



8.0 MNES - Littoral Rainforest EEC Assessment

8.1. Description

The community “*Littoral Rainforest and Coastal Vine Thickets of Eastern Australia*” is listed as a Critically Endangered Ecological Community (CEEC) under the EPBCA 1999 (DEWHA 2008). It consists of rainforest and coastal vine thickets that occur along the East Coast of Australia on a variety of landforms and geological substrates generally within 2km of the coastline (DEWHA 2009, 2008).

The canopy is often irregular and may take the form of wind sheared thickets in exposed areas to a forest structure in sheltered sites. Several strata are usually present, including emergents in some areas and a variety of plant forms such as trees, shrubs, vines and epiphytes are a common feature (DEWHA 2009, 2008).

8.2. Diagnostic Characteristics and Condition Thresholds

The key diagnostic characteristics of Littoral Rainforest and Coastal Vine Thickets of Eastern Australia CEEC are:

- Occurs in the specified Interim Biogeographic Regionalisation for Australia (IBRA) regions.
- Occurs within 2km of the coast.
- Structure of a closed canopy or patchy canopy in exposed areas with several vegetation strata.
- Contain a range of plant life forms including trees, vines, herbs, ferns and epiphytes.
- Plants with xeromorphic and succulent features are common and canopy stems are small (DEWHA 2009).

Contending patches must also meet the following condition thresholds (DEWHA 2009):

- Small patches can be resilient and viable, but the minimum size of a patch needs to be 0.1 ha; **and**,
- The cover of transformer weed species is 70% or less. Transformer weeds are highly invasive taxa with the potential to seriously alter the structure and function of the ecological community. This threshold recognises the relative resilience and recoverability of the ecological community to invasion by weed species; **and**,
- The patch must have:
 - at least 25% of the native plant species diversity characteristic of this ecological community in that bioregion; **or**,
 - at least 30% canopy cover of one rainforest canopy (either tree or shrub) species (excluding Banksia and Eucalyptus species that may be part of the ecological community).

The first two condition criteria and at least one part of the third must be met (DEWHA 2009).



8.3. Assessment

All the communities assessed met the key diagnostic characteristics listed above. The following tables assess each community against the condition thresholds to determine if they qualify as Littoral Rainforest TEC.

Table 3: Littoral rainforest A assessment

Criterion	Y/N	Comments
Greater than 0.1ha	Y	Continuous with SEPP 26 littoral rainforest to the north
Weed cover <70%	Y	Only a few weeds in the ground layer
>25% characteristic species	Y	>70% of species present are characteristic species
>30% rainforest species canopy cover	Y	>30% cover of <i>Endiandra sieberi</i>
Qualifies as Littoral Rainforest TEC?	Yes	

Table 4: Littoral rainforest B assessment

Criterion	Y/N	Comments
Greater than 0.1ha	Y	
Weed cover <70%	Y	Only a few weeds in the ground layer
>25% characteristic species	Y	>50% of species present are characteristic species
>30% rainforest species canopy cover	N	Patchy canopy with a mix of species
Qualifies as Littoral Rainforest TEC?	Yes	

Table 5: Shrubland assessment

Criterion	Y/N	Comments
Greater than 0.1ha	Y	
Weed cover <70%	Y	Only a few weeds in the ground layer
>25% characteristic species	N	Dominant species were <i>Leptospermum</i> and <i>Melaleuca</i> .
>30% rainforest species canopy cover	N	Canopy cover primarily <i>Leptospermum</i> and <i>Melaleuca</i>
Qualifies as Littoral Rainforest TEC?	No	



Table 6: Banksia woodland assessment

Criterion	Y/N	Comments
Greater than 0.1ha	Y	
Weed cover <70%	Y	Only a few weeds in the ground layer
>25% characteristic species	N	Dominant species was Banksia
>30% rainforest species canopy cover	N	Canopy cover primarily Banksia
Qualifies as Littoral Rainforest TEC?	No	

8.4. Discussion

As seen in the tables above and Figure 9, only the two Littoral Rainforest communities qualified as the EPBCA 1999 *Littoral Rainforest* CEEC. These communities also qualify as the NSW TSCA 1995 EEC (NSWSC 2004c).

