Reptile and Amphibian Surveys

Active reptile and targeted amphibian searches were undertaken. Active reptile searches involved searching potential basking sites for reptiles during daylight hours, and lifting up debris that may provide habitat for reptile species and identifying those observed or captured. Amphibian searches included active tadpole and adult frog searches, call listening surveys, and call playback and spotlighting.

Cumberland Plain Land Snail

This species has been recorded within the study area (DECC 2008) so active searches for this species were carried out. Techniques included actively sifting through leaf litter, looking under logs, woody debris and rubbish, and digging into the soil under remnant trees to look for live snails or old shells.

Incidental Scats & Tracks

Any incidental sightings of fauna or fauna tracks were also noted. Any predator or unusual scats found across the site were collected. Scats of feral animals often provide important information on native species present at the site and were therefore also collected. Analysis of samples is completed by Barbara Triggs of Dead Finish.

Spotlighting

Spotlighting for arboreal fauna and nocturnal avifauna was carried out on the site over two nights. Two ecologists traversed the site over both nights and all species heard or seen were noted.

Call Playback

Call playback was conducted for threatened species for which potential habitat was present on the site. Call playback comprised an initial listening period of 10 minutes followed by broadcasting of the calls for approximately five minutes per species. Call playback was followed by another 10 minute listening period and a 10-minute spotlight search of the area.

Microchipertan Bats

As previous surveys identified the threatened Eastern (Common) Bentwing-Bat occurring on the site, and indicated that the site offered potential habitat for a number of other threatened bat species, targeted bat surveys were carried out using the following techniques:

- Placement of a Z-caim Anabat over two nights at two locations within the site;
- Placement of a Harp Trap at two locations over two nights within the site.

Using both Anabats and Harp traps helped ensure the site was thoroughly surveyed for this suite of species.

Anabat Analysis

Calls collected during the field survey were identified using zero crossing analysis and Analook software by visually comparing call traits with reference calls. No reference calls were collected during the survey. The bat calls of NSW: Region based guide to the echolocation calls of microchipertan bats (2004) was used as a guide to call analysis. Due to the high level of variability and overlap in call characteristics and lack of local reference calls a conservative approach was taken when analysing calls.

A call was defined as a sequence of three or more consecutive pulses of similar frequency. Pulses separated from another sequence by a period of five seconds were considered to be separate calls. Scattered sequences, where intermittent pulses were not separated by more than five seconds, were

recognised as a single pass. Where constant activity was recorded, a single pass was defined as 15 seconds (i.e. one full display screen comprising as Anabat sequence file). Although this method underestimates the number of bat passes when there is continuous activity, the standard unit of time remains consistent (Law et al., 1998; Law et al., 1999).

Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills et al. 1996 & Duffy et al. 2000) as summarised in Table 2.

Table 2 Confidence ratings applied to calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call types.
PO - Possible	Call characteristics are comparable with the species, but there exists a reasonable probability of confusion with one or more bat similar species or quality or length of call prohibits a confident identification.
Species Group	Call made by one of two or more species. Call characteristics overlap making it to difficult to distinguish between species e.g. *Vespadelus spp / M. schreibersii oceanensis* *C. gouldii / M. planiceps species 2* (spf) *Nyctophilus sp.* The calls of *Nyctophilus geoffroyi* and *N. gouldi* cannot be distinguished during the analysis process and are therefore lumped together.

2.3 Limitations

If surveys are undertaken outside the optimal survey period for some species it is possible that some species that utilise the site may not be detected during the survey period. These species are likely to include cryptic species and some threatened flora such as orchids, which may not be flowering during the survey period. Some fauna species are also mobile and transient in their use of resources. Consequently, it is likely that not all species either resident or transitory to the site would be recorded during the site inspection.

Consequently, this survey was not designed to detect all species, either resident or transitory to the study area. Instead it was aimed at providing an overall assessment of the ecological values of the site with particular emphasis on threatened species to allow an assessment of the conservation values of the site and potential impacts of future development of the site on these values.

Dedicated trapping surveys (e.g. Elliot traps, cage traps and pitfall traps) were not proposed during the fauna surveys.

3. Results

3.1 Literature Review

Results of the literature review indicate a number of threatened species have been recorded within a 10 kilometre radius of the site, or have the potential to occur within the locality. The results of the DECC database searches are shown in Appendix B. Not all species listed are likely to occur within the study area. Threatened species that have been previously recorded within the site / study area and their potential to occur within the study area are listed in Appendix B.

