



## 16.0 Review Of Eastern Chestnut Mouse Concept Approval Conditions

The Concept Plan Approval contains two conditions relevant to the ECM. The intention of these conditions was presumably to maintain and enhance the viability of the population of this threatened species on the property.

These conditions are reviewed in the following sections with corresponding recommendations to achieve the best biodiversity conservation outcome.

### 16.1. Condition B6 For Lot 5

Approval B6 of the Concept Plan Approval (DPI 2012) states:

*“The concept plan and principles plan provided with the PPR is to be amended to make provision for the identified ECM habitat on Lot 5 DP 25886 as recorded in Appendix 6 of the Environmental Assessment. This area is to be collectively fenced off, revegetated by way of Coastal Sands Forest Regeneration (as per the Environmental Land Use Management Plan) and the total area regenerated and managed appropriately for these species in perpetuity to maximise the potential viability of this small population. This excluded area must be fenced off and incorporated into the central corridor as shown in the amended Principles Plan in Plan II.”*

The Concept Plan determination included a mark-up of the Lot 5 Principles Plan, as shown in Figure 17.

As noted in Section 8.2, this measure appears to be redundant in terms of attempting to conserve the former small population of ECM detected in 2003 given the current data strongly suggests the small population has succumbed to local extinction due to a combination of small population size, lack of suitable refugia, and ongoing regrowth suppression via at least regular slashing and cattle grazing.

The likelihood of this species re-colonising this area and establishing a long term viable population, even after the corridor in the Open Space area is established, is also (at best) remote, as discussed in Sections 8.2 and 14.1.

The nominated area to be regenerated under Condition B6 is also only about 1.5ha. While the literature suggests home range size is around 0.5ha, survey of the regenerating areas in the southwest (see Section 14.2) estimated home range to be around 0.27ha, but this is probably an indicator of currently optimum habitat and may decline as the vegetation matures as typical of the species (Fox 1998, Watts and Tweedie 1993, Meek and Triggs 1996, Luo *et al* 1994, Luo and Fox 1995).

Hence, this proposed 1.5ha ‘island’ of habitat on Lot 5 could only support (again) a very small population of potentially 3-6 animals (i.e. similar to the size of the previous population which appears to have become extinct). Such a small population has very limited viability on the basis of genetic constraints alone (Lindenmayer and Fisher 2006). Furthermore, as detailed in sections 13 and 14, adjoining habitats have been demonstrated to be either unsuitable or unlikely to offer significant support for the ECM, further constraining long term viability of any population in this area.



Figure 17: DPI Plan II – Concept Plan determination 1 March 2012



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In summary, as detailed in Section 14.1, given this small potential population size due to the limited carrying capacity of the nominated area; and as the adjacent habitats appear at best marginal if not unsuitable; the probability of maintaining a viable population in the ECM habitat on Lot 5 is extremely remote given the high vulnerability of this population to:



- Genetic constraints, with relative isolation from known habitat posing severe constraints on emigration rate and volumes needed to maintain heterozygosity;
- Significantly limited carrying capacity;
- High risk of extinction due to catastrophic stochastic events e.g. disease, breeding failure, extensive fire, etc;
- Habitat not being artificially maintained in the optimum stage to maximise population size at all times;
- Predation readily exceeding fecundity rates eg foxes and feral cats as well as native predators;
- Competition with conspecifics better able to make use of both adjacent habitats and the regeneration area, e.g. Swamp Rat.

Furthermore, the Condition specifically refers to restoring the area to a Coastal Sands Forest. While this is likely to be ideal for Squirrel Gliders and a range of other threatened species in the long term due to records of such species in this habitat (eg Berrigan 2002c, 2000a, 2000b, Darkheart 2004a, 2004b, 2004c, 2004d, Sharpe and Goldingay 1998, Quinn 1993, 1995), and potentially suitable for the Common Planigale (Berrigan 2002c): it would have to be managed intensively over the long term (e.g. thinning out undergrowth manually to form a grassy woodland or implementing a high fire frequency - which would pose a threat to the adjacent *Littoral Rainforest* CEEC) to be suitable habitat for ECM ie to promote a tall dense groundcover.

In summary, management of this area in perpetuity for the ECM is clearly not only onerous in the long term, but has only a low probability of achieving its prime objective which is maintaining the long term viability of a population of ECM on Lot 5.

The better biodiversity and ECM outcome is clearly to:

1. Increase the extent of habitat in the area where the population has already been recorded to be both persisting and increasing and where a larger area of interconnected known and potential habitat occurs on-site and adjacent; and,
2. Allowing the nominated ECM habitat area (Zone 2) on Lot 5 to regenerate to Coastal Sands Blackbutt forest to enhance broader connectivity across the Open Space area and along the coastal strip, and provide habitat for a more diverse range of threatened species and generally achieve a greater net biodiversity benefit (as detailed in Section 8.2).

As detailed in the following section, the best/most efficient area for ECM habitat expansion is in the southwest around the Southern School Site and adjacent to the known population. This is detailed further in Section 15.2.



