Technical Studies: Flora and Fauna Survey & Ecological Assessment: Lot 2 in DP805023 Kurmond Road, Kurmond

5 May 2014

Prepared for
Mr. Ernest. Bennett

Prepared by
UBM Ecological Consultants Pty Ltd

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Executive Summary

Background

UBM Ecological Consultants has been commissioned by project managers Falson & Associates on behalf of the Proponent Mr Ernest Bennett to undertake Ecological Investigations in support of a proposed 12-Lot residential subdivision on Lot 2 in DP 805023; which is located at #1420 Kurmond Road, Kurmond. The current Report comprises a revision of an earlier report prepared UBM (April 2010) for a previous landowner and has been undertaken at the request of Glen Falson of Falson & Associates and following discussions with the Proponent. The Ecological Studies Report will be submitted to Hawkesbury City Council accompanied by a Development Application in the near future.

The Subject Property known as 'Dayspring' is a rural residential property 11.4 ha in size located on the northern fringe of Kurmond Village close to Bells Line of Road. It adjoins Kurmond Primary School to the south-west, while rural residential properties are located on its other boundaries. Howes Creek flows though the northern part of the Property, effectively dividing Lot 2 into two (2) unequal parcels of land; with only the larger parcel on the southern side of the Creek being proposed for development.

The Subject Property is former agricultural land used first for orcharding and latterly for stock grazing. It is currently vacant land with two (2) existing dwellings and outbuildings located close to Kurmond Road. There are two (2) farm dams on the Property.

The Property retains a large stand of native vegetation (bushland) with a highly modified understorey. This bushland is located in the gully which runs along the Property's western boundary, and extends along Howes Creek, a tributary of the Hawkesbury River which traverses the Property close to its northern boundary (see aerial photograph *Figure 2.2*). The current Proposal includes the retention and conservation of approximately six (6) ha of native bushland which occupies the gully along the western property boundary and extends down to the riparian corridor along Howes Creek.

The objective of the current Report is to provide updated information on the ecological resources of the Subject Property and to determine the likelihood of any threatened ecological communities, species or populations occurring on site. The presence of any threatened entity may present a constraint to the Proposal.

This Report has been prepared to consider those threatened entities listed under the Schedules of the NSW *Threatened Species Conservation Act 1995* ('*TSC Act*') and/or the Commonwealth *Environmental Protection & Biodiversity Conservation Act 1999* ('*EPBC Act*').

Results:

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

Two (2) regionally significant species were located: *Eucalyptus bosistoana* and *Celstrus australis.* These species are considered to be rare regionally and therefore are ecologically significant (NPWS 1997). However, regionally significant species are not listed or protected under the legislation.

Plant Communities:

Four (4) plant communities: were recorded: three (3) were naturally occurring (or native) communities and the fourth was an introduced grassland established as grazing pasture. These communities are described as:

- Forest Red Gum Woodland (=Cumberland Shale Plains Woodland with elements of Moist Shale Woodland);
- Forest Red Gum-Cabbage Gum Woodland (=Cumberland Shale Sandstone Transition Forest with elements of Moist Shale Woodland);
- Wattle-Privet Scrub
- Exotic Grassland (pasture).

Cumberland Shale Plains Woodland is part of the Cumberland Plain Woodland Complex which is listed as 'critically endangered' under both the NSW *TSC Act* and Commonwealth *EPBC Act.*

Moist Shale Woodland is listed under the NSW legislation as 'endangered', while (Cumberland) Shale Sandstone Transition Forest is listed under both NSW and Commonwealth legislation as 'endangered'.

The Cumberland Shale Plains Woodland with elements of Moist Shale Woodland is found on the upper slopes of the Property off Kurmond Road and in the broad gully on the western boundary. This area is not proposed for development, although it is possible that part of this bushland may be cleared or modified to create an Asset Protection Zone for bushfire safety purposes.

Cumberland Shale Sandstone Transition Forest occurs along Howes Creek, which is downslope (north) and outside the proposed development area. A minimum area of 40 metres from the riparian corridor is recommended to serve as a 'buffer zone' between the lower edges of the proposed development and the reserved bushland.

Fauna: Three (3) habitat types, associated with varying degrees of significance, were identified on the Property: Woodland (moderate value), Aquatic (moderate value) and open pastoral/paddock (low value). The Open Woodland and Aquatic habitats will not be directly impacted by the development and hence require no further assessment. The low value pastoral land in the south eastern section of the Subject Property will present a low impact on resident fauna species.

By the completion of the field survey (April 2014), 42 bird species were detected within, adjacent to, or flying over the Subject Property; the latter identified by their distinctive calls as well as observation. One (1) native reptile and three (3) amphibians were identified within the Subject Property. Two (2) introduced (domestic) mammals and one (1) pest species were also identified (*Appendix 4*). Horses have grazed on pastoral land within Property within a period of the last several years.

Six (6) species of microchiropteran bats were identified with varying degrees of confidence. Two (2) 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 the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) was identified as a 'possible' call (see *Table 4.2* and *Appendix 4*).

Considering that no roosting sites or foraging habitats will be removed or impacted under the Proposal and the fauna assessment has confirmed that these microbat species will not be influenced by off-site impacts. a Seven-part Test of Significance is not required for these three (3) microbat species, listed as Vulnerable under NSW State legislation, i.e. the *TSC Act.* However as there are two (2) large habitat trees (Forest Red Gum, *E. tereticornis*) in the south western corner of the Property and two stags in the far end of the paddock (see *Figure 4-5*) that will likely be removed during construction, it is recommended that a qualified Ecologist be present whilst the felling of these trees occurs.

No other threatened fauna species were identified during the current field investigations.

Recommendations:

In considering the potential ecological impacts of the proposed rural residential subdivision at 1420 Kurmond Road Kurmond, UBM recommends that:

- The reserved bushland in the western gully and extending to the Howes Creek Riparian Corridor should be managed under a site specific Vegetation Management Plan. Such a plan will provide guidelines for bush regeneration/weed control works and will identify priority tasks and actions to re-establish the native bushland as a viable ecological community.
- Noxious weed control (5 species identified) should be given priority in any future bush regeneration/weed control program.
- 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).
- There is some 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 (even those non-indigenous trees on the upper slopes around the existing residences) 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 stringy bark 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 along Howes Creek. A grassed buffer

zone between the lowest building allotment and the creek is highly recommended. The Office of Water recommends a minimum width of 40 metres.

- Care should be taken to maintain the integrity of the aquatic habitats present in the two (2) farm dams: these will be incorporated into the reserved bushland area and appropriately managed as habitat for native fauna.
- Hollow-bearing trees should be allocated the highest priority for retention, given public safety issues and bushfire protection considerations. See *Figure 4.5* for location of habitat trees.
- Where potential habitat trees are removed for construction or bushfire safety purposes, an experienced Ecologist should be on site to examine the tree for the presence of native fauna. If such fauna are located and no obvious habitat on site is available for relocation, WIRES should be contacted to help relocate the animal. If fauna is injured or requires an assessment of health then WIRES or a local Wildlife Carer should be contacted immediately.
- In order to replace any habitat trees removed, the installation of nesting boxes for microbats should be considered. Habitat trees likely to be utilised by microbats are those with small hollows and/or deep fissured bark.

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.

Front Cover:

Photo 1 – Emerald-spotted Tree Frog (Litoria peronii) on the Subject Property at Kurmond
Photo 2 – Gully running north towards Howes Creek from the entrance of the Subject Property
Photo 3 – Farm dam with water lilies on the south eastern end of the Property

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Certification

I, Judith Rawling Managing Director of UBM Ecological Consultants Pty Ltd hereby state that the Flora and Fauna Survey and Ecological Investigations undertaken for the Subject Property, that is Lot 2 DP805023 at 1420 Kurmond Road, Kurmond has been prepared in consideration of the schedules and requirements of *the* NSW *Threatened Species Conservation Act 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Survey methods conform to the *'Threatened Species and Regional Biodiversity Survey and Assessment Guidelines'* (DECC 2007).

The UBM Ecological Consultants project team charged with preparing this Report were:

- Judith Rawling (BA,DipEd,DipEnvStud,MEnvSt)
- De-Anne Attard (BSc, Hons)
- Heather Clarksen (BLibStud, Hons)

Disclaimer

The preparation of this Report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the Report. All findings, conclusions or recommendations contained within the Report are based only on the aforementioned circumstances.

The Report has been prepared for use by the Client, and no responsibility for its use by other parties is accepted by UBM Ecological Consultants Pty Ltd.

Judith Rawling
Managing Director UBM Ecological Consultants
Member AIB, MESA, MEIANZ, Member Executive Council ECA (NSW)

Draft Report 28 April 2014
Final Report 5 May 2014

Definition of Terms

Council/HCC– Hawkesbury City Council

CPW – Cumberland Plain Woodland; listed as a 'critically endangered ecological community' under the NSW *Threatened Species Conservation Act 1995 and* (with) Shale-Gravel Transition Forest under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

CSPW – Cumberland Shale Plains Woodland (per Tozer 2006/2010) – a component of the above-named CPW ecological community

CSHW - Cumberland Shale Hills Woodland (per Tozer 2006/2010) – a component of the above-named CPW ecological community

Ecological Community – an assemblage of species with 6 types of properties, composition; structure; habitat; distribution; interactions between their component species, and ecological processes and function (Keith 2009); and occupying a particular area at a particular time.

CEEC – Critically Endangered Ecological Community – as determined by the NSW Scientific Committee and described as–a community facing an extremely high risk of extinction in the immediate future, as listed under State and/or Commonwealth threatened species legislation

EVNT – Critically Endangered, Endangered, Vulnerable, Near-threatened and/or Threatened fauna/flora species as listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the *NSW Threatened Species Conservation Act 1995* (TSC Act).

EEC – Endangered Ecological Community – as determined by the NSW Scientific Committee and described as–a community facing a risk of extinction in the immediate future, as listed under State and/or Commonwealth threatened species legislation

DECCW – NSW Department of Environment, Climate Change and Water (now the Office of Environment & Heritage under the Department of Premier and Cabinet)

Direct Impacts are those that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat.

Indirect Impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas.

EPBC Act – Commonwealth *Environment Protection & Biodiversity Conservation Act 1999*

Habitat – an area or areas occupied, or periodically or occasionally occupied by a species, population or ecological community, and including any biotic or abiotic components present.

LGA – Local Government Area, here Hawkesbury

Locality – generally, an area within 1-2 kilometres of the Study Area

MSW – Moist Shale Woodland, an endangered ecological community under the NSW *TSC Act* and together with Western Sydney Dry Rainforest is listed under the Commonwealth *EPBC Act.*

Noxious Weed – a species gazetted for the Hawkesbury County Council Control Area (which includes Hawkesbury LGA) under the *Noxious Weeds Act 1995* (amended 2000)

NPWS – National Parks & Wildlife Unit of the Office of Environment & Heritage

OEH – Office of Environment & Heritage under the NSW Department of Premier and Cabinet (formerly DECCW)

RFS – NSW Rural Fire Service

SCIVI – *Southeast NSW Native Vegetation Classification and Mapping,* by Tozer *et al.* 2010 for former NSW Department of Environment and Climate Change (DECCW)[1].

SSTF – Shale Sandstone Transition Forest, a plant community listed as 'endangered' under the NSW *TSC Act* and the Commonwealth *EPBC Act.*

Study Area - means all land likely to be affected under the Proposal, either directly or indirectly.

Subject Property – means the land proposed for residential subdivision,-Lots 104 and 105 in DP1051618 at #1442 /1442A Kurmond Road, Kurmond

TSC Act – NSW *Threatened Species Conservation Act 1995*

UBM – UBM Ecological Consultants Pty Ltd: formerly trading as Urban Bushland Management Consultants ('UBMC')

Vegetation Community – described as an assemblage of native flora species known to occur in association with each other as a result of topography, soil landscape and rainfall.

WoNS – Weed of National Significance (Commonwealth Listing)

[1] **Reference:** Tozer, M.G., Turner, K., Simpson, C., Keith, D.A., Beukers, P., MacKenzie, B., Tindall, D. & Pennay, C. (2010). Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tableland, in Cunninghamia 11 (3)

1 INTRODUCTION

1.1 Background Information

UBM Ecological Consultants has been commissioned by project managers Falson & Associates on behalf of the Proponent Mr. Ernest Bennett to undertake Ecological Investigations in support of a proposed residential subdivision on Lot 2 in DP 805023; located at 1420 Kurmond Road.

The **Subject Property** known as 'Dayspring' is a rural residential property 11.4 ha in size located on the northern fringe of Kurmond Village close to Bells Line of Road. It adjoins Kurmond Primary School to the south-west, while other rural residential properties are located on its other boundaries. Howes Creek flows though the northern part of the Property, effectively dividing Lot 2 into two (2) unequal parcels of land; with only the larger parcel on the southern side of the Creek being proposed for development.

The Subject Property is former agricultural land used first for orcharding and latterly for stock grazing. It is currently vacant land with two (2) existing dwellings and outbuildings located close to Kurmond Road. There are two (2) farm dams on the Property. Similar residential properties on acreage are found throughout the Kurmond/Kurrajong areas. Significant stands of native bushland also occur in the Locality, especially along local drainage lines and permanent creeks.

The Subject Property retains a large stand of native vegetation (bushland) with a highly modified understorey. This bushland occurs in the deep gully which runs along the Property's western boundary, and along Howes Creek, a tributary of the Hawkesbury River which traverses the Property close to its northern boundary (see aerial photograph *Figure 2.2*).

The Subject Property is within an area mapped as Category 1 bushfire prone land (Hawkesbury City Council Bushfire Pone Lands Map). A *Bushfire Assessment Report* has been prepared by Control Line Consulting (draft March 2014).

The objective of the current Report is to provide up provide accurate information on the ecological resources of the Subject Property and to determine the likelihood of any threatened ecological communities, species or populations occurring on the site, these potentially providing some constraint to the subdivision proposal.

This Report has been prepared to consider those threatened entities listed under the Schedules of the NSW *Threatened Species Conservation Act 1995* (*'TSC Act'*) and/or the Commonwealth *Environmental Protection & Biodiversity Conservation Act 1999* (*'EPBC Act'*).

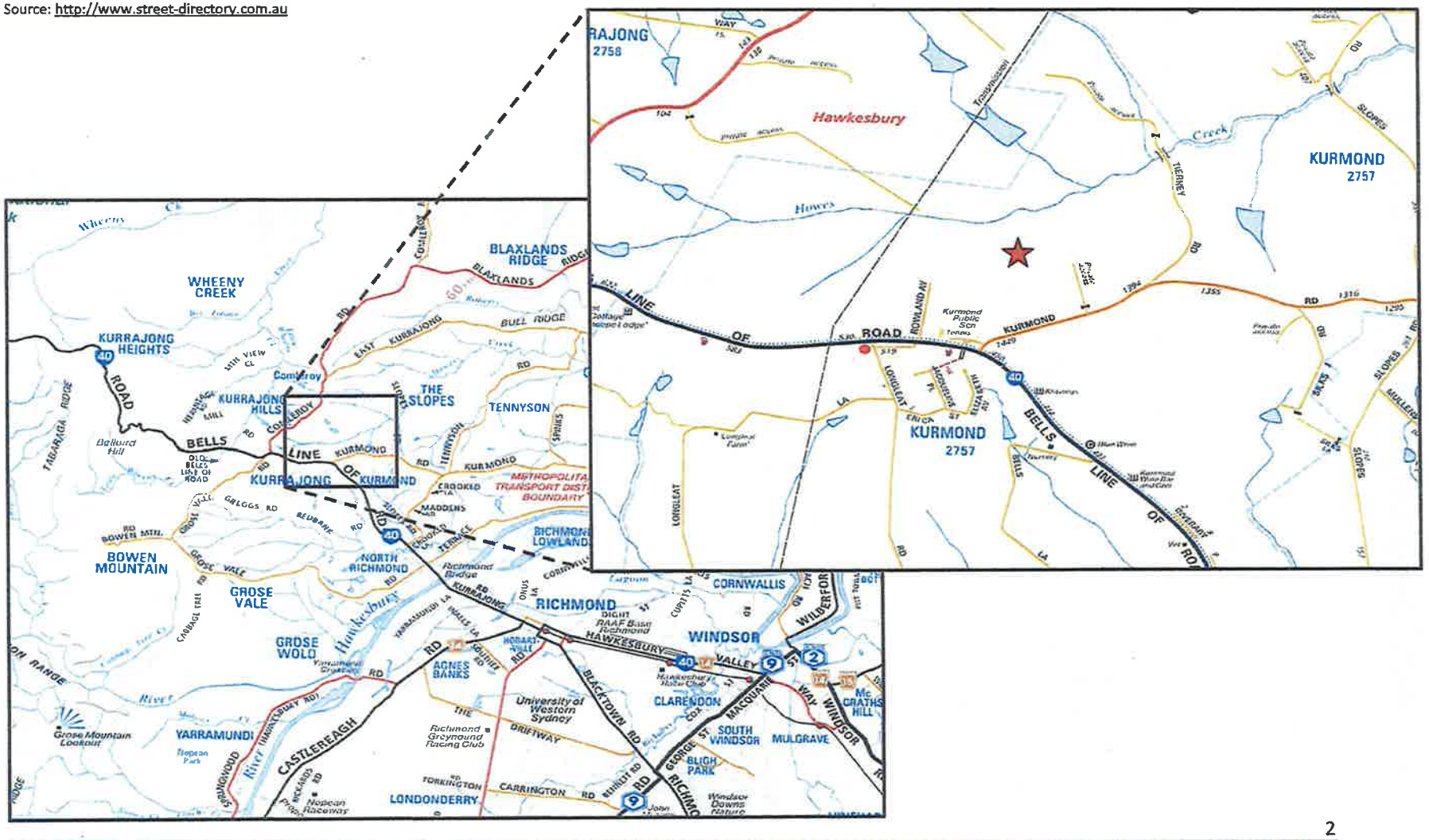
The ecological resources of the area proposed for development (the building footprints on 12 Lots), the remnant vegetation, and land elsewhere on the Subject Property has been assessed by the current Report – this area is described as 'the Study Area'.

