



4 FAUNA ASSESSMENT

4.1 Overview

The Subject Property is a rural residential property in the suburb of Kurmond. Approximately half of the property has been cleared to grassland. The remainder of the property has intact or modified native vegetation communities. Horses have previously been grazed on the property. The Subject Property is surrounded by other rural residential properties on acreage, while extensive stands of undisturbed native bushland occur in the Locality and Region.

Howes Creek flows through the northern portion of the Subject Property in an easterly direction. A drainage line from the southern gully flows into a dam on a neighbouring property. Dense vegetation surrounds both of these drainage lines.

In order to assess the likelihood of native fauna species utilising the native vegetation within the Study Area as habitat, a fauna survey was undertaken. All species listed as 'threatened' under the NSW TSC Act and/or Commonwealth EPBC Act 1999 (see Table 4.2) have been considered during the field survey.

4.2 Fauna Methods

Preliminary fauna surveys were conducted to determine the potential for threatened species to utilise the Subject Property. A habitat assessment and fauna survey were undertaken by Ecologist Rebecca Carman (BSc, MPhil, PGDipWildMgt) on 20th November 2013. Survey effort is outlined in Table 4.1.

The entire Subject Property comprised the Study area with particular focus on areas that a most likely to be impacted by the proposed subdivision.

Table 4.1: Fauna survey effort

DATE	TIME	TIME OF DAY	WEATHER CONDITIONS				ACTIVITY
			TEMP.	WIND	CLOUD	RAIN	
20/11/13	1.5 hours	Morning	25°C	None	2/8	None	Habitat assessment, diurnal bird survey, herpetofauna search
	5 days	All		Variable			Infrared camera monitoring
26/11/13	2 nights	Night		Variable		None	Ultrasonic bat detection

The fauna field survey was aimed at assessing the species richness of the site; to investigate the range of fauna habitats present, and to determine the potential for local threatened fauna species to occur.

The fauna survey incorporated a range of techniques designed to target species from all fauna groups that would be expected to occur on the site, including birds, mammals and reptiles. These techniques included a series of diurnal bird censuses, searches for active herpetofauna (reptiles), and recording of indirect evidence of fauna presence (e.g. tracks, scats, hollows, nests, diggings, bones and other traces). In addition, all opportunistic sightings of fauna were recorded.



All relevant previous reports and databases were reviewed and drawn upon. Particular attention was paid to records of species listed under the Schedules of the *EPBC* or *TSC Acts*.

Field surveys were restricted to the land that comprised the Subject Property. While surveying this area, the condition and structure of any fauna habitats present were identified, and a consideration of their potential to support locally-occurring populations of threatened fauna was determined.

Species specific survey methods are set out below.

Diurnal Birds

Formal bird point censuses were conducted from various locations within the Study Area. The formal census involved 'point bird counts' at this location. This method was used in addition to the opportunistic bird census conducted over the remaining areas of the Study Area. Birds were identified on the basis of visual identification and by their characteristic calls. All opportunistic observations of bird species were recorded while undertaking general field survey activities.

Herpetofauna Census

Reptiles and amphibians were surveyed using hand-searches around the Study Area. Searches concentrated on areas containing woody debris or urban refuse and around the base of trees; and this included techniques such as carefully turning over rocks, logs or large pieces of rubbish wherever these were encountered. These were replaced on site after inspection. All opportunistic sightings were noted.

Bats

One (1) stationary ultrasonic bat call detector (Anabat SD1, Titley Electronics) was used to record bat calls within the Subject Property. The unit was positioned where predicted 'fly-ways' exist and left in position for two (2) nights from 26th November 2013 (see *Figure 4.1* for locations).

In relation to the analysis of those microchiropteran (microbat) calls obtained, it is noted that some insectivorous bat species have distinctive echolocation calls that are unlikely to be confused with those of other species. Other bats species overlap in both call frequency and structure, making identification problematic in some cases. The degree of confidence or reliability associated with call identifications will depend on the quality of the recordings as well as the activity of the bat at the time of recording and flight direction. In some instances, a particular species may be identified with confidence, while at other times its identification will be less certain (refer to *Bat Calls of NSW* Pennay, Law *et al.* 2004).

All Fauna

Two (2) infrared cameras (SG550V8, ScoutGuard) were placed on site and left in position for 5 days (see *Table 4.1* and *Figure 4.1*). The units employ a passive infrared (PIR) system, operating diurnally and nocturnally. The cameras were set to a sensitivity level of 'normal', capturing 2 images when triggered with a one (1) minute recovery time. The cameras were placed at a height of around 1.5m above ground level and angled slightly downwards (as per the directions provided in the unit's instruction manual).

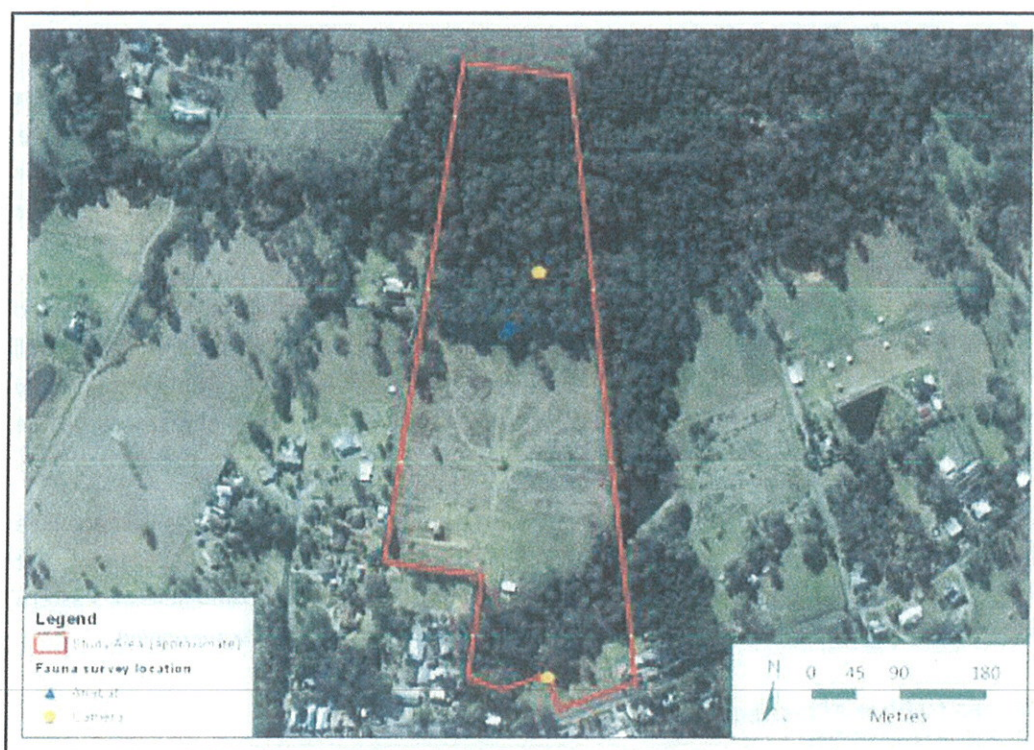


Searches for Evidence of Species Presence

Searches were conducted for animal scats of both predatory and non-predatory species. Where these were encountered, scats were identified on site; first to genus and then to species level, wherever possible. The search concentrated on the ground area beneath trees, in garden beds and edge sites, as well as amongst leaf litter and on the open lawns.

Searches were also made for other characteristic signs of fauna species' presence; including tracks, bones, hair, shed skins and animal remains, as well as nests, diggings, burrows, chew marks, scratchings and pellets (indicative of birds of prey).

Figure 4.1: Fauna survey locations



4.2.1 Limitations to Fauna Field Surveys

The diversity of the species recorded during the current field surveys is expected to be influenced by seasonal factors. For this reason, survey results can always be improved by extending the time allowed to provide an investigation in all seasons.