## 16.2. Concept Approval Condition B5 for the Southern School Site

This condition states:

*“The identified Common Planigale and Eastern Chestnut Mouse habitat area (the entire drain and a fully vegetated buffer zone of at least 30m to the east as recorded in Appendix 6 of the Environmental Assessment) west of the southern school site is excluded from any filling, clearing, etc. This area is to be collectively fenced off, revegetated with southwest dry sclerophyll/swamp forest (as per the Environmental Land Use Management Plan), and the total area regenerated and managed appropriately for these species to maximise the potential viability of these small populations. These excluded areas must be fenced off and incorporated into the central corridor as shown in Plan I.”*

### 16.2.1. Justification for Increasing Habitat Extent

Concept Approval Condition B5 is derived from the DECCW (2010) submission which required conservation of the Western Hill area where the ECM (as well as the Wallum Froglet and Common Planigale) was recorded in 2003 (Darkheart 2008a).

This measure was limited to protecting the habitat identified to be used by these species in 2003, which was previously partially impacted by an Asset Protection Zone to the proposed southern school site (AECOM 2010). This Condition only adds approximately 0.7ha to the currently 2.5ha Western Hill regeneration area (total of about 3.2ha), located south of the central drain (see Figure 18); and increases connectivity to the known ECM habitat (about 3.2ha) in the southwest EEC regeneration area. About another 0.97ha of pasture within the Open Space Corridor just north of the school is also slowly regenerating, and both it and the B5 area will connect the Southwest Hill ECM habitat to the southwest EEC regeneration area (where the species was recorded in high density).

However, retaining this highly significant area of habitat alone is still not considered likely to be sufficient to maintain the long term viability of this population due to (Lindenmayer and Fisher 2006, Amarasekare and Possingham 2001, Elkin and Possingham 2008):

- *Genetic constraints:* The limited area of current habitat means that maximum population size will remain small due to the limited carrying capacity, hence long term genetic constraints may undermine this population unless a larger population spread over a series of interconnected habitats is established;
- *Catastrophic extinction risk:* A small population confined to a limited area has high exposure to extinction via stochastic events, e.g. extensive fire leaving no refugia; and,
- *Vulnerability to ecological processes:* Risk of extinction due to over-predation by native and feral predators, or competition with the Swamp Rat.

Measures to further enhance population size and enhance dispersal are thus clearly required to increase the viability of this population on the property. The primary means to do this is to increase the extent of suitable habitat which, in turn, will allow higher breeding success and recruitment and buffer against the natural threats to increase population size; and enhance connectivity both other portions of potential habitat in the Open Space Corridor and potential habitat on adjoining land.





Optimising the ECM population size is also beneficial for several reasons all of which relate to maximising long term population viability and achieving the objects of the *TSCA 1995*.

Firstly, in terms of genetic viability, a larger population would increase genetic heterozygosity (Lindenmayer and Fisher 2006, Amarasekare and Possingham 2001, Elkin and Possingham 2008). Inbreeding is a significant risk to small populations of threatened species (Lindenmayer and Fisher 2006, Amarasekare and Possingham 2001, Elkin and Possingham 2008) and, prior to this assessment, was considered likely to lead to local extinction since 2003 of the western population (Darkheart 2008a). While the population in the southwest has evidently increased due to initial preservation of known habitat and creation of new habitat which is currently in an optimum stage for this species, this small population will still remain vulnerable to extinction unless (Lindenmayer and Fisher 2006, Amarasekare and Possingham 2001, Elkin and Possingham 2008):

- More habitat is available to colonise and expand the population size.
- Connectivity between known habitats is enhanced to maintain genetic vigour.
- Competition with the Swamp Rat is minimised by habitat management.
- Provisions for colonisation from other potential populations (e.g. potential habitat to the southwest – see Figure 20) are established and enhanced ie enhancing linkages.
- Habitat condition is maintained in a preferred state ie mosaic of disturbances.

Secondly, a larger population size reduces the risk of catastrophic extinction from competition, excessive predation and stochastic events, e.g. disease and extensive fire. For a population to remain viable, recruitment must exceed mortality and fecundity must be retained. This is statistically more likely with a larger population (Lindenmayer and Fisher 2006, Amarasekare and Possingham 2001, Elkin and Possingham 2008).

Thirdly, recovery is dependant not only on increasing population size and maximising population size, but animals dispersing from source habitats to colonise other habitats and establishing new populations. This provides insurance against loss of local populations within a meta-population framework (Lindenmayer and Fisher 2006, Amarasekare and Possingham 2001, Elkin and Possingham 2008). With establishment of protected links (which the corridor is intended to achieve) the spread of several local populations over the property and enhancement of linkage to potential off-site populations is more likely to allow re-colonisation in the event of a catastrophic event.

Hence there is strong justification for increasing the extent of ECM habitat.

### **16.2.2. Opportunities to Increase Habitat and Enhance Viability**

As detailed in Section 13, for this assessment, survey was undertaken in one of the three new regeneration areas near the Southern School Site to indicate if these areas were of benefit to the ECM, particularly in regards to the preliminary hypothesis that the Lot 5 population had succumbed to local extinction (which appears confirmed) since its detection in 2003.