The local positioning of the Subject Property is shown on *Figure 1.1.*

The plan of proposed rural subdivision is shown on *Figure 1.2.*

Figure 1-1: Local Positioning of the Subject Property (1420 Kurmond Road, Kurmond)

Source: http://www.street-directory.com.au



1.2 Previous Studies and Investigations

A Flora and Fauna Study was undertaken and an Ecological Assessment Report prepared for the Subject Property Dayspring on behalf of a previous owner (UBM April 2010). This Report was undertaken in support of a proposal to clear the disused orchards from the Property and to remove mullock heaps and woody weed thickets on the upper and middle slopes and land bordering the bushland gully on the eastern property boundary. It was also proposed to clear regrowth vegetation on the far northern side of Howes Creek to re-establish the grazing paddock on that part of the Property. This Proposal was subsequently approved by Hawkesbury City Council, and in 2012 the Property was sold to the current owner, who undertook the approved works.

In December 2013, preliminary ecological investigations were undertaken by UBM for Lots 104 and 105 at 1442.1442A Kurmond Road; a property which adjoins Dayspring to the west, and which is currently proposed as a similar rural residential subdivision. This property has been cleared in part to create grazing paddocks but it retains stands of native bushland, including the modified bushland in the gully which divides the two (2) properties. This subdivision proposal is currently in preparation.

More recent investigations include a Bushfire Hazard Assessment Report (Control Line Consulting, 18 March 2014) which provides for Asset Protection Zones (APZs) between the hazard (the bushland on new Lot 1) and the development footprints. These APZs will be located in cleared open paddocks.

A report entitled 'Site Constraints to On-site Wastewater Treatment and Disposal for rezoning of 1420 Kurmond Road Kurmond (Toby Fiander & Associates, 24 April 2014) has also been submitted in draft form.

1.3 Report Purpose and Objectives

The objectives of the current Report are to provide accurate up-to-date information about the ecological resources of the Subject Property and to identify any species, populations or ecological communities listed under the legislation (*TSC Act/EPBC Act)* which might occur on site.

The presence of any threatened entity may provide some level of constraint for the proposed residential subdivision, and if any such entities are present the direct and indirect impacts of the proposed development must assessed under Section 5(a) of the *Environmental Planning & Assessment Act 1979* (*'EP&A Act'*) – this commonly referred to as the Seven-part Test.

For any threatened entity present which is deemed to be of 'National Significance' the impacts of the Proposal must be reviewed under the Commonwealth Significant Assessment Guidelines. The role of the Ecological Investigations (this Report) is to flag any issues of ecological significance to be addressed in the subdivision design.

1.4 Development Proposal

The current Proposal is to subdivide existing Lot 2 to create a 12-Lot rural residential subdivision; with Lots ranging in size from 0.4 ha to 0.62 ha (see *Figure 1.2*). The draft Plan of Proposed Subdivision prepared by McKinlay Morgan & Associates (February 2014) responds to Council's *Residential Lands Strategy* (2011) which identifies areas/localities suitable for urban expansion; with lot sizes ranging from traditional small residential lots to larger peripheral lots in transitional areas between urban development and surrounding rural areas.

The Proposal includes construction of a private access road from Kurmond Road and retains both farm dams and the bushland in the western gully. For (4) allotments are proposed to front Kurmond Road and the remaining allotments are located on either side of the central access road.

Bushland in the western gully and the riparian corridor along Howes Creek has been designated as future Lot 1 and will be conserved and managed as a native bushland reserve under Community Title (Figure 1-3). Lot 1 is 6.1 ha in size and has been excluded from any future development.

If, after assessment of the forthcoming Development Application, Council requires site-specific recommendations for the conservation and management of the remnant bushland on the Subject Property, this will be considered under a separate vegetation management plan.

PLATE: View north-west from Kurmond Road over pastures: bushland gully to LHS

Figure 1-2: Concept Plan of Proposed Rural Subdivision at 1420 Kurmond Rd, Kurmond

Source: Mckinlay Morgan and Associates Pty. Ltd., 2014

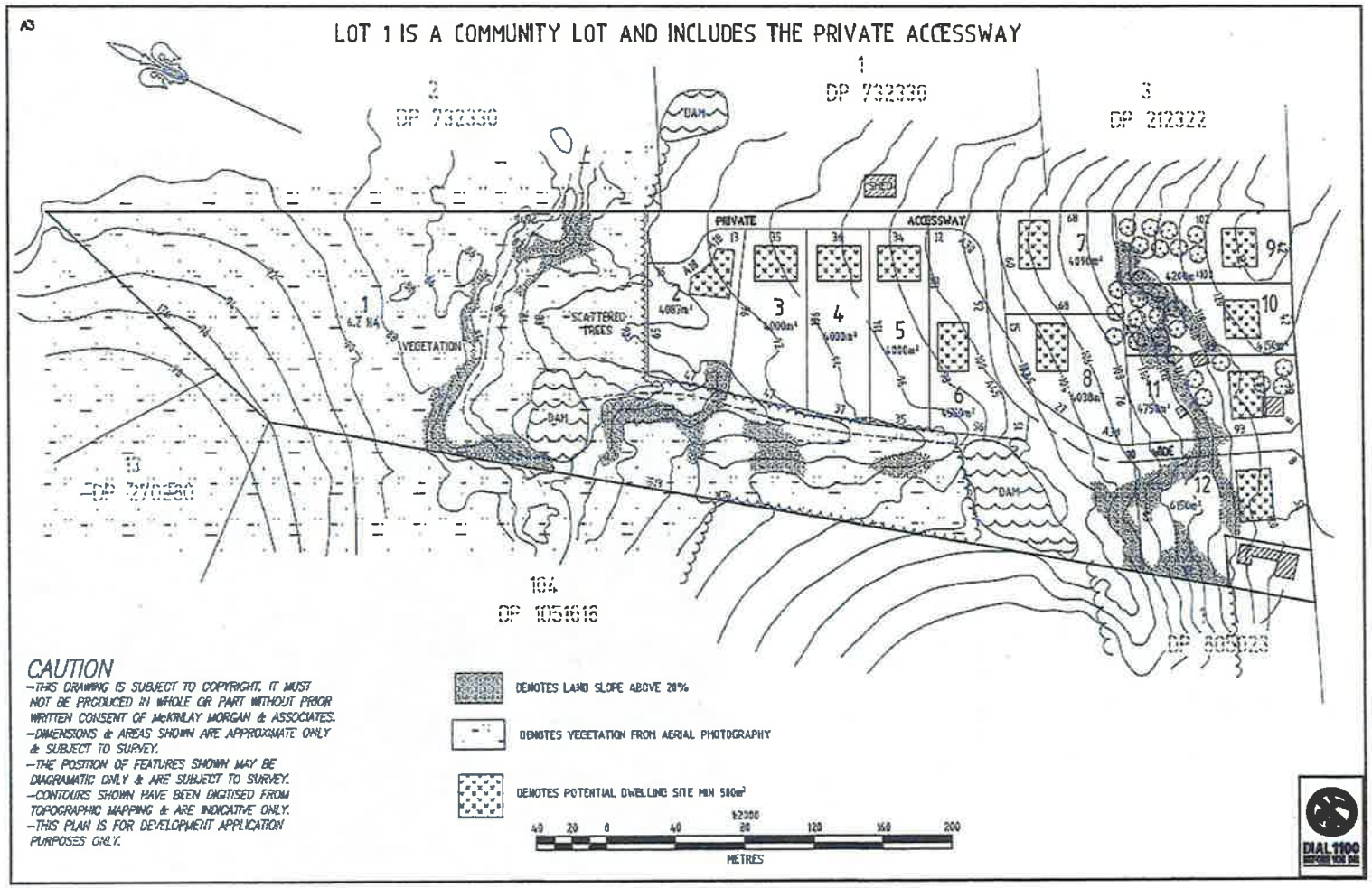
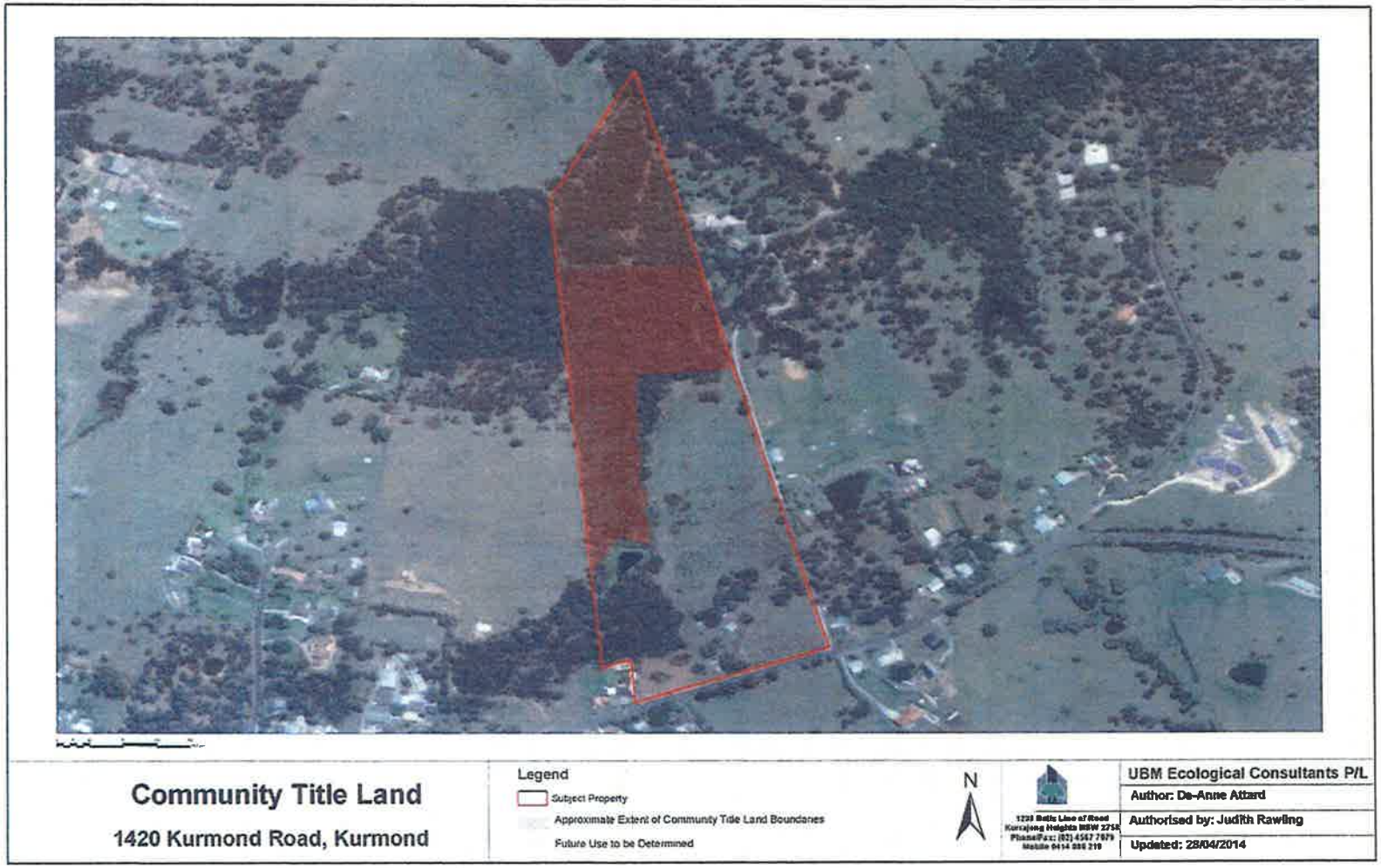


Figure 1-3 Land for Future Community Title on the Subject Property



2 SITE DESCRIPTION

This chapter provides a brief description of the physical and biological environments for the Subject Property at 1420 Kurmond Rd, Kurmond. This information has been gathered from a range of sources, including previous surveys and investigations, information held by City Council, the client, and the author's local knowledge.

2.1 Location and Setting

The Subject Property at 1420 Kurmond Road is located close to the small village of Kurmond, which is on Bells Line of Road about 85 km north-west of Sydney CBD.

Nearby settlements include Kurrajong and Kurrajong Hills. Situated in an area characterised by large rural properties on acreage, land in the Locality has been identified in the *Hawkesbury Residential Lands Strategy* (2011) as having the potential for increased residential density. Local land uses include new and existing rural residential properties, hobby farming and horse grazing; while previous land uses were mainly agricultural in nature.

The Subject Property is a rural residential allotment zoned RU-2 (Primary Production). There are two (2) existing dwelling on the Property: one a weatherboard cottage and the other a substantial architect designed residence with outbuildings. Both are located close to Kurmond Road. It is understood that the cottage will be demolished but the larger residence will be retained.

A stand of native bushland with a modified understorey is located in the deep gully which runs along the western property boundary and extends into the neighbouring property. A broad stand of riparian bushland extends close to the northern boundary - the Howes Creek Riparian Corridor (see *Figure 2.2* and *Plates*).

Prior to recent clearing, extensive stands of regrowth wattle (*Acacia* spp) and woody weeds (Privet, Lantana) extended across the upper slopes near Kurmond Road and behind the weatherboard cottage. These have now been cleared and maintained as an Asset Protection Zone for bushfire safety purposes.

Most local properties have retained native trees and some support small bushland remnants, but otherwise much of the land has been cleared and developed for agriculture or equine culture. On the northern side of Kurmond Road, neighbouring properties back onto bushland along Howes Creek. There are extensive areas of bushland on the northern side of Howes Creek, in Kurrajong Hills and on the Escarpment. The nearby Kurrajong Hills area is known to support a population of the endangered Koala (*Phascolarctos cinereus*).

The vegetation on the Subject Property is mapped as Category 1 Bushfire Prone Land (HCC Bushfire Prone Lands Map), which means that any development must consider the bushfire risk and plan accordingly.

2.2 Site Definition

Site Definition for the Subject Property is provided in *Table 2.1.*

Table 2-1: Site Definition

TITLE INFORMATION	Lot 2 DP805023
LOCATION	1420 Kurmond Road, Kurmond
TOTAL AREA	11.4 ha
TOPOGRAPHIC MAP	Kurrajong 9030-4N: 1 25 000
GRID REFERENCE	33°32'47.395S, 150°41'43.45"E (centroid).
OWNERSHIP	Privately owned by Ernest Bennett
LOCAL GOVERNMENT AREA	Hawkesbury
ZONING (Hawkesbury LEP 2012)	RU-2 Primary Production
CURRENT LAND USE	Rural residential (former grazing land)
PROPOSED DEVELOPMENT	Proposed 12-Lot subdivision

PLATE: Bushland in western gully: under-scrubbing in foreground; Howes Creek to rear

2.3 Physical Environment

The physical characteristics of the Study Area and local environs are summarised in *Table 2.2*.

