60 WALLGROVE ROAD, MINCHINBURY (LOT 1 DP 1040948)

Ecological Assessment

For:

AFTERON LTD.

November 2009

Final Report

Cumberland Ecology
PO Box 2474, Carlingford Court 2118

Report No. 9001RP1

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 Cumberland Ecology.

Approved by:	David Robertson
Position:	Project Director
Signed:	
Date:	*24 November, 2009*

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INTRODUCTION

Cumberland Ecology Pty. Ltd. (Cumberland Ecology) has been commissioned by the proponent, Afteron Ltd. (Afteron), to conduct an ecological study as part of an Environmental Assessment (EA) of the land at 60 Wallgrove Road, Minchinbury (hereafter referred to as the 'subject site'). The purpose of this report is to describe the current biodiversity values of the subject site and to assess the potential impacts of development of the subject site on flora and fauna, particularly threatened species, populations and communities that are listed under the schedules of the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

BACKGROUND

The subject site is a 22 hectare property located in Minchinbury at the intersection of the M7 Westlink and the M4 Western Motorway. It is part of land to which the *State Environmental Planning Policy (Western Sydney Employment Area) 2009* applies and is designated for industrial use under the IN1 General Industrial zoning.

The subject site contains native vegetation that also provides some habitat for native flora and fauna. The proponent has considered a number of options for the future industrial development of the subject site that range from partial development of the subject site and partial conservation of native vegetation, through to complete development of industrial land.

After a series of consultations with the NSW Department of Planning (DoP) and the Department of Environment, Climate Change and Water (DECCW), it was decided that there was limited scope to conserve native vegetation *in situ*. This report discusses the nature and extent of ecological impacts under the assumption that there will be no on site protection of existing native vegetation.

A Concept Plan for the subject site will be submitted to DoP and will be assessed via the Part 3A mechanism under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

METHODS

Flora and fauna databases were consulted to gain an understanding of the types of threatened species that have the potential of occur on the subject site. The lists generated from these searches were used to assist targeted on-ground surveys to detect threatened species known to occur in the locality.

Flora and fauna surveys were carried out over the following dates: from 16-20 February, 15 May, 22 July and 12 November 2009. Flora surveys included quadrat sampling, random meander surveys and targeted threatened species searches. Quadrat surveys involved recording the presence and abundance of flora species within 20m x 20m quadrats, and random meander transects were conducted to detect species not located within quadrats. A total of six quadrats were sampled within the subject site.

Fauna surveys included a fauna habitat assessment, hair tube surveys, spotlighting, call playback surveys and bat surveys. Hair tubes were used to detect terrestrial and arboreal mammals. Spotlighting was conducted for nocturnal mammals, birds and reptiles. Call playback was conducted for threatened frog species previously recorded in the Blacktown Local Government Area (LGA). A hand-held Anabat unit was used to recorded microchiropteran bat calls. Any incidental vertebrate fauna species that were observed, heard calling or otherwise detected on the basis of tracks or signs were also recorded.

RESULTS

Vegetation Communities

The subject site was historically cleared of native vegetation for farmland but some native Cumberland Plain vegetation remains. Currently the site is used as an active quarantine station and the remnant native vegetation occurs in isolated fragments amid buildings and roads. In addition to native woodland, some exotic trees, shrubs and ground covers have been planted for landscaping purposes. All vegetation on the property is actively managed and the majority of the site is mown. As a consequence of historical land use and current management actions, the native woodland consists of relatively young, even-aged trees with a heavily altered understorey. There are few tree hollows and there is no substantial fallen timber remaining on the ground as habitat for wildlife.

This study identified three ecological communities as occurring on the subject site. The three ecological communities are:

- *Eucalyptus moluccana – Eucalyptus tereticornis* Woodland;
- *Melaleuca decora* Woodland/Open Forest; and
- *Casuarina glauca* Forest.

Despite their modified nature, all three communities are consistent with the final determinations for Endangered Ecological Communities (EECs) listed under the TSC Act.

The *Eucalyptus moluccana – Eucalyptus tereticornis* Woodland is consistent with the EEC, Cumberland Plain Woodland, albeit occurring in a much altered condition. Cumberland Plain Woodland is also listed as an EEC under the EPBC Act.

The *Melaleuca decora* Woodland/Open Forest occurring on the subject site is recognised to be a highly modified form of the EEC Shale Gravel Transition Forest. This community often grades into Cumberland Plain Woodland with increasing influences of shale in the soil. Shale Gravel Transition Forest occurs in wetter conditions than Cumberland Plain Woodland.

The *Casuarina glauca* Forest occurring on the subject site is considered to be a modified form of the riparian forest, EEC Swamp Oak Floodplain Forest, as some understorey elements of this community still exist. The past modification of the subject site's drainage patterns is likely to have lead to the reduction in the distribution of these forest communities on the subject site.

Flora

Over 80 flora species were recorded on the subject site. Of these, 30 species were exotic and 53 species were native. Two exotic species are declared noxious weeds under the NSW *Noxious Weeds Act 1993* (NW Act) for Blacktown LGA and are subject to the relevant control requirements. No threatened flora species were recorded on the subject site. The remnant areas on the subject site, particularly in the back paddock, provides habitat of some value for threatened species recorded previously in the Blacktown LGA.

Fauna Habitat

The subject site generally offers limited habitat for fauna as it contains low density vegetation with very simple structure. A few trees are hollow-bearing and include *Eucalyptus molucanna* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum). Since the understorey is mown, there is little opportunity for the establishment of forbs and shrubs and little protection for ground-dwelling or ground-foraging fauna. There are no linkages to vegetation off site and so vegetation connectivity is very poor. Limited roosting habitat is located on the subject site for native arboreal species in the form of a few hollow-

bearing trees and buildings. The subject site also provides some foraging habitat in the form of the two ponds on the subject site, where species may forage for aquatic insects.

The proximity of the main motorways on the remaining boundaries is expected to discourage the use of the site by fauna for anything more than occasional foraging. The likely fauna groups to make use of the subject site are mobile species like bats and birds, which is consistent with other land in the Western Sydney Employment Area.