3.2 Vegetation Description

The site contained a mixture of vegetation communities including open cleared grassland, private residential areas and gardens, remnant and regenerating wet sclerophyll forest, and dense areas of Privet and Pittosporum including a mixture of exotic and native species. Two stormwater drainage channels flow into the site from Colbarra Place and Hill Road, forming a creek line through the centre of the site, running into Darling Mills Creek to the south of the site.

Evidence of past clearing (likely > 45 years ago) was evident from the age of much of the canopy trees occurring across the site, along with the high level of woody weed infestation in the understorey.

Despite no recent rainfall events, the vegetation on site contained a high moisture level along the entire creek line and within the surrounding areas.

3.2.1 Grassland and Domestic Gardens

Grassland areas occurred predominately to the north and northwest of the site, and surrounding residential areas in the centre and south west of the site. These areas were dominated by a mixture of native and exotic grass and herbaceous species including Paspalum (*Paspalum dilatatum*), Weeping Meadow Grass (*Microlaena stipoides*), Couch (*Cynodon dactylon*), Pigeon Grass (*Setaria sp.),* Slender Rat's Tail Grass (*Sporobolus creber*), Mullumbimby Couch (*Cyperus brevifolius*) and Queensland Blue Grass (*Dichanthium sericeum*). These areas appeared subject to regular mowing and grazing from European Rabbits.

Domestic gardens occurred surrounding both residential houses on the site and contained a mixture of cultivated species including Jacaranda (*Jacaranda mimosifolia*), Oleander (*Nerium oleander),* Queen Palm (*Arecastrum romanzoffianum)*, Agapanthus (*Agapanthus praecox subsp orientalis*), Fishbone Fern (*Nephrolepis cordifolia),* Cotoneaster (*Cotoneaster glaucophyllus)*, and Silky Oak (*Grevillea robusta*). Encroachment of exotic species from existing and past garden areas on the surrounding native vegetation was evident across much of the site.

3.2.2 Remnant and Regrowth Native Vegetation Communities

Two distinct native vegetation communities occurred on the site. The first community comprised remnant and regrowth maturing Sydney Blue Gum (*Eucalyptus saligna*) dominating the canopy layer with Hickory (*Acacia implexa*), Small-leaved and Broad-leaved Privet (*Ligustrum sp*), and Sweet and Rough-fruit Pittosporum (*Pittosporum sp*), dominating the shrub and sub canopy stratums. Ground covers were sparse under the dense sub canopy of Pittosporum and Privet and included Mat Rush (*Lomandra*

longifolia), Common Maidenhair Fern (*Adiantum aethiopicum*), False Bracken Fern (*Calochaena dubia*), and Wombat Vine (*Eustrephus latifolius)*. This community contains species indicative of Blue Gum High Forest, listed as a critically endangered ecological community under the NSW *Threatened Species Conservation Act 1995 (TSC Act)* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. This vegetation community dominated the site and was in a degraded state with evidence of past disturbance including clearing, and contained a high woody weed infestation in the understorey. Evidence of rubbish and garden waste dumping within this community was also visible.

The second distinct vegetation community occurred as a small pocket of remnant vegetation in the far north east corner of the site and was dominated by a mixture of canopy species including Red Mahogany (*Eucalyptus resinifera*), Northern Grey Ironbark (*Eucalyptus siderophloia*), Grey Ironbark (*Eucalyptus paniculata*) and Sydney Blue Gum with a diverse shrub layer including Breynia (*Breynia oblongifolia*), Everlasting (*Ozothamnus diosmifolium*), Sydney Golden Wattle (*Acacia longifolia*), Lantana (*Lantana camara*), and Hairy Clerodendrum (*Clerodendrum tormentosum*). Groundcovers included Native Wandering Jew (*Commelina cyanea*), *Einadia hastata*, Bridal Creeper (*Asparagus asparagoides),* Blue Flax-lily (*Dianella caerulea var producta*), *Pratia purpurascens*, and Hedgehog Grass (*Echinopogon ovatus*). This vegetation community contained species indicative of Sydney Turpentine – Ironbark Forest, listed as an endangered ecological community under the *TSC Act* and critically endangered under the *EPBC Act)*. This community was in good condition with no obvious signs of past clearing within remaining vegetation, and contained only moderate levels of weed invasion and signs of rubbish dumping.