Table 2-2: Physical Features of the Study Area & Environs

FEATURE	DESCRIPTION
Soil Landscape Unit	The Subject Property is dominated by the Luddenham (lu) Soil Landscape Unit (SLU) (see *Figure 2.1*).
Geology & Soils	The Luddenham SLU is underlain by the Wianamatta Group Ashfield Shale and Bringelly Shale formations. Ashfield Shale consists of laminate and dark grey shale, while Bringelly Shale consists of shale, calcareous claystone and laminate. Luddenham soils are moderately deep (50-150cm), hard-setting yellow podzolics and yellow soloths. Limitations include high soil erosion hazard; localised impermeable highly plastic subsoil which is moderately reactive when the vegetation cover is removed (Chapman & Murphy 1989).
Topography	Topography is typical of the Cumberland Lowlands physiographic unit, with low rolling to steep low hills. Local relief is generally 50-120m, with slopes 5-20% Chapman & Murphy 1989). The Subject Property slopes from the ridge on Kurmond Road, north to Howes Creek, and rises again on the northern side of the Creek. The land varies in height from ~125 metres ADH along the Kurmond Road frontage to ~ 80 metres at Howes Creek, then rising to the rear of the site to ~105 metres ADH (Falson & Associates 2013).
Local Hydrology	A permanent watercourse Howes Creek flows through the Property, effectively dividing the property into two (2) sections: being paddocks to the north and south of the Creek. Howes Creek flows into the Hawkesbury River at Sackville Two (2) large farm dams are located in a gully on the western side of the Property, being connected by an ephemeral watercourse.
Climatic Details	The mean daily maximum temperature is 23.7°C, with highest temperatures recorded in December, January and February. The mean daily minimum temperature is 10.9°C, with lowest temperatures recorded in June, July and August. Mean annual rainfall is 810.3 mm; with January, February and March recording the highest mean levels (Bureau of Meteorology 2009, Richmond RAAF #067033).

Figure 2-1: Soil Landscapes

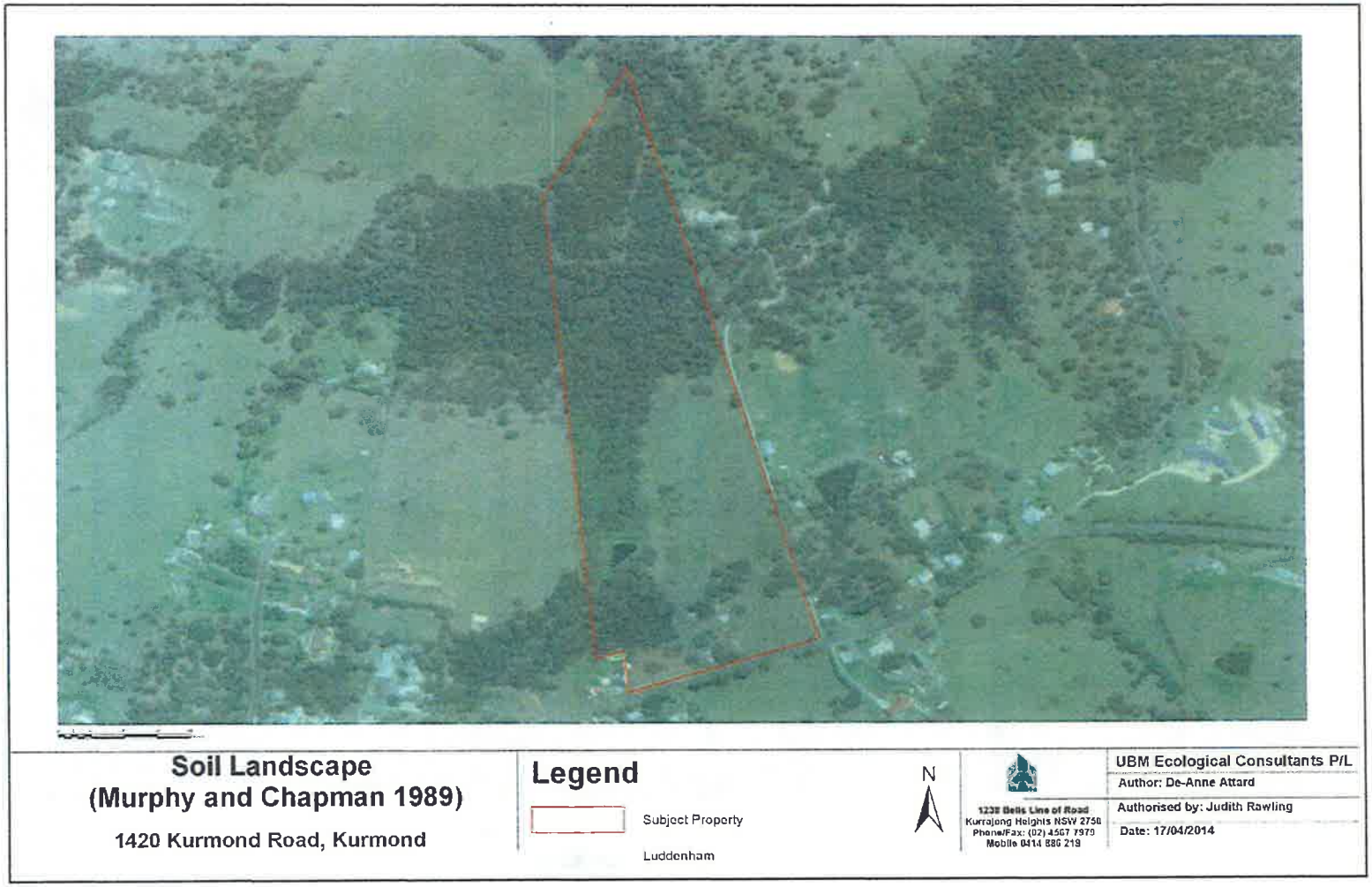
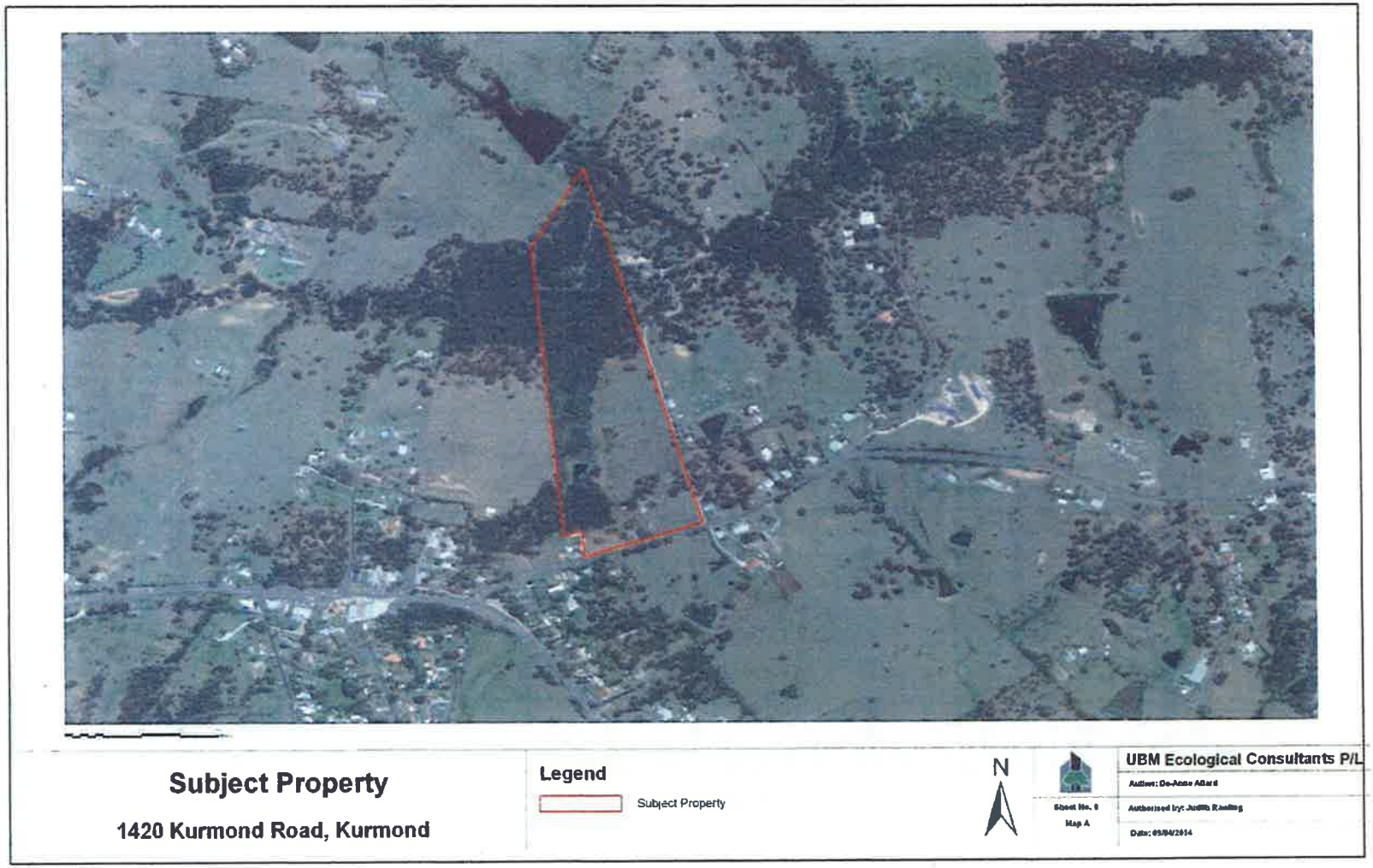


Figure 2-2: Subject Property with extent of surrounding bushland: intersecting Howes Creek.



2.4 Biological Environment

Vegetation Communities

The native vegetation on the south eastern region of the Subject Property has been substantially cleared as it has been used for agricultural activities for many years – initially for orcharding and latterly for grazing. Bushland has been retained on steep land in the gully along the western boundary and along Howes Creek which runs along the toe of the slope close to the northern property boundary.

Early mapping by the former National Parks & Wildlife Service (NPWS 2002) identifies the vegetation in the southern part of the Property close to Kurmond Road as Shale Plains Woodland, while vegetation along the Howes Creek Corridor was mapped as Shale Sandstone Transition Forest – high sandstone influence (see *Figure 2.3*)

More recent mapping by Tozer *et al.* (2010) for the former-DECCW similarly identifies the vegetation on the upper slopes as **Cumberland Shale Plains Woodland** ('CSPW'), and as **Cumberland Shale Sandstone Transition Forest** ('CSSTF') along the Howes Creek Corridor (see *Figure 2.4*[2]).

CSPW is a component of the **Cumberland Plain Woodland** ecological community ('CPW'), which is listed under Schedule 1, Part 2 of the NSW *TSC Act* as 'critically endangered', and similarly listed (with *Shale Gravel Transition Forest*) under the Commonwealth *EPBC Act.*

The riparian vegetation CSSTF along the Howes Creek Corridor is listed as 'endangered' under Schedule 1, Part 1 of the *TSC Act*. CSSTF is similarly listed under the Commonwealth *EPBC Act.*

Ground-truthing has been undertaken as part of the current survey in order to determine the accuracy of this vegetation mapping, and to ascertain if the vegetation in the Subject Property conforms to the descriptions offered by NPWS (2002) and/or Tozer *et al.* (2010). See *Section 3.2* for survey results.

NOTE: early mapping by the former-NPWS (2002) did not generally consider existing land uses and (as is the case in the current Study Area) mapped remnant native trees over urban development, pasture or exotic gardens as 'native vegetation' or 'bushland'. DECCW/OEH adopts a similar methodology. In contrast, Tozer *et al.* (2010) only identifies native vegetation with a significant understorey component as 'bushland', thereby eliminating land which has now been cleared in the understorey and developed for other land uses.

These discrepancies in community nomenclature are somewhat confusing for the layman and rest in the interpretation of field data by different botanists. However, it is important to understand that vegetation mapping is likely to have been based largely on aerial photography and geology maps with limited ground-truthing.

A description of the two (2) extant plant communities; CSPW and CSSTF have been included as *Appendix 1 and 2.*

[2] Note that Tozer uses the prefix 'Cumberland' for communities on the Cumberland Plain

Figure 2-3: Native Vegetation Communities Mapped by NPWS (2002)

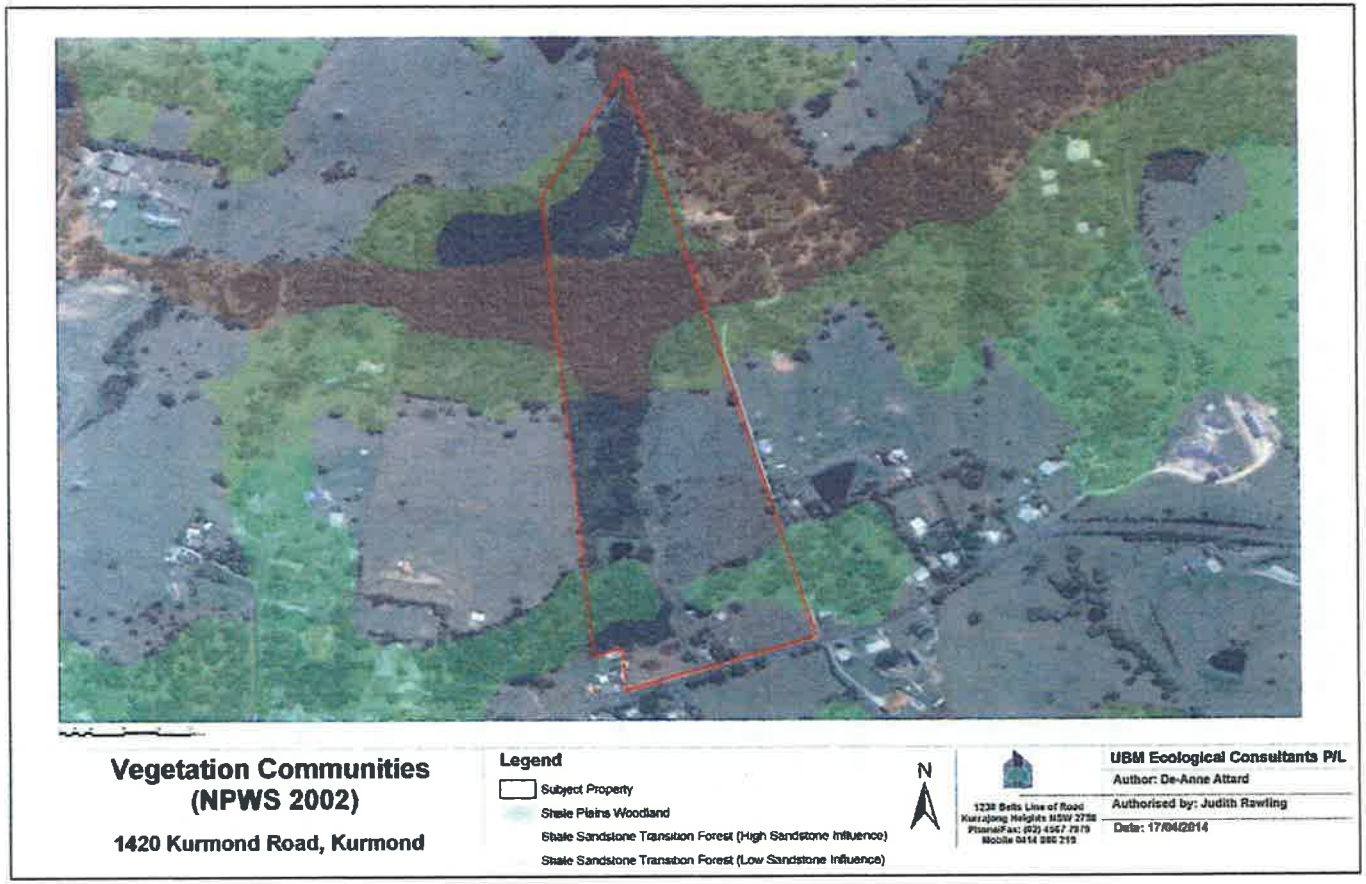
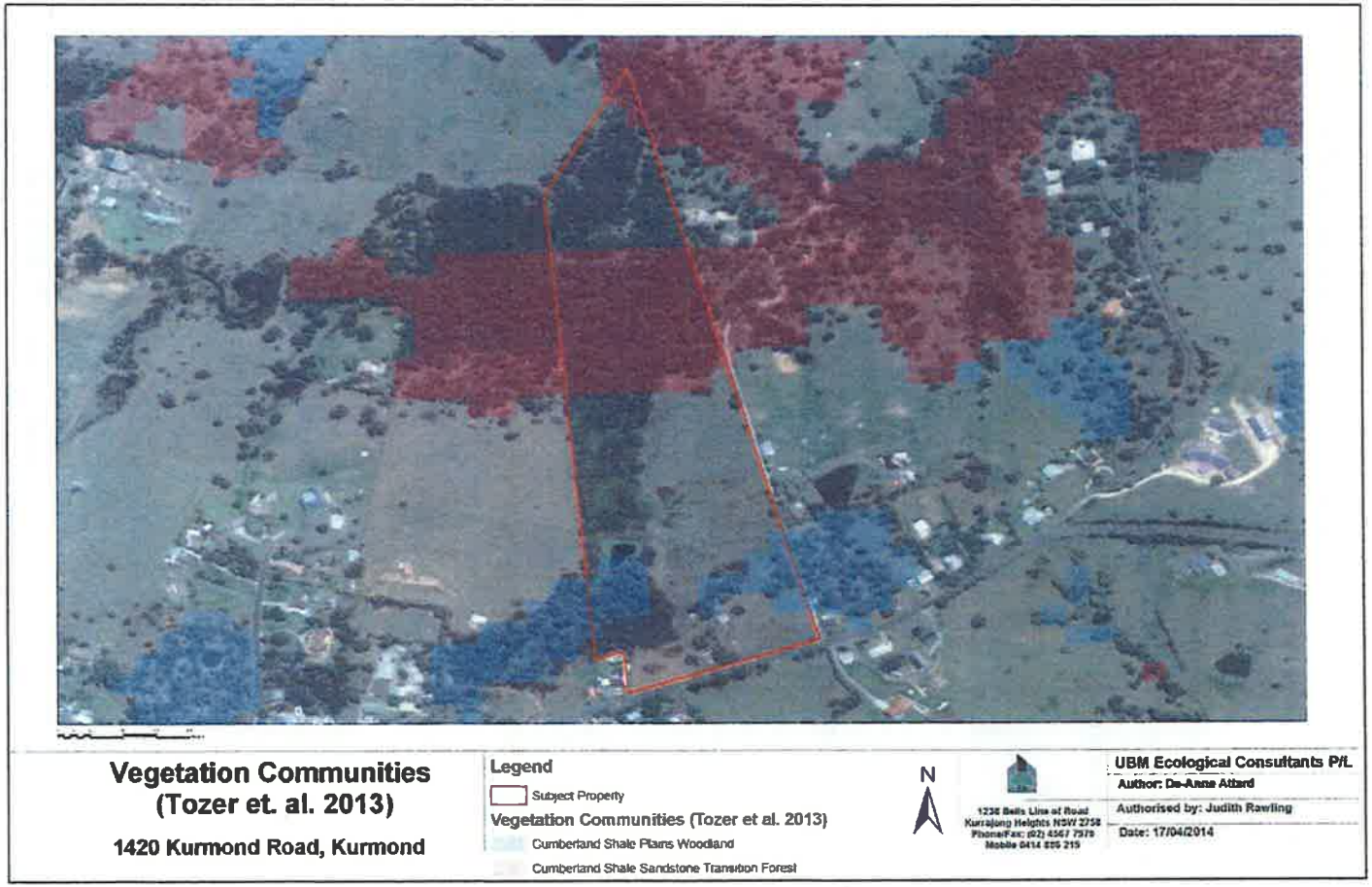