Fauna

A total of 34 fauna species were recorded on the subject site including, four frog, 26 bird, two mammal and two reptile species. Of these species, four are exotic species. One threatened fauna species under the TSC Act, the Large-footed Myotis (*Myotis macropus*), was detected via echolocation recording over the subject site. The Cattle Egret (*Ardea ibis*), which is a protected migratory species under the EPBC Act, was also detected on the site. These species are expected to make only occasional use of the site for foraging.

IMPACT ASSESSMENT

Clearing of Native Vegetation

The subject site is zoned IN1 General Industrial, which potentially permits industrial development of the entire site. If the entire site is developed, it will necessitate the removal of 5.10 hectares of native vegetation from the subject site (see **Table S.1**). Although this vegetation is currently degraded through a prolonged history of regular maintenance and grazing, and suffers a high degree of fragmentation, this vegetation is protected under the TSC Act or EPBC Act as EECs. 'Clearing of Native Vegetation' is listed as a Key Threatening Process and has been identified as a direct cause in the decrease in biodiversity (NSW Scientific Committee, 2004).

Table S.1 AREA OF VEGETATION TO BE CLEARED

Vegetation Communities	Area to be cleared (ha)	Total area on site (ha)
Shale Gravel Transition Forest	0.73	0.73
Swamp Oak Floodplain Forest	0.35	0.35
Cumberland Plain Woodland	4.01	4.01
Total	**5.10**	**5.10**

Impacts to Threatened Flora

No threatened species of plants were detected on the subject site. Suitable habitat does occur for a number of threatened flora species on the subject site. However, based on survey effort, the condition of habitat, level of previous disturbance and current management of the subject site, additional threatened flora species known from the locality are not expected to occur on the subject site. The development will not have a significant impact on any listed threatened plant species.

Impacts to Threatened Fauna

Two threatened fauna species were detected on the subject site. The Large-footed Myotis is a microchiropteran bat species that is listed as Vulnerable under the TSC Act and was recorded flying over the subject site. The Cattle Egret is a protected migratory species under the EPBC Act and was also detected visually on the subject site. These species are very mobile and are likely to forage only occasionally on the subject site. They are not expected to rely on the subject site for roosting. The potential development of the whole site is not expected to significantly impact these species.

Several threatened fauna species have been recorded from the locality including birds, microbats and non-flying mammals. Some of these are bat and bird species that also have potential to forage on site. All such species are likely to lose some foraging habitat as a result of clearing for the proposed development. However, the site does not represent locally or regionally significant foraging habitat and impacts on threatened birds and bats are not expected to be significant.

The grassland communities do not provide quality of habitat such that threatened species are likely to occur; however the regenerating woodland and forest communities represent suitable habitat. Impacts from any proposed development are most likely to be through the loss of potentially regenerating woodland and woodland communities. Additional impacts will include the removal of riparian and aquatic habitat and a few hollow-bearing trees.

Proposed development of the subject site will not remove any major wildlife corridors. Mobile fauna that move between remnant patches can be vulnerable to predation if vegetated links are impacted and sedentary species can be isolated if distances between patches are significantly increased. Due to the current isolated nature of the vegetation occurring on the subject site, the proposed clearing of vegetation on the subject site is unlikely to increase the isolation of habitat for fauna species.

MITIGATION MEASURES AND OFFSET

Feasibility of In Situ Conservation

The subject site is zoned for industrial development. In developing the Concept Plan for the subject site, the proponent has considered a range of options for mitigating the projected clearance of EECs and subsequent loss of potential habitat for flora and fauna.

If a proportion of the existing vegetation was to be retained on site, a high level of investment in the rehabilitation of this vegetation would be necessary to achieve any valuable conservation outcome. As the vegetation on the subject site exists as small, disconnected fragments of highly altered remnant bushland, extensive work would need to be carried out to establish woodland vegetation in the cleared areas between fragments, so as to increase the overall patch size and reduce the edge:area ratio of the existing vegetation.

Furthermore, connectivity to native vegetation in surrounding properties is largely absent and dual carriage-way roads to the south and east prevent offsite connections to other significant areas of remnant vegetation. This limits the scope for improvement to local biodiversity values and means that on site conservation will have little bearing on regional biodiversity values.

Thus, the subject site is considered to have low conservation potential; that is, protecting vegetation *in situ* will not readily deliver a good conservation outcome.

Conversely, the subject site is located on valuable industrial land and has good development potential. It is situated at the intersection of two major arterial roads, the M7 and the M4 and has been slated for complete industrial development under the SEPP (WSEA) 2009. Based on the above rationale, it was decided that the proposed development should maximise the industrial potential of the subject site and a completely off site offset be sought, which delivered better conservation outcomes than what could be feasibly achieved on site.

Offsite Offsets

The subject site contains 5.10 hectares of native vegetation that is protected under environmental legislation, albeit in a highly modified and degraded form of the original vegetation communities. This vegetation also has some habitat value for native flora and fauna. If the whole site is developed for industrial purposes, off site compensatory measures will be required to offset the loss of 5.10 hectares of EEC and fauna habitat values.

There are two offset alternatives considered to be appropriate for the proposed concept development. The first is the acquisition of land containing a sufficient area of remnant

vegetation to provide a net increase in the area of the EECs that will be affected by the development. This land would need to be subject to a management plan to ensure that the biodiversity values of the land improve over time. The second alternative is to offset the loss of EECs and habitat values by purchasing and "retiring" BioBanking biodiversity credits.

Acquiring land as an offset can deliver good conservation outcomes because the proponent has control over where the offset will be located and the outcomes of the management of this land. This would allow the proponent to ensure that compensation measures are properly directed to address the biodiversity loss of the development site.

However, the time spent to negotiate the size of the offset can often be lengthy and is not necessarily guided by precedence; which is to say that there is no method or formula for determining what the size of the offset should be. Furthermore, opportunities for land purchase in Western Sydney are expensive and not readily available. If adequate areas of EECs cannot be sought on a single property, offsets may then need to be split over several properties. This would be undesirable in terms of good conservation principles (*i.e.* large patch size and connected vegetation) and would be even more costly to acquire. A Vegetation Management Plan would then also need to be prepared to manage and improve the biodiversity values of the land(s).