The list of fauna species recorded by the current field surveys should not be regarded as being fully comprehensive, but rather as providing an indication of the species present at the time of the survey (November 2013). Surveys carried across all seasons over a period of several years are needed to identify all of the species present in an area, especially as some species are only present at certain times of the year (e.g. migratory birds), while others may require specific weather patterns and seasonal conditions for optimum levels of detection, e.g. amphibians.



Therefore, when establishing the suite of resident native species occurring or potentially occurring in an area by utilising the habitat requirements and associations of these animals, the diversity of other native species that could occur on occasion can be determined. For example, if a hollow-associated owl is detected, then there is the potential that, if previously recorded in the vicinity of the Study Area, other species of owls with similar nesting requirements may also be present. By using those species recorded to predict the full range of fauna potentially present in the Study Area helps to overcome some of the limitations associated with seasonal constraints and of surveys of limited duration.

4.3 Survey Results

4.3.1 Fauna Species Recorded

Previous fauna surveys and compilation lists from the Atlas of NSW Wildlife (OEH 2012) database have identified 52 mammals, 170 birds, 26 native reptiles, and 13 native frogs for the Region (i.e. within a 10 x 10 km area centred on the Study Area). Of those native species previously recorded in the Region, 22 are listed as 'vulnerable', 'endangered' and/or 'migratory' under the Schedules to the EPBC and/or TSC Acts (see Table 4.2).

By the completion of the current field survey (November 2013), 35 bird species were detected within, adjacent to, or flying over the Study Area; the latter identified by their distinctive calls as well as observation (Appendix 4). Three (3) native reptiles were observed within the Study Area. Three (3) introduced mammals were identified within the Study Area. Horses have been grazed on the Property and there is evidence of this being on-going.

Seven (7) species of microchiropteran bats were identified with varying degrees of confidence (see Appendix 4). Four (4) of these species are listed as threatened; the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Eastern Freetail Bat (*Mormopterus norfolkensis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*).

4.3.2 Fauna Habitat Assessment

Habitat Type: Modified Woodland

Fauna Conservation Significance: Moderate

The vegetation of the Subject Property has been highly modified for rural residential living, property access, gardens and previous horse grazing. Natural elements of the vegetation have been retained in the form of large canopy trees and some small areas of native understorey occurring towards the rear of the Property. The majority of the groundcover is maintained through regular mowing and the majority of understorey shrubs have been cleared. There are occasional rocks and scattered debris for sheltering of reptiles.

Habitat Type: Grassland

Fauna Conservation Significance: Low

Much of the Subject Property has been cleared for previous land uses. Up until recently horses grazed on the property, not only restricted to the grassland. There are scattered trees and piles of debris that provide addition habitat features. The grassland is maintained through regular mowing.



Habitat Type: Aquatic

Fauna Conservation Significance: High

Howes Creek is tributary of the Hawkesbury River and flows through the Subject Property in an easterly direction. The creek is surrounded by dense vegetation and in parts there are steep embankments. At the time of survey the creek was flowing and is expected to do so most of the time. Additional aquatic habitat occurs in a very small dam in a gully in the south of the property. This dam is likely to be ephemeral.

4.3.3 Connectivity

The vegetation in the north of the Subject Property forms part of the Howes Creek riparian corridor, connecting to larger areas of bushland within the locality and region. Vegetation in the south of the Subject Property is connected to this corridor by a band of vegetation along the western boundary of the neighbouring property.

4.3.4 Threatened Fauna Assessment

Table 4.2 assesses the likelihood of threatened fauna species previously recorded, and/or thought to potentially occur within the Study Region, being present, or utilising the Study Area. It also considers any potential impacts the proposed development may have on the said threatened species.

Four (4) microchiropteran bats listed as 'vulnerable' under the TSC Act were detected during the current field investigations with varying degrees of confidence. The Eastern Freetail Bat (*Mormopterus norfolkensis*) was identified with confidence and a 'possible' identification was made for the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*) (Table 4.2 and Appendix 4).

Considering the findings of the current field investigations and given that some threatened species are known to occur in the Region, a Seven-part Test of Significance under part 5A of the EP&A Act should be undertaken for each of the following species to assess the impacts of the proposed development at 1442/1442A Kurmond Road:

- Powerful Owl (*Ninox strenua*)
- Square-tailed Kite (*Lophoictinia isura*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Eastern Freetail-bat (*Mormopterus norfolkensis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)

Each assessment will consider the requirements for land clearing based on the Plan of Proposed Rural Subdivision and APZ requirements. These will be undertaken upon completion of the final concept plan at the time of subsequent development application for subdivision



Table 4.2: Threatened Fauna Assessment for species recorded in the Region during the past 10 years

E1/E = Endangered Species and V = Vulnerable Species

* Habitat requirements were generally extracted from OEH (2012), with other references used being identified in the bibliography.

^ Within a 10 x 10 km² area centred on the Study Area

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS	CLOSEST PROXIMITY & DATE	MOST RECENT & PROXIMITY		
Birds (6)								
Black-chinned Honeyeater (eastern subspecies) (<i>Melithreptus gularis</i> <i>gularis</i>)	V	-	Rarely recorded east of the Great Dividing Range although recorded from Richmond and Clarence River. Needs large home range in open woodlands of at least 5 ha. Foragers for insects, nectar and honeydew.	1	1.77km (2006)	2006 (1.77km)	Low	Insufficient suitable habitat available. Unlikely to utilise the Subject Property. Further assessment of this species is not required.
Painted Honeyeater (<i>Grantiella picta</i>)	V	-	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> .	1	5.75km (2004)	2004 (5.75km)	Low	No suitable foraging habitat available. Further assessment of this species is not required.
Powerful Owl (<i>Ninox strenua</i>)	V	-	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats.	4	3.06km (2006)	2008 (2.44km)	Moderate	Suitable hunting habitat available within the Subject Property. No suitable nesting sites identified. Further assessment of this species is required.



COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS	CLOSEST PROXIMITY & DATE	MOST RECENT & PROXIMITY		
Square-tailed Kite (<i>Lophoictinia isura</i>)	V	-	Inhabit a range of wooded habitats including woodlands and open forests. Regularly visits major west-flowing river systems in NSW and migrates to SE in summer for breeding along watercourses. Hunts for passerines (esp. honeyeaters) and insects in 100km range.	2	3.65km (2006)	2006 (3.65km)	Moderate	Suitable foraging habitat and prey species available. Further assessment of this species is required.
Scarlet Robin (<i>Petroica boodang</i>)	V	-	Lives in dry woodlands with abundant logs and fallen timber. In winter may live in open grasslands. Forage for small invertebrates.	6	2.98km (2004)	(2006 (3.67km)	Low	Insufficient suitable habitat available. Further assessment of this species is not required.
Varied Sittella (<i>Daphoenositta chrysoptera</i>)	V	-	Occurs in woodlands and forests preferring rough and stringy barked trees where it searches for insects. Builds nests in forks of trees.	2	2.00km (2006)	2006 (2.00km)	Moderate	Suitable foraging and nesting habitat available. Further assessment of this species is required.
Mammals (8)								
Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>)	V	-	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Hunt in forested areas, catching moths and other flying insects above the tree tops.	3	1.90km (2000)	2008 (3.23km)	High (detected during current field surveys)	Some suitable roosting sites available in buildings. Suitable foraging habitat available. Further assessment of this species is required.