Figure 2-4: Native Vegetation Communities Mapped for DECCW (Tozer *et al.* 2010)



2.5 Legislative & Planning Context

Comments and assessments within this Report are based on the requirements of the *Environmental Planning and Assessment Act 1979* – with consideration given to the principals of Ecologically Sustainable Development, NSW *TSC Act*, and Commonwealth *EPBC Act*.

Table 2.3 provides a summary of policies, local planning and legislative requirements applicable to the Subject Property and the current Planning Proposal.

Table 2-3: Summary of Local Planning Policies & Legislative Requirements

GOVERNMENT LEVEL	RELEVANT POLICY/ LEGISLATION	RELEVANCE TO STUDY AREA
LOCAL	*Hawkesbury Local Environmental Plan 2012*	Zoned RU-2 Primary Production which allows for lots of not less than 10 ha in size. The LEP allows for development provided that this does not have an adverse effect on water catchments; including surface and groundwater quality and flows, land surface conditions, and important ecosystems such as streams and wetlands.
	Hawkesbury Residential Lands Strategy 2011	Guides future residential development within the LGA with the aim of accommodating between 5,000 – 6.000 new dwellings by 2031. The Strategy identifies existing centres with the potential to accommodate ~600 of the total 5,000-6,000 new dwellings proposed. It provides for the residual dwellings to be established on 'greenfield' sites and/or as developments around the periphery of existing towns and villages.
STATE	*SREP 20 - Hawkesbury-Nepean River*	Clause 6 of SREP 20 outlines relevant flora and fauna policies. In general, these policies aim to manage flora and fauna communities so that the diversity of species and genetics within the Hawkesbury-Nepean Catchment is conserved and enhanced. The proposed development will comply with SREP-20 by retaining the *in situ* native vegetation and riparian bushland along Howes Creek.
	Threatened Species Conservation Act 1995	A stand of Cumberland Shale Plains Woodland (a component of the 'critically endangered' Cumberland Plain Woodland) occurs in the southern part of the Property, close to Kurmond Road. Elements of a second listed community also occur – the 'endangered' Moist Shale Woodland Vegetation along Howes Creek to the north is mapped as Shale-Sandstone Transition Forest, a community listed as 'endangered' under the *Act*. Flora species – no listed flora species or populations were

		recorded. During the current field investigations two (2) species listed as Vulnerable under the TSC Act were identified in the Subject Property. The Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) and the Eastern Freetail-bat (*Mormopterus norfolkensis*) were recorded calling over the property during the evenings of Ultrasonic remote recording. There is suitable habitat in the large trees with small to medium hollows for these species to use as potential roost sites and it is possible that these species may forage on the Property (*Table 4.2*). However these species are unlikely to be impacted by development on this property as the vegetated expanse of the Property will not be developed and is proposed to remain as Community Titled Land.
	State Environmental Planning Policy No 19 – Bushland in Urban Area	The Subject Property is privately owned, and there is no community land located in close proximity, therefore the requirements of SEPP-19 will not apply.
	Noxious Weeds Act 1993 (Amended 2005)	At least five (5) noxious weed species listed for the Hawkesbury River County Council Local Control Area ('HRCC') occur within the Subject Property (see *Table 3.2*) The landowner has a legal responsibility to control noxious plants and to prevent their spread to adjoining land. HRCC is charged with enforcement of the *Act* on private property, while the Council also has a legal responsibility to control noxious weeds on their own land and to prevent weed spread to adjoining properties.
	Rural Fires Act 1997 / Amendment Act 2002	Hawkesbury City Council Land Information Service Map (Bushfire) indicates that the Study Area is classified as Bushfire Prone Land: Vegetation Category 1. The fire history of this area suggests that grass fires pose a considerable risk to life and property.
COMMONWEALTH	*Environment Protection and Biodiversity Conservation Act 1999*	A stand of Cumberland Shale Plains Woodland (a component of the 'critically endangered' Cumberland Plain Woodland) occurs in the southern part of the Property. Flora – no listed flora species occur Fauna species – no listed fauna species were recorded.

Other relevant NSW State government legislation may include:

- *Environment Planning & Assessment Act 1779;*
- *Crown Lands Act 1989;*
- *Rural Fires Act 1997*
- *National Parks and Wildlife Act 1974;*
- *Soil Conservation Act 1938;*
- *Rural Lands Protection Act 1998;*
- *Pesticides Act 1999;*
- *Occupational Health & Safety Act 1983;*
- *Waste Minimisation and Management Act 1995;*

- *Protection of the Environment Administration Act 1991; and*
- *Protection of the Environment Operations Act 1997.*

3 FLORA ASSESSMENT

The flora assessment was undertaken to determine the ecological communities occurring within and adjacent to the Subject Property and to describe the current status of the indigenous vascular vegetation present. The conservation value of the vegetation in the National, State and regional context has been considered in relation to vegetation community types and flora species present.

3.1 Methods

3.1.1 Literature Review

During the preparation of this Report, relevant databases and other studies were accessed, including previous studies and investigations for the Locality.

The main documents referenced were:

- *Native Vegetation of the Cumberland Plain* (NPWS 2002);
- *Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands* (Tozer *et al.* for DECCW 2010).
- Flora & Fauna Study & Ecological Assessment *for 'Dayspring', Lot 2, DP 805023, 1420 Kurmond Road, Kurmond*[3] (UBM Ecological Consultants 2010) ; and
- Preliminary Flora & Fauna Study & Ecological Assessment*: Lots 104 & 105 in DP1051618 at 1442 / 1442A Kurmond Road, Kurmond* (UBM Ecological Consultants 2013).

In addition, the NPWS *Atlas of New South Wales Wildlife Database* (DECCW 2012; search area 10 km x 10 km centred on the Subject Property –33°32'47.395S, 150°41'43.45"E (centroid) were accessed to identify previous recordings of flora species of conservation significance within the Region.

3.1.2 Flora Field Survey

Flora survey was carried out for the Study Area by Ecologist David Thomas on 14th April 2014. Survey effort was approximately four (4) hours. Supplementary investigations were carried out on several occasions by Restoration Ecologist Judith Rawling. Particular emphasis was placed on searching for threatened flora which had previously been recorded within a 10 km radius of the Subject Property.

Survey methodology was based on the typical requirements of the document entitled *Guidelines for Threatened Species Survey and Assessment* (DECC 2007). Based on the above, the survey used the Random Meander technique described by Cropper 1993 and applied to the native vegetation throughout the bushland zone (described in this Report as 'the Study Area').

The Study Area included the upper part of the western gully near Kurmond Road, the upper farm dam margins, the Wattle and Privet scrub below the dam, and the bushland and modified bushland along the lower slopes near Howes Creek.

[3] This is the same property, with investigations carried out by UBM in 2010 for the previous owner.

In addition, a 20 x 20 metre quadrat (400 square metres) was established in the bushland zone near Howes Creek.

As the open grassland in the central and eastern parts of the Property formerly used as grazing pasture comprised predominantly introduced grasses and forbs detailed investigations were not carried out in these areas. However, where native plants were observed, these were recorded.

In the course of this survey, all observed vascular flora species were recorded. Observations were also made about topography, soil and vegetation changes as well as assessment of disturbance within the Study Area. Assessment recorded landscape position, vegetation structure, and dominant plant species within each stratum.

Desktop research undertaken prior to the field survey provided a list of threatened flora species known, or with the potential to occur within a 10km radius of the Property (*Table 3.1*). Targeted searches for each of these species were conducted in the field; informed by habitat associations and the life history of these species.

Plant identifications were made according to nomenclature in PlantNet (2007). Stands of vegetation were described by their structural characteristics according to Specht (1981). The plant community was initially described using the dominant tree species and structure of the community. This was subsequently related to the Final Determinations for potential threatened ecological communities.

The condition of the on-site vegetation was recorded according to the estimated percentage of exotic species observed in the canopy tree, small tree, shrub and ground cover strata.

3.1.3 Limitations

The field surveys were conducted in early autumn (14 April 2014) following periods of light to medium heavy rain in the preceding weeks. Weather conditions during the flora surveys were fine and mild, often overcast, and with little if any wind noted.

There were no significant limitations to identification of species apart from any that might be cryptic and obvious in other seasons only. Some of the vegetation in the western gully was very dense and precluded easy access. It was however considered the survey was adequate for assessment of the conservation value of the site and recorded and potential species.

3.2 Results

3.2.1 Habitat Details

The Subject Property was located north of Kurmond Road and extended downslope to the permanent creek at the bottom of the west-facing slopes, this being Howes Creek. Howes Creek enters the Hawkesbury River at Sackville.

The geology at and surrounding the Subject Property is Wianamatta Shale. Soils in the Study Area were mainly red podzolics derived from the Wianamatta Group Shales. No sandstone outcrops were

observed; however sandstone has been observed by previous workers near the boundary of the present Study Area, but further downslope (UBM 2010).

3.2.2 Plant Communities

Two (2) plant communities or associations were recorded in the Study Area. One was a modified form of the natural vegetation of the site (i.e. native bushland), whilst the other was a largely exotic grassland and scrub community arising from previous land uses, which has included orcharding and stock grazing. Where the orchards were removed (post 2010), there has been subsequent invasion of introduced woody weeds species such as Privet and Lantana.

It was noted that the area around the existing residence and access driveway had been planted with a variety of non-indigenous native trees, including stands of *Corymbia maculata* (Spotted Gum). The vegetation in this part of the Property was not surveyed as its ecological values were considered to be low to absent.

The two (2) plant communities recorded in the Study Area were:

- Moist Shale Woodland[4] (two [2] variants were recorded), and a
- Wattle-Privet Scrub.

A brief description of each of these plant communities is provided below.

Moist Shale Woodland

1. **Forest Red Gum Mesic Woodland (variant 1)**

The southern section of the Subject Property adjoining Kurmond Road included a shallow gully with woodland that had been under-scrubbed to remove most of its native understorey, presumably to provide an Asset Protection Zone to nearby houses for bushfire safety purpose. The remaining understorey vegetation contained a mixture of indigenous and introduced species, including introduced pasture grasses and other herbs of generally agricultural origin. More open areas on these upper slopes included some relatively large patches of native grasses with smaller proportions of other herbs (see *Appendix 3, Transect #1*).

In the Forest Red Gum Mesic Woodland the tree cover mainly comprised *Eucalyptus tereticornis* (Forest Red Gum) with smaller numbers of *Eucalyptus crebra* (Narrow-leaved Ironbark) and a few *Eucalyptus moluccana (Grey Box)*. Eucalyptus *bosistoana*, a regionally significant species, was also present. Small trees were generally absent, apart from a few *Acacia parramattensis* (Green Wattle), *Acacia implexa* (Hickory Wattle) and *Alphitonia excelsa* (Red Ash).

Ten (10) shrub and shrub-sized tree species were recorded, but these were in relatively early stages of regeneration following previous clearing. Regenerating woody weeds such as *Rubus fruticosus* (Blackberry) and *Ligustrum* spp (Privets) were also noted.

The ground cover varied from grassy to soil covered by mulch, presumably remaining from earlier under-scrubbing of the understorey. The main herbaceous species recorded were: *Bidens pilosa*

[4] Moist Shale Woodland is mapped by Tozer *et al.* as Cumberland Shale Plains Woodland (see Section xx).

(Farmers' Friends), *Paspalum dilatatum* (Paspalum), *Microlaena stipoides* (Weeping Meadow Grass) and *Paspalidium distans*. In total, 11 native species and 14 introduced species were recorded in this area.

NOTE: the area described by UBM as Moist Shale Woodland has been mapped by Tozer *et al.* (2010) as Cumberland Shale Plains Woodland (see *Figure 2.4*). MSW typically looks like CSPW but it contains a few mesic species not usually found in the drier CSPW. Remnants of the MSW community were observed to occur on the upper slopes and in nearby properties, close to Kurmond Road.

Table 3-1 Typical floristics & structure of Forest Red Gum Mesic Woodland

Strata	Main species	Height range	Projective foliage cover
Canopy trees	*Eucalyptus tereticornis, Eucalyptus crebra*	15-20 metres	20%
Small Trees	*Acacia parramattensis, Acacia implexa, Alphitonia excelsa*	4-10 m	5%
Shrubs	*Hakea salicifolia, Dodonaea triquetra, Banksia ericifolia*	0.5-1 m	5%
Ground Cover	*Bidens pilosa*, Microlaena stipoides, Paspalidium distans*	0-0.5 m	5-70%

**=introduced species*

2. Cabbage Gum-Forest Red Gum Mesic Woodland (variant 2)

The lower (northern) section of the Property extended into a shallow gully with woodland that had been cleared of most of its understorey many decades previously, but in the more recent absence of stock had regenerated or was in the process of regenerating. It was noted that the understorey in some sections of this community where it adjoins the open pasture had also been cleared again recently and a fence has been erected to identify the pasture/bushland boundary.

The earlier cleared section (now regenerating) contained a mixture of small trees, shrubs and ground covers, while the more recently cleared understorey was largely limited to ground covers, residual mulch and regenerating trees and shrubs. Both the old and new understoreys contained a mixture of indigenous and introduced species. (*Appendix 1, Transect 3* & *Quadrat 1*).

The tree cover mainly comprised *Eucalyptus amplifolia* (Cabbage Gum) and *Eucalyptus tereticornis,* with the occasional *Eucalyptus moluccana (Grey Box). Eucalyptus crebra* (Narrow-leaf Ironbark) was rare at the ecotone with the upslope community. Smaller trees occurred in lower numbers and included: *Alphitonia excelsa, Melaleuca styphelioides* (Prickly-leaf Paperbark), *Acacia parramattensis* and *Acacia implexa*. *Melia azedarach* (White Cedar) and *Pittosporum undulatum* (Sweet Pittosporum) were uncommon.

Lantana camara and *Ligustrum* spp. were the main shrub species (many of these regenerating from rootstock post-slashing). Indigenous species included: *Polyscias sambucifolius* (Elderberry Panax),

Ozothamnus diosmifollus (Dogwood), *Notelaea longifolia* (Native Olive), *Breynia oblongifolia* (Dwarf's Apples), *Pittosporum revolutum* (Rough-fruited Pittosporum) and *Bursaria spinosa* (Blackthorn). *Backhousia myrtifolia* (Grey Myrtle) appeared to be restricted to the lower slopes near Howes Creek.