The option to offset through the BioBanking scheme provides a simple process to determining appropriate offsets for the development. It reduces the time spent in sourcing and negotiating an appropriate offset package because the BioBanking methodology states what types and number of credits should be retired to sufficiently offset the development. It is a one-off transaction that negates the need for the proponent to buy land or be involved in the management of this land.

A BioBanking assessment was conducted over the subject site to determine the likely number and types of credits that would be required to compensate for the loss of EECs and threatened species habitat. This report has been appended to this ecological assessment and can be reviewed at **Appendix C** to this report. The subject site will require the retirement of a total of 76 biodiversity credits. This is a relatively low number of credits; larger developments often require hundreds or thousands of credits to offset biodiversity loss.

Whilst no credits are available at present for Cumberland Plain Woodland, Shale Gravel Transition Forest and Swamp Oak Floodplain Forest, the option to purchase the appropriate credits appears to be imminent. The current risks with the BioBanking pathway of offsetting is firstly, that there is no certainty as to when biodiversity credits will be available; and secondly, there is no information at present regarding how much credits will cost. This is attributable to the novelty of the scheme, as no credit market currently exists. Despite this, the condition to retire credits can still be incorporated into the Statement of Commitments to guarantee that credits are purchased and retired prior to the commencement of development on the subject site.

CONCLUSION

If the maximum industrial potential of the subject site is realised, then 5.10 hectares of EEC and some habitat for native flora and fauna will be impacted by future development of the subject site. Future development of the site will require compensatory measures to offset the loss of EEC and fauna habitat values.

Conservation of a proportion of the existing vegetation on the subject site will not deliver a good conservation outcome because of the size of the existing fragments and their isolation from larger areas of remnant vegetation. A better conservation outcome can potentially be achieved by seeking offsets off site.

The appropriate offset options include land acquisition or the retirement of BioBanking credits. Both alternatives carry benefits and risks. Land acquisition can be an expensive option, whilst BioBanking relies on biodiversity credits being available to purchase. BioBanking may be a more attractive option at the present time because despite the absence of an active credit market, the availability of suitable credits appears to be imminent. Furthermore, there is a possibility of incorporating the retirement of BioBanking credits into the Statement of Commitments, giving the proponent some flexibility to wait for the credit market to mature.

Chapter 1

Introduction

1.1 Purpose of the Report

Cumberland Ecology Pty. Ltd. (Cumberland Ecology) has been commissioned by the proponent Afteron Ltd. (Afteron), to conduct an ecological assessment to support a proposed concept development plan for land at 60 Wallgrove Road, Minchinbury 2770 (hereafter referred to as the 'subject site').

The purpose of this report is to describe the current biodiversity values of the subject site and to assess the potential impacts of development of the subject site on flora and fauna, particularly threatened species, populations and communities that are listed under the schedules of the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Specifically, this report aims to:

- Describe and map vegetation communities, identifying threatened communities listed under the TSC Act and EPBC Act and any other communities of high conservation value;
- Assess the likelihood that threatened flora and fauna could occur on the subject site;
- Identify key areas of habitat for fauna and faunal movement corridors;
- Describe the types and extent of potential impacts arising from development of the subject site and assess these impacts as they relate to threatened communities and species; and
- Where relevant, recommend measures for mitigation in order to manage impacts on threatened species, populations and communities and areas of high conservation value.

1.2 Background

The subject site is a 22 hectare property that is currently used as the Australian Quarantine Inspection Service (AQIS) Animal Quarantine Station. This property has been identified under the New South Wales Government's Metropolitan Strategy for employment purposes and is referred to as Precinct 9 (Quarantine Station) within the *State Environmental Planning Policy (Western Sydney Employment Area) 2009* (SEPP (WSEA) 2009). The whole subject site is zoned IN1 General Industrial under the SEPP (WSEA) 2009.

The SEPP (WSEA) 2009 aims to promote economic development and the creation of employment in Western Sydney by providing for the development of major warehousing, industrial, high technology, research or ancillary facilities with good access to the existing and proposed road freight. The SEPP (WSEH) 2009 also aims to rezone the land for employment or environmental conservations purposes.

1.2.1 Location

The subject site is located at 60 Wallgrove Road, Minchinbury (Lot 1 DP 1040948). It is situated at the intersection of two motorways, the M7 Westlink and the M4 Western Motorway, and is bounded on the northern and western sides by Pinegrove Memorial Park Lawn Cemetery (**Figure 1.1**). The subject site is belongs to the Blacktown Local Government Area (LGA).

1.2.2 Proposed Project

The subject site contains native vegetation that also provides some habitat for native flora and fauna. The proponent has considered a number of options for the future industrial development of the subject site that range from partial development of the subject site and partial conservation of native vegetation, through to complete development of industrial land.

After a series of consultations with the NSW Department of Planning (DoP) and the Department of Environment, Climate Change and Water (DECCW), it was decided that there was limited scope to conserve native vegetation *in situ*. This report discusses the nature and extent of ecological impacts under the assumption that there will be no on site protection of existing native vegetation.

A Concept Plan has been prepared for the industrial development of the entire subject site. This Concept Plan includes provisions for visual landscaping, and storm water and floodwater mitigation. Infrastructure for storm water and floodwater mitigation will be located at the north western corner of the subject site and considers the natural topography of the land.

The development project will be assessed via the Part 3A assessment process under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.2.3 Land Use History and Site Characteristics

The subject site is currently operating as the AQIS Animal Quarantine Station, which was established in the 1980s. Historically, the subject site was part of a larger holding of land acquired by the Commonwealth of Australia in 1941. During World War II the subject site was used as a government army training facility, which supported the Army camp at Wallgrove. In the 1960s the facility was converted to a migrant hostel.

The flat topography of the site is typical of much of the Western Sydney terrain. A gentle ridgeline runs approximately north east to south west across the subject site, with low points occurring generally at the north-western corner and south-eastern corner. The site occurs over Wianamatta Shale-derived soils. The site has slow drainage, with large areas experiencing moderate levels of inundation.