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	TSC ACT	EPBC ACT		NUMBER OF RECORDS	CLOSEST PROXIMITY & DATE	MOST RECENT & PROXIMITY		
Eastern False Pipistrelle (<i>Falsistrellus tasmaniensis</i>)	V	-	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter.	1	4.98km (2003)	2003 (4.98km)	High (detected during current field surveys)	Few suitable roosting sites available. Some suitable foraging habitat available. Further assessment of this species is required.
Eastern Freetail-bat (<i>Mormopterus norfolkensis</i>)	V	-	Occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in man-made structures.	5	1.90km (2000)	2008 (3.23km)	High (detected during current field surveys)	Suitable roosting and foraging habitat available. Further assessment of this species is required.
Greater Broad-nosed Bat (<i>Scoteanax rueppellii</i>)	V	-	Inhabits woodland through to moist and dry eucalypt forest and rainforest. Roosts in tree hollows and buildings. Feeds on beetles, other slow-flying insects and other bat species.	1	4.98km (2003)	2003 (4.98km)	High (detected during current field surveys)	Suitable foraging habitat available. Further assessment of this species is required.
Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>)	V	V	Occur in sub-tropical and temperate forests and urban areas. Roost in trees near food sources (nectar/pollen/fruits). Large numbers in roosts used for breeding and young rearing. Site fidelity is high.	1	3.09 km (2005)	2005 (3.09km)	Moderate	Suitable foraging habitat available when eucalypt species are in flower. Further assessment of this species is required.



COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION ^A			POTENTIAL UTILISATION OF STUDY AREA	ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS	CLOSEST PROXIMITY & DATE	MOST RECENT & PROXIMITY		
Koala (<i>Phascolarctos cinereus</i>)	V	V	Populations exist in the Wedderburn/ Campbelltown area, in the Blue Mountains in Wollemi National Park and the Colo River area and likely around Little Cattai Creek and the O'Haras Creek/Cattai Creek catchment area. Inhabits eucalypt forest and woodlands with specific primary food trees depending on region.	4	1.57km (1956)	2007 (4.50km)	Low	Some preferred feed trees available (Forest Red Gum, Grey Box, Grey Gum). No indication that these trees are used by this species. Unlikely to occur within the Subject Property. Further assessment of this species is not required.
Southern Myotis (<i>Myotis macropus</i>)	V	-	Roosts in groups of 10-15 close to water in caves, shafts, tree hollows, storm water channels, buildings, under bridges and in dense foliage. Forage over water for insects and small fish.	1	3.23km (2008)	2008 (3.23km)	Low	No suitable foraging or roosting habitat available. Further assessment of this species is not required.
Squirrel Glider (<i>Petaurus norfolcensis</i>)	V	-	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites.	4	0.90km (1992)	2006 (1.31km)	Low	No suitable habitat available. Unlikely to utilise the Subject Property. Further assessment of this species is not required.



5 CONCLUSION, DECLARATION & SIGN-OFF

The current report has provided ecological data for the Subject Property at 1442/142A Kurmond Road, Kurmond. It also considers the potential impacts on native flora and fauna that may arise from the proposed rural lands subdivision.

Impacts upon the Ecological Community may be described as Direct Impacts – activities expected to directly affect the listed community e.g. clearing of vegetation, or Indirect Impacts – activities which are expected to affect the community indirectly e.g. changes in local hydrology and an increase in soil nutrient levels due to runoff from lawns and gardens.

Flora: No (0) flora species or populations listed under the *TSC Act* or *EPBC Act* were recorded for the Study Area; therefore no impact to any threatened species is envisaged, and no Assessment of Significance (Seven-part Test or Commonwealth Assessment) will be required for flora species issues.

Plant Communities: There are two (2), possibly three (3) native plant communities within the Subject Property at Kurmond: Cumberland Plain Shale Woodland, with elements of Moist Shale Woodland on the upper slopes and in the gully, and Shale Sandstone Transition Forest on the Howes Creek Riparian Corridor.

Although the native vegetation has been modified for agriculture over a period of many years, under the precautionary principle a Seven-part Test should be prepared to assess the potential impacts of the Proposal on both the remnant CSPW and SSTF along the watercourse.

Given the matters raised above, a Seven-part Test of Significance has been recommended under section 5(A) of the NSW Environment Planning & Assessment Act prior to the submission of a future Development Application. It is however, considered that a further Assessment under the Commonwealth Significant Impact Assessment Guidelines is not required.

Fauna: Four (4) microchiropteran bats listed as 'vulnerable' under the *TSC Act* were detected during the current field investigations. The **Eastern Freetail Bat** (*Mormopterus norfolkensis*) was identified with confidence and a 'possible' identification was made for the **Eastern Bentwing Bat** (*Miniopterus schreibersii oceanensis*), **Eastern False Pipistrelle** (*Falsistrellus tasmaniensis*) and **Greater Broad-nosed Bat** (*Scoteanax rueppellii*) (Table 4.2 and Appendix 4).

Considering the findings of the current field investigations and given that some threatened species are known to occur in the Region, a Seven-part Test of Significance under part 5A of the *EP&A Act* should be undertaken for each of the following species to assess the impacts of the proposed development at 1442/1442A Kurmond Road:

- Powerful Owl (*Ninox strenua*)
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- Grey-headed Flying-fox (*Pteropus poliocephalus*)

Each assessment will consider the requirements for land clearing based on the Plan of Proposed Rural Subdivision and the APZ requirements. These will be undertaken upon completion of the final concept plan submitted as part of a Development Application if the Planning Proposal is ultimately approved.

5.1 Flora Management Issues

5.1.1 Upper Patch of CSPW/MSW near Kurmond Road

This area of bushland could be viable provided that the dense understorey of noxious woody weeds is removed (e.g. Privet and Lantana) and native ground covers are allowed to regenerate. However, under-scrubbing to remove the woody weed thickets and/or clearing on the steep slopes has the potential to create soil erosion and soil scour, so that preventative measures must be set in place at the outset.

APZs would reduce potential for the natural regeneration of the native understorey, but given that the clay-based soils are highly dispersible once the protective vegetation cover is removed, it will be critical to retain or re-establish some understorey cover. Native ground covers are allowable under *Planning for Bush Fire Protection* (RFS 2006) provided that shrub cover is maintained at <30%.

Development of this area would also provide an improvement for the APZ to the adjoining school.

5.1.2 Northern stand of SSTF in the Howes Creek Corridor

Currently viable, although localised weeds and early stages of invasion by Privet spreading from elsewhere on the Property and from properties upstream threaten its viability. Privet seed is dispersed by birds and foxes. Lantana is locally common at the margins, although it does not generally intrude into the shady interior bushland.

The riparian bushland retains 'high' conservation significance and provides habitat for a variety of native fauna. The riparian corridor along the creek is likely to be retained in adjacent properties as development potential is strictly limited, even if it is very weedy in some parts.

Any proposal to develop additional residential lots near Howes Creek would reduce the size, viability and value of this habitat for local flora and fauna. Potential issues such as site access and provision of facilities could reduce the value of this bushland further. Recreational uses would likely further impact its habitat value due to nutrient enrichment.

Recommendations:



In considering the potential ecological impacts of the proposed rural residential subdivision at 1442/1442A Kurmond Road Kurmond, UBM recommends that:

- Given the requirements of the threatened species legislation, a number of Seven-part Tests under Part 5A of the *Environment Planning & Assessment Act* will be required as part of any subsequent Development Application should the Planning Proposal ultimately be approved. These Assessments will be required for both flora and fauna issues (see above).
- Depending on the outcome of the Seven-part Tests undertaken any proposal which requires the clearance or modification of an endangered plant community may trigger a Species Impact Statement. The determination of 'significance' will depend largely on how much bushland is to be removed or modified.
- Clearing or modification of bushland to create an Asset Protection Zone between the hazard (bushland) and the development should conform to the requirements of *Planning for Bush Fire Protection* (Rural Fire Service 2006), as set out in the *Bushfire Assessment Report* (T. O'Toole December 2013).
- There is the potential that the removal of woody weed thickets and some native understorey species (e.g. shrubs) to create the Asset Protection Zone will destabilise the soils and encourage soil erosion. In order to avoid this, native ground covers and small shrubs (<30% coverage) should be retained or planted.
- Wherever possible, all healthy mature native trees should be retained and protected during construction. Trees should be protected with tree guards during construction works. Remnant native trees could then be incorporated into the landscape design for the development.
- Future landscaping should endeavour to use a majority of locally indigenous species and be representative of the original plant communities, here CSPW/MSW. This will retain local landscape character and benefit local wildlife. In particular, native trees with rough, fissured or stringybark which are known to be utilised by microbats should be retained or replaced wherever possible.
- A soil and water management plan should be developed to ensure that runoff from the subdivision does not impact on the riparian bushland on Howes Creek. A grassed buffer zone between the lowest building allotment and the creek is highly recommended. The Office of Water recommends a minimum 40 metres width.