While they may contain some scattered rainforest species (most commonly Satinwood, which is not a characteristic species), which can appear prominent in aerial photos, the Shrubland and Banksia Woodland communities did not qualify due to a low diversity and sufficient cover of characteristic rainforest species in the canopy.

9.0 Consent Condition B3: Threats and Buffer Zones to the Crown Reserve

9.1. Threats and Buffer Zones Review

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.”

The following table evaluates the potential threats induced by future residential development in the proposed development envelope as nominated by the proponent and the advantages of a 50m wide buffer zone as specified in Condition B3, or a tapered buffer of 50m to 25m as proposed by the proponent.



Figure 9: Littoral Rainforest CEEC/EEC in the adjacent section of Crown Reserve





Table 7: Indirect threats/impacts associated with the proposal.

THREAT/ IMPACTS	LITERATURE REVIEW	CURRENT AND FUTURE THREAT STATUS	BENEFITS OF TAPERED BUFFER	BENEFITS OF 50M BUFFER
Direct Clearing	Littoral Rainforest is listed as an EEC at the NSW and Federal level. ERM (1996) reviewed aerial photos of the area between Bonny Hills and Lake Cathie, documenting the contraction of native vegetation to the west. Sand mining is also known to have occurred north of Bonny Hills and most of the vegetation east of the site indicates this, as well as the modified dune topography.	The SEPP 26 area and other identified Littoral rainforest falls within Crown Land east of private landholdings. A current beach access exists. No vegetation removal is proposed in the Reserve as the existing beach access alignment will be formalised. Previously highly weed infested, these have largely been removed and work is underway to close the edge. Section 8.2 details further measures to protect this vegetation.	Edge of rainforest hidden by buffer fronted with pungent leaved plants to deter new path-making. No further clearing required or likely in future.	Edge of rainforest hidden by buffer fronted with pungent leaved plants. Bottom end of buffer falls within a nominated water supply easement, hence potential to be either disturbed or required to at most be vegetated with Matrush.
Weed Invasion	Bitou Bush is the main weed threat to Littoral Rainforest due to its ability to penetrate closed canopies and overwhelm existing communities, as well as out-compete native regrowth (Buchanan 1989, ERM 1996, NSWSC 1999, Hamilton <i>et al</i> 2008). Lantana is also a threat as it dominates the edges and suppresses establishment of native species (ERM 1996, Lamb	Crown Reserve has been subject to major bush regeneration works since 2009 with major weeds removed from the Littoral rainforest, along the beach access, within the rainforest and Bitou on the foredune (see Photos 6-14). Removal of Bitou from the foredune has significantly increased maritime stresses which is restricting recovery of Littoral Rainforest B. Ongoing work required to suppress Bitou on	Regeneration works will require elimination of pasture species in footprint of buffer and development to west will extinguish pasture. Including boundary fence in plantings will close open edge north and partially south of beach access, limiting weed entry at these points. Buffer zone will extend existing edge into paddock. As most weeds will occur on the outer fringe where	As for tapered buffer. No significant benefit to buffering weed invasion from west as rainforest edge will be closed regardless of buffer width by infill plantings and outermost edge of the buffer will be subject to same stresses as tapered buffer edge. Provided the 25m buffer planting is dense enough, should protect the Reserve rainforest from weeds penetrating in from the west.