3.2.3 Woody Weed Thickets

Dense patches of woody weed thickets occur along the northwest, west, and south west of the site predominately within the private property (Lot 4), and most likely remnants of previous hedge plantings on the site as seen in historical aerial photos taken of the site (Appendix H). Small-leaved and Broad-leaved Privet, Sweet and Rough-fruit Pittosporum, Lantana, African Olive (*Olea europea*) and Blackberry (*Rubus fruticosus*) dominated the vegetation in these thickets, with some patches containing regenerating Hickory and Sydney Blue Gum saplings. Evidence of rubbish dumping within these thickets was also visible. Regular mowing of the grassy areas surrounding these thickets is currently containing the further spread of these thickets.

3.3 Endangered Ecological Communities (EEC)

Vegetation occurring across the majority of the site constituted Blue Gum High Forest, listed as a critically endangered ecological community under the *TSC Act* and the *EPBC Act*. This EEC contains a narrow strip of remnant canopy along the creek line that runs through the centre of the site, as well as maturing regrowth across the remaining extent of this community. Almost the entire extent of this EEC contains a dense understorey of Privet, Pittosporum, and Lantana with a mixture of other native and exotic species occurring throughout.

Despite the high proportion of woody weeds within the sub canopy and shrub stratums, this EEC still contains a number of species indicative of this ecological community within the sub canopy, shrub, and ground layers.

Private property abutting the site along its southeastern edge toward Aiken Road contains a broader suite of canopy and groundcover species indicative of this community, however largely lacks a midstorey or shrub layer due to the current management of the property. This area has also recently been approved for subdivision, with a restricted development area along the creekline running south of the site.

A small patch of vegetation occurring on the far northeastern corner of the site contains species indicative of Sydney Turpentine – Ironbark Forest, listed as an endangered ecological community under the NSW *TSC Act* and critically endangered ecological community under the Commonwealth *EPBC Act*. This EEC contained a high diversity of species with only a moderate level of woody weed invasion in the shrub layer. Sydney Turpentine – Ironbark Forest is also present in the Colbarra Place Council reserve immediately to the north of the site.

The vegetation mapping provided by BHSC mapped the entire site as Sydney Turpentine-Ironbark Forest, which differs from the findings of the ground surveys for the site. EEC's found on the site during the current surveys have been mapped and an assessment made of the contribution of vegetation on the site to vegetation links or 'corridors' in the locality and region (Appendix F).

3.4 Noxious Weeds

Blackberry, Bridal Creeper, Lantana, exotic Oxalis, Broad-leaved Privet, and Small-Leaved Privet are all listed as Noxious Weeds under the *Noxious Weeds Act 1995* for the Hawkesbury River County Council, including the local council areas of Baulkham Hills, Blacktown, Hawkesbury, and Penrith. These species must be suppressed and controlled by the landowner under the Act. These species were found to occur across the site. Due to the high prevalence of Small-leaved and Broad-leaved Privet across the site, in particular under the canopy of the Blue Gum High Forest, it was deemed inappropriate to map the extent of noxious weed invasion across the site separately to other vegetation mapping (Appendix E).

3.5 Fauna Habitat

Despite the highly urban nature of the area surrounding the site, including a recent subdivision development along the southeast of the site, the presence of large tracts of bushland to the north, northeast and northwest of the site, namely Cumberland State Forest and Colbarra Council reserve, and south of Aiken Road, as well as an existing vegetation corridor along Darling Mills Creek between these areas of which the site is a part, suggest this site provides an important vegetation and habitat corridor between these larger tracts of vegetation, as well as providing transitory and permanent habitat for a variety of fauna species found within the study area.

The site provides a variety of habitat for native fauna, including that of a number of threatened species. The site contains large canopy trees including hollow-bearing trees, stags (dead standing trees), a creek line and dense shrubby vegetation providing suitable habitat for amphibians, small birds, microchipertan bats, and potential foraging habitat for arboreal mammals and some owl species. A number of small and medium sized hollows were evident across the site in stags and older remnant trees along the creek line and to the northeast of the site, providing suitable habitat for microchiropteran bats, arboreal mammals and breeding sites for some bird species.

Two stormwater drainage channels flow into the site forming a creek line that dissects the site from north to south, eventually running into Darling Mills Creek to the south of the site. The creek line contained running water at the time of surveys, and lacked any visible signs of Gambusia. Common Froglets (*Crinia*

signifera) were heard calling from the creek line during current surveys. Active searches did not reveal the presence of tadpoles within the waterway. The vegetation and creekline also provide suitable foraging habitat for other species of insectivorous micro bats.