By adopting the recommendations identified in this Report, the impacts of the development on the native bushland, flora or fauna species or populations occurring within the Subject Property and Locality generally will be minimised.



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7 APPENDICES

APPENDIX 1: Description of Cumberland Shale Plains Woodland (per Tozer 2010)

GW p29: Cumberland Shale Plains Woodland

Sample Sites: 150

Area Extant (ha): 6800

Estimated % remaining: 5-25%

Area in conservation reserves (ha): 560

Estimated % of pre-clearing area: <2%

No. taxa (total / unique): 364 / 3

No. taxa per plot (±sd): 39.3(10.1)

Cumberland Shale Plains Woodland (GW p29) is equivalent to GW 29 described by Tindall *et al.* (2004), and is a eucalypt woodland with an open shrub layer and grassy groundcover. It occurs on clay-loam soils derived from Wianamatta shale and is restricted to the Cumberland Plain, western Sydney. Cumberland Shale Plains Woodland is primarily found below 150m ASL but may occur on flat terrain up to 300m ASL. It lies in a coastal rain shadow receiving 750 – 950 mm mean annual rainfall. Cumberland Shale Plains Woodland grades into Cumberland Shale Hills Woodland (GW p28) as elevation and topographic roughness increase in the southern half of the Cumberland Plain. Towards the margins of the plain Cumberland Shale Plains Woodland grades into Cumberland Shale Sandstone Transition Forest as the depth of the underlying sandstone strata decreases. Cumberland Shale Plains Woodland shares some species with Castlereagh Shale-Gravel Transition Forest (DSF p502), which occurs on shale soils with a high concentration of iron-indurated gravel or overlain by Tertiary alluvium. Cumberland Shale Plains Woodland, also described by Tozer (2003), was extensively cleared for the rural and urban development of western Sydney. The remaining stands are small fragments threatened by continued clearing, degradation, weed invasion and high fire frequency. A few occurrences are represented within conservation reserves, such as Scheyville National Park. Together with Cumberland Shale Hills Woodland and Cumberland Moist Shale Woodland, this unit is included within Cumberland Plain Woodland listed on Schedule 1 of the NSW *Threatened Species Conservation Act*, 1995. It falls within the Coastal Valley Grassy Woodlands vegetation class (Keith 2004).

Floristic Summary:

Trees: *Eucalyptus molluccana*, *E. tereticornis*. **Shrubs:** *Bursaria spinosa*. **Climbers:** *Glycine tabacina*, *G. clandestina*. **Groundcover:** *Dichondra repens*, *Cheilanthes sieberi*, *Aristida vagans*, *Microlaena stipoides*, *Themeda australis*, *Brunoniella australis*, *Desmodium gunnii*, *Opercularia diphylla*, *Wahlenbergia gracilis*, *Dichelachne micrantha*, *Paspalidium distans*, *Eragrostis leptostachya*, *Lomandra filiformis*, *L. multiflora*, *Dianella longifolia*, *Oxalis perennans*, *Euchiton sphaericus*, *Goodenia hederacea*, *Aristida ramosa*, *Arthropodium milleflorum*, *Austrodanthonia tenuior*, *Cymbopogon refractus*, *Echinopogon caespitosus*.



Vegetation structure:

Stratum	Frequency (n=136)	Height (m) (+StDev)	Cover (%) (+StDev)
Emergent	2	24.7 (5)	3.7 (1.2)
Tree canopy	100	20.9 (5)	18.7 (9.9)
Small tree	75	9.4 (3.9)	18.2 (15.2)
Shrub	65	2.5 (0.6)	14.4 (12.2)
Ground cover	99	0.9 (0.2)	47.3 (22.4)

Diagnostic Species:

A 0.04ha plot located in this Map Unit is expected to contain at least 26 positive diagnostic species (95% confidence interval) provided that the total number of native species in the plot is 31 or greater. A 95% confidence interval means that five percent of plots sampled (1 in 20 plots) in this Map Unit may contain fewer than 26 positive diagnostic species.

C/A: Cover/abundance within Map Unit (50 percentile)

Freq: Frequency (%) within Map Unit

C/AO: Cover/abundance in other Map Units (50 percentile)

FreqO: Frequency (%) within other Map Units

Species	C/A	Freq	C/AO	FreqO	Species	C/A	Freq	C/AO	FreqO
<i>Acacia decurrens</i>	1	25	1	2	<i>Calotis dentex</i>	2	7	1	1
<i>Acacia falcata</i>	1	13	1	1	<i>Carex inversa</i>	1	20	1	3
<i>Acacia implexa</i>	1	15	1	6	<i>Centella asiatica</i>	1	21	1	4
<i>Acacia parramattensis</i>	1	22	1	4	<i>Centaurium spicatum</i>	1	4	1	0
<i>Ajuga australis</i>	1	15	1	3	<i>Cheilanthes distans</i>	1	7	1	2
<i>Amyema gaudichaudii</i>	1	3	1	0	<i>Cheilanthes sieberi</i>	2	87	1	12
<i>Amyema miquelii</i>	1	2	1	0	<i>Chloris truncata</i>	1	5	1	0
<i>Angophora subvelutina</i>	3	5	2	0	<i>Chloris ventricosa</i>	1	17	1	1
<i>Aristida ramosa</i>	1	51	1	4	<i>Chorizema parviflorum</i>	1	5	1	0
<i>Aristida vagans</i>	2	80	1	7	<i>Commelina cyanea</i>	1	21	1	4
<i>Arthropodium milleflorum</i>	1	33	1	5	<i>Cymbopogon refractus</i>	1	41	1	4
<i>Arthropodium minus</i>	1	5	1	1	<i>Cynodon dactylon</i>	1	10	1	1
<i>Asperula conferta</i>	1	26	1	3	<i>Cyperus enervis</i>	1	2	1	0
<i>Astroloma humifusum</i>	1	12	1	4	<i>Cyperus gracilis</i>	1	15	1	2
<i>Austrodanthonia fulva</i>	2	7	1	2	<i>Cyperus laevis</i>	1	4	1	1
<i>Austrodanthonia racemosa</i>	1	26	1	5	<i>Daviesia ulicifolia</i>	1	24	1	6
<i>Austrodanthonia tenuior</i>	1	32	1	2	<i>Desmodium brachypodum</i>	1	18	1	3
<i>Bossiaea prostrata</i>	1	15	1	2	<i>Desmodium rhytidophyllum</i>	1	9	1	1
<i>Bothriochloa decipiens</i>	1	7	1	0	<i>Desmodium varians</i>	1	79	1	20
<i>Bothriochloa macra</i>	1	12	1	1	<i>Dianella longifolia</i>	1	51	1	4
<i>Breynia oblongifolia</i>	1	21	1	12	<i>Dichelachne micrantha</i>	1	65	1	8
<i>Brunoniella australis</i>	2	81	1	2	<i>Dichopogon fimbriatus</i>	1	3	1	0
<i>Bursaria spinosa</i>	3	93	1	13	<i>Dichondra spp.</i>	2	93	1	24
<i>Caesia parviflora</i>	1	19	1	2	<i>Dichelachne parva</i>	1	12	1	1
<i>Calotis cuneifolia</i>	1	5	1	0	<i>Dichanthium sericeum</i>	1	3	1	0
					<i>subsp. sericeum</i>				