THREAT/ IMPACTS	LITERATURE REVIEW	CURRENT AND FUTURE THREAT STATUS	BENEFITS OF TAPERED BUFFER	BENEFITS OF 50M BUFFER
	<p>1982, NSWSC 2006a). Other weeds such as Winter Senna , exotic scramblers and grasses also compete with native species especially at the edge (NSWSC 2006c).</p> <p>Disturbance of soil provides the opportunity for weed invasion. Weeds may also be transported into Littoral Rainforest via informal tracks made by people as well as grazing stock, e.g. cattle and horses. Dumping of green wastes may also introduce plant propagules or introduce nutrients which advantage such species (ERM 1996, Buchanan 1989).</p> <p>Some ornamental plants also have the potential to escape and become weeds (Bennet <i>et al</i> 2000), though restrictions on the sale of such plants under the <i>Noxious Weeds Act 1993</i> reduce this threat.</p>	<p>foredune into Littoral Rainforest B. Rainforest A generally very low weed content – some Winter Senna. Edges adjacent to beach access main area needing attention.</p> <p>Pasture grasses (e.g. Rhodes Grass) and weeds (e.g. Crofton Weed) dominate the beach access. These will be eliminated as part of the beach access formalisation.</p>	<p>nutrients and solar radiation access may be higher, this buffer will reduce the potential for weeds to penetrate into the Littoral Rainforest. As the pasture will be removed from Lot 5 or at the least into maintained lawn and the risk of green waste dumping will be minimal due to setback, the weed threat should be at most minimal post-development. Hence little justification for a wide buffer zone to buffer weeds.</p>	<p>Note however, that a storm event leading to tree fall, canopy damage, canopy burn, etc, could also allow weeds to enter the rainforest regardless of the width of the western buffer.</p> <p>The primary agent for transformer weeds posing a threat to the rainforest is the maritime stresses and storms from the east, the effects of which are demonstrated by the stunting of the regenerating rainforest in the Littoral Rainforest B community. Unless weed control is maintained in this front and supplementary regeneration (currently undertaken by community groups/Landcare) restores natural barrier vegetation to the east in the short term, the EEC in this direction will remain suppressed.</p>
Fencing	<p>Fences have potential to obstruct the movement of threatened fauna across the site. Some threatened fauna can be injured by collision</p>	<p>Eastern boundary is currently fenced with strand boundary fence. south of the beach access, the fence is largely overgrown with native</p>	<p>Fence retained to act as impediment to human penetration and minimise soil disturbance. Native vegetation to be planted around it to incorporate the fence as a structure within the forest.</p>	



THREAT/ IMPACTS	LITERATURE REVIEW	CURRENT AND FUTURE THREAT STATUS	BENEFITS OF TAPERED BUFFER	BENEFITS OF 50M BUFFER
	with wire fences, particularly barbed wire, e.g. the Yellow-Bellied Glider, bats, owls and Squirrel Glider have been recorded being injured by barbed wire fences (Lindenmayer 2002, Woodford 1999, Maclean 2007).	species. north of the access, the fence stands out from the forest. This poses a minor (compared to barbed wire) potential injury risk to birds and perhaps Microbats at dusk and dawn and at night during times of limited visibility.	Both sides of beach access will also be fenced and planted with pungent leaved plants.	
Erosion and Sedimentation	<p>Sedimentation and erosion impacts can occur at both the construction and establishment phases.</p> <p>Erosion/sedimentation may occur via erosion of fill material and disturbed soils, scouring of exposed soil, earthen banks and habitats adjacent to the development area via directed flow (eg stormwater), or where runoff is concentrated.</p>	<p>Local topography is generally flat hence erosion by water flow is a very minor risk. Standard erosion and sedimentation measures will be applied to ensure no impacts on Littoral Rainforest from adjacent development or construction of the formal beach access.</p> <p>Beach access is highly eroded (gully formation) at eastern end. This will be addressed as part of the beach access formalisation – see Section 12.1.</p>	No significant change to impact threat due to either buffer width as minimal threat and standard control measures to apply.	
Noise, Physical Disturbance, Human Presence	Noise effects on fauna in Australia are relatively poorly studied (Clancy 2001, Berrigan 2001d). Most evidence presented is anecdotal but suggests most fauna have a fair degree of tolerance and adaptation at least to residential noise depending on species,	<p>Background noise dominated by ocean. No proximate roads and limited vehicle activity on beach.</p> <p>Noise will increase due to:</p> <ul style="list-style-type: none"> Public using beach access as primary access to beach. 	<p>Vegetation offers a limited sound buffer (ERM 1996) but has value as a visual buffer for some species sensitive to human presence and similar edge effects (Gibbons and Lindenmayer 2006).</p> <p>Given the relatively narrow and linear nature of the existing habitat (hence exposure to edge effects and limited carrying capacity), noise-sensitive and shy species have limited potential to occur although a small group of Wompoo Fruit-Doves were sighted flying low along the coastal strip in 2003.</p>	