Dense Pittosporum and Privet sub canopy and shrub stratums across the site provide a good food source for a number of bird and mammal species reliant on fruiting bodies for foraging. The dense nature of this vegetation also provides excellent habitat and protection for resident arboreal mammals such as the Common Ringtail Possum (*Pseudocheirus peregrinus*) and potentially for other species of ground dwelling and arboreal mammals and rainforest birds. A Satin Bowerbird (*Ptilonorhynchus violaceus*) Bower (Appendix I) was also found within the dense understorey provided on the site.

The high number of flowering Eucalypt species on the site would also provide an excellent source of seasonal foraging material for nectar eating birds and bat species including the Grey-headed Flying-fox.

Rabbit burrows were found in high densities among the dense privet understorey, and high numbers of European Rabbits (*Oryctolagus cuniculus*) were found occurring across the site, in particular utilising the cleared grassy areas to the north and northwest of site and surrounding residential properties.

No Foxes were recorded during surveys however residents suggested these animals frequent the reserve throughout the year.

3.6 Microchiropteran Bats

3.6.1 Harp Trapping

Appropriate locations to place a Harp trap where the equipment would be safe from public access and potential theft or harm to captive animals were limited across the site. No microchipertan bats were caught during Harp trapping on the site, and very little bat activity was noted during spotlighting efforts on both nights of surveys. Cold nights may have limited the food supply and activity levels of these bats. Possible seasonal hibernation or migration of these species may also be responsible for the lack of bat activity across the site at the time of surveying.

3.6.2 Anabat

Microchiropteran bat echolocation calls were recorded for two nights within the site, for a total of ~17 hrs hours. Little Mastiff-bat (*Mormopterus planiceps species 2.*) was probably (PR) identified as a result of Anabat call analysis. No other species were definitely identified.

3.7 Threatened Species

The Grey-headed Flying-fox (*Pteropus poliocephalus)*, listed as a vulnerable species under the *TSC Act* and the *EPBC Act*, was recorded in the canopy trees of the site and as a fly-over during surveys. Flowering Eucalypt species, along with fruiting Privet and Pittosporum, provide an excellent source of seasonal foraging material for Grey-headed Flying-fox. The Eastern (or Common) Bent-wing Bat, listed as vulnerable under the *TSC Act* was located on the site during previous surveys (Abel Ecology 2005). However, this species was not recorded during current survey efforts. Hollow-bearing trees and stags also provide potential roosting sites for the Eastern Bent-wing bat and other threatened microchipertan bats. Note: this species is primarily a cave-roosting species but can use hollows as temp roost sites. Site provides foraging habitat for this and other micro bats

The site also offers a variety of habitats for threatened fauna occurring in the area, as well as providing a link with areas of adjacent vegetation, particularly through the canopy stratum, facilitating the movement of threatened and other faunal species across the landscape to the north and south of the site.

Appendix B provides a list of all threatened species recorded within the locality, including habitat requirements and an assessment of the likelihood of occurrence on the site.

4. Constraints and Opportunities

4.1 Identified Constraints

An ecological assessment of the site has been made with respect to identifying potential constraints and opportunities for future development. This assessment has involved consideration of the ecological values and conservation significance of the site and respective environmental and planning statutory requirements.

The primary ecological constraints on the site comprise:

- the presence of two critically endangered ecological communities;
- the known occurrence of two threatened fauna species and their habitat;
- the presence of habitat and specific habitat features for other threatened fauna species known from the locality; and
- creeklines and vegetation that contribute to local and regional wildlife corridors.

4.1.1 Endangered Ecological Communities

Two EEC's occur on the site: Blue Gum High Forest and Sydney Turpentine – Ironbark Forest. Both of these communities are listed for protection under state and national legislation (See section 4.3). Blue Gum High Forest is the most extensive community, extending across a reasonably large proportion of the site. EEC's found on the site have been mapped (Appendix E).

Despite the high level of noxious and woody weed invasion in the understorey of these EEC's, there remains a suitable diversity of native species present to facilitate effective regeneration if appropriate weed control measures and revegetation plans are put in place across the site and on adjoining properties.

Any proposed development on the site that required clearing of EEC vegetation would be subject to assessment under the provisions of the TSC and EPBC Acts. The legislative requirements pertaining to both these Acts with respect to future development of the site are discussed further in section 4.3 of this report.

4.1.2 Threatened Species & Habitat

The threatened Grey-headed Flying-fox and Eastern Bent-wing Bat have been recorded on the site during current and previous surveys (Abel Ecology 2005). The vegetated areas of the site provide known foraging and temporary roosting habitat for these species, including flowering and fruiting trees, habitat for insect prey and tree-hollows and stags.