Species	C/A	Freq	C/AO	FreqO
<i>Dichopogon strictus</i>	1	5	1	0
<i>Digitaria diffusa</i>	1	5	1	0
<i>Digitaria parviflora</i>	1	12	1	2
<i>Digitaria ramularis</i>	1	9	1	1
<i>Dillwynia sieberi</i>	1	23	1	1
<i>Dodonaea viscosa</i> subsp. <i>cuneata</i>	1	11	1	0
<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	1	38	1	6
<i>Echinopogon ovatus</i>	1	38	1	13
<i>Einadia hastata</i>	1	27	1	3
<i>Einadia nutans</i>	1	9	1	3
<i>Einadia polygonoides</i>	1	4	1	0
<i>Einadia trigonos</i>	1	12	1	1
<i>Entolasia marginata</i>	1	28	1	11
<i>Eragrostis brownii</i>	1	25	1	3
<i>Eragrostis leptostachya</i>	1	61	1	3
<i>Eragrostis parviflora</i>	1	2	1	0
<i>Eremophila debilis</i>	1	27	1	0
<i>Eriochloa pseudoacrotricha</i>	1	5	1	0
<i>Eucalyptus amplifolia</i> subsp. <i>amplifolia</i>	3	4	2	1
<i>Eucalyptus crebra</i>	3	32	2	2
<i>Eucalyptus eugenioides</i>	1	25	2	4
<i>Eucalyptus fibrosa</i>	2	14	2	3
<i>Eucalyptus moluccana</i>	3	61	3	1
<i>Eucalyptus tereticornis</i>	3	71	2	6
<i>Euchiton sphaericus</i>	1	37	1	3
<i>Exocarpos cupressiformis</i>	1	20	1	5
<i>Fimbristylis dichotoma</i>	1	20	1	0
<i>Glossogyne tannensis</i>	1	6	1	0
<i>Glycine clandestina</i>	1	48	1	26
<i>Glycine microphylla</i>	1	37	1	4
<i>Glycine tabacina</i>	1	63	1	6
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	1	41	1	13
<i>Grevillea juniperina</i>	1	3	2	0
<i>Hardenbergia violacea</i>	1	37	1	17
<i>Hibbertia diffusa</i>	1	19	1	3
<i>Hypericum gramineum</i>	1	31	1	16
<i>Hypoxis hygrometrica</i>	1	28	1	1
<i>Hypoxis pratensis</i> var. <i>pratensis</i>	1	4	1	0
<i>Indigofera australis</i>	1	17	1	9
<i>Juncus usitatus</i>	1	21	1	2
<i>Lachnagrostis aemula</i>	1	2	1	0
<i>Lachnagrostis filiformis</i>	1	18	1	3
<i>Lagenifera gracilis</i>	1	13	1	3

Species	C/A	Freq	C/AO	FreqO
<i>Laxmannia gracilis</i>	1	19	1	3
<i>Leucopogon juniperinus</i>	1	18	1	5
<i>Linum marginale</i>	2	3	1	0
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	2	43	1	10
<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	1	47	1	24
<i>Maytenus silvestris</i>	1	3	1	1
<i>Melaleuca decora</i>	1	15	3	1
<i>Melaleuca styphelioides</i>	1	5	2	2
<i>Mentha diemenica</i>	1	6	1	1
<i>Microlaena stipoides</i>	3	93	1	35
<i>Murdannia graminea</i>	1	3	1	0
<i>Opercularia diphylla</i>	1	67	1	6
<i>Opismenus aemulus</i>	1	21	1	5
<i>Oxalis exilis</i>	1	12	1	3
<i>Oxalis perennans</i>	1	52	1	12
<i>Ozothamnus diosmifolius</i>	1	33	1	8
<i>Panicum effusum</i>	1	17	1	2
<i>Panicum simile</i>	1	28	1	5
<i>Paspalidium distans</i>	2	67	1	2
<i>Paspalidium albobillosum</i>	2	2	2	0
<i>Paspalidium aversum</i>	1	2	1	0
<i>Phyllanthus virgatus</i>	1	26	1	0
<i>Pimelea curviflora</i> var. <i>subglabrata</i>	1	3	2	0
<i>Pimelea spicata</i>	2	2	1	0
<i>Plantago debilis</i>	1	19	1	7
<i>Plantago gaudichaudii</i>	1	5	1	1
<i>Polymeria calycina</i>	1	10	1	1
<i>Polygala japonica</i>	1	5	1	0
<i>Poranthera microphylla</i>	1	36	1	15
<i>Pratia purpurascens</i>	1	47	1	17
<i>Pultenaea microphylla</i>	1	7	1	1
<i>Scaevola albida</i> var. <i>albida</i>	1	3	1	0
<i>Scleria mackaviensis</i>	1	4	1	0
<i>Scutellaria humilis</i>	1	4	1	1
<i>Senecio hispidulus</i> var. <i>dissectus</i>	1	2	1	0
<i>Solanum prinophyllum</i>	1	43	1	6
<i>Solenogyne bellioides</i>	1	3	1	0
<i>Sorghum leiocladum</i>	1	4	1	0
<i>Sporobolus creber</i>	1	15	1	1
<i>Sporobolus elongatus</i>	1	16	1	0
<i>Stackhousia muricata</i>	1	3	1	0
<i>Stackhousia viminea</i>	1	41	1	2
<i>Themeda australis</i>	3	85	1	16
<i>Tricoryne elatior</i>	1	40	1	2



Species	C/A	Freq	C/AO	FreqO
<i>Vernonia cinerea</i> var. <i>cinerea</i>	1	35	1	4
<i>Veronica plebeia</i>	1	40	1	10
<i>Vittadinia cuneata</i> var. <i>cuneata</i>	1	5	1	1
<i>Vittadinia pustulata</i>	1	3	1	0

Species	C/A	Freq	C/AO	FreqO
<i>Wahlenbergia communis</i>	1	7	1	2
<i>Wahlenbergia gracilis</i>	1	59	1	10
<i>Wurmbea dioica</i> subsp. <i>dioica</i>	1	8	1	0
<i>Zornia dyctiocarpa</i> var. <i>dyctiocarpa</i>	1	6	1	0



APPENDIX 2: Final Determination Shale Sandstone Transition Forest

Shale/sandstone transition forest - endangered ecological community listing

NSW Scientific Committee - final determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list the Shale/Sandstone Transition Forest in the Sydney Basin Bioregion as an ENDANGERED ECOLOGICAL COMMUNITY on Part 3 of Schedule 1 of the Act. The listing of endangered ecological communities is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. Shale/Sandstone Transition Forest (SSTF) is the name given to the plant community characterised by the species assemblage listed in paragraph 4, which occurs on areas transitional between the clay soils derived from Wianamatta Shale and the sandy soils derived from Hawkesbury Sandstone on the margins of the Cumberland Plain. All sites are within the Sydney Basin Bioregion. (The community is identified and discussed in UBBS (1997) under the name Western Shale/Sandstone Transition Forest. Most of the UBBS Eastern Shale/Sandstone Transition Forest is attributable to Cooks River Clay Plain Scrub Forest.)
2. SSTF occurs or has occurred in the Bankstown, Baulkham Hills, Blue Mountains, Campbelltown, Hawkesbury, Liverpool, Parramatta, Penrith, and Wollondilly Local Government Areas (LGAs).
3. The floristic composition of the community includes species otherwise characteristic of, or occurring in, either sandstone or shale habitats. The structure of the community is forest or woodland.
4. SSTF is characterised by an assemblage of species:

- | | |
|-----------------------------------|---------------------------------|
| • <i>Acacia brownii</i> | • <i>Corymbia gummifera</i> |
| • <i>Acacia decurrens</i> | • <i>Corymbia maculata</i> |
| • <i>Acacia falcata</i> | • <i>Cryptandra amara</i> |
| • <i>Acacia implexa</i> | • <i>Cymbopogon refractus</i> |
| • <i>Acacia parramattensis</i> | • <i>Danthonia tenuior</i> |
| • <i>Acacia parvipinnula</i> | • <i>Daviesia ulicifolia</i> |
| • <i>Allocasuarina littoralis</i> | • <i>Dianella prunina</i> |
| • <i>Allocasuarina torulosa</i> | • <i>Dodonaea triquetra</i> |
| • <i>Angophora bakeri</i> | • <i>Einadia hastata</i> |
| • <i>Angophora costata</i> | • <i>Entolasia stricta</i> |
| • <i>Angophora floribunda</i> | • <i>Eragrostis brownii</i> |
| • <i>Aristida vagans</i> | • <i>Eremophila debilis</i> |
| • <i>Arthropodium milleflorum</i> | • <i>Eucalyptus agglomerata</i> |
| • <i>Astrotricha latifolia</i> | • <i>Eucalyptus beyeriana</i> |
| • <i>Banksia spinulosa</i> | • <i>Eucalyptus crebra</i> |
| • <i>Bossiaea obcordata</i> | • <i>Eucalyptus eugenioides</i> |
| • <i>Bossiaea prostrata</i> | • <i>Eucalyptus fibrosa</i> |
| • <i>Bracteata bracteantha</i> | • <i>Eucalyptus globoidea</i> |
| • <i>Breynia oblongifolia</i> | • <i>Eucalyptus haemastoma</i> |
| • <i>Bursaria spinosa</i> | • <i>Eucalyptus moluccana</i> |
| • <i>Calotis cuneifolia</i> | • <i>Eucalyptus notabilis</i> |
| • <i>Cheilanthes sieberi</i> | • <i>Eucalyptus oblonga</i> |
| • <i>Chenopodium carinatum</i> | • <i>Eucalyptus paniculata</i> |
| • <i>Corymbia eximia</i> | • <i>Eucalyptus pilularis</i> |



- *Eucalyptus punctata*
- *Eucalyptus resinifera*
- *Eucalyptus sclerophylla*
- *Eucalyptus siderophloia*
- *Eucalyptus sparsifolia*
- *Eucalyptus squamosa*
- *Eucalyptus tereticornis*
- *Euchiton sphaericus*
- *Exocarpos cupressiformis*
- *Exocarpos strictus*
- *Glycine clandestina*
- *Gompholobium grandiflorum*
- *Goodenia hederacea*
- *Grevillea mucronulata*
- *Hakea dactyloides*
- *Hakea sericea*
- *Hardenbergia violacea*
- *Hibbertia aspera*
- *Hibbertia diffusa*
- *Hypericum gramineum*
- *Indigofera australis*
- *Kunzea ambigua*
- *Lasiopetalum parviflorum*
- *Lepidosperma laterale*
- *Leptospermum trinervium*
- *Leucopogon juniperinus*
- *Leucopogon lanceolatus*
- *Leucopogon microphyllus*
- *Leucopogon muticus*
- *Lomandra filiformis*
- *Lomandra longifolia*
- *Lomatia silaifolia*
- *Melaleuca thymifolia*
- *Microlaeana stipoides*
- *Microlaeana stipoides*
- *Olearia microphylla*
- *Ozothamnus diosmifolius*
- *Persoonia linearis*
- *Phyllanthus gasstroemii*
- *Phyllanthus hirtellus*
- *Pimelea linifolia*
- *Platylobium formosum*
- *Poa labillardieri*
- *Poa sieberiana*
- *Pomax umbellata*
- *Pratia purpurascens*
- *Pultenaea flexilis*
- *Pultenaea villosa*
- *Siegesbeckia orientalis*
- *Solanum prinophyllum*
- *Sporobolus creber*
- *Stackhousia muricata*
- *Stellaria flaccida*
- *Styphelia laeta*
- *Syncarpia glomulifera*
- *Themeda australis*
- *Vernonia cinerea*
- *Wahlenbergia gracilis*

Not all these species will be present in every single stand, and the total species list from all stands of the community is considerably larger than that listed above. Depending on the disturbance history of a particular site a proportion of the species may be present only in the soil seed bank.

5. Characteristic tree species in SSTF are; *Eucalyptus punctata*, *Eucalyptus resinifera*, one of the stringybarks (*Eucalyptus globoidea*, *Eucalyptus eugenioides*, *Eucalyptus sparsifolia*, *Eucalyptus agglomerata*). One or more ironbarks (*Eucalyptus fibrosa*, *Eucalyptus crebra*, *Eucalyptus paniculata*, *Eucalyptus beyeriana*) may be locally important.

6. SSTF has an understorey which may be either grassy and herbaceous or of a shrubby nature. In areas that have not been burnt for an extended period of time the understorey may be dense.

7. Species composition varies between sites depending on geographical location and local conditions (e.g., topography, relative influence of sandstone or shale).

8. SSTF provides habitat for a number of plant species recognised as being of national, state or regional conservation significance in UBBS (1997). These include:

- *Acacia irrorata*
- *Acacia leiocalyx*
- *Acacia lunata* (formerly part of *A. buxifolia*)
- *Arthropodium milleflorum*
- *Bossiaea prostrata*
- *Bothriochloa decipiens*
- *Bothriochloa macra*
- *Calotis dentex*
- *Centaurium spicatum*
- *Chamaesyce dallachyana*
- *Cyperus laevis*



- *Danthonia racemosa*
- *Darwinia biflora*
- *Dichelachne crinita*
- *Digitaria ramularis*
- *Einadia trigonos*
- *Entolasia stricta* var *hirsuta*
- *Epacris purpurascens* var *purpurascens*
- *Eucalyptus globoidea*
- *Eucalyptus pilularis*
- *Eucalyptus squamosa*
- *Glycine microphylla*
- *Gompholobium huegelii*
- *Gonocarpus longifolius*
- *Lasiopetalum ferrugineum*
- *Lepidium pseudohyssopifolium*
- *Leucopogon juniperinus*
- *Leucopogon juniperinus*
- *Mentha satuireioides*
- *Oxalis perennans*
- *Persoonia hirsuta*
- *Phyllanthus similis*
- *Platylobium formosum*
- *Polymeria calycina*
- *Prostanthera incisa*
- *Pterostylis saxicola*
- *Pultenaea scabra* var *biloba*
- *Scaevola albida*
- *Senecio hispidulus*
- *Solenogyne bellioides*
- *Sporobolus creber*
- *Stackhousia muricata*
- *Tetratheca glandulosa*
- *Thysanotus juncifolius*
- *Thysanotus tuberosus*
- *Viola betonicifolia*

9. SSTF generally occurs on soils derived from a shallow shale or clay material overlying sandstone, or where shale-derived materials has washed down over sandstone-derived substrate. Such sites are generally close to the geological boundary between the Wianamatta Shale and the Hawkesbury Sandstone.

10. SSTF occurs on plateaux and hillsides and at the margins of shale cappings over sandstone.

11. Many occurrences of SSTF are as linear stands, which may be as narrow as 20 metres. The small size and scattered distribution of the remnant stands of the community makes provision of a comprehensive map of occurrences impractical. Details of the distribution of many stands are provided in UBBS (1997).

12. Adjacent communities on shale soils are generally Cumberland Plain Woodland, while adjacent communities on sandstone soils are generally part of the Sydney Sandstone Complex (sensu Benson & Howell 1990).

13. Small areas of SSTF are presently included in only three conservation reserves, Blue Mountains National Park, Cattai National Park and Gulguer Nature Reserve.

14. A large proportion of the area where SSTF occurred in the past has been cleared for agriculture and urban development. Remnants are small and scattered. Identified threats include: clearing, physical damage from recreational activities, rubbish dumping, grazing, mowing and weed invasion.