The site has two drainage exit points – one at the south eastern culvert that drains out under Wallgrove Road and one at the northern boundary of the site in the back paddock. The latter currently drains out to a large dam in the adjacent cemetery.

The subject site has a back paddock containing two ponds. One pond has a small island in its centre and the second is a large holding/separation pond in the south west corner (to which effluent water is pumped). These both drain to the northern culvert that flows into the cemetery. Other features of this property include areas of low density vegetation (remnant and planted) and infrastructure associated with the quarantine facility (i.e. horse stables and surgery, administration offices and animal enclosures). The site is regularly maintained and is mown approximately every six months.

The vegetation on the subject site is isolated from significant areas of native vegetation in the wider locality. Native woodland on the southward side of the M4 Western Motorway is zoned E2 Environmental Conservation but this vegetation is severed from the subject site by the motorway. Likewise, vegetation to the east is separated from the subject site by the M7 Westlink. The vegetation in the adjacent cemetery is largely planted and landscaped by nature of the land use.

1.3 Relevant Legislation

1.3.1 NSW Environmental Planning and Assessment Act 1979

The EP&A Act is the overarching planning document for NSW. This Act provides for the creation of planning instruments that guide land use. The Act also provides for the consideration of biodiversity values, which is addressed in Section 5A (Significant effect on species, populations or ecological communities or their habitats). The Act requires that an "Assessment of Significance" under Section 94A of the TSC Act, also known as the "Seven-Part Test", is undertaken in relation to species, communities, habitat and processes listed under either the TSC Act or the *Fisheries Management Act 1994* (FM Act).

The Part 3A amendment to the EP&A Act consolidates the assessment and approval regime for all Major Projects previously addressed under Part 4 (Development Assessment) or Part 5 (Environmental Assessment) of the Act. There is no statutory requirement to undertake an "Assessment of Significance" for a development being assessed under Part 3A. An Environmental Assessment (EA) is required for Part 3A development proposals and must be prepared in accordance with the Director-General's environmental assessment guidelines.

The proposed project will be assessed under Part 3A of the Act. This report forms the Flora and Fauna component of the EA that is required to enable the Project to be assessed under Part 3A of the EP&A Act. The draft Director-General's Environmental Assessment Requirements (DGR) for the Project, pursuant to Section 75 F(2) of the EP&A Act and as pertains to biodiversity issues, requests that the following are provided:

- *Details of the type and extent of vegetation to be cleared;*
- *Impacts on critical habitats, threatened species or populations or ecological communities;*
- *Justification for the proposed site layout and access, and alternatives considered to minimise impacts;*
- *Proposed offset measures to avoid and/or mitigate any significant impacts, including details of the provision and protection of land for conservation purposes; and*
- *Details of the objectives, ownership and maintenance regime for conservation areas.*

1.3.2 NSW Threatened Species Conservation Act 1995

The TSC Act aims to protect and encourage the recovery of threatened species, populations and communities that are listed under the Act, through threat abatement and species recovery programs.

The TSC Act requires consideration of whether a development (Part 4) or an activity (Part 5) is likely to significantly impact threatened species, populations, communities or their habitat. The potential impacts of any developments, land use changes or activities would need to undergo an "Assessment of Significance" under Section 5A of the EP&A Act.

1.3.3 Fisheries Management Act 1994

The threatened species Schedules of the FM Act comprise lists of threatened marine, estuarine and freshwater fish or other aquatic animal life at any stage of their life history and ecological communities of fish. The Act provides for the conservation of key fish habitats and threatened species, populations and ecological communities of fish and marine vegetation. It does not include whales, mammals, reptiles, birds or amphibians.

The FM Act does not apply to the proposed project as there is no habitat available that would support a significant community of fish.

1.3.4 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides for the protection of nationally listed matters of environmental significance and includes Cumberland Plain Woodland, which has been identified on the subject site. The EPBC Act is administered by DEWHA.

A project that may impact on nationally listed matters is referred to DEWHA. DEWHA determines whether the impact to nationally listed matters is likely to be significant. If the project is determined to be likely to have a significant impact on nationally listed matters, the project is declared a "controlled action" and additional assessments will be required to gain approval from the Commonwealth Minister for the Environment.

The project has been referred to DEWHA. DEWHA has determined that the proposed project will not have a significant impact on nationally listed matters, which includes impacts to Cumberland Plain Woodland.

1.4 Terms and Abbreviations

DECCW	Department of Environment and Climate Change and Water (formerly the Department of Environment and Climate Change DECC);
DEWHA	Department for the Environment, Water, Heritage and the Arts;
EA	Environmental Assessment;
EEC	Endangered Ecological Community as defined under the *Threatened Species Conservation Act 1995*;
EP&A Act	*Environmental Planning and Assessment Act 1979*;
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*;
FM Act	*Fisheries Management Act 1994*;
LGA	Local Government Area;
NW Act	*Noxious Weeds Act 1993*;
PFC	Projective foliage cover, a measure of the percentage cover of canopy trees;
SEPP (WSEA) 2009	State Environmental Planning Policy (Western Sydney Employment Area) 2009;
Subject Site	The site of the proposed development, at 60 Wallgrove Road, Minchinbury (Lot 1 DP 1040948); and
TSC Act	*Threatened Species Conservation Act 1995*.

Coordinate System: MGA Zone 56 (GDA 94)

N
Grid North

100 0 100 200 m

Map Legend

Site Boundary

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Figure 1.1 The Subject Site and its Surrounds

CUMBERLAND ECOLOGY

Chapter 2

Methodology

2.1 Literature Review and Database Analysis

Documents that were reviewed as part of the desktop study included a due diligence study conducted of the subject site on behalf of the Department of Finance and Administration (DASCEM, 2001). Available flora and fauna studies that were conducted for nearby properties within the Western Sydney Employment Hub were also reviewed and included the following:

- Cumberland Ecology (2007) Ecological Assessment - Oakdale Concept Plan. Prepared for Goodman International Limited; and
- Cumberland Ecology (2008) Part 3A (Major Project) Development at 813-913 (Lot 5 DP 24094) Wallgrove Road, Horsley Park. Flora and Fauna Assessment. Prepared for Gazcorp Pty. Ltd. (Unpublished).