The main ground cover species were: *Microlaena stipoides*, *Austrostipa verticillata* (Slender Bamboo Grass) and *Oplismenus aemulus* (Basket Grass). Other common species were: *Pseuderanthemum variabile* (Pastel Flower), *Commelina cyanea* (Blue Scurvy Weed), *Trema aspera* (Poison Peach) *Entolasia stricta* (Wiry Panic Grass) and the exotics *Cirsium vulgare* (Spear Thistle) and *Solanum nigrum* (Deadly Nightshade).

NOTE: The Cabbage Gum-Forest Red Gum Woodland broadly corresponds to Cumberland Shale Sandstone Transition Forest mapped by Tozer *et al.* (2010).

NOTE ALSO: the Cabbage Gum-Forest Red Gum mesic woodland is not proposed for clearing and will be incorporated into new Lot 1 which will be conserved and managed under Community Title.

Table 3-2 Typical floristics & structure of Cabbage Gum-Forest Red Gum woodland

Strata	Main species	Height range	Projective foliage cover
Canopy trees	*Eucalyptus amplifolia, Eucalyptus tereticornis*	20-25 metres	30%
Small Trees	*Alphitonia excelsa, Melaleuca styphelioides, Acacia parramattensis, Acacia implexa*	4-10 m	10%
Shrubs	*Lantana camara*, Ligustrum sinense*, Ligustrum lucidum**	0.7-2 m	10%
Ground Cover	*Microlaena stipoides, Austrostipa verticillata, Oplismenus aemulus*	0-0.7 m	5-60%

**=introduced species*

Wattle-Privet Scrub

Following the early clearing of areas of native vegetation for agricultural purposes and the subsequent reduction in use and maintenance of parts of the farm, regeneration of indigenous species has begun, as well as colonisation by woody exotics. In areas that had not been used for a long time, this growth had reached a height varying from 4 to 10 metres, with a dense shrubby stratum below. The ground cover was usually very sparse or absent where the shading was greatest. Species richness is generally low.

The Scrub-type vegetation between the upper farm dam and the Cabbage Gum-Forest Red Gum Woodland was dominated by the woody weeds *Ligustrum* spp (Privets), with a margin of the native wattle *Acacia parramattensis* on its eastern side. *Alphitonia excelsa* was locally common. *Pittosporum undulatum* and *Ligustrum lucidum* were generally in the earlier stages of growth and were typically large shrub-sized at the time of this survey.

The canopy varied from about 3-4 metres where the woody weeds *Ligustrum sinense* (Small-leaf Privet) and *Ligustrum lucidum* (Large-leaf Privet) dominated, to 5-7 metres where the native pioneer species *Acacia parramattensis* dominated.

Its understorey comprised leaf litter with scattered herbs, mainly *Pellaea falcata* where the overhead canopy was dense and provided deep shade. Grasses, especially *Microlaena stipoides,* dominated along the more open margins. It was noted that *Microlaena stipoides* also occurred as large patches of open grassland close to the upper dam margins.

In the lower paddocks north of Howes Creek, the Wattle Scrub is an early regrowth form of Cabbage Gum Woodland (part of the Tozer-mapped CSSTF), but as it comprises predominantly Wattle saplings and woody weed thickets (Lantana and Privet) over introduced grazing pasture, it cannot now be described as a viable native plant community.

Table 3-3 Typical floristics & structure of Wattle-Privet scrub

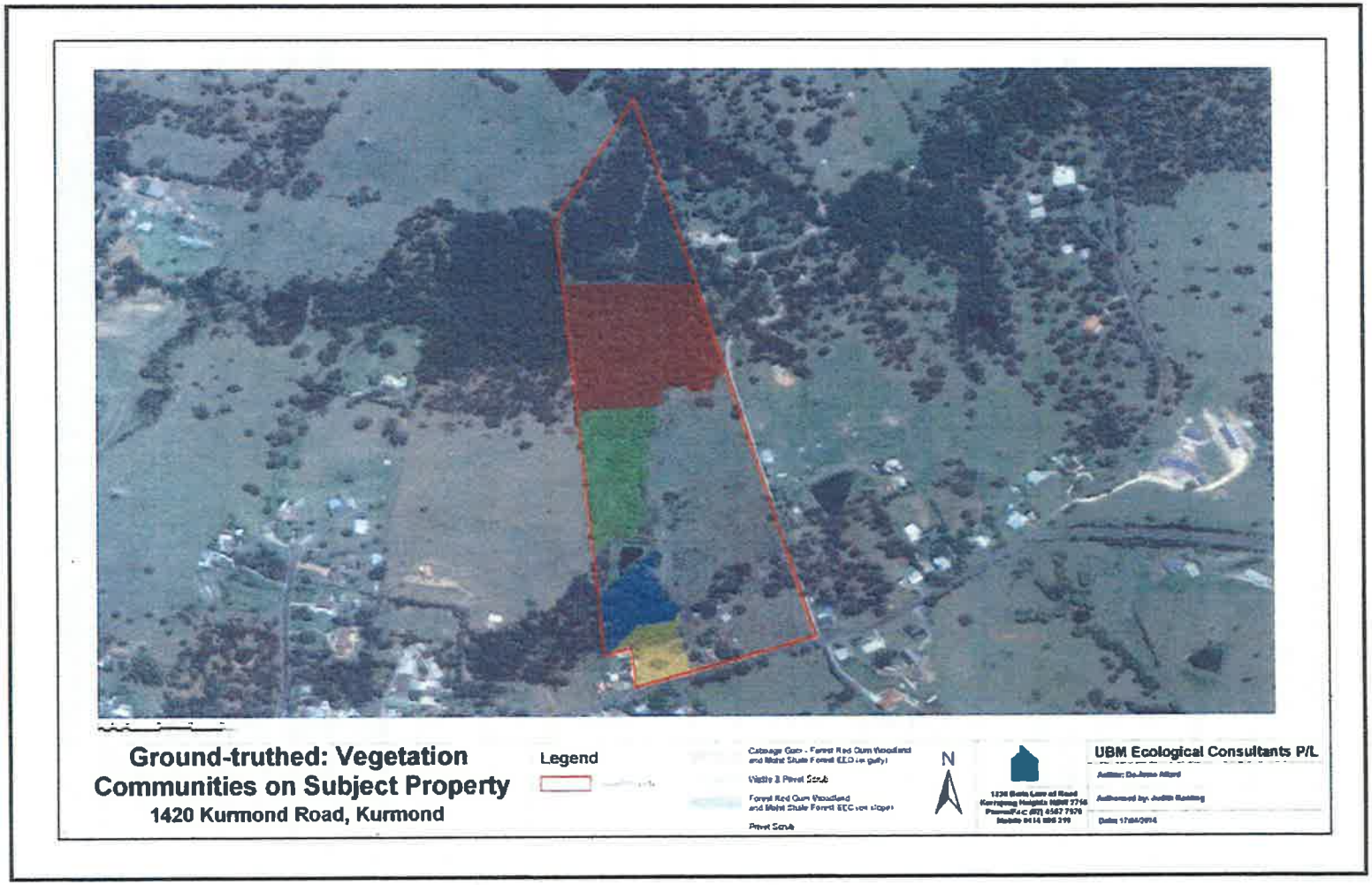
Strata	Main species	Height range	Projective foliage cover
Canopy trees	absent		
Small Trees	*Acacia parramattensis, Ligustrum lucidum*, Pittosporum undulatum*	4-10 m	10⁺%
Shrubs	*Ligustrum sinense*, Ligustrum lucidum*, Lantana camara**	0.7-2 m	70%
Ground Cover	*Microlaena stipoides, Pellaea falcata, Oplismenus aemulus, Commelina cyanea*	0-0.5 m	1-70%

**=introduced species*

The approximate boundaries of each of the plant communities observed is shown on *Figure 3.2*

PLATE: Former Privet Scrub on upper slopes near Kurmond Road, now cleared

Figure 3-1: Observed Native Plant Communities (approximate locations only)



3.2.3 Threatened Species

A database search (OEH 2013) provided a list of five (5) flora species with records occurring in the Study Region (i.e. within a 10 km radius) and listed under the NSW *TSC Act 1995* and/or Commonwealth *EPBC Act 1999*. This list is provided in *Table 3.4*.

Table 3-4 Threatened Flora Table

E/E1 = Endangered, V = Vulnerable
*Within a 10km x 10km area centred on the Subject Property (OEH 2013)

Scientific Name	Common Name	Legal Status		Number of Records*
		TSC ACT	EPBC ACT	
Myotis macropus	Southern Myotis	V		1
Cynanchum elegans	White-flowered Wax Plant	E1	E	2
Tetratheca glandulosa	-	V		2
Leucopogon fletcheri subsp. fletcheri	-	E1		2
Zieria involucrata	-	E1	V	1

Despite targeted searches, no (0) threatened flora species or populations were recorded for the Study Area.

3.2.4 Regionally Significant Flora Species

A targeted search was also undertaken for those flora species considered to be inadequately reserved in Western Sydney (NPWS 1997). This was done in order to consider the significance of the Study Area in the regional context. This allows for an assessment of the site that incorporates the regional setting, as well as the State and National context. Although considered to be vulnerable within the Region, these species are relatively common to widespread, and are well represented in the system of Reserves across the Study Region.

Two (2) regionally significant species were located: *Eucalyptus bosistoana* (Coast Grey Box) and *Celstrus australis.* Both species are considered to be rare regionally and therefore are ecologically significant (NPWS 1997). *Eucalyptus bosistoana* occurred in all native plant communities, but especially on the mid slope and in the western gully which runs between the two (2) farm dams.

In 2010, a survey located *Celastrus australis* in riparian vegetation on the northern side of Howes Creek. Similarly, the regionally significant *Glycine* sp. A was recorded in 2010 in generally the same area This area was not surveyed again in 2014 as it is outside the area proposed for development and is contained within the area proposed to be conserved and managed as native bushland under Community Title. It is envisaged that a more detailed survey of the proposed community land will be carried out at a later date.

Further, four (4) species recorded are considered to be inadequately conserved in Western Sydney (NPWS 2007). These are *Calotis dentax* V2 (Burr Daisy), *Stellaria flaccid* V3, *Solanum stelligerum* (Star Nightshade) and *Alphitonia excelsa* V3 (Red Ash).

Appendix 3 presents a list of flora species recorded for the Study Area, with an indication of their location, frequency of occurrence and ecological status. This list is not intended to be a comprehensive list of all plants occurring in the Subject Property, but represents only those species observed when carrying out a targeted survey for threatened or otherwise significant flora species.

3.2.5 Introduced Species

Many of the understorey species recorded were introduced agricultural grasses and flowering forbs or weeds (44 species or ~33% of the 136 species recorded).

Five (5) species are declared as 'noxious weeds' gazetted for HRCC (*Noxious Weeds Act 1993 [amended 2005]).* These were woody weeds such as *Ligustrum lucidum* and *L. sinense* (Privets), *Lantana camara* (Lantana) and *Rubus fruticosus* (Blackberry), while the scrambling ground cover *Asparagus asparagoides* (Bridal Veil Creeper) was also recorded. Other noxious species are likely to occur in the lower gully and along Howes Creek but these were not recorded during the current survey.

Table 3-5 Noxious Weed Species recorded for the Study Area

FAMILY	BOTANICAL NAME	COMMON NAME	NOXIOUS WEED CLASS
Asparagaceae	*Asparagus asparagoides*	Bridal Veil Creeper	Class 4, WoNS
Oleaceae	*Ligustrum lucidum*	Large-leaf Privet	Class 4
Oleaceae	*Ligustrum sinense*	Small-leaf Privet	Class 4
Rosaceae	*Rubus fruticosus*	Blackberry	Class 4, WoNS
Verbenaceae	*Lantana camara*	Lantana	Class 4, WoNS

Actions Required For Noxious Weed Classes
1 The plant must be eradicated from the land and the land must be kept free of the plant
2 The plant must be eradicated from the land and the land must be kept free of the plant
The plant must be fully and continuously suppressed and destroyed
The growth and spread of the plant must be controlled according to the measures specified in a management plan* published by the local control authority and the plant may not be sold, propagated or knowingly distributed
The requirements in the Noxious Weeds Act 1993 (as amended 2005) for a notifiable weed must be complied with

3.3 Condition of Vegetation

The code used to assess the Condition of Vegetation assumes four (4) structural strata: tall tree (canopy), small tree, shrub and ground cover. The % of exotics is estimated for each stratum and entered with a slash / between.

If a stratum is absent, this is shown by an "a" in the relevant place. Where there are a few individuals present, but less than the 5% considered necessary to form a structural stratum, "a"

might be used with the % of these species that are exotic (e.g. a-80), in the relevant place. An example would be 0/a/a-20/60%.

The Condition of Bushland Weed Code for the Subject Property at Kurmond is as follows:

Moist Shale Woodland

Forest Red Gum Mesic Woodland
0/a-0/a-95/40-95%

Cabbage Gum-Forest Red Gum Mesic Woodland
0/0/a-80/40%

Wattle-Privet Scrub
a/a-0/99/20%

Exotic Grassland (Pasture)
a/a.a.80%

If required, a colour-coded Condition of Bushland Map can be prepared using the above-listed weed codes. This map has not been prepared as this may be more appropriate to any future Vegetation Management Plan required.

3.4 Conservation Significance

3.4.1 Plant Communities

The vegetation of the upper southern slopes has been mapped (Tozer *et al.*, 2010) as Cumberland Shale Plains Woodland (CSPW) – a CEEC. During the current fieldwork (April 2014) and previous survey April 2010) in the adjoining property it was suggested that the presence of numerous mesic species meant that the community was more closely related to the EEC Moist Shale Woodland rather than Cumberland Shale Plains Woodland. This is partly disguised by the present poor condition of the vegetation on the slope in the current Study Area.

The vegetation of the lower slope and gully was previously mapped by Tozer *et al.* (2010) as the EEC Cumberland Shale Sandstone Transition Forest (CSSTF). However the vegetation has a largely mesic understorey which suggests elements of the EEC Moist Shale Woodland. The soil in the Study Area was heavy clay material, derived from Wianamatta Shale.

Moist Shale Woodland is not mapped in the locale; however it is considered by the author that this is largely the result of a lack of ground truthing rather than accuracy of prediction of aerial photographic interpretation. Moist Shale Woodland is listed under the NSW *TSC Act* as an endangered ecological community (EEC).

The Wattle-Privet Scrub is dominated by exotic species. The original community would have been part of the continuum between the drier and moister forms of Moist Shale Woodland. The Wattle-Privet Scrub is considered to have low conservation significance except as a corridor between the two occurrences of native vegetation on site and extending into the adjacent property.

Any rehabilitation of this scrub vegetation would rely on bushland reconstruction rather than bush regeneration.

3.4.2 Plant Species

No (0) threatened flora species listed under the NSW *TSC Act* or Commonwealth *EPBC Act* were recorded in the current Study Area.

Two (2) regionally significant species were located: *Eucalyptus bosistoana* and *Celstrus australis.* Both species are considered to be rare regionally and therefore are ecologically significant (NPWS 1997), but they are not legally protected.

3.5 Flora Assessments of Significance

The NSW *TSC Act* aims to conserve threatened species, populations, ecological communities and their habitats; to promote their recovery; and manage the processes that threaten or endanger them. Threatened species are listed under Schedules 1 and 2 of the Act, while communities considered 'at risk of extinction' are listed as 'Endangered Ecological Communities' ('EECs') under Part 3, Schedule 1.

Under the terms of the legislation, Local Government must assess the impacts of any proposed activity which might adversely impact on the EEC or any threatened species or populations, and where these are likely to occur, must identify strategies to minimise any such impacts. Further, development on adjoining land may also have a significant impact on the bushland's natural values, so that such activities must be carefully assessed by the Consent Authority (here HCC) prior to development consent being granted.

Under Section 5A of the *EP&A Act*, any development activity impacting on a species, population or ecological community listed under the *TSC Act* requires the application of an "Assessment of Significance". As well, listings under the Commonwealth *EPBC Act* require are subject to a similar Assessment process.

An Assessment of Significance (commonly called 'the Seven-part Test') is designed to determine *"whether there is likely to be a significant effect on threatened species, populations, ecological communities or their habitats"* (as listed on the Schedules of the NSW *TSC Act*), and consequently, to determine whether a Species Impact Statement is required. As the remnant vegetation on site does not meet the diagnostic criteria for SSTF established under the *EPBC Act*, an assessment under the Commonwealth guidelines has not been undertaken.

In order to determine whether further studies are required, a search of the relevant ecological databases is required in order to identify those ecological communities, threatened species or populations known for the Locality and Region. This is followed by a comprehensive site survey to determine the presence, or potential presence of any threatened entities.

The field investigations undertaken provide the required ecological studies. Results of those investigations are presented in *Section 3.2* (flora) and *Section 4.3* (fauna) of this Report. The

recommendation on whether or not to apply the Seven-part Test has been made with respect to the outcomes of these investigations.