15. In view of the small size of existing remnants the threat of further clearing and other threatening processes, the Scientific Committee is of the opinion that SSTF in the Sydney Basin Bioregion is likely to become extinct in nature unless the circumstances and factors threatening its survival cease to operate and that listing as an endangered ecological community is warranted.

Proposed gazettal date: 11/9/98

Exhibition period: 11/9/98 to 23/10/98

References:

UBBS (1997) - Urban Bushland Biodiversity Survey, National Parks and Wildlife Service and Benson, D.H. and Howell, J. (1990), Taken for granted: the bushland of Sydney and its suburbs (Kangaroo Press, Kenthurst)



APPENDIX 3: List of Flora Species Recorded at 1442 & 1442A Kurmond Road, Kurmond

Plant Communities

Forest Red Gum-Grey Box-Acacia Woodland (CSHW/Moist Shale Woodland) - T1

Cabbage Gum-Forest Red Gum-Acacia Woodland (Moist Shale Woodland) - T2

Exotic grassland surround - T3

KEY

Indicative frequency of occurrence in transects

v = very common

c = common

o = occasional

r = rare

* indicates introduced species

"adj" indicates occurs adjacent to transect

FAMILY	SCIENTIFIC NAME	COMMON NAME	TRANSECT		
			T1	T2	T3
Canopy Trees					
Myrtaceae	<i>Eucalyptus amplifolia</i>	Cabbage Gum	o		
	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	v	c	
	<i>Eucalyptus moluccana</i>	Grey Box	o	r	
	<i>Eucalyptus ?paniculata</i>	Grey Ironbark	adj		
	<i>Eucalyptus punctata</i>	Grey Gum		r	
	<i>Eucalyptus tereticornis</i>	Forest Red Gum	v	o	
Small Trees					
Casuarinaceae	<i>Allocasuarina torulosa</i>	Forest Oak	r	r	
Fabaceae	<i>Acacia implexa</i>	Hickory Wattle	r	r	
	<i>Acacia parramattensis</i>	Parramatta Wattle	c	v	
Meliaceae	<i>Melia azedarach</i>	White Cedar	o	r	
Myrtaceae	<i>Backhousia myrtifolia</i>	Grey Myrtle		v- ck	
Oleaceae	* <i>Ligustrum lucidum</i>	Large-leaved Privet	r		
	* <i>Olea europaea</i> subsp <i>cuspidata</i>	African Olive	o		
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash	o	r	
Santalaceae	<i>Exocarpos cupressiformis</i>	Cherry Ballart		r	
Shrubs					
Araliaceae	<i>Polyscias sambucifolius</i>	Elderberry Panax		r	
Asteraceae	<i>Ozothamnus diosmifolius</i>	White Dogwood		c	
Boragibaceae	<i>Ehretia acuminata</i>	Koda		r-ck	
Celastraceae	<i>Maytenus silvestris</i>	Narrow-leaved Orangebark	r	o	
Euphorbiaceae	<i>Breynia oblongifolia</i>	Dwarfs Apples		o	
	<i>Phyllanthus gasstroemii</i>			r	
Fabaceae	<i>Acacia implexa</i>	Hickory Wattle saplings		o	
	<i>Acacia parramattensis</i>	Parramatta wattle saplings			r
	* <i>Acacia podalyrifolia</i>	Queensland Wattle	r		
	* <i>Senna floribunda</i>		r	o	
Meliaceae	<i>Melia azedarach</i>	White Cedar saplings	o		r
Myrtaceae	* <i>Corymbia citriodora</i>	sapling	r		
	<i>Eucalyptus teretifolia</i>	saplings	o		
Ochnaceae	* <i>Ochna serrulata</i>	Mickey Mouse Plant	o	o	



FAMILY	SCIENTIFIC NAME	COMMON NAME	TRANSECT		
			T1	T2	T3
Oleaceae	* <i>Ligustrum lucidum</i>	Privet saplings & seedlings	o	o	
	* <i>Ligustrum sinense</i>	Privet saplings & seedlings	v	c	r
	<i>Notelaea longifolia</i>	Large Mock Olive		o	
Pittosporaceae	<i>Bursaria spinosa</i>	Blackthorn	c	v	
	<i>Pittosporum undulatum</i>	Sweet Pittosporum saplings		r	
Proteaceae	* <i>Grevillea robusta</i>	Silky Oak sapling	r		
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash saplings	o	o	
Solanaceae	* <i>Lycium ferocissimum</i>	African Boxthorn	o		
	* <i>Solanum mauritianum</i>	Tobacco Weed	r	r	
Sterculiaceae	* <i>Brachychiton acerifolius</i>	Flame Tree sapling	r		
Ulmaceae	<i>Trema aspera</i>	Poison Peach		r	
Verbenaceae	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum		r	
	* <i>Lantana camara</i>	Lantana	v	c	
Herbs - Ferns					
Adiantaceae	<i>Adiantum aethiopicum</i>	Common Maidenhair Fern		c -ck	
Aspleniaceae	<i>Asplenium flabellifolium</i>	Necklace Fern		r	
Blechnaceae	<i>Doodia aspera</i>	Rasp Fern		c-ck	
	<i>Doodia caudata var caudata</i>	Little Rasp Fern		r-ck	
Dicksoniaceae	<i>Calochlaena dubia</i>	False Bracken Fern		r	
Sinopteridaceae	<i>Cheilanthes sieberi</i>	Rock Fern	o	o	
	<i>Pellaea falcata</i>	Sickle Fern	c	c	
Herbs - Dicots					
Acanthaceae	<i>Pseuderanthemum variabile</i>	Pastel Flower	o	o	
	<i>Brunoniella australis</i>	Purple Trumpet		o	
Apiaceae	<i>Centella asiatica</i>	Pennywort	o	o	c
Asteraceae	* <i>Bidens pilosa</i>	Farmers Friends	o		
	<i>Calotis dentex</i>			c	
	* <i>Cirsium vulgare</i>	Spear Thistle	r		
	* <i>Conyza bonariensis</i>	a Fleabane	c	c	c
	<i>Chrysocephalum apiculatum</i>	Yellow Buttons		r	
	* <i>Gnaphalium americanum</i>	a Cudweed		r	
	* <i>Hypochaeris microcephala</i>		r		
	* <i>Hypochaeris radicata</i>	Flatweed		r	c
	* <i>Senecio madagascariensis</i>	Fireweed	o	o	c
	<i>Sigesbeckia orientalis</i>		r	o	
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	r		
Convolvulaceae	<i>Dichondra repens</i>	Kidney Plant	c	c	
Geraniaceae	<i>Geranium homeanum</i>	a Storksbill		r	
Lamiaceae	<i>Ajuga australis</i>	Austral Bugle	r		
Lobeliaceae	<i>Pratia purpurascens</i>	White Root		o	
Malvaceae	* <i>Sida rhombifolia</i>	Paddys Lucerne	c	o	o
Oxalidaceae	<i>Oxalis ?perennans</i>			o	
Phytolaccaceae	* <i>Phytolacca octandra</i>	Inkweed	r		
Plantaginaceae	<i>Plantago debilis</i>			o	
	* <i>Plantago lanceolata</i>	Lambs Tongue	c		v
Polygonaceae	<i>Persicaria decipiens</i>		r		
	<i>Rumex brownii</i>		r		
Primulaceae	* <i>Anagallis arvensis</i>	Scarlet Pimpernel		r	o
Solanaceae	* <i>Solanum nigrum</i>	Blackberry Nightshade	o	o	