Database analysis was conducted for the locality using both the Department of the Environment and Climate Change and Water (DECCW) Atlas of NSW Wildlife Database (DECCW (NSW), 2009) and the Department of the Environment and Water Heritage and the Arts (DEWHA) Protected Matters Search Tool (DEWHA, 2009). The Atlas search generated records of threatened flora and fauna species listed under the TSC Act detected in Blacktown LGA. The Protected Matters search generated a list of potentially occurring flora, fauna and ecological communities listed under the EPBC Act within a 5km radius of the subject site. The lists generated from these searches were used to assist on-ground surveys targeting threatened species known to occur in the locality.

2.2 Flora Survey

The subject site was surveyed following a general inspection in order to obtain an overview of the nature and distribution of the vegetation occurring. Flora surveys were conducted from 16-20 February 2009. Additional searches were conducted on 15 May, 22 July and 12 November 2009. Flora surveys involved the following:

- Quadrat sampling (20m x 20m) to obtain information on floristic composition and community structure;

- Random meander surveys to detected additional flora species not recorded within the quadrats;
- Meander-transect surveys to ground-truth the occurrence and extent of different community types, making records of boundary changes using a handheld Global Positioning Systems (GPS) unit; and
- Targeted threatened species searches for threatened flora previously recorded from the Blacktown LGA.

In each quadrat, the following information was recorded as a minimum:

- All vascular flora species present within the plot or directly adjacent to the plot;
- The stratum in which each species occurred;
- The relative frequency of occurrence of each plant species;
- Vegetation structural data (i.e. height and percentage cover of each stratum);
- A waypoint to mark the location of the quadrat, using a handheld GPS; and
- Photographs of the quadrat.

A total of six quadrats were surveyed on the subject site. The locations of these quadrats were chosen so that sampling was conducted in areas most representative of the condition and composition of the vegetation patch. **Figure 2.1** shows the locations of flora surveys.. The relative abundance and cover of each species within the quadrat was approximated using a scoring system based on the Braun-Blanquet scoring system (Braun-Blanquet, 1927). A flora species list is provided in **Appendix A,** which also contains a definition of the cover abundance scores used. Structural data within each of the quadrats was also recorded and is provided in **Appendix A**.

All vascular plants recorded or collected were identified using keys and nomenclature provided in Harden (1990-1993). Other references used to assist identification of more cryptic specimens include Richardson *et al.* (2006) and Brooker and Kleinig (2006). Where known, taxonomic and nomenclatural changes have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust, 2009). Any specimens that were not readily identifiable were lodged with the National Herbarium of NSW at the Royal Botanic Gardens, Sydney.

2.3 Fauna Survey

2.3.1 Fauna Habitat Assessment

The fauna habitat assessment included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks and soaks.

An assessment of the structural complexity of vegetation, the age structure of the forest and the nature and extent of human disturbance throughout the subject site was also undertaken and considered. Structural features considered included the nature and extent of the understorey and ground stratum, extent of canopy and flowering characteristics.

Tree hollows were used as a general indication of habitat quality for arboreal fauna, and hollow dwelling birds and bats. Indirect indicators of fauna use of the site such as droppings, diggings and nests were also noted.

2.3.2 Fauna Species

i. Introduction

Fauna surveys were conducted from 16-20 February 2009. Additional searches were conducted on 22 July and 12 November 2009. Fauna surveys were conducted, where possible, to comply with standards provided in the DECCW '*Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities*' (2004).

ii. Hair Tubes

'Faunatech' hair tubes were used during the survey period to detect arboreal and terrestrial mammals. Two transects of 15 hair tubes were established on the subject site. Along each transect hair tubes alternated between being located on the ground and on a tree. Hair funnels were baited with rolled oats, peanut butter and honey. Hair samples were analysed by Georgeanna Story of 'Scats About'. A total of 30 hair tubes were deployed for a period of 10 nights giving a survey effort of 300 trap nights. Hair tube transects are shown in **Figure 2.1**.

iii. Spotlighting

Spotlighting was conducted for nocturnal mammals, birds and reptiles. Nocturnal surveys were conducted using a hand-held spotlight while walking through the subject site. Spotlighting surveys were undertaken on 18 and 19 February 2009. The subject site was surveyed for a total of 2 hours.

iv. Call Playback

The presence of Green and Golden Bell Frog (*Litoria aurea*) and Giant Burrowing Frog (*Heleioporus australiacus*) were targeted by broadcasting taped calls through an amplifier. Calls were played for 2-minute periods at 5-minute intervals. This was followed with quiet listening and spotlighting. Call playback surveys were undertaken on 18 and 19 February 2009.

v. Bat Survey

Microchiropteran bats (microbats) were surveyed using an Anabat unit to record ultrasonic bat calls. An Anabat unit was utilised on each survey night and were carried throughout the subject site. The Anabat unit was turned on before dusk and switched off once all night survey was completed. Calls recorded on each Anabat were analysed to determine which species were present within the subject site.

vi. Incidental observations

Any incidental vertebrate fauna species that were observed, heard calling or otherwise detected on the basis of tracks or signs were recorded and listed in the total species list for the subject site.

2.4 Limitations

At the time of the survey the weather conditions had been favourable for plant growth and production of features required for identification of most species. Given the flora survey was undertaken over several days it is likely that the majority of flora species have been recorded, allowing issues including conservation significance of the flora, condition and viability of bushland and likely impact on native vegetation to be satisfactorily assessed.

Access to some areas of the subject site was restricted; however the vegetation in these areas was generally represented in the surveyed areas. Canopy species were recorded in the restricted areas thus assisting with community classification.

The fauna surveys are limited in being “snapshot” investigations and so present a view of the fauna that were active during the time of the surveys. Extensive fauna surveys have been conducted in the locality within the Blacktown LGA. For this reason, there is an excellent database of information to interrogate for threatened species records. Given the size and location of the subject site and extensive records available from the Wildlife Atlas, it is considered that adequate fauna data was collected to meet the requirements of the investigation.