THREAT/ IMPACTS	LITERATURE REVIEW	CURRENT AND FUTURE THREAT STATUS	BENEFITS OF TAPERED BUFFER	BENEFITS OF 50M BUFFER
	<p>situation, habitat/lifecycle stage affected, habitat significance, etc. Generally as noise is accompanied with a physical disturbance it has a greater negative effect (ERM 1996, Clancy 2001, Radle <i>undated</i>).</p> <p>Human presence and associated disturbances can deter shy species from using habitat interfaces or disturb critical lifestyle stages, e.g. nesting (ERM 1996, Clancy 2001, Radle <i>undated</i>).</p>	<ul style="list-style-type: none"> Establishment of a tourist facility or similar adjacent. Establishment of carpark and loop road. <p>This elevated level of anthropogenic activity may deter use of habitat in close proximity to the beach access by diurnal birds. Limited activity is expected at night (e.g. fishermen) with consequentially limited impacts.</p>	<p>These birds and other species nest in core habitat areas which are not likely to be present in the coastal strip, i.e. insufficient resources.</p> <p>Post-construction, long term noise levels likely to be typical of the adjacent development are likely to be relatively low, e.g. lawn mowers, traffic. Human presence will significantly alter in terms of numbers of users compared to now.</p> <p>A wider buffer may increase the visual buffer for activity sensitive species which inhabit the rainforest but given a Wompoo was observed roosting adjacent to Ocean Drive in the same survey, the Reserve is not breeding habitat for a sensitive threatened species and the forest edge will be closed regardless of where it is positioned: there is limited justification for a wide buffer. Provided buffers close sight penetration reasonably quickly, adverse reactions to noise and human presence should be minimised regardless of buffer width.</p>	
Introduction of feral/ introduced species	<p>Urban and rural developments are often associated with the introduction of non-native species, i.e. rodents, cats and dogs. Cats are significant predators of native species (NSWSC 2000a, Dickman 1996) and domestic dogs are significant threats to species such as the Koala (Wilkes and Snowden 1998, Port Stephens Council 2001, Connell Wagner 2000b, DECC 2009b). Rodents compete with native species but also form component of native species prey</p>	<p>Deer, rats, mice, foxes and wild dogs recorded adjacent to Reserve. Deer tracks are evident in the rainforest and dune vegetation.</p> <p>Establishment of residential development to west will create reservoir for feral cats. Pet dogs may wander unleashed.</p>	<p>Width of buffer zone has no significant positive or negative impact on these threats, other than reducing penetration of exotic rodents and birds due to established natives or lack of suitable habitat. Feral cats, foxes and deer are not limited by these factors.</p> <p>Seral stage habitat in buffer zone may suit exotic rodents but these should progressively be displaced as the canopy closes and food sources (eg pasture grasses) are displaced and native species out-compete them. Wider buffer may suit deer in terms of better diurnal refugia more remote from human contact/detection.</p>	



THREAT/ IMPACTS	LITERATURE REVIEW	CURRENT AND FUTURE THREAT STATUS	BENEFITS OF TAPERED BUFFER	BENEFITS OF 50M BUFFER
	(DECC 2009b, Debus 1993). Foxes may also be attracted to urbanised and rural areas by opening up forest to open woodland (NPWS 2001, NSWSC 2000b), and food scraps (NPWS 2001, NSWSC 2000b).			
Artificial Lighting	<p>Lighting may potentially discourage particularly nocturnal native species from foraging near areas of development (e.g. Squirrel Gliders), especially given light may travel significant distances and it can have a similar effect to a full moon on the hunting success of predators such as owls, or a behavioural avoidance impact by potential prey species (DEC 2004a, Andrews 1990, Grayson and Calver 2004, ERM 1996). Artificial lighting also shown to affect Yangochiropteran bat assemblages positively and negatively (Scanlon and Petit 2008).</p> <p>Conversely, wallabies, kangaroos, Tawny Frogmouth Owls, Kookaburras, Magpies and possums have been noted</p>	<p>Currently no artificial light source in any proximity to Crown Land.</p> <p>Artificial lighting will exist in close proximity to the Crown Land from:</p> <ul style="list-style-type: none"> • Street and path lighting. • Lighting in any carpark. • Lighting around and in any building. • Vehicle headlights. <p>Light spillage dissipates with distance (ERM 1996) but in general ambient light levels are expected to significantly increase. This may affect nocturnal fauna in the adjacent Crown Land.</p>	<p>Buffer will diffuse impacts from light spillage, especially if a denser closed canopy is established over most of the buffer.</p> <p>Strategic placement and design of lighting (e.g. bollard) and using light deflection designs would further reduce light spillage.</p>	<p>Wider buffer will further diffuse any impacts associated with light spillage, again more so the sooner that a closed canopy is established.</p>