Flora Considerations

No flora species or populations listed under either the NSW TSC Act or Commonwealth EPBC Act were recorded in the Study Area or the larger Subject Property. There no Assessments of Significance which assesses the impacts of the Proposal on these entities has been required.

There are differing opinions relating to the plant communities mapped (Tozer *et al.* 2010) and the variants described in this Report (UBM 2010 & 2014). These are the mapped the CEEC Cumberland Plains Woodland, the EEC Cumberland Shale Sandstone Transition Forest, and the described EEC Moist Shale Woodland. These discrepancies are the result of detailed ground survey and analysis, an approach which often identifies variants in the previously mapped communities, and at times results in the identification of a new plant community. This appears to be the case for vegetation occurring in the Subject Property.

Notwithstanding these differing opinions, it must to stressed that no native plant communities will be directly impacted (cleared or modified) under the Proposal, the subdivision development being restricted to cleared open pastures. All of the native vegetation on the Subject Property (new Lot 1) is proposed to be protected, conserved and managed as a bushland reserve under Community Title. Any indirect impacts of the Proposal (e.g. runoff, weed invasion from gardens) will be strictly managed and as such, are not expected to impact on the reserved bushland.

Accordingly, as no impacts to the native plant communities represented in the reserved Community Title bushland are likely to occur, no Assessments of Significance under either the NSW *TSC Act* or Commonwealth EPBC Act have been prepared. However, in the event that the development design does change (see *Figure 1.2*) and areas of naive bushland are impacted, Assessments under both pieces of legislation will be required.

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. The Subject Property is surrounded by other rural residential properties 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 a southern gully flows into the creek. Moderate to dense shrub cover (primarily introduced woody weeds) occurs on both drainage lines.

There are two (2) small farm dams on the eastern side of the Subject Property. The northern-most dam is surrounded by a moderate to dense shrub cover (primarily introduced weeds), making access to this water body difficult.

In order to assess the likelihood of native fauna species utilising the native vegetation within the Subject Property as habitat, a fauna survey was undertaken. All species listed as Endangered, Vulnerable, Threatened or Near-Threatened (EVNT) under the NSW *TSC Act* and/or Commonwealth *EPBC Act* 1999 (see *Table 4.2*) has 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 De-Anne Attard (BSc, Hons) on the 11th – 16th of April 2014. Survey effort is outlined in *Table 4.1*.

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

Table 4-1: Fauna survey effort

DATE	TIME	TIME OF DAY	WEATHER CONDITIONS				ACTIVITY
			TEMP (°C)	WIND (km/h)	CLOUD (obs)	RAIN (mm)	
11/04/14	1.5 hours	AM	12 – 25	4 - 10	Cloudy	5 – 10	Initial habitat assessment, morning bird survey, herpetofauna search
15/04/14	1 ½ hours	Night	12 – 23	7 - 13	Variable	1 – 5	Spotlighting for nocturnal fauna
11/04/14 – 16/04/14	5 nights	Day/Night	12 – 25	6 - 13	Variable	5 – 10	Infrared camera monitoring (SG550V8, ScoutGuard)
11/04/14 – 16/04/14	5 nights	Night	12 – 25	6 - 13	Variable	5 – 10	Ultrasonic bat call detector (Anabat unit)

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 described Study Area. Whilst 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 (-33.546738 S, 150.695068 E) and left in position for five (5) nights from 08th April 2014 (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

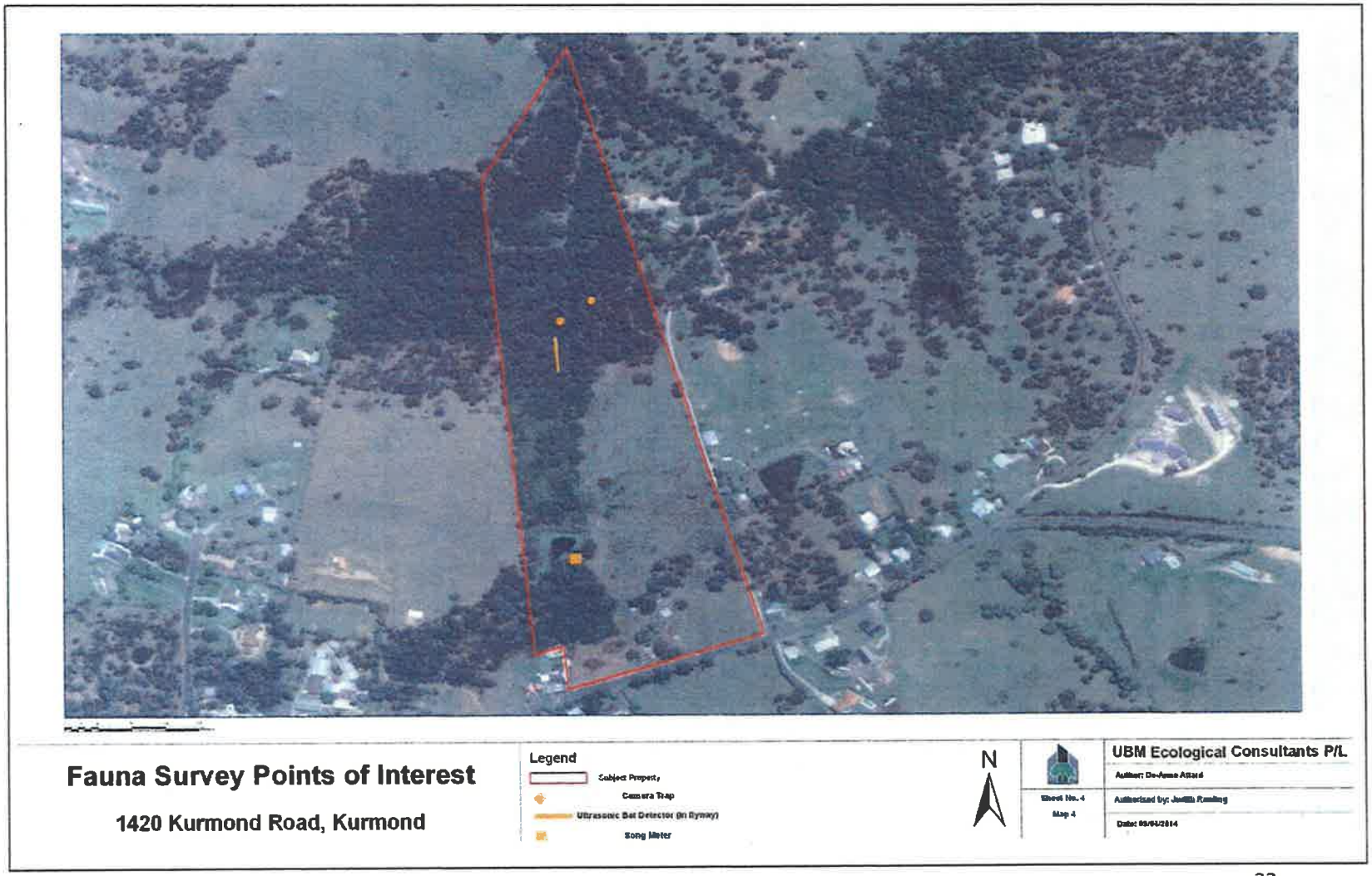
Two (2) infrared cameras (SG550V8, ScoutGuard) were placed on site and left in position (Camera 1: (- 33.557667 S, 150.933667 E; and Camera 2:- 33.547056 S, 150.695 E) for five (5) nights (see *Table 4.1* and *Figure 4.1*). The units employ a passive infrared (PIR) system, operating diurnally and nocturnally. The cameras were set to a sensitivity level of 'normal', capturing two (2) images when triggered with a one (1) minute recovery time. The cameras were placed at a height of around 1.5 m 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 investigations 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 (April 2014). 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 23 mammals, 81 birds, 8 native reptiles, and 8 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, 14 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 (April 2014), 42 bird species were detected within, adjacent to, or flying over the Study Area; the latter identified by their distinctive calls as well as observation. One (1) native reptile and 3 amphibians were identified within the Subject Property. Two (2) introduced (domestic) mammals and one (1) feral pest were identified within the Subject Property (*Appendix 4*). Horses have been grazed on the Subject Property in the past five (5) years.

Six (6) species of microchiropteran bats were identified with varying degrees of confidence (see *Appendix 4*). Two (2) of these species are listed as Vulnerable; the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) and the Eastern Freetail Bat (*Mormopterus norfolkensis*).

No other threatened species, listed under the *EPBC Act* or *TSC Act*, were observed on the Subject Property.

4.3.2 Fauna Habitat Assessment

The southern portion of the property, intended for development, has been cleared for previous land uses (refer to *Figure 2-2*). Large Forest Red Gums (*Eucalyptus tereticornis*), some with multiple medium (200 – 300 mm) to large (> 300 mm) hollows, are scattered throughout the most southern portion of the Property and are also found throughout the northern section of the Property around the drainage channels and Howes Creek.

The paddock on the south eastern section of the Property has been completely cleared and has low fauna conservation significance, although providing good cover with a range of introduced and native pastoral grasses, there are few refuge sites for herpetofauna in this area and most of the grasses are no longer seeding.

There are three (3) aquatic values of note; these include the two (2) farm dams on the western edge of the Property, and Howes Creek that runs through the northern end of the Subject Property. A number of bird and bat species use both the northern and southern dams on the western side of the Property. The northern part of Property is dominated by a stand of native wattles (*Acacia parramattensis*) and surrounded by a shrubby understory. The three (3) habitat types identified on the Property, i.e. Open Woodland, Pasture/Paddock and Aquatic habitats, and their associated fauna conservation significance are summarised below.

Habitat Type: Open woodland Fauna Conservation Significance: *Moderate*

There is small farm dam covered in water lilies and surrounded by scattered Forest Red Gum (*E. tereticornis*) which are constantly inhabited by numerous Bell Minors (*Manorina melanophrys*), visible perched and calling throughout the daytime. These trees contain medium (200 – 300 mm) to large (> 300 mm) sized hollows that may provide refuge for nesting birds, arboreal mammals and arboreal herpetofauna. The shrub layer (including a large amount of *Lantana camara*) that surrounds the drainage lines, the dams and Howes Creek in the northern end of the Subject Property, provides good shelter for most of the 39 bird species identified, specifically for the smaller species including grainivores and insectivores (

Figure 4-2*J*. The exfoliating bark and woody debris surrounding the large *E. tereticornis* provides good shelter for small herpetofauna. Overall the heavily disturbed open woodland that makes up approximately half of the Subject Property is of *moderate significance* for a number of arboreal mammals, birds and various herpetofauna.

Figure 4-2 Open Woodland Habitat

Note: Open woodland adjacent to the Paddock in the central quarter of the Subject Property (RHS); and open woodland on the boundary of Howes Creek (LHS).

Habitat Type: Aquatic Fauna Conservation Significance: *Moderate*

Howes Creek (*Figure 4.4*) is tributary of the Hawkesbury River and flows through the Subject Property in an easterly direction. The Creek is surrounded by moderate to dense vegetation, primarily consisting of the woody weed *Lantana camara*, likely to have spread from upstream during past clearing events. At the time of survey the Creek was flowing and is expected to do so most of the time. This habitat type is likely used by a number of fauna, herpetofauna were observed using the waterway during field surveys, and it is likely that a number of avian species also use this watercourse. Additional aquatic habitat occurs in a two (2) small dams on the east of the Property. Both dams are likely to be ephemeral (Figure *4-3*). Numerous species of birds and bats are known to use these water bodies and crayfish are likely to inhabit the southernmost dam. The aquatic habitat available on the Subject Property is rated as *moderate conservation significance* and if removed or dramatically altered, will likely affect fauna assemblages on the site.

Figure 4-3 Aquatic Habitat

NB: Howes creek (RHS); and small dam at the southern most edge of the Subject Property (LHS).

Habitat Type: Pasture/Paddock Fauna Conservation Significance: *Low*

The paddock on the south eastern section of the property has been completely cleared and has low fauna conservation significance, although providing good cover with a range of introduced and native pastoral grasses, there are few refuge sites for herpetofauna in this area and most of the grasses are no longer seeding (

Figure 4-4*).* There is a single habitat feature on the northern boundary of the paddock; a stag that has some small hollows and may be refuge for herpetofauna and/or microbats (noted in *Section 4.3.4*). The *fauna conservation significance of this area is low* and the impact on fauna assemblages in the region is likely to be minimal, as surrounding properties contain similar species of grasses and tracts of pastoral lands for potential fauna use.

Figure 4-4: Agricultural land and paddock

NB: View of the paddock from the northern section of the Subject Property. The habitat feature (stag with hollows) is present in the far left of the photograph.

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.

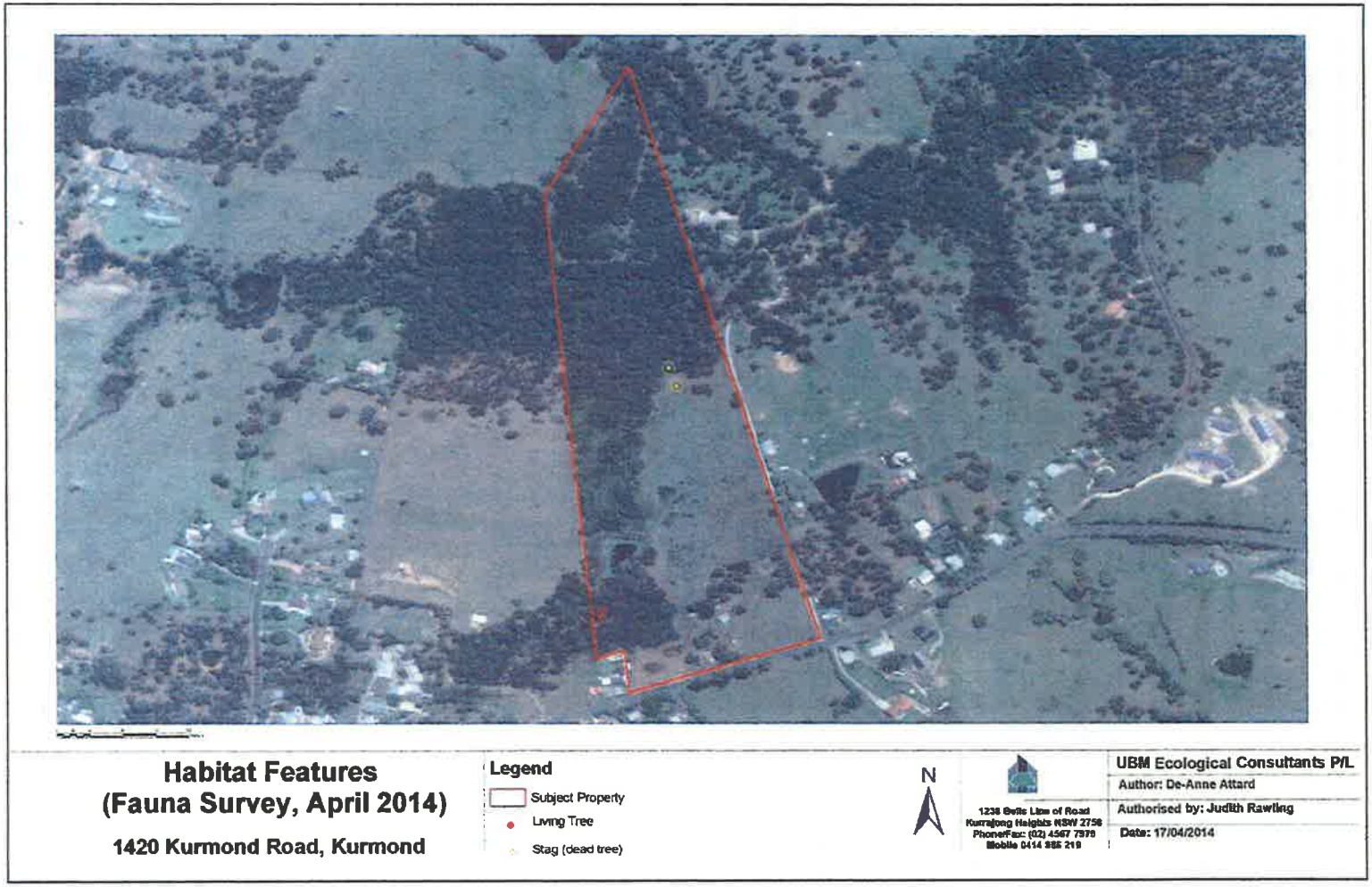
4.3.4 Habitat Features

There are four (4) of habitat features of note that occur on this site (*Figure 4-5*). Two (2) of large *E. tereticornis* that are located on the southern edge of the property have been identified as habitat features due to large hollows in the trunk and upper branches (> 300 mm).