Coordinate System: MGA Zone 56 (GDA 94)

Grid North

1
2
3
4
5
6

Map Legend

Site Boundary

Flora sampling quadrats

Ground hair tubes

Arboreal hair tubes

50 0 50 100 150

I:\...\9001\Figures\Figure 2.1.pdf

Figure 2.1 Flora and Fauna Survey Locations

CUMBERLAND ECOLOGY

Chapter 3

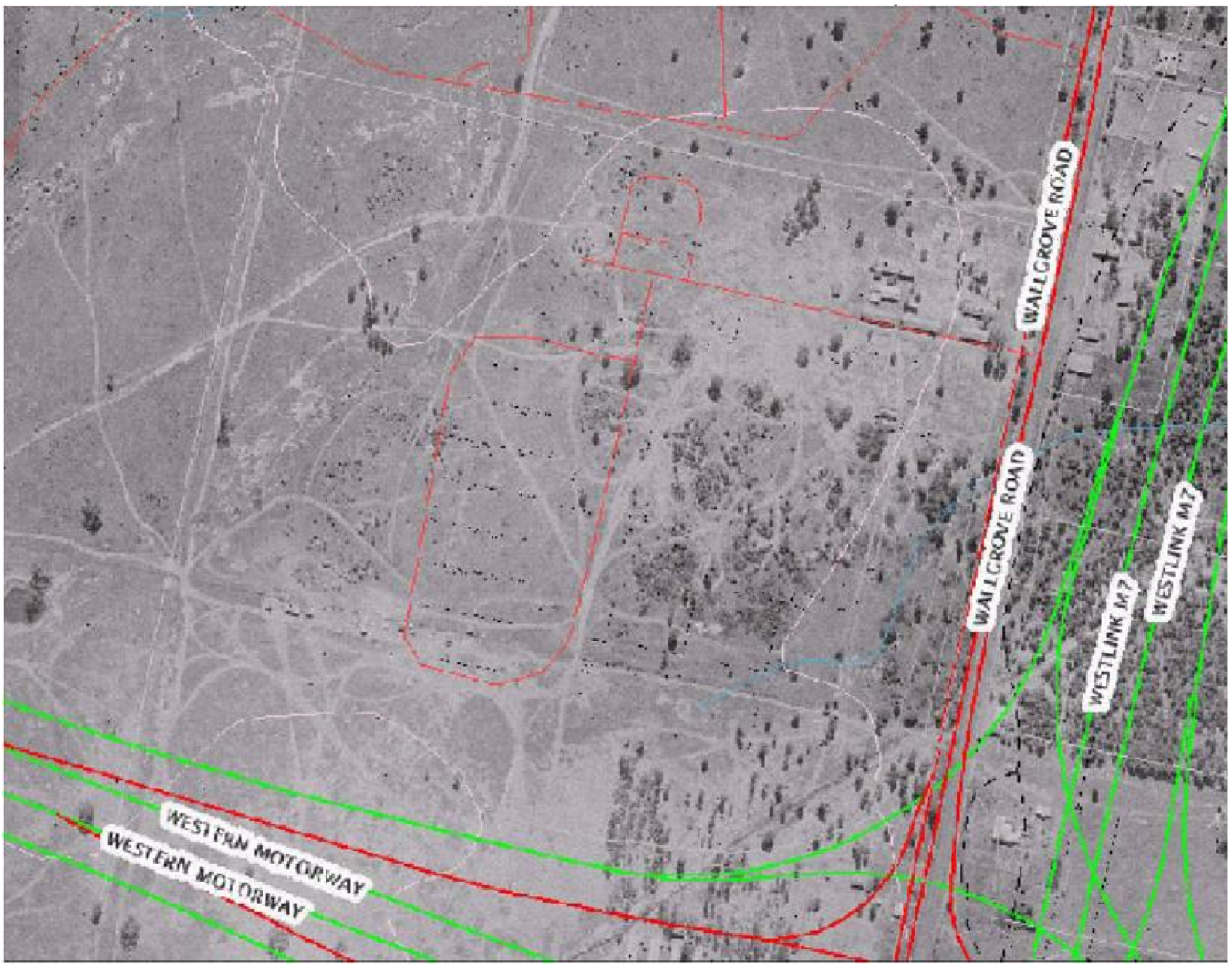
Results

3.1 Introduction

The aerial photographs in **Figure 3.1** show that the subject site vegetation historically comprised open grassland with very few trees but that some native vegetation has regrown since the 1940s. Additionally, the drainage patterns of the site have been altered and it appears as though the streams have been deliberately channelised to allow drainage of wetter portions of the site.

Currently the property is used as an active quarantine station and consists of a number of roads and buildings interspersed with vegetation. Two larger blocks of vegetation occur in the western and south eastern portions of the site. The subject site supports infrastructure, such as cat and dog enclosures, a horse surgery, horse stables and quarantine offices, all of which occupy a large proportion of the 22 hectare property.

All vegetation on the property is actively managed and the majority of the site is mown. As a consequence of the historical land use and current management actions, the native woodland consists of relatively young, even-aged trees with a heavily altered understorey. There are few tree hollows and there is no substantial fallen timber remaining on the ground as habitat for wildlife. There are no current signs of major disturbance (i.e. no over grazing impacts, severe erosion etc.), except for an area at the back paddock near the holding/separation pond, which is used as a livestock burial area.



Grid North

I:\...\9001\Figures\Figure 3.1

Figure 3.1 Site Aerial in 1943 (top) and 2007 (bottom). Source: NSW Department of Lands Six Viewer. Copyright six.nsw.gov.au

CUMBERLAND ECOLOGY

3.2 Ecological Communities

3.2.1 Introduction

The larger more significant areas of vegetation on the subject site are largely confined to an unused back paddock that is approximately 7 hectares in size. This remnant vegetation is much altered from its original condition and form, with the regular maintenance of the understorey limiting the development of the shrub and ground strata. Historically, the canopy trees would have been cleared and the existing trees are young. The historical vegetation would have also occurred in much wetter conditions than is currently observed.