THREAT/ IMPACTS	LITERATURE REVIEW	CURRENT AND FUTURE THREAT STATUS	BENEFITS OF TAPERED BUFFER	BENEFITS OF 50M BUFFER
	<p>foraging under artificial lighting in residential areas, e.g. around Lake Innes, Port Macquarie and Kendall (personal observations). Artificial lighting may also be beneficial to Yangochiropteran bats by localised aggregation of insects, with these animals being observed foraging under streetlights, floodlights, and even landing on fully lit footpaths in Horton St, Port Macquarie, to scamper for insects (personal observations).</p> <p>Artificial lighting can also have the positive impact of increasing sight detection of fauna on roads, thus reducing risk of road kills, e.g. Koalas (Wilkes and Snowden 1998, AKF 2003, Connell Wagner 2000, Port Stephens Council 2001, Lunney <i>et al</i> 1999, DECC 2008d).</p>			
Bushfire	<p>Bushfire is an extinction threat to the ecological integrity of Littoral Rainforest (ERM 1996, Keith 2004, NSWSC 2004a, DEWHA 2009). Small fires only burning the edges can also open up closed canopies, altering microclimates, resulting in lower humidity and drying out. This</p>	<p>There is no evidence of recent fire in the Crown Land but extensive fire could readily lead to local extinction of the local occurrence.</p> <p>Post-development, risk of arson should be minor as only foredune vegetation very flammable (ignition</p>	<p>Buffer will have to be designed and established to have majority characterised by a high moisture content and closed canopy to be a buffer to arson risk.</p>	<p>Wider buffer places higher dependence on establishing an artificial community with a high moisture content and closed canopy. This is difficult, costly (high management requirements for about 10yrs) and uncertain, e.g. drought</p>



THREAT/ IMPACTS	LITERATURE REVIEW	CURRENT AND FUTURE THREAT STATUS	BENEFITS OF TAPERED BUFFER	BENEFITS OF 50M BUFFER
	also prevents extension of the community, and provides an edge for weeds to establish (ERM 1996, DEWHA 2009, NSWSC 2004a).	in other communities would be difficult without significant accelerant used) and high visibility/detectability would be a limitation.		over establishment phase may delay, stunt or even induce failure.
Overshadowing	Overshadowing by buildings does not appear to be an issue for this community. ERM (1996) suggests overshadowing may have positive impacts via protecting exposed western edges from drying out and disadvantaging light favouring weeds.	Current edge exposed to western sun due to extent of pasture and limited or no ecotone vegetation. Formerly semi-closed edge has been opened by removal of weeds, with supplementary plantings undertaken to assist closure. At most three storey buildings may be erected though single storey more likely. With required setbacks for Asset Protection Zones, very limited potential for any substantial overshadowing.	As sufficient setback is required for buildings, overshadowing is not considered a significant threat. Regardless, a shorter buffer zone could benefit by protecting more vegetation from the western sun.	
Maritime Stresses	Onshore salt laden winds are a primary environmental factor responsible for the character of this community (NSWSC 2004a, DEWHA 2009, ERM 1996, Keith 2004, Floyd 1990). The wind and salt content is a prime influence in the dune vegetation succession but also provides nutrients to otherwise poor soils.	Prior to recent bush regeneration work undertaken by Landcare and bush regenerators funded by the proponent, the foredune vegetation contained at times high infestations of low Bitou Bush which hampered development of a tall Banksia woodland which is required to protect the Littoral rainforest. This was removed but has left the interior Littoral Rainforest (previously	Beach access will be formalised with design to minimise penetration of wind funnel effect. As the source of maritime stress is from the east the buffer width has no consequence on this key threat to the EEC.	