There are two (2) stags on the Subject Property that have also been identified as habitat features. All habitat features are arboreal and have been outlined in Figure *4-5*. All identified habitat trees (stags or live trees) that may be identified for removal will require the presence of an Ecologist on site during felling.

Due to a large area of dense shrub cover that lines the banks of Howes Creek, a number of trees on the edge of the creek could not be assessed for hollows or exfoliating bark. If further habitat trees (any trees that have large amounts of exfoliating bark or hollows) are identified during future clearing works surrounding the Creek, an Ecologist will be required to be present at the time of felling. Any native animals that are located will need to be removed to a secure conservation area, preferably in close proximity to the felled tree(s).

Figure 4-5 Locations of habitat features on the Subject Property



4.3.5 Threatened Fauna Assessment

The threatened fauna assessment assesses the likelihood of any species listed under the *EPBC Act* or *TSC Act* that is Endangered, Vulnerable, Threatened, Near-threatened and/or Migratory (EVNT) and that has been previously recorded and/or is likely to potentially occur within the Subject Property (refer to *Table 4.2*). This assessment also outlines the number of individuals for each species that is likely to occur within a both a 1km and 10km radius of the Subject Property over the last 10 years. It also assesses the potential impacts the proposed development may have on each listed species.

Two (2) 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 the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) was identified as a 'possible' call. The Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) is known to overlap in frequency with both the Large Forest Bat (*Vespadelus darlingtoni*) and the Southern Forest Bat (*Vespadelus regulus*) and due to the quality of the recording it was not possible to attain a high confidence ranking for this individual (*Table 4.2* and *Appendix 4*).

Considering no roosting habitat or foraging habitat will be removed or impacted on the Subject Property and the fauna assessment has outlined that this species will not be influenced by off-site impacts of this proposal, a Seven-part Test of Significance is not required for these three (3) microbat species, listed as Vulnerable under NSW State legislation, i.e. the *TSC Act*. However as there are 2 large habitat trees (Forest Red Gum, *E. tereticornis*) in the south western corner of the property and two stags in the far end of the paddock (Figure 4-5) that will likely be removed during construction, it is recommended that a qualified Ecologist be present whilst the felling of these trees occurs.

A threatened species fauna assessment of all species listed under both Commonwealth and State legislation as either Critically Endangered, Endangered, Vulnerable, Threatened or Near-threatened (referred to as EVNT species) has been compiled to include any species reported in the last 10 years and observed within a 10 km radius of the Subject Property (**Error! Reference source not found.**). This assessment outlines the habitat requirements of the species, the species status, the most recent observation and proximity to the Subject Property, the likelihood and potential utilisation of the species to the Subject Property and conclusions of the likely impact and assessment considerations.

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	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS WITHIN 10KM	NUMBER OF RECORDS WITHIN 1KM	MOST RECENT		
Birds (7)								
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	V		In summer this species is generally found in tall mountain/alpine forests and woodlands, particularly in heavily timbered and mature and old growth, wet sclerophyll forests. In winter this species may inhabit lower altitudes in drier more open eucalypt forests and woodlands, and often seen in urban areas. Nests and roosting generally occur in tall trees in old growth forests (Pizzey and Knight, 2003; Cameron 2007).	1	0	1996	Possible	Targeted but not located during field investigations. Potentially uses the resources of the larger Subject Property but given the abundance of similar resources in the Locality, the Proposal is unlikely to impact on the local occurrence of this species. Further assessment is NOT required.
Swift Parrot (*Lathamus discolour*)	E1,	E	In NSW this species is a winter migrant and mostly occurs on the coast and south west slopes (OEH, 2012b). On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations.	2	0	2002	Unlikely	Targeted but not located during field investigations. Potentially uses the resources of the larger Subject Property but given the abundance of similar resources in the Locality and the absence of a constant

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS WITHIN 10KM	NUMBER OF RECORDS WITHIN 1KM	MOST RECENT		
			Known feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens* and lerp infested trees such as Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis* (OEH, 2012b).					food source, the Proposal is unlikely to impact on the local occurrence of this species. Further assessment is NOT required.
Powerful Owl (*Ninox strenua*)	V		Forests containing mature trees for shelter or breeding & densely vegetated gullies for roosting. Their main prey are medium-sized arboreal mammals and as such this species generally requires large tracts of land with suitable habitat for prey items (Pizzey & Knight, 2003).	3	0	2008	Possible	Targeted but not located during field investigations. Potentially uses the resources of the larger Subject Property but given the abundance of similar resources in the Locality, the Proposal is unlikely to impact on the local occurrence of this species. Further assessment is NOT required.

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS WITHIN 10KM	NUMBER OF RECORDS WITHIN 1KM	MOST RECENT		
Varied Sittella (*Daphoenositta chrysoptera*)	V		Occurs in woodlands and forests preferring rough and stringy barked trees where it searches for insects. Builds nests in forks of trees (Marchant and Higgins, 1990).	3	0	2006	Possible	Targeted but not located during field investigations. Potentially uses the resources of the larger Subject Property but given the abundance of similar resources in the Locality, the Proposal is unlikely to impact on the local occurrence of this species. Further assessment is NOT required.
Scarlet Robin (*Petroica boodang*)	V		Inhabits dry eucalypt forests and woodlands with an open grassy understorey. They inhabit areas with an abundance of fallen debris, logs and timber. This species is known to breed in hills and foothills of western slopes (OEH, 2013b).	7	0	2006	Possible	Targeted but not located during field investigations. Potentially uses the resources of the larger Subject Property but given the abundance of similar resources in the Locality, the Proposal is unlikely to impact on the local occurrence of this species. Further assessment is NOT required.

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS WITHIN 10KM	NUMBER OF RECORDS WITHIN 1KM	MOST RECENT		
Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*)	V		Inhabits drier areas of woodland and prefers Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*)(Chapman, 1995). Feeding territories are generally large, making this species nomadic (Pizzey & Knight, 2003).	1	0	2006		Targeted but not located during field investigations. Potentially uses the resources of the larger Subject Property but given the abundance of similar resources in the Locality, the Proposal is unlikely to impact on the local occurrence of this species. Further assessment is NOT required.
Regent Honeyeater (*Anthochaera phrygia*)	E	E	Generally inhabit dry Box-Ironbark eucalypt woodland and dry sclerophyll forest associated with moist areas of low relief including in valleys with creeks and along rivers (Webster and Menkhorst, 1992). This species are associated with plants that produce large volumes of nectar and can include Mugga Ironbark (*Eucalyptus sideroxylon*), Yellow Box (*E. melliodora*), White Box and Yellow Gum (*E. leucoxylon*), but also in association with woodland species such as Grey Box (*E. microcarpa*), Red Box (*E. polyanthemos*), Blakely's Red Gum (*E. blakelyi*), River Red Gum	2	0	1997		Targeted but not located during field investigations. Potentially uses the resources of the larger Subject Property but given the abundance of similar resources in the Locality, the Proposal is unlikely to impact on the local occurrence of this species. Further assessment is NOT required.

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS WITHIN 10KM	NUMBER OF RECORDS WITHIN 1KM	MOST RECENT		
			(*E. camaldulensis*), Silver-leaved Ironbark (*E. melanophloia*), Narrow-leaved Ironbark (*E. crebra*), Caley's Ironbark (*E. caleyi*) and Rough-barked Apple (*Angophora floribunda*) (Higgins et al. 2001; Webster & Menkhorst 1992). This species regularly occur in non-remnant patches of woodland and pastoral land.					
Mammals (7)								
Spotted-tailed Quoll (*Dasyurus maculatus*)	V	E	This species has a preference for mature wet forest habitat; however this species has been known to inhabit a wide range from habitat including open and closed woodlands, lowland forest, sub-alpine woodlands to coastal heathland. This species requires suitable den sites such as hollow logs, caves and rock outcrops. This species also forages in relatively intact areas of vegetation (Jones et al., 2003; NSPWS, 1999).	2	0	1994	Unlikely	No suitable habitat was present within or adjacent to the Study Area. Further assessment is not required.

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS WITHIN 10KM	NUMBER OF RECORDS WITHIN 1KM	MOST RECENT		
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	Inhabits a number of areas including rainforests, open-forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. Roost sites are usually located near water on lakes, rivers or coastlines (Van der Ree et al. 2005).	1	0	2005	Possible	Targeted but not located during field investigations. Possible that the species forages on the flowering flora of the larger project region, however no critical habitat within the Subject Property is likely to be modified to compromise the local existence of this species. Further assessment is NOT required.
Eastern Freetail-bat (*Mormopterus norfolkensis*)	V		Inhabits 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 (Churchill, 1998).		0	2008	Possible	Foraging and roosting habitat present in the Open Forest habitat close to the Subject Property, however the site conditions suggested that a targeted nocturnal survey was not required. Although possible roosting and foraging habitat may be present within the Subject Property, it will not be impacted by development and hence an Assessment of

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COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS WITHIN 10KM	NUMBER OF RECORDS WITHIN 1KM	MOST RECENT		
								Significance (i.e. a Seven-Part Test) is not required for this species.
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	V		Primarily roost in caves, however also known to roost in stormwater pipes and in buildings. Maternity caves require specific temperature and humidity ranges (Churchill, 1998).		0	2008	Possible	Foraging and roosting habitat present in the Open Forest habitat close to the Subject Property, however the site conditions suggested that a targeted nocturnal survey was not required. Although possible foraging habitat may be present within the Subject Property, it will not be impacted by development and hence an Assessment of Significance (i.e. a Seven-Part Test) is not required for this species. In addition, it is unlikely that this species uses roosting habitat on the Subject Property due to the little to no presence of primary

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS WITHIN 10KM	NUMBER OF RECORDS WITHIN 1KM	MOST RECENT		
								available roosting habitat.
Southern Myotis (*Myotis macropus*)	V		Primarily roosts in caves, mine shafts, tree hollows, storm water channels and known to roost in buildings. This species forages over pools and streams, creeks and rivers eating insects and small fish (Churchill, 1998).	1	0	2008	Possible	Foraging and roosting habitat present in the Open Forest habitat close to the Subject Property, however the site conditions suggested that a targeted nocturnal survey was not required. No suitable habitat is present within the Subject Property. Further assessment is NOT required.
Koala (*Phascolarctos cinereus*)	V	V	Inhabit temperate, sub-tropical and tropical forests, woodland and semi-arid communities which have an ample supply of food trees dominated by Eucalyptus species in the Blue Mountains region (Martin & Handasyde, 1999). A growing body of evidence suggests shelter trees (exhibiting	2	0	2007	Possible	Targeted but not located during field investigations. In addition no scratches, scats or other traces of this species were found during field investigations. No critical habitat is likely to be modified to compromise the local existence of this

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS WITHIN 10KM	NUMBER OF RECORDS WITHIN 1KM	MOST RECENT		
			features such as bushy cover) are also a factor in habitat selection (Crowther et. al., 2013). However these trees are variable and often difficult to predict.					species. Further assessment is NOT required.
Yellow-bellied Glider (*Petaurus australis*)	V		Inhabit tall old growth Eucalypt forest, generally in areas of high rainfall (Goldingay & Kavanagh, 1991). Feeding on mainly plant and insect exudates, signs of foraging include 'V' – shaped incisions on favoured food trees (Menkhorst and Knight, 2001).	1	0	2000	Unlikely	Targeted but not located during field investigations. In addition no scratches, scats or other traces of this species were found during field investigations. No critical habitat is likely to be modified to compromise the local existence of this species. Further assessment is NOT required.
Squirrel Glider (*Petaurus norfolcensis*)	V		Inhabits mature and old growth box-box Ironbark woodlands and Blackbutt –Bloodwood forest (not known within the study region) (Menkhorst and Knight, 2001). Inhabit multiple tree hollows for refuge and nest sites with similar	1	0	2006	Unlikely	Targeted but not located during field investigations. In addition no scratches, scats or other traces of this species were found during field investigations. No critical habitat is likely to be modified to compromise

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS WITHIN 10KM	NUMBER OF RECORDS WITHIN 1KM	MOST RECENT		
			dietary requirements of that of the Yellow-bellied Glider.					the local existence of this species. Further assessment is NOT required.

5 CONCLUSION, DECLARATION & SIGN-OFF

The current report has provided ecological data for the Subject Property at 1420 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 if 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. All communities listed are considered to be either endangered or critically endangered under the environmental legislation.

Cumberland Shale Plains Woodland is part of the Cumberland Plain Woodland Complex which is listed as 'critically endangered' under both the NSW *TSC Act* and Commonwealth *EPBC Act.* The Cumberland Shale Plains Woodland with elements of Moist Shale Woodland is found on the upper slopes of the Property off Kurmond Road and in the broad gully on the western boundary. This area is not proposed for development, although it is possible that part of this bushland may be cleared or modified to create an Asset Protection Zone for bushfire safety purposes.

Moist Shale Woodland is listed as a separate plant community under NSW legislation as 'endangered', while (Cumberland) Shale Sandstone Transition Forest is listed under both NSW and Commonwealth legislation as 'endangered'.

Cumberland Shale Sandstone Transition Forest occurs along Howes Creek, which is downslope (north) and outside the proposed development area. A minimum area of 40 metres from the riparian corridor is recommended to serve as a 'buffer zone' between the lower edges of the proposed development and the reserved bushland.

Although the native vegetation has been modified for agriculture over a period of many years, if any native vegetation were to be removed or modified under the development Proposal, 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.

However, under the current Proposal native bushland on the Subject Property will be protected, conserved and managed for its natural conservation values as a bushland reserve under Community Title. Given this, and given that no native vegetation is likely to be impacted, it has not been

considered necessary to carry out the Seven-part Test of Significance under section 5(A) of the NSW *Environment Planning & Assessment Act* prior to the submission of a Development Application. It is also considered that an Assessment under the Commonwealth Significant Impact Assessment Guidelines is not required.

Fauna: Two (2) 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 the **Eastern Bentwing Bat** (*Miniopterus schreibersii oceanensis*) was identified as a 'possible' call (*Table 4.2* and *Appendix 4*).

Considering no roosting habitat or foraging habitat will be removed or impacted on the Subject Property and the fauna assessment has outlined that this species will not be influenced by off-site impacts of this proposal, a Seven-part Test of Significance is not required for these three (3) microbat species, listed as Vulnerable under NSW State legislation, i.e. the *TSC Act.* However as there are 2 large habitat trees (Forest Red Gum, *E. tereticornis*) in the south western corner of the property and two stags in the far end of the paddock (Figure 4-5) that will likely be removed during construction, it is recommended that a qualified Ecologist be present whilst the felling of these trees occurs.

Recommendations:

In considering the potential ecological impacts of the proposed rural residential subdivision at 1420 Kurmond Road Kurmond, UBM recommends that:

- The reserved bushland in the western gully and extending to the Howes Creek Riparian Corridor should be managed under a site specific Vegetation Management Plan. Such a plan will provide guidelines for bush regeneration/weed control works and will identify priority tasks and actions to re-establish the native bushland as a viable ecological community.
- Noxious weed control (5 species identified) should be given priority in any future bush regeneration/weed control program.
- 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).
- There is some 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 (even those non-indigenous trees on the upper slopes around the existing residences) 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 stringy bark 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 along Howes Creek. A grassed buffer zone between the lowest building allotment and the creek is highly recommended. The Office of Water recommends a minimum width of 40 metres.

- Care should be taken to maintain the integrity of the aquatic habitats present in the two (2) farm dams: these will be incorporated into the reserved bushland area and appropriately managed as habitat for native fauna.

- Hollow-bearing trees should be allocated the highest priority for retention in Asset Protection Zones. See Figure 4.5 for location of habitat trees.

- Where potential habitat trees are removed for construction or bushfire safety purposes, an experienced Ecologist should be on site to examine the tree for the presence of native fauna. If such fauna are located and no obvious habitat on site is available for relocation, WIRES should be contacted to help relocate the animal. If fauna is injured or requires an assessment of health then WIRES or a local Wildlife Carer should be contacted immediately.

- In order to replace any habitat trees removed, the installation of nesting boxes for microbats should be considered. Habitat trees likely to be utilised by microbats are those with small hollows and/or deep fissured bark.