Any proposed development on the site that has the potential to adversely impact on these species or their habitats would require assessment under Section 5A of the TSC Act. Potential adverse impacts on the Grey-headed Flying-fox and its habitat would also be required under the provisions of the EPBC Act. The legislative requirements pertaining to both these Acts with respect to future development of the site are discussed further in section 4.3 of this report.

4.1.3 Creeklines and Corridors

The EEC's on the site form part of a vegetated link between the Cumberland State Forest to the northwest and Richard Webb Reserve to the south of the site and as such contribute to the local and regional wildlife corridor network. The creekline and associated vegetation, although modified and degraded provide habitat for a range of terrestrial and aquatic species and flow into Darling Mills Creek to the south of the site.

Despite the highly urban nature of the surrounding area, the site still contributes to an important habitat corridor within the local area, linking vegetation to the north, northeast and northwest of the site with areas of vegetation to the south. Loss of existing vegetation and canopy cover on the subject site would further reduce habitat and connectivity through the landscape in particular in light of adjacent approved developments. The adjacent subdivision to the southwest of the site, along with a recently approved subdivision to the southeast, will result in some reduction of habitat, however restricted development along the creekline area within the latter subdivision area and presumed retention of canopy trees, will help to maintain a link with the site and areas of vegetation to the south.

4.2 Assessment of Constraints

To determine the conservation significance and corresponding development constraint of respective areas of the site the following assessment criteria have been applied:

- presence or absence of an EEC;
- presence or absence of threatened flora or fauna species;
- presence or absence of hollow-bearing trees or other significant habitat features (e.g. stags);
- presence or absence of significant foraging trees or shrub species for threatened species known or having the potential to occur on the site or in the locality;
- level of weed invasion;
- presence or absence of Noxious weeds;
- contribution to vegetation links and connectivity through the site and with adjoining vegetation; and
- potential for regeneration and rehabilitation and long-term viability.

Based on the findings of this conservation significance assessment process, areas of the site have been assigned a High, Medium or Low Conservation Significance/Development Constraint Value, as follows:

4.2.1 High Conservation Significance - areas containing:

- remnant or maturing, regenerating EEC listed under the *NSW* TSC Act and/or EPBC Act with high recovery potential;
- known habitat or habitat features for threatened fauna species listed under the NSW TSC Act and/or EPBC Act;
- habitat or habitat features (e.g. large hollow-bearing trees/stags) of potential relevance to threatened fauna species known to occur within the locality;
- significant canopy stratum that contributes to the connectivity of vegetation within the site and with surrounding vegetation; and

- creek lines and associated riparian vegetation.

4.2.2 Medium Conservation Significance – areas containing:

- dense weed regrowth with component EEC species, important for maintaining the connectivity of EEC's on the site; and
- native or other vegetation (not part of an EEC) known to provide habitat (food and refuge) for native fauna species, occurring on the site and within the locality.

4.2.3 Low Conservation Significance – areas containing;

- predominately exotic vegetation of a highly modified nature (e.g. maintained open grassland/lawns and residential gardens);
- scattered pockets of dense weed thickets, that whilst potentially providing some food sources and habitat for fauna species, are not considered critical for the conservation of native fauna species on site or in the locality; and
- a lack of canopy stratum or connectivity values.

The outcomes of this assessment have been mapped and can be seen in Appendix F. Areas of high, medium and low conservation significance/development constraint are noted, as well as the presence of significant habitat trees.

The results of this mapping show the majority of the vegetated portion of the site presents a high development constraint, predominately due to it comprising critically EEC's (Blue Gum High Forest and Sydney Turpentine – Ironbark Forest), providing known habitat for threatened fauna species (Eastern Bent-wing Bat and Grey-head Flying-fox) and contributing to local and regional vegetation corridors. As such, there is a potential for future development of these areas to have a significant impact (direct and/or indirect) on threatened species and their habitats, ecological communities and to sever existing wildlife corridors.

The existing cleared areas of the site and residences and surrounding gardens are considered of low conservation significance and provide opportunity for future development. However, any future development in these areas would have to take into account the potential for adverse impacts on retained significant vegetation, habitat and creeklines and incorporate appropriate impact mitigation and environmental management measures to ensure impacts were avoided or reduced to an acceptable level.

From an ecological perspective there is also the opportunity future use of the site to make a substantial contribution to the conservation of biodiversity in the locality through the:

- protection and enhancement of long-term viability of vegetation and habitat of local, regional, state and federal conservation significance;
- protection and management of threatened species and their habitat; and
- consolidation and protection of vegetation links on site and with adjoining vegetation with a subsequent contribution to the local and regional corridor network.