This survey indicated the regeneration areas near the southwest population offer ideal habitat for the ECM (more significant at this time, than their original habitat in 2003), and given the previous record in similar habitat on-site, would be likely to suit the Common Planigale as well as offer foraging (and possibly breeding in wetter years) habitat for the Wallum Froglet.



As noted above, the Concept Approval B5 requirement to establish a buffer 30m east of the southwest hill will only increase the extent of potential habitat for these species by about 0.7ha. Given the survey results in the adjacent EEC regeneration area, this addition, while minor, is highly likely to assist with further expansion of the southwest ECM population. This addition will also enhance the connectivity between both the adjacent regeneration area and the wider corridor (see Figure 18). This corridor also links east to other new potential ECM habitat in constructed wetlands on the southern side of the large dams and down to potential habitat in the southeast (see Figure 19), which in turn links to a substantial area of potential ECM habitat southwest of Ocean Drive (Darkheart 2006d). Enhancing this linkage is thus a positive ecological outcome for landscape connectivity and expansion of the ECM population.

However, despite the current extension required by the Concept Approval Condition B6, the corridor at this point just above the Southern School Site forms a bottleneck due to the current Southern School Site's configuration and the adjoining playing fields further to the north. This bottleneck not only limits potential dispersal effectiveness, but also predisposes the area to a higher level of edge effects, e.g. predation pressure (Lindenmayer and Fisher 2006). A similar situation exists for the narrow corridor running along the drain to Ocean Drive on the southern boundary (see Figure 19).

Consequently, widening of these bottlenecks is desirable for biodiversity conservation to:

- Increase functional connectivity;
- Buffer edge effects from the school interface (likely to be managed grounds, i.e. an APZ); and,
- Increase carrying capacity and hence net population size, and in turn increase the likelihood of long term viability of species with small home ranges ie Wallum Froglet, Common Planigale and ECM.

Given the above and limitations for the ECM on Lot 5, SVF propose to revise the footprint of the southern school site to 7.2ha to provide more ECM habitat where the species is known to occur and expanding, and enhance connectivity in the Open Space Corridor to allow the ECM to colonise other suitable habitat (see Figures 18 and 19).





Figure 18: Proposed expansion of ECM habitat and Swamp Sclerophyll Forest EEC regeneration