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
Acacia decurrens	1	25	1	2
Acacia falcata	1	13	1	1
Acacia implexa	1	15	1	6
Acacia parramattensis	1	22	1	4
Ajuga australis	1	15	1	3
Amyema gaudichaudii	1	3	1	0
Amyema miquelii	1	2	1	0
Angophora subvelutina	3	5	2	0
Aristida ramosa	1	51	1	4
Aristida vagans	2	80	1	7
Arthropodium milleflorum	1	33	1	5
Arthropodium minus	1	5	1	1
Asperula conferta	1	26	1	3
Astroloma humifusum	1	12	1	4
Austrodanthonia fulva	2	7	1	2
Austrodanthonia racemosa var. racemosa	1	26	1	5
Austrodanthonia tenuior	1	32	1	2
Bossiaea prostrata	1	15	1	2
Bothriochloa decipiens	1	7	1	0
Bothriochloa macra	1	12	1	1
Breynia oblongifolia	1	21	1	12
Brunoniella australis	2	81	1	2
Bursaria spinosa	3	93	1	13
Caesia parviflora	1	19	1	2
Calotis cuneifolia	1	5	1	0

Species	C/A	Freq	C/AO	FreqO
Calotis dentex	2	7	1	1
Carex inversa	1	20	1	3
Centella asiatica	1	21	1	4
Centaurium spicatum	1	4	1	0
Cheilanthes distans	1	7	1	2
Cheilanthes sieberi	2	87	1	12
Chloris truncata	1	5	1	0
Chloris ventricosa	1	17	1	1
Chorizema parviflorum	1	5	1	0
Commelina cyanea	1	21	1	4
Cymbopogon refractus	1	41	1	4
Cynodon dactylon	1	10	1	1
Cyperus enervis	1	2	1	0
Cyperus gracilis	1	15	1	2
Cyperus laevis	1	4	1	1
Daviesia ulicifolia	1	24	1	6
Desmodium brachypodum	1	18	1	3
Desmodium rhytidophyllum	1	9	1	1
Desmodium varians	1	79	1	20
Dianella longifolia	1	51	1	4
Dichelachne micrantha	1	65	1	8
Dichopogon fimbriatus	1	3	1	0
Dichondra spp.	2	93	1	24
Dichelachne parva	1	12	1	1
Dichanthium sericeum subsp. sericeum	1	3	1	0

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

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

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

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

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

- *Eucalyptus punctata*
- *Eucalyptus resinifera*
- *Eucalyptus sclerophylla*
- *Eucalyptus siderophloia*
- *Eucalyptus sparsifolia*
- *Eucalyptus squamosa*
- *Eucalyptus tereticornis*
- *Euchiton sphaericus*
- *Exocarpos cuppressiformis*
- *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 satureioides*
- *Oxalis perennans*
- *Persoonia hirsuta*
- *Phyllanthus similis*
- *Platylobium formosum*
- *Polymeria calycina*
- *Prostanthera inclsa*
- *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 1420 Kurmond Road, Kurmond

Plant Communities

Forest Red Gum Mesic Woodland (Moist Shale Woodland) – T3, Q1
Cabbage Gum-Forest Red Gum Mesic Woodland (Moist Shale Woodland) T1
Wattle-Privet Scrub (previously Moist Shale Woodland) - T2
Wetland and Exotic Grassland Surround – T4

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	T4	Q1
Canopy Trees								
Myrtaceae		*Eucalyptus amplifolia*	Cabbage Gum			v		5
		Eucalyptus bosistoana	Coast Grey Box	o	o			
		Eucalyptus crebra	Narrow-leaved Ironbark	r				
		Eucalyptus moluccana	Grey Box	r				
		Eucalyptus tereticornis	Forest Red Gum	v		c		1
Small Trees								
Pinaceae	*	*Pinus radiata*	Monterey Pine	r				
Fabaceae		*Acacia implexa*	Hickory Wattle	r				1
		A. parramattensis	Parramatta Wattle	r	c	r		1
Meliaceae		*Melia azedarach*	White Cedar					
Myrtaceae		*Backhousia myrtifolia*	Grey Myrtle			r		
		Melaleuca styphelioides	Prickly Paperbark			r		1
Oleaceae	*	*Ligustrum lucidum*	Large-leaved Privet		c			1
Pittosporaceae		*Pittosporum undulatum*	Sweet Pittosporum			r		
Rhamnaceae		*Alphitonia excelsa*	Red Ash	r		o		5
Shrubs								
Araliaceae		*Polyscias sambucifolius*	Elderberry Panax			o		2
Asteraceae		*Ozothamnus diosmifolius*	White Dogwood			o		
Celastraceae		*Maytenus silvestris*	Narrow-leaved Orangebark			r		1

FAMILY		SCIENTIFIC NAME	COMMON NAME	TRANSECT				
				T1	T2	T3	T4	Q1
Euphorbiaceae		*Breynia oblongifolia*	Dwarfs Apples	r		r		1
		Homalanthus populifolius	Bleeding Heart					1
Fabaceae		*Acacia implexa*	Hickory Wattle saplings		r	o		
		A. parramattensis	Parramatta wattle saplings	o		c		2
Lauraceae	*	*Cinnamomum camphora*	Camphor Laurel saplings			r		
Meliaceae		*Melia azedarach*	White Cedar saplings	r	r	r		2
Myrtaceae		*Eucalyptus tereticornis*	saplings	r				
Ochnaceae	*	*Ochna serrulata*	Mickey Mouse Plant	o	c	o		2
Oleaceae	*	*Ligustrum lucidum*	Privet saplings & seedlings		v	c		
	*	*L. sinense*	Privet saplings & seedlings	o	v	v		3
		Notelaea longifolia	Large Mock Olive			o		1
Pittosporaceae		*Bursaria spinosa*	Blackthorn	o	o	r		
		Pittosporum revolutum	Yellow Pittosporum			r		
	*	*Pyracantha sp.*	Firethorn	o				
Rhamnaceae		*Alphitonia excelsa*	Red Ash saplings	o	o	o		2
Solanaceae	*	*Solanum mauritianum*	Tobacco Tree	o	o	o		
Ulmaceae		*Trema aspera*	Poison Peach					1
Verbenaceae		*Clerodendrum tomentosum*	Hairy Clerodendrum	r		r		
	*	*Lantana camara*	Lantana	c	o	v		5
Herbs - Ferns								
Adiantaceae		*Adiantum aethiopicum*	Common Maidenhair Fern		o	r		
Blechnaceae		*Doodia aspera*	Rasp Fern			r		
Dennstaedtiaceae		*Hypolepis muelleri*	Harsh Ground Fern		o	o		
Dicksoniaceae		*Calochlaena dubia*	False Bracken Fern			o		
Sinopteridaceae		*Pellaea falcata*	Sickle Fern		c			
Herbs - Dicots								
Acanthaceae		*Pseuderanthemum variabile*	Pastel Flower			c		3
		Brunoniella australis	Purple Trumpet	r				
Amaranthaceae		*Alternanthera denticulata*		o	o	o	o	
	*	*Amaranthus viridis*		o				
Apiaceae		*Centella asiatica*	Pennywort		r	o	o	

FAMILY		SCIENTIFIC NAME	COMMON NAME	TRANSECT				
				T1	T2	T3	T4	Q1
	*	*Ciclosperma leptophylla*		r				
		Hydrocotyle pedunculata				r		
Asteraceae	*	*Bidens pilosa*	Farmers Friends	v	r			1
		Calotis dentex				r		
		Centipeda minima				r	c	
	*	*Cirsium vulgare*	Spear Thistle		o	c		2
	*	*Hypochaeris radicata*	Flatweed			o		2
	*	*Senecio madagascariensis*	Fireweed	o			r	
		Sigesbeckia orientalis	Indian Scurvy Weed	o				4
	*	*Sonchus oleraceus*	Sow Thistle	o	r			3
		Vernonia cinerea		r				
Brassicaceae		*Lepidium* sp		r				
Caryophyllaceae		*Stellaria flaccida*		r		r		1
Chenopodiaceae		*Chenopodium pumilio*	Small Crumbweed	r				
		Einadia hastata	Saloop					adj
		E. trigonos	Fishweed	o				
Convolvulaceae		*Dichondra repens*	Kidney Plant	r	r	r		1
Fabaceae	*	*Lotus* sp		o				
	*	*Trifolium repens*	White Clover	r				
Geraniaceae		*Geranium homeanum*	Storksbill	c		o		
Lobeliaceae		*Pratia purpurascens*	White Root	r	o			1
Malvaceae	*	*Malva parviflora*	Small-flowered Mallow	r				
	*	*Modiola caroliniana*	Mallow	c				
	*	*Sida rhombifolia*	Paddys Lucerne	c	o			1
Nympheaceae	*	*Nymphea* sp.	Water Lily				c	
Oxalidaceae	*	*Oxalis ?carnea*		r				
		O. perennans		r				1
Phytolaccaceae	*	*Phytolacca octandra*	Inkweed	o	r			2
Plantaginaceae		*Plantago debilis*	Buckthorn			r		
	*	*P. lanceolata*	Lambs Tongue	c				
Polygonaceae		*Persicaria decipiens*	Spotted Knotweed				c	

FAMILY		SCIENTIFIC NAME	COMMON NAME	TRANSECT				
				T1	T2	T3	T4	Q1
		P. hydropiper			r	r		
		Rumex brownii	Swamp Dock			r		
Primulaceae	*	*Anagallis arvensis*	Scarlet Pimpernel	r				1
Solanaceae	*	*Solanum chenopodioides*			r			
	*	*S. nigrum*	Blackberry Nightshade	o	o	c		2
		S. prinophyllum		c		o		3
		S. stelligerum	Star Nightshade	r		o		3
Violaceae		*Viola hederacea*	Native Violet			r		
Herbs - Monocots								
Asparagaceae	*	*Asparagus densiflorus*	Fern Asparagus	r				
Commelinaceae		*Commelina cyanea*	Blue Wandering Jew	o		c		3
Cyperaceae		*Carex appressa*	A sedge		o	o		
		Carex inversa		o				
		Carex longebrachiata			o			
		Cyperus gracilis		r				
		Cyperus trinervis			r	r		
		Cyperus sp.	A sedge			r	o	
		Elaeocharis sphacelata					r	
		Gahnia aspera	Rough Saw-sedge			r		
Juncaceae		*Juncus usitatus*	Soft Tussock Rush		r			
Lomandraceae		*Lomandra longifolia*	Spiny-headed Mat-rush			o		2
Phormiaceae		*Dianella longifolia*	Blue Paroo Lily		r	r		1
Poaceae		*Aristida vagans*	Three-awned Grass	r				
		Austrostipa verticillata	Slender Bamboo Grass		r	o		3
	*	*Axonopus affinis*	Carpet Grass				o	
		Bothriochloa decipiens	Barb-wire Grass	r				
	*	*Bromus catharticus*	Prairie Grass	o				
	*	*Cynodon dactylon*	Couch Grass	c	o		o	
	*	*Digitaria sanguinalis*	Summer Grass	o	o			
	*	*Echinochloa crus-galli*	Barnyard Grass				r	
	*	*Ehrharta erecta*	Veldt Grass	c				

FAMILY		SCIENTIFIC NAME	COMMON NAME	TRANSECT				
				T1	T2	T3	T4	Q1
		Entolasia marginata	Margined Panic	o	r	o		1
		E. stricta	Wiry Panic		o	c		2
		E. leptostachya	Paddock Love-grass	r				
	*	*Lolium* sp.	Rye Grass	r				
		Microlaena stipoides	Weeping Meadow-grass	v	c			3
		Oplismenus aemulus	Basket Grass	c	c	c		5
		Panicum simile	Two-flowered Panic	r				
		Paspalidium distans		c		o		1
	*	*Paspalum dilatatum*	Paspalum	o				
		P. distichum	Water Couch				o	
	*	*Setaria gracilis*	Slender Pigeon Grass	o		o		
	*	*Sporobolus indica var major*	Giant Parramatta Grass	r				
Vines								
Apocynaceae		*Parsonsia straminea*	Common Silkpod			c		3
	*	*Araujia sericifera*	Moth Vine	r	r	r		
Asclepiadaceae		*Tylophora barbata*	Purple Tylophora			o		1
Asteraceae	*	*Delairea odorata*	Cape Ivy		o	o		2
Bignoniaceae		*Pandorea pandorana*	Wonga Wonga Vine			o		2
Convolvulaceae		*Polymera calycina*				r		1
Fabaceae		*Glycine microphylla*	A love twiner	r	o			
		G. tabacina		o		r		
Ranunculaceae		*Clematis glycinoides*	Travellers Joy		r	o		2
Rosaceae	*	*Rubus fruticosus* spp. agg.	Blackberry			r		
		R. parvifolius	Small-leaved Bramble		o	r		
Rubiaceae		*Morinda jasminoides*	Jasmine Morinda			r		1
Solanaceae	*	*Solanum seaforthianum*		r	r	r		
Vitaceae		*Cayratia clematidea*	Slender Grape	r	r	o		2
Asparagaceae	*	*Asparagus asparagoides*	Bridal Veil Creeper		o			
Luzuriagaceae		*Eustrephus latifolius*	Wombat Berry			o		
		Geitonoplesium cymosum	Scrambling Lily		r			2

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
Amphibians (3)				
Person's Tree Frog	*Litoria peronii*	W/O	1	-
Eastern Dwarf Tree Frog	*Litoria fallax*	W	5 – 10	-
Smooth Toadlet	*Uperoleia laevigata*	W	5 – 10	-
Reptiles (1)				
Eastern Water Dragon	*Physignathus lesueurii*	O	1	-
Birds (42)				
Australian Magpie	*Cracticus tibicen*	O	2	-
Bell Miner	*Manorina melanophrys*	O/W	>30	-
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O	2	-
Common Myna *	*Sturnus tristis*	O	2	-
Crested Pigeon	*Ocyphaps lophotes*	O	2	1
Eastern Rosella	*Platycercus eximius*	O/W	5 - 10	-
Eastern Whipbird	*Psophodes olivaceus*	O/W	4	-
Grey Fantail	*Rhipidura albiscapa*	W	1	-
Laughing Kookaburra	*Dacelo novaeguineae*	O/W	4	2
Magpie-lark	*Grallina cyanoleuca*	O/W	2	2
Noisy Miner	*Manorina melanocephala*	O	8	-
Rainbow Lorikeet	*Trichoglossus haematodus*	W	-	2

COMMON NAME	SCIENTIFIC NAME	OBSERVATION METHOD	COUNT	
			WITHIN SITE	NEARBY/ FLY-OVER
Red-browed Finch	*Neochmia temporalis*	O/W	10 - 20	-
Striated Thornbill	*Acanthiza lineata*	O	3	
Sulphur-crested Cockatoo	*Cacatua galerita*	O/W	-	8
Superb Fairy-wren	*Malurus cyaneus*	O/W	5 - 6	-
Willie Wagtail	*Rhipidura leucophrys*	O	2	-
Pied-currawong	*Strepera graculina*	O/W	2	4
Yellow-tailed black cockatoo	*Calyptorhynchus funereus*	O/W	-	2
Spotted Dove	*Spilopelia chinensis*	O	6	-
Pacific Black Duck	*Anas superciliosa*	O	2	-
White-bellied Cuckoo Shrike	*Coracina papuensis*	O	1	-
Dollarbird	*Eurystomus orientalis*	O	1	-
Masked Lapwing	*Vanellus miles*	W	-	2
Rufous Whistler	*Pachycephala rufiventris*	O/W	1	-
Eastern Spinebill	*Acanthorhynchus tenuirostris*	O	1	-
Restless Flycatcher	*Myiagra inquieta*	O/W	3	-
Eastern Yellow Robin	*Eopsaltria australis*	O	1	-
Buff-rumped Thornbill	*Acanthiza reguloides*	O	2	-
Silvereye	*Zosterops lateralis*	O	3	-
Weebill	*Smicrornis brevirostris*	O/W	4	-
Brown Thornbill	*Acanthiza pusilla*	O	1	-
Red-whiskered Bulbul	*Pycnonotus jocosus*	O	2	-
Brush Cuckoo	*Cacomantis variolosus*	O	1	-
White-browed Scrubwren	*Sericornis frontalis*	O	1	-

COMMON NAME	SCIENTIFIC NAME	OBSERVATION METHOD	COUNT	
			WITHIN SITE	NEARBY/ FLY-OVER
King Parrot	*Alisterus scapularis*	O	2	2
Little Egret	*Egretta garzetta*	O	-	10 - 15
Torresian Crow	*Corvus orru*	O	-	1
Welcome Swallow	*Hirundo neoxena*	O	3	-
Wonga Pigeon	*Leucosarcia picata*	W	1	-
Grey Shrike Thrush	*Colluricincla harmonica*	W	1	-
Mammals (0)				
Cat	*Felis catus*	W	1	-
Rabbit	*Oryctolagus cuniculus*	W	1	-
Dog *	*Canis lupus familiaris*	W	1	-
Eastern Bentwing Bat #	*Miniopterus schreibersii oceanensis*	W (Possible)	-	-
Eastern Freetail Bat #	*Mormopterus norfolkensis*	W (Confident)	-	-
Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	W (confident)	-	-
Gould's Wattled Bat	*Chalinolobus gouldii*	W (Confident)	-	-
Little Forest Bat	*Vespadelus vulturnus*	W (Confident)	-	-
Chocolate Wattled Bat	*Chalinolobus morio*	W (Confident)	-	-