenaea retusa*
-	*A. longifolia*
Sweet-Scented Wattle	*A. suaveolens*
Prickly Moses	*A. ulicifolia*
Coastal Wattle	*A. sophorae*
Myrtle Wattle	*A. myrtifolia*
Crinklebush	*Lomatia silaifolia*
Breynia	*Breynia oblongata*
Maidens Wattle	*Acacia maidenii*
-	*Daviesia genistifolia*
-	*D. squarrosa*
Ferns and Mosses	
Cartilage Fern	*Blechnum cartilagineum*
False Bracken	*Calochlaena dubia*
Bracken Fern	*Pteridium esculentum*
Grasses	
Paspalum	*Paspalum dilatatum*
Wiry Panic	*Entolasia stricta*
Bladey Grass	*Imperata cylindrica*
Carpet Grass	*Axonopus affinis*
Kangaroo Grass	*Themeda australis*
Couch	*Cynodon dactylon*
Barbed-Wire Grass	*Cymbrogen refractus*
-	*Ottochloa gracillima*
-	*Oplismenus aemulus*
a finger grass	*Digitaria breviglumis*
Groundcovers and herbs	

A saw sedge	*Gahnia aspera*
Spiny Mat Rush	*Lomandra longifolia*
Pastel Flower	*Pseuderanthemum variabile*
Purple Flag	*Patersonia glabrata*
-	*Lepidosperma laterale*
-	*Centella asiatica*
-	*Oxalis corniculata*
-	*Gonocarpus micranthus ssp ramosissimus*
Blue Flax Lilly	*Dianella caerulea*
Handsome Flat Pea	*Platylobium formosum*
Cudweed	*Gnaphalium gymnocephalum*
Violet-leaved Goodenia	*Goodenia hederacea*
a goodenia	*G. heterophylla*
Violet	*Viola hederacea*
White Root	*Pratia purpurascens*
Wetland species	
sedge	*Isolepis spp*
sedge	*Juncus pp*
Tussock Rush	*Juncus usitatus*
Lianas and Scramblers	
Wombat Berry	*Eustrephus latifolius*
Climbing Guinea Flower	*Hibbertia scandens*
Scrambling Lily	*Geitonoplesium cymosum*
False Sarsaparilla	*Hardenbergia violacea*
Glycine	*Glycine microphylla*
Wonga Wonga Vine	*Pandorea pandorana*
Dusky Coral Pea	*Kennedia rubicunda*
Kangaroo Grape	*Cissus antarctica*
Native Sarsaparilla	*Smilax glyciphylla*
-	*S. australis*
Exotics	
Penny Wort	*Hydrocotyle bonariensis*
Purpletop	*Verbena spp*
Fireweed	*Senecio madagascariensis*
Black Berry	*Rubus ulmifolius*
Paddy's Lucerne	*Sida rhombifolia*
Lantana	*Lantana camara*
Bitou Bush	*Chrysanthemoides monilifera*
Farmers Friend	*Bidens Pilosa*
Cottonbush	*Gomphocarpus physocarpus*
Parasites and Epiphytes	
Snake Orchid	*Cymbidium suave*
Devils Twine	*Cassytha glabella*

APPENDIX 4: Site Photos

Series 1: View west to north of the clump of trees where the dam is. Photo taken from APZ

Series 2: View northeast to east from APZ in 7(d) zone over rear of Lots 614, etc. Band of forest on left is the parkland area to be retained as open space in current approved stages