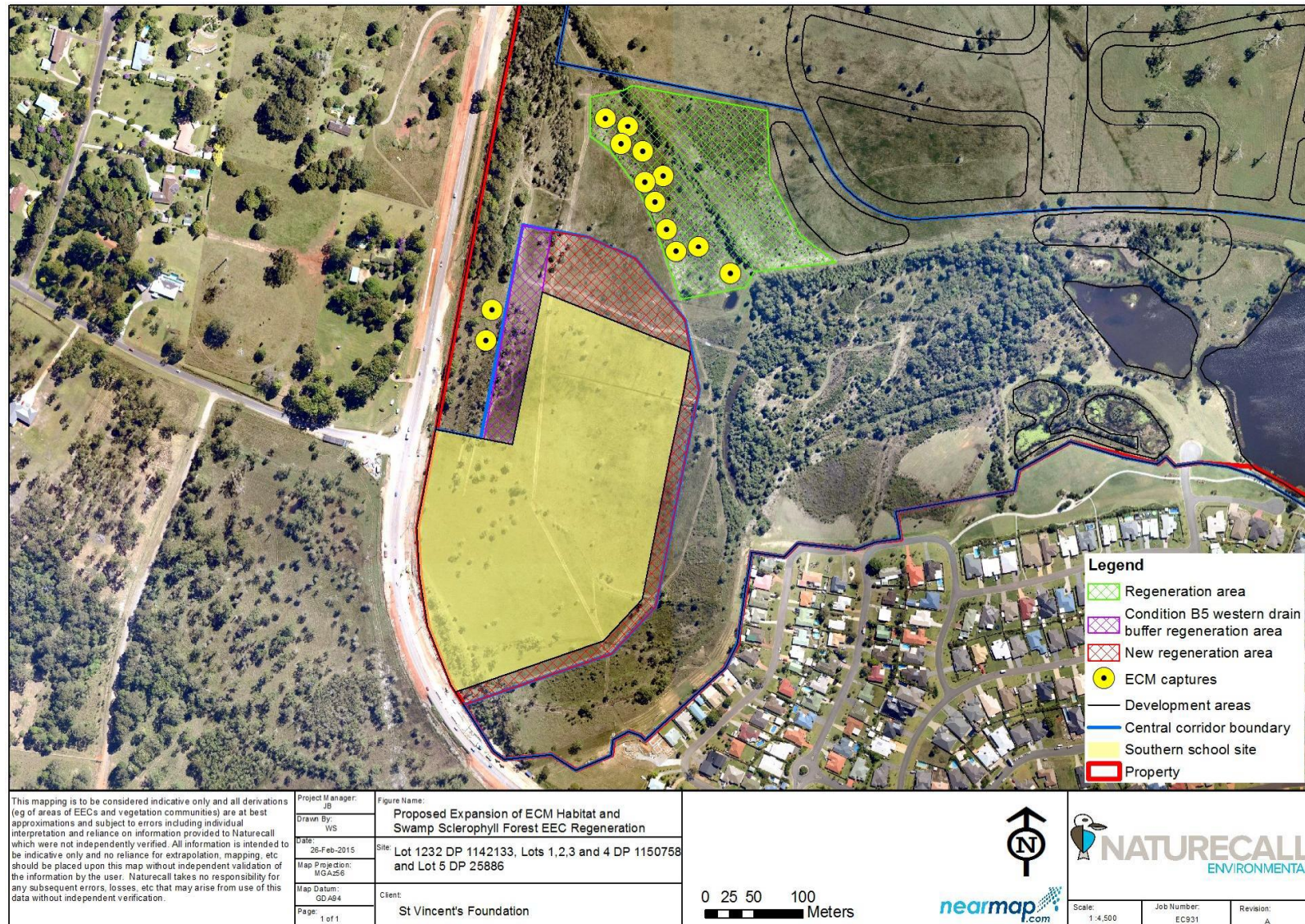
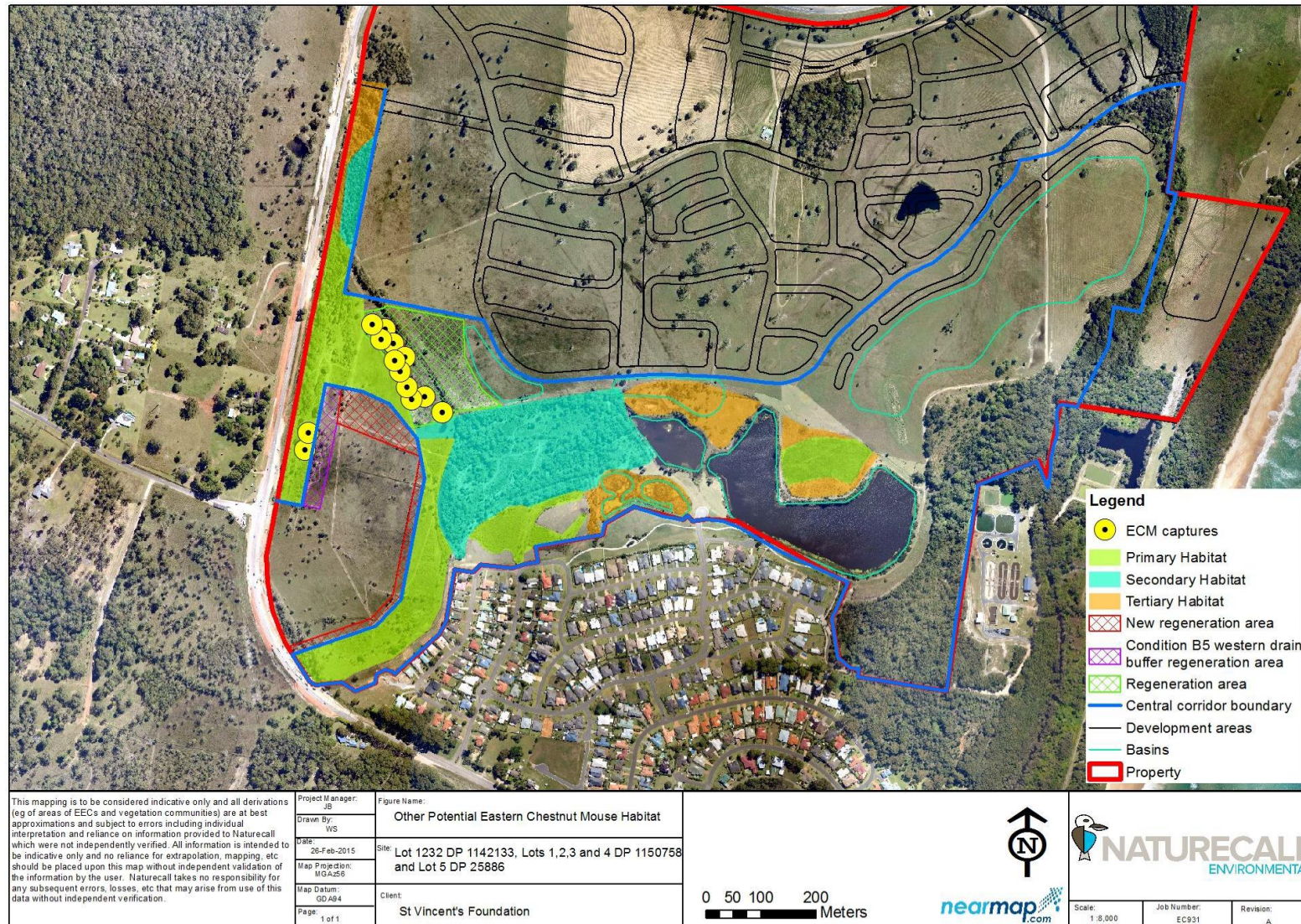






Figure 19: ECM records and other potential ECM habitat in the Open Space Corridor







Including the area required to meet condition B5, this has added approximately 2.5ha to the Open Space Corridor to the north and east of the school. Adding this to an area of about 0.97ha of currently only partially regenerated land in the Corridor between the school site and the southwest regeneration area to the north, this is a total of about 3.47ha of new habitat for the ECM that should be suitable within a few years for habitation. This net addition will substantially widen the east-west corridor to a minimum width of 150m, and the north-south corridor east of the school site to 100m (see Figure 18). This conforms with corridor widths recommended in the literature to provide both in-situ habitat and dispersal corridors (Lindenmayer and Fisher 2006, Whitten *et al* 2011, CHCC 2009).