THREAT/ IMPACTS	LITERATURE REVIEW	CURRENT AND FUTURE THREAT STATUS	BENEFITS OF TAPERED BUFFER	BENEFITS OF 50M BUFFER
	Clearing or modification of seafront vegetation can allow salt-laden winds to penetrate into the closed rainforest, affecting humidity and moisture content as well as toxic effects resulting in die off of sensitive species and invasion by weeds or seral natives, e.g. <i>Banksia</i> and <i>Leptospermums</i> .	heavily infested with weeds) exposed to maritime stresses. This stress will continue to limit rainforest regeneration until native protective vegetation develops on the seaward side – this will depend on ongoing work by Landcare. The current access cuts to just above mean high tide level in the foredune and forms a relatively low threat wind funnel to and from the beach. This will be addressed by the access design which will include establishing a closed edge along the track to protect sensitive vegetation – see Section 11.		
Other Wind Impacts	Turbulence formed by the lack of continuity to the forest or a gradual ecotone, as well as gaps in the canopy on the western side, allow the microclimate to dry out by hot Westerly winds (ERM 1996). Salt burn may also result on the western due to turbulence and eddies (ERM 1996). Windshear effects created by locating buildings close to Littoral	ERM (1996) report dieback on the western side of the community due to salt burn as a result of loss of buffering vegetation and impacts on wind patterns. No salt damage was evident on western side of rainforest adjacent to the subject site (Lot 5). Vegetation north of beach access generally has typically wind-sheared shaped canopy with limited gaps. Vegetation south of beach access	Could be argued that a wider buffer may push these impacts further away from the rainforest, although photos in 2008 and now show no signs of dieback, hence this threat appears to be very minor. Consequently, buffer width is arbitrary. Wider buffer however increases risk of an uneven canopy due to varying growth rates, tree heights, tree species, hence creates uncertainty in regards to how the current regime may change.	



THREAT/ IMPACTS	LITERATURE REVIEW	CURRENT AND FUTURE THREAT STATUS	BENEFITS OF TAPERED BUFFER	BENEFITS OF 50M BUFFER
	Rainforest, where there is no height gradation in vegetation or a funnel effect between buildings and retained vegetation (ERM 1996). This may also contribute to wind sheer, exacerbating the above impacts.	very patchy with many gaps promoting turbulence. Buildings will be setback from Crown Land vegetation at least 30m due to APZs, hence will create an open space between built zone and Crown Land vegetation and may affect wind patterns.		
Rubbish Dumping	Rubbish dumping can assist the introduction of some weeds via transport of propagules and crushing of native vegetation during access or by dumped materials.	Several piles of old concrete lie on the eastern boundary of Lot 5. Possibly a relic of former sandmining activities. Provision of bins and setback of development from vegetation edge should deter this threat.	Concrete piles will be removed. Litter will be controlled by Council fines advertised on signage with sufficient bins provided for litter control. Wider buffer would increase time it takes for pedestrian to pass through the access, hence increases risk of littering due to laziness or perception that won't be seen by peers.	
Hydrology and Eutrophication	Conversion of catchments into urban areas modifies local hydrology eg more and faster runoff, less groundwater penetration, etc. Nutrients from lawn fertilisers, dog faeces and petrochemical residues are also directed via stormwater to areas where runoff may collect. Where stormwater discharges into native vegetation, localised	No risk as catchment has limited urbanisation and located well away from stormwater collection areas. Crown Land and adjacent area of site falls on flat land, hence rain will most likely infiltrate in situ or be directed to Duchess Gully. Runoff from adjacent future residential land to north will be subject to Water Sensitive Urban	Given relatively flat nature of land and permeability of soils as direction of stormwater drainage from the urbanised catchment, buffer width has no significant bearing on these impacts as filtration is not a likely function of the buffer zone.	