FAMILY	SCIENTIFIC NAME	COMMON NAME	TRANSECT		
			T1	T2	T3
	<i>Solanum prinophyllum</i>			c	
Verbenaceae	* <i>Verbena</i> sp.	Purpletop		r	
Violaceae	<i>Viola hederacea</i>	Native Violet		r-ck	
Herbs - Monocots					
Asparagaceae	* <i>Asparagus asparagoides</i>	Bridal Veil Creeper	o		
Anthericaceae	* <i>Chlorophytum comosum</i>	Spider Lily		r	
Commelinaceae	<i>Commelina cyanea</i>	Blue Wandering Jew	c	c	
Cyperaceae	<i>Carex appressa</i>			o-ck	
	<i>Carex longibrachiata</i>		c	v	o
	<i>Gahnia aspera</i>	Rough Saw-sedge	c	c	
	<i>Juncus usitatus</i>	Forest Rush			r
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush		o	
Poaceae	<i>Aristida ramosa</i>	Tree-awned Grass	r		
	<i>Austrostipa ?ramosissima</i>	Bamboo Grass		r	
	* <i>Axonopus affinis</i>	Carpet Grass		r	
	<i>Bothriochloa decipiens/macra</i>		r		
	* <i>Cynodon dactylon</i>	Couch Grass	c		v
	<i>Echinopogon ovatus</i>	Hedgehog Grass		r	
	<i>Entolasia stricta</i>	Wiry Panic		c	
	<i>Microlaena stipoides</i>	Weeping Meadow-grass	v	v	c
	<i>Oplismenus aemulus</i>	Basket Grass	c	c	
	* <i>Paspalum dilatatum</i>	Paspalum	o		v
	* <i>Pennisetum clandestinum</i>	Kikuyu	r	r	
	<i>Themeda australis</i>	Kangaroo Grass	v		
Vines					
Apocynaceae	* <i>Araujia sericifera</i>	Moth Vine	r		
Asclepiadaceae	<i>Tylophora barbata</i>	Purple Tylophora		r	
Bignoniaceae	* <i>Macfadyena unguis-cati</i>	Cats Claw Creeper	o		
	<i>Pandorea pandorana</i>	Wonga Wonga Vine		r	
Fabaceae	<i>Glycine tabacina</i>		r		
Menispermaceae	<i>Sarcopetalum harveyanum</i>	Pearl Vine		r	
Ranunculaceae	<i>Clematis glycinoides</i>	Travellers Joy	r		
Rosaceae	* <i>Rubus fruticosus</i>	Blackberry	r	r	o
	<i>Rubus parvifolius</i>	Small-leaved Bramble	r	r	
Rubiaceae	<i>Morinda jasminoides</i>	Jasmine Morinda		r	
Vitaceae	<i>Cayratia clematidea</i>	Slender Grape		r	
	<i>Cissus antarctica</i>	Simple-leaved Water Vine		r	
Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat Berry		r	
	<i>Geitonoplesium cymosum</i>	Scrambling Lily		r	



APPENDIX 4: List of Fauna Species Recorded within the Study Area

Observation Type:

A	Stranding/Beaching	I	Subfossil/Fossil remains	S	Shot
B	Burnt	K	Dead	T	Trapped or netted
C	Cat kill	M	Miscellaneous	U	Anabat
D	Dog Kill	N	Not located	V	Fox kill
E	Nest/Roost	O	Seen	W	Heard
F	Tracks or scratchings	P	Scat	X	In scat
FB	Burrow	Q	Camera	Y	Bone, teeth, shell
G	Crushed cones	R	Road kill	Z	In raptor/owl pellet
H	Hair, feathers or skin				

* Introduced species > greater than + at least # threatened species

Note: For this report, echolocation call identifications have been assigned to three categories with regard to certainty of identification (see Section 4.2). These are:

C - Confident Identification. Small possibility of confusion of calls with those of other bat species.

P - Probable Identification. Some possibility of confusion of calls with those of other bat species.

Po - Possible Identification. Likely to be confused with calls with those of other bat species.

COMMON NAME	SCIENTIFIC NAME	OBSERVATION METHOD	COUNT	
			WITHIN SITE	NEARBY/ FLY-OVER
Reptiles (3)				
Dark-flecked Sunskink	<i>Lampropholis delicata</i>	O	4	-
Eastern Water Dragon	<i>Physignathus lesueurii</i>	Q	1	-
Robust Ctenotus	<i>Ctenotus robustus</i>	O	1	-
Birds (35)				
Australian Magpie	<i>Cracticus tibicen</i>	O	2	-
Australian Raven	<i>Corvus coronoides</i>	O	2	7
Australian White Ibis	<i>Threskiornis molucca</i>	O		>30
Bar-shouldered Dove	<i>Geopelia humeralis</i>	W	1	
Bell Miner	<i>Manorina melanophrys</i>	O/W	>20	2
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	O	1	-
Brown Cuckoo-dove	<i>Macropygia amboinensis</i>	W	1	-
Common Myna *	<i>Sturnus tristis</i>	O	2	-
Crested Pigeon	<i>Ocyphaps lophotes</i>	O	-	1
Eastern Rosella	<i>Platycercus eximius</i>	O	4	-
Eastern Whipbird	<i>Psophodes olivaceus</i>	O/W	2	-
Eurasian Blackbird *	<i>Turdus merula</i>	O	3	-
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>	W	1	
Galah	<i>Eolophus roseicapillus</i>	O	2	
Golden Whistler	<i>Pachycephala pectoralis</i>	O/W	1	-
Grey Butcherbird	<i>Cracticus torquatus</i>	O/W	1	1
Grey Fantail	<i>Rhipidura albiscapa</i>	W	1	-
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	O/W	1	2
Lewin's Honeyeater	<i>Meliphaga lewinii</i>	O	1	-
Little Corella	<i>Cacatua sanguinea</i>	O	-	1
Magpie-lark	<i>Grallina cyanoleuca</i>	O	2	2
Noisy Miner	<i>Manorina melanocephala</i>	O	2	-
Olive-backed Oriole	<i>Oriolus sagittatus</i>	O	1	-
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	W	-	2
Red-browed Finch	<i>Neochmia temporalis</i>	O	4	-



COMMON NAME	SCIENTIFIC NAME	OBSERVATION METHOD	COUNT	
			WITHIN SITE	NEARBY/ FLY-OVER
Red-rumped Parrot	<i>Psephotus haematonotus</i>	O	-	1
Rufous Fantail	<i>Rhipidura rufifrons</i>	O	1	-
Sacred Kingfisher	<i>Todiramphus sanctus</i>	O	1	-
Striated Thornbill	<i>Acanthiza lineata</i>	O	3	
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	O/W	-	2
Superb Fairy-wren	<i>Malurus cyaneus</i>	O/W	5+	2
Varigated Fairy-wren	<i>Malurus lamberti</i>	O	3	-
Welcome Swallow	<i>Hirundo neoxena</i>	O	4	-
White-browed Scrub-wren	<i>Sericornis frontalis</i>	O	3	-
Willie Wagtail	<i>Rhipidura leucophrys</i>	O	2	-
Mammals (11)				
Deer (unidentified) *	<i>Cervus</i> sp.	Q	1	-
Dog *	<i>Canis lupus familiaris</i>	Q	2	-
Eastern Bentwing Bat #	<i>Miniopterus schreibersii oceanensis</i>	U (possible)	1+	N/A
Eastern False Pipistrelle #	<i>Falsistrellus tasmaniensis</i>	U (possible)	1+	N/A
Eastern Freetail Bat #	<i>Mormopterus norfolkensis</i>	U (confident)	1+	N/A
Greater Broad-nosed Bat #	<i>Scoteanax rueppellii</i>	U (possible)	1+	N/A
Horse *	<i>Equus caballus</i>	P	1+	-
Little Forest Bat	<i>Vespadelus vulturnus</i>	U (probable)	1+	N/A
Rabbit *	<i>Oryctolagus cuniculus</i>	O/F/P	2+	-
Undescribed Freetail Bat	<i>Mormopterus "Species 2"</i>	U (probable)	1+	N/A
White-striped Freetail-bat	<i>Tadarida australis</i>	U (confident)	1+	N/A