This habitat addition proposed by SVF via shrinking the southern school site will thus not only enhance connectivity for species dependant on continuous vegetative cover in the Open Space Corridor, but will offer high quality habitat for what is evidently an expanding ECM population (with correct management – see Section 16.1.3). Using an indicative home range of 0.27-0.5ha, this new area of habitat could support at least 6-12 animals. This additional area proposed by SVF thus substantially adds to and enhances the effectiveness of the area currently required by Condition B5 to be added to the habitat corridor, and the overall effectiveness of the corridor itself (Lindenmayer and Fisher 2006).

This area has identical regenerative capacity as the southwest EEC regeneration area with the groundcover dominated by native sedges, herbs and grasses and numerous shrubs, as shown in Photo 35. As demonstrated in section 1.2, the proponent has also provided evidence of an effective capacity to adequately regenerate and manage habitat within the Open Space/Habitat Corridor, hence regeneration of this additional area would readily slip into the current management regime.

**Photo 35: Sample photo of middle of proposed additional ECM offset habitat area**

View is to west showing southwest hill. Note dominance by sedges, grasses and herbs, which has been demonstrated to be ideal for the ECM.



Enhancing this part of the corridor's effectiveness also has the flow on benefits of increasing access of the growing ECM population to other potential habitat in the Habitat Corridor. Currently about 2ha of existing *Swamp Sclerophyll Forest* EEC regeneration in the key southern link also offers suitable potential habitat (virtually identical to the known habitat in the northwest EEC regeneration area of the Habitat Corridor surveyed in this assessment). This corridor/habitat area is also particularly important as it links (albeit currently tentatively due to recent road widening of Ocean Drive) to a sizeable area of



other potential habitat to the south of Ocean Drive (Darkheart 2006d). This adjacent habitat contains a similar groundcover in an open swamp woodland formation, which has also been subject to periodic burns and slashing (Darkheart 2006d), and interlinks to a substantial body of very open swamp forest/shrubland which also has potential for the ECM.

Expanding the ECM population on site, and maintaining and expanding linkage to this habitat therefore offers the potential for future expansion of the species to this adjacent habitat, which has very limited future development potential due its low-lying nature.

Other portions of the Habitat/Open Space Corridor also has potential habitat for this species, as shown in Figure 19. Figure 19 shows the Open Space area classed as follows in terms of suitability for the ECM:

- **Primary potential habitat:** High quality habitat with preferred forage species and structure. ECM occurrence likely to be high density residential ie core habitat (see photos 36 to 37).
- **Secondary potential habitat:** Medium quality habitat, with less preferred floristics and/or structure. ECM occurrence likely to be low density residential (photo 38).
- **Tertiary potential habitat:** Low quality habitat – marginally suitable for foraging and refugia. ECM occurrence is likely to be only as short term transients (photo 39).

By encouraging the population to expand and disperse into these areas provides longer term viability insurance if a catastrophic event occurred (eg broad-scale fire or flooding), and also encourages the development of genetic heterozygosity by supporting dispersal between populations.

Photo 36: Primary potential habitat in a constructed wetland in the Open Space Corridor.







Photo 37: Primary potential habitat in the southeast leg of the Open Space Corridor.



Photo 38: Secondary potential habitat in the central part of the Open Space Corridor.

While cover is sufficient these areas do not have preferred foraging vegetation types over the majority of its extent but provide linkages and less optimal habitat. Despite its limitations, the area on the 'island' could act a flood refugia.







Photo 39: Tertiary potential habitat in the Open Space Corridor.

If groundcover is managed appropriately these areas could significantly improve in terms of ECM habitat potential.



### 16.2.3. Management Regime and Measures

#### 16.2.3.1. Further Survey/Monitoring

Condition C21 of the Concept Plan determination requires an annual monitoring report to be prepared from the date of construction until at least completion of the project. The Condition specifies that baseline information is to be collated including for the ECM. Data collected for this assessment will form part of this information.

As part of this baseline information and subsequent monitoring, it is recommended that targeted survey be undertaken of all potential ECM habitat identified in Figure 19 to determine if the species is present/absent and an approximate density. This information will provide some indication on the gradual dispersal and establishment of the species and ideally also an indication of the recommended state its habitat needs to be managed in to maximise population size.