The subject site has previously been mapped by the National Parks and Wildlife Service (NPWS) during the broad-scale mapping of the Cumberland Plain (NSW NPWS, 2002). One community, Shale Plains Woodland, was mapped on the subject site, which conforms to the endangered ecological community (EEC) Cumberland Plain Woodland. Cumberland Ecology refined this mapping and identified three ecological communities as occurring on the subject site. The three ecological communities are:

- *Eucalyptus moluccana – Eucalyptus tereticornis* Woodland
- *Melaleuca decora* Woodland/Open Forest; and
- *Casuarina glauca* Forest.

These communities are shown in **Figure 3.2** and described in detail below.

3.2.2 Eucalyptus moluccana – Eucalyptus tereticornis Woodland

This community has a native canopy stratum and is dominated by *Eucalyptus moluccana* (Grey Box) in the south eastern arm of the back paddock (**Photograph 3.1**) and dominated by *Eucalyptus tereticornis* (Forest Red Gum) in the western portion of this community (**Photograph 3.2**). Trees are to a height of 12m with a projective foliage cover (PFC) of 5-55%. The shrub layer is largely absent; however there are some occurrences of *Bursaria spinosa* (Blackthorn). The shrub layer is to 1.5m in height and has a PFC of 5%. Common groundcover species include *Brunoniella australis* (Blue Trumpet), *Einadia trigonos* (Fishweed), *Dichondra repens* (Kidney Weed), Senecio madagascariensis (Fireweed), Cynodon dactylon (Couch Grass), *Cymbopogon refractus* (Barb-wire Grass), *Paspalidium distans* and *Paspalum dilatatum* (Paspalum). The groundcover layer is to 0.2m in height and has a PFC of 40-90%. This community occupies 4.01 hectares of the subject site.

A small area of woodland comprising a stand of *Eucalyptus molucanna* (Grey Box) is situated near the plant quarantine offices and the bee house (**Photograph 3.3**). These trees are relatively young and measure at approximately 15-18m in height.

i. Legal Status

Despite its modified nature, the vegetation in this community is consistent with the final determination for the EEC Cumberland Plain Woodland, albeit occurring in a much altered condition. Cumberland Plain Woodland is currently listed as an Endangered Ecological Community under the TSC Act and also under the EPBC Act. This community has been recommended for listing as a critically endangered ecological community (NSW Scientific Committee, 1997, DECC (NSW), 2005).

The dominant canopy species on the subject site, *Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum) are listed as dominant species within Cumberland Plain Woodland in the final determination of the community. In addition to this, a subdominant species, *Eucalyptus eugenioides* (Thin-leaved Stringybark) is also present in the north-western corner of the site in small numbers. A total of 22 flora species recorded on the subject site are listed in the final determination for Cumberland Plain Woodland and under the proposed listing, the subject site contains 34 characteristic native plants of the 112 listed.

Photograph 3.1 ***Eucalyptus moluccana* dominated area of Cumberland Plain Woodland**

Photograph 3.2 ***Eucalyptus tereticornis*** **dominated area of Cumberland Plain Woodland**

Photograph 3.3 **Stand of** ***Eucalyptus moluccana*** **adjacent to the beehouse.**

3.2.3 Melaleuca decora Woodland/Open Forest

The occurrence of this community is associated with the lower areas in the eastern side of the subject site. This community has a native canopy stratum and is dominated by *Melaleuca decora* (**Photograph 3.4**). Trees are to a height of 7m with a PFC of 5%. A shrub layer is absent in this community. Grasses dominated the ground stratum with common grasses including *Cynodon dactylon* (Couch Grass) and *Paspalidium distans*. Other groundcover species include *Brunoniella australis* (Blue Trumpet), *Dichondra repens* (Kidney Weed), *Einadia trigonos* (Fishweed), *Aristida vagans* (Threeawn Speargrass), *Cyperus gracilis* (Slender Flat-sedge), *Paspalum dilatatum* (Paspalum) and *Glycine tabacina*. The groundcover layer is to 0.1m in height and has a PFC of 85%. This community occupies 0.73ha of the subject site.

i. Legal Status

This community is considered a highly modified form of Shale Gravel Transition Forest, as some elements of this community still exist. Shale Gravel Transition Forest is listed as an EEC under the TSC Act and often occurs on the Cumberland Plain in association with Cumberland Plain Woodland. Shale Gravel Transition Forest generally occurs in wetter areas than Cumberland Plain Woodland and often grades into Cumberland Plain Woodland where the influence of gravel soil declines.

This community is usually dominated by *Eucalyptus fibrosa* (Red Ironbark), however in its absence *Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum) are present. The small tree stratum is typically dominated by *Melaleuca decora*.

Photograph 3.4 ***Melaleuca decora*** **Woodland/Open Forest**

3.2.4 Casuarina glauca Forest

The occurrence of this community is associated with the drainage lines and the separation pond within the back paddock. This community has a native canopy stratum and is dominated by *Casuarina glauca* (Swamp Oak), with the occasional occurrence of *Eucalyptus tereticornis* (Forest Red Gum) (**Photograph 3.5**). The canopy layer is to 12m in height and has a PFC of 60-65%. The shrub layer is largely absent; however there are some occurrences of *Atriplex semibaccata* (Creeping Saltbush), *Bursaria spinosa* (Blackthorn) and *Lycium ferocissimum* (African Boxthorn). The shrub layer is to 2m in height and has a PFC of 5%. Common groundcover species include *Epaltes australis* (Spreading Nut-heads), *Einadia hastata* (Berry Saltbush), *Senecio madagascariensis* (Fireweed), *Plantago lanceolata* (Lamb's Tongue), *Cynodon dactylon* (Couch Grass) and *Eragrostis leptostachya* (Paddock Lovegrass). The groundcover layer is to 0.3m in height and has a PFC of 45%. This community occupies 0.35ha of the subject site.

i. Legal Status

This community is considered a modified form of Swamp Oak Floodplain Forest, as some elements of this community still exist. Swamp Oak Floodplain Forest is listed as an EEC under the TSC Act. The community is dominated by *Casuarina glauca* (Swamp Oak).

The modification of the subject sites drainage patterns has lead to the reduction in the distribution of this community on the subject site.

Photograph 3.5 *Casuarina glauca* Forest

3.2.5 Other Vegetation

The majority of vegetation in proximity of the buildings and animal compounds are planted with species such as *Eucalyptus sideroxylon* (Mugga Ironbark), *Corymbia maculata* (Spotted Gum), *Melaleuca quinquinervia* (Broad-leaved Paperbark) and *Grevillea robusta* (Silky Oak).