THREAT/ IMPACTS	LITERATURE REVIEW	CURRENT AND FUTURE THREAT STATUS	BENEFITS OF TAPERED BUFFER	BENEFITS OF 50M BUFFER
	elevated moisture and nutrient levels can lead to dieback or displacement of native species with other natives adapted to such conditions or weed species (ERM 1996, Webb 1995, DLWC 1998a, 1998b).	Design (WSUD) principles and appropriate treatment before discharge to Duchess Gully. Treatment basin nominated to be located on middle-south part of Lot 5 in currently open pasture.		

The buffer zone potentially has other functions which may be influenced by width, as reviewed in the following table:

Table 8: Review of other potential values/functions of the littoral rainforest buffer

Other Values/Functions	Tapered Buffer	50m Buffer
Wildlife Corridor Effectiveness	<p>Either buffer zone will increase the width of the coastal strip from about 100m to 125-150m, which will compliment the widening via similar planting of a 50m buffer to the Littoral rainforest on adjacent land to the north (King and Campbell 2010). This total width should buffer edge effects from the west and increase carrying capacity (Lindenmayer and Fisher 2006, Scotts and Drielsma 2003), increasing the potential facility of the coastal strip vegetation.</p> <p>However, on Lot 5, this will narrow back to around 100m wide in the Reserve from south of the southern limit of the Littoral rainforest/development envelope buffer to the boundary with the Bonny Hills STP.</p> <p>Hence either buffer option will have limited change/benefit to current corridor functions in landscape terms, other than incrementally increasing its carrying capacity and incrementally reducing the potential significance of edge effects in the upper end of the coastal strip but retaining a bottleneck in the mid portion.</p>	
Interior Habitat and Edge Effects.	<p>The linear nature of the coastal strip predisposes it to penetration of edge effects due to the high perimeter to volume ratio, hence the justification for a buffer (Gibbons and Lindenmayer 2006, Scotts and Drielsma 2003). However as the vegetation in the Reserve currently has a relatively intact to closed edge on its western side adjacent to future development, most edge effects have limited current and future impacts on the western side (as evaluated in Table 10). Either buffer option will further buffer these threats.</p> <p>As noted in Table 10, edge effects in the form of impacts on microclimate and salt burn via maritime stresses and weed invasion are most prevalent on the eastern side due to recent removal of Bitou Bush and lack of protective vegetation on the seaward side. These</p>	



	<p>stresses are clearly limiting the recovery of Littoral Rainforest on the eastern margins of the coastal strip. As noted above, the width of the western buffer will have no influence on this, other than perhaps potentially (assuming regeneration restores ecological processes) increasing the extent of Littoral Rainforest and allowing for a retreat scenario due to edge effects from the east.</p> <p>Establishing a buffer on the western side will have the effect of a net increase in habitat width (assuming the majority will be planted to climax into Littoral Rainforest), which may have the benefit of increasing the extent of interior habitat (habitat relatively exempt from edge effects and used by the most sensitive species) and the literature argues that wider buffers would have some benefit on reducing the penetration of edge effects depending on vegetation type (Gibbons and Lindenmayer 2006, Scotts and Drielsma 2003). Hence a greater width of interior habitat free of edge effects could possibly be established (if regeneration is fully successful), which could enhance overall biodiversity, especially given a similar result is expected to occur by widening the buffer on land to the north (King and Campbell 2010). Hence in this regard, the 50m wide buffer could be more beneficial but, as detailed below, the increase is not significant.</p>
Carrying Capacity	<p>As for interior habitat, the logical deduction is that the greater the net area of habitat created, the higher the potential carrying capacity. In this regard, the wider buffer could result in a larger extent of habitat and hence greater carrying capacity. This would benefit the function of both the east-west Corridor and the viability of populations of small home range species in the coastal strip.</p> <p>However, compared to the tapered option, the uniformly 50m wide buffer will only add about 30% more habitat, hence the difference due to the increase is not particularly significant (an additional 0.3ha), nor does either option offer a significant new extent of habitat (i.e. ~1ha).</p>