#### 16.2.3.2. Disturbance Regime

##### **General Issues and Management Requirements**

The recovery of the ECM is considered likely to be the primary driver for the management regime and ultimate ecological character of the Habitat/Open Space Corridor, as the needs of other potentially and known species using this corridor (e.g. Koala) are more readily able to be met eg by providing suitable forage species. This will present a challenge to the long term management authority due to the regularity of disturbance that will be required, and the need to maintain a mosaic of refugia and seral habitats.

Conversely, the corridor is intended to be biodiversity multifunctional, hence the management regime which will ultimately define the character of the community must also ensure that the species most likely to use habitat residually or as a corridor, e.g. Squirrel Glider, Koala, Wallum Froglet,





Yangochiropteran bats (Darkheart 2008a, Quinn 1995, 1993, Connell Wagner 2000b, Elkin and Possingham 2008, Lindenmayer and Fisher 2006), can effectively utilise the habitat.

However, as demonstrated by this assessment's results (i.e. abundance of Swamp Rats in the former ECM habitat area), maintaining a uniform or static habitat throughout the entire corridor is not beneficial to the viability of the ECM.

Furthermore, the climax habitat over most of the western to middle sections of the Habitat/Open Space Corridor (most likely to be swamp sclerophyll forest dominated by a paperbark-Swamp Mahogany association) may not be suitable for this species, i.e. a dense swamp forest or woodland with a dense shrub layer (such as just west of the smaller dam) would have a limited development of groundcover.

Fortunately, the regeneration of the corridor is in the early stages, and planning can be undertaken to develop a management regime that not only can establish a mosaic of seral stages suitable for the ECM, but also habitat types to maximise overall biodiversity. The current aerial photo shows this pattern beginning to emerge with true forest likely to develop in the head of and along the main drain which runs east to the lagoons from Ocean Drive, and around the western lagoon; with more open woodland habitats able to be maintained in the middle west, southwest hill, the southern heaths and in the southeast connection. Such a mosaic is more likely to be capable of supporting a wider diversity of fauna (Lindenmayer and Fisher 2006).

Hence the management regime for habitat which is known or likely to be important to support the ECM will need to be subject to some kind of periodic artificial disturbance regime to maintain a mosaic of habitats in various recovery states to maximise carrying capacity; ensure that a closed shrub layer or canopy that results in suppression of groundcover does not eventuate over too great an area at the risk of compromising the ECM's viability; and that the corridor retains its multi-functions.

### **Immediate Management Requirements**

The Western Hill habitat was fenced off in 2007 and has not been slashed since that time. No disturbance, such as slashing or fire, has occurred since 2007. As demonstrated by the current survey results, this has led to development of a relatively static groundcover habitat which is now rank and needs to be refreshed by either burning or slashing to promote fresh growth that the ECM prefers (and to reduce Swamp Rat abundance).

In addition to this, the area needs to be kept open to promote the ongoing development of a dense groundcover. Hence regenerating shrubs and trees should be selectively pruned/removed to maintain an open woodland structure. As regeneration will be ongoing, this will need to be an integral part of the reserve's management.

#### **16.2.3.3. Deer Exclusion**

The prevalence of well-trodden trails, and areas of localised flattening of the groundcover, clearly illustrate that deer have a negative current and future impact on the ECM habitat. Trail-making adds an extra impact of increasing risk of predation by foxes which are well known to follow and hunt along trails in otherwise unbroken cover (May and Norton 1996).



Hence, exclusion fencing (i.e. electric fencing) is recommended to be erected around all ECM habitats to protect from deer disturbance. Ongoing controls will also be required (i.e. removal of deer), but as these will return from nearby reservoir habitats (e.g. Lake Innes Nature Reserve, Queens Lake State Forest), and are clearly developing a tolerance to persist in peri-urban areas (as demonstrated by sightings in this survey and local resident reports), total elimination is not considered feasible by the proponent acting in isolation. That said, there have been recent developments with Council, the National Parks and Wildlife Service, and other stakeholders trying a coordinated approach to feral deer control (James Dunn, pers. comm.).

## Part E: Summary and Conclusion

### 17.0 Swamp Oak Floodplain Forest EEC

For the purposes of consistency with the *Urban Investigation Area (UIA) 14 Urban Growth Strategy*, and the associated *Comprehensive Koala Plan of Management* (Biolink 2012, 2005, 2003), the vegetation community and EEC mapping of the property prepared by Biolink (2012, 2005) was generally adopted by Darkheart (2008a) for the EA (AECOM 2010).

Biolink mapped the EEC – *Swamp Oak Floodplain Forest on Coastal Floodplains* as occurring in the area known as ‘Eastern Creek’. This area lies upstream of Duchess Gully and comprises a drainage depression, with channels consisting of artificial drains. Vegetation around the Eastern Creek area is predominantly Swamp Oak forest.

Review of legal precedents and significant new soil landscape data found the extent of this EEC (assuming the Swamp Oak forest occurs on soils predominantly alluvial in origin) is restricted to a significantly smaller area than originally mapped by Biolink.

This significant change is predominantly due to the upper limit of the floodplain (as defined by the 1:100 ARI) being well below most of the extent of this community and, to a lesser extent, due to soils not being alluvial in origin.

Consequently, it is recommended:

- The minimum width of the required buffer vegetation adjacent to the residential zone is to be 25m, as shown in Figure 6. As an existing buffer occurs on the northern side, the new buffer only needs to be applied on the southwest. The concept development layout is to be adjusted accordingly to allow for this buffer. This buffer excludes Asset Protection Zones and road reserves, as per Condition B2.
- Where existing vegetation is absent in this buffer zone, ecotonal species (currently present in the northeast corner) typical of the locality and the edaphic position are to be planted. Example species include *Callistemon saligna*, *Syzygium australe*, *Melaleuca quinquenervia*, *M. stypheloides*, *M. linariifolia*, *Eucalyptus robusta*, *E. tereticornis*, *Glochidion ferdinandi*, *Ficus coronata*, *Gahnia clarkei*, *Lomandra longifolia*, *Elaeocarpus reticulatus* and *Acmena smithii*. These will not only close the edge but improve the habitability of the northwest drainage line,





given Swamp Oak offers very limited habitat resources, i.e. lacks nectar producing capabilities and rarely produces hollows.

- The edge is to be closed along the urban fringe by planting with pungent plants such as *Lomandra longifolia* and *Gahnia* spp. on the outermost fringe.
- Weeds (generally consisted of *Paspalum* spp., Winter Senna, and Lantana) are to be controlled by standard bush regeneration techniques.

## 18.0 Lot 5 - Crown Reserve Interface

The Concept Plan determination condition B3 states:

*“The cleared pasture area on Lot 5 DP 25886 situated between the residential area of the concept plan and the Crown land reserve to the east identified as R754444 is required to have a minimum biodiversity enrichment/fully vegetated buffer of 50 metres as shown on the amended Principles Plan at Plan II. The biodiversity enrichment/full vegetated buffer is to be revegetated in accordance with ELUC 17-18 of the Environmental Land Use Management Plan.”*

A review was made of the benefits of a uniform 50m buffer to a tapered buffer as proposed by SVF. No significant benefit of either option was identified.

Conversely, failure to detect a population of ECM in former habitat and potential refugia on Lot 5 supported the recommendation that the better biodiversity outcome would be to:

1. Extend the proposed tapered buffer continuously from the southern limit of the current nominated buffer zone to the Bonny Hills STP boundary.
2. Assist regeneration of about 1.5ha of Zone 2 into fully structured Coastal Sands Blackbutt forest to provide habitat for a greater range of species and incorporate the above buffer where it falls into Zone 2.

Consequently, this option is recommended to be adopted and Condition B3 amended accordingly.

## 19.0 Eastern Chestnut Mouse

Targeted survey for this species in previously known habitat in the southwest regeneration areas within the Open Space/Habitat Corridor area and in open pasture/grassland on Lot 5 found:

- The previously recorded small and isolated population of the species on Lot 5 is highly likely to have become extinct since its detection in 2003, with no ECM found, and only limited numbers of Swamp Rats. The ECM is also not considered to be present in adjacent habitats.
- The small population in the southwest has expanded into the EEC regeneration areas within the Open Space/Habitat Corridor, with other proximate and interlinked sections of the Open Space/Habitat Corridor also offering suitable habitat (to varying degrees). Consequently, long term viability of this population is strongly indicated due to the extent of potential habitat in the Open Space/Habitat Corridor.



The Concept Plan Approval has two conditions relative to the ECM:

- **B5:** *“The identified Common Planigale and Eastern Chestnut Mouse habitat area (the entire drain and a fully vegetated buffer zone of at least 30m to the east as recorded in Appendix 6 of the Environmental Assessment) west of the southern school site is excluded from any filling, clearing, etc. This area is to be collectively fenced off, revegetated with southwest dry sclerophyll/swamp forest (as per the Environmental Land Use Management Plan), and the total area regenerated and managed appropriately for these species to maximise the potential viability of these small populations. These excluded areas must be fenced off and incorporated into the central corridor as shown in Plan I.”*
- **B6:** *“The concept plan and principles plan provided with the PPR is to be amended to make provision for the identified ECM habitat on Lot 5 DP 25886 as recorded in Appendix 6 of the Environmental Assessment. This area is to be collectively fenced off, revegetated by way of Coastal Sands Forest Regeneration (as per the Environmental Land Use Management Plan) and the total area regenerated and managed appropriately for these species in perpetuity to maximise the potential viability of this small population. This excluded area must be fenced off and incorporated into the central corridor as shown in the amended Principles Plan in Plan II.”*

As detailed in Section 8.2, Condition B6 is considered redundant given the evidence strongly suggests the species is locally extinct from Lot 5 and has only (at best) a remote chance of re-colonising the area and/or establishing a long term viable population (the latter predominantly due to insufficient suitable habitat and hence carrying capacity). The area designed to be managed for the ECM on Lot 5 is considered best used as high quality habitat for a broader range of species and to enhance linkage with the coastal strip and the Open Space/Habitat Corridor.