Coordinate System: MGA Zone 56 (GDA 94)

N

Grid North

Map Legend

Site Boundary

Shale Gravel Transition Forest

Cumberland Plain Woodland

Swamp Oak Floodplain Forest

50 0 50 100 150

I:\...\9001\Figures\Figure 3.2.pdf

Figure 3.2 Ecological Communities on the Subject Site

CUMBERLAND ECOLOGY

3.3 Flora

Over 80 flora species were recorded on the subject site. Of these, 30 species were exotic and 53 species were native. Two exotic species are declared noxious weeds under the NSW *Noxious Weeds Act 1993* (NW Act) for Blacktown LGA and are subject to the relevant control requirements.

Lists of the flora species recorded on site, the weed species recorded on site and the quadrat data collected are provided within **Appendix A** to this report.

No threatened flora species were recorded on the subject site. The remnant areas on the subject site, particularly in the back paddock, provides habitat of some value for threatened species, but the regular maintenance of the understorey makes the establishment of threatened species such as *Pimelea spicata* unlikely. Nevertheless, threatened species like the orchid, *Pterostylis saxicola* can be fairly cryptic. A number of threatened flora species have been recorded within the Blacktown LGA. Chapter 4 provides an analysis of the likely impacts on threatened species with potential to occur on the subject site.

3.4 Fauna

3.4.1 Fauna Habitat

The subject site generally offers poor habitat for fauna as it contains low density vegetation with very low structure complexity. Since the understorey is mown, there is little opportunity for the establishment of forbs and shrubs and little protection for ground-dwelling or ground-foraging fauna. As the vegetation is relatively young, there are no old-growth trees and few hollow-bearing trees. The canopy connection across the site is low and patches of remnant areas of vegetation are separated by large, cleared areas of grass and/or outhouses and enclosures. Adjoining properties offer little by way of vegetation connectivity, with the cemetery being largely cleared for the establishment of burial plots. The proximity of the main motorways on the remaining boundaries is expected to discourage the use of the site by fauna for anything more than occasional foraging over the site.

Nevertheless, there are some groups of fauna that are expected to make use of the resources on the site. Based on the high availability of water on the site, these groups are frogs and birds. Microchiropteran bats, particularly those that are insectivorous and forage over water, may forage over the site from time to time but there are few trees suitable for roosting or nesting, being relatively young with few hollows. Thus, the subject site provides low quality foraging habitat and minimal roosting/nesting habitat for frogs, birds and bats.

3.4.2 Fauna Species

A total of 34 fauna species were recorded on the subject site including, four frog, 26 bird, two mammal and two reptile species. Of these species, four are exotic species. A list of fauna recorded on the subject site is provided in **Appendix B**.

One threatened fauna species under the TSC Act, the Large-footed Myotis (*Myotis macropus*), was detected from a single reading on the Anabat. The Cattle Egret (*Ardea ibis*), which is a protected migratory species under the EPBC Act, was also detected on the site. These species are expected to make only occasional use of the site for foraging.

A number of additional threatened fauna species have been recorded within the LGA and on nearby sites. These include species like Square-tailed Kite (*Lophoictinia isura*) (Cumberland Ecology, 2008), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Greater Broad-nosed Bat (*Scoteanax ruepellii*) (Cumberland Ecology, 2007). However, the subject site is unlikely to significantly support a wide variety of reptiles, amphibians and ground mammals as the site is almost entirely surrounded by either roads or cleared land. More mobile species like bats and birds may occasionally forage over the site but is unlikely to use the site for nesting or roosting.

Chapter 4 provides an analysis of the likely impacts on threatened species with potential to occur on the subject site.

3.5 Wildlife Corridors

Vegetation connectivity in the locality has suffered from substantial existing developments, particularly roads and housing developments, which have prevented the maintenance of complete linkages. Such existing barriers will limit the potential movement of smaller and less mobile species. Notwithstanding this, many species, particularly birds and bats, are quite mobile and will negotiate such barriers.

The vegetation on the subject site is isolated from significant areas of native vegetation in the wider locality. Native woodland on the southward side of the M4 Western Motorway is zoned E2 Environmental Conservation but this vegetation is severed from the subject site by the motorway. Likewise, vegetation to the east is separated from the subject site by the M7 Westlink. The vegetation in the adjacent cemetery is largely planted and landscaped by nature of the land use.

Chapter 4

Impact Assessment

4.1 Threatened Ecological Communities

The subject site is zoned IN1 General Industrial, which potentially permits industrial development of the entire site. If the entire site is developed, it will necessitate the removal of 5.10 hectares of native vegetation from the subject site (see **Table 4.1**). Although this vegetation occurs as isolated fragments of degraded woodland and forest, it is recognised as modified forms of highly cleared ecological community types and is protected under the TSC Act or EPBC Act. 'Clearing of Native Vegetation' is listed as a Key Threatening Process and has been identified as a direct cause in the decrease in biodiversity (NSW Scientific Committee, 2004).

Table 4.1 SUMMARY OF VEGETATION CLEARANCE

Vegetation Communities	Area to be cleared (ha)	Total area on site (ha)
Shale Gravel Transition Forest	0.73	0.73
Swamp Oak Floodplain Forest	0.10	0.35
Cumberland Plain Woodland	4.01	4.01
Total	**5.10**	**5.10**

4.2 Threatened Flora

No threatened species of plants were detected on the subject site. The following table (**Table 4.2**) provides an assessment of the likely impacts to threatened flora species known from the LGA. Based on survey effort, the condition of habitat, level of previous disturbance and current management of the subject site, additional threatened flora species known from the locality are not expected to occur on the subject site. The development will not have a significant impact on any listed threatened plant species.

Table 4.2 ANALYSIS OF THE LIKELY IMPACTS OF THE PROPOSAL ON THREATENED FLORA SPECIES RECORDED IN THE LGA

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	LGA Count	Habitat Requirements	Likely Impacts due to the proposal
Apocynaceae	*Marsdenia viridiflora