The proponent also proposes to significantly extend on Condition B5 and reduce the overall footprint of the Southern School Site by about 2.5ha to increase the area of ECM habitat in the southwest. As this will significantly enhance corridor functional effectiveness, ECM population size (and hence viability), and centralise management of this species to a single distinct area, this offer is recommended to be supported and the Consent Conditions amended accordingly.

## 20.0 Beach Access Construction Area

A review of the potential threats to the high value vegetation adjacent to the existing access track as a result of its formalisation was undertaken to address Concept Plan Approval Condition 23 which states:

*“Prior to lodgement of any development application for residential subdivision, the proponent must prepare and implement a vegetation management plan for the Crown land reserve to the east identified as R754444 to the satisfaction of Council. The plan must demonstrate:*

- a) the establishment of a ‘vegetated regeneration area’;*
- b) removal of all weed species and retention of all native vegetation within the vegetated regeneration area’;*





- c) *replanting of endemic rainforest species within vegetated regeneration area’;*
- d) *erection of temporary fencing;*
- e) *erection of fencing enclosing regeneration area.”*

In addition to measures recommended to be implemented to meet the latter parts of this Condition, it was determined via weed density mapping and the aforementioned impact review, that the ‘vegetated regeneration area’ should be focussed on a band at most 25m north and south of the track alignment. This area includes the highest weed infestations within 50m of the track, and infill planting of this distance will effectively address impacts associated with the access via enclosing the track within closed forest.

The remainder of the Reserve will remain under management of Council and Landcare.

## **21.0 Conclusion**

This assessment has collated and submitted significant new information which supports a review of the specified Consent Conditions.

The amendments proposed should not only maintain the intention of these Conditions but if appropriately implemented, are expected to achieve a significantly higher net ecological and conservation benefit.



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## APPENDIX 1: Total hair identification results

	Date	Location	Sample #	Mammal ID - definite	Mammal ID - probable
Hair samples	24/6/2012	SW Regen	B4	<i>Pseudomys gracilicaudatus</i>	
	24/6/2012	SW Regen	F21	<i>P. gracilicaudatus</i>	
	24/6/2012	SW Regen	17	<i>P. gracilicaudatus</i>	
	25/6/2012	SW Regen	1	<i>no guard hairs</i>	<i>Rattus lutreolus</i> (young)
	25/6/2012	SW Regen	2	<i>P. gracilicaudatus</i>	
	25/6/2012	SW Regen	3	<i>P. gracilicaudatus</i>	
	25/6/2012	West Hill		<i>P. gracilicaudatus</i>	
	25/6/2012	West Hill		<i>no guard hairs</i> *	<i>R. lutreolus</i> (young)
	25/6/2012	Lot 5		<i>no guard hairs</i> *	<i>Rattus</i> sp.
	27/6/2012	SW Regen	B5	<i>few guard hairs</i> *	<i>P. gracilicaudatus</i>
	27/6/2012	SW Regen	6	<i>P. gracilicaudatus</i>	
	27/6/2012	SW Regen	7	<i>P. gracilicaudatus</i>	
	27/6/2012	SW Regen	20	<i>P. gracilicaudatus</i>	
	27/6/2012	Lot 5		<i>Rattus</i> sp. *	<i>R. fuscipes</i>
Hair tubes		Lot 5 (open paddock)	1	<i>Mus musculus</i>	
		Lot 5	2	<i>M. musculus</i>	



	(open paddock)			
	Lot 5 (open paddock)	3	<i>M. musculus</i>	
	Duchess Gully	1	<i>R. fuscipes</i>	
	DG	2	<i>R. fuscipes</i>	
	DG	3	<i>Rattus sp.</i>	<i>R. fuscipes</i>
	DG	4	<i>Rattus sp.</i>	<i>R. fuscipes</i>
	DG	5	<i>R. rattus</i>	
	DG	6	<i>R. rattus</i>	
	Dune Scrub	1	<i>Isoodon macrourus</i>	
	DS	2	<i>M. musculus</i>	
	DS	3	<i>I. macrourus</i>	
	DS	4	<i>I. macrourus</i>	
	SW Regen	2	<i>R. fuscipes</i>	
	SW Regen	3	<i>R. fuscipes</i>	
	SW Regen	4	<i>M. musculus</i>	
	SW Regen	5	<i>no hairs - plant fibres</i>	
	SW Regen	6	<i>M. musculus</i>	
	SW Regen	7	<i>M. musculus</i>	





	SW Regen	8	<i>P. gracilicaudatus</i>	
	West Hill	1	<i>R. lutreolus</i>	
	West Hill	2	<i>R. lutreolus</i>	
	West Hill	3	<i>R. lutreolus</i>	
	West Hill	5	<i>few rodent hairs</i>	<i>Rattus sp.</i>
	West Hill	6	<i>few rodent hairs</i>	<i>Rattus sp.</i>
	West Hill	7	<i>I. macrourus; R. lutreolus</i>	
	West Hill	8	<i>I. macrourus</i>	
	West Hill	9	<i>few rodent hairs</i>	<i>Rattus sp.</i>
	West Hill	10	<i>I. macrourus</i>	
	West Hill	11	<i>R. lutreolus</i>	
	West Hill	12	<i>R. lutreolus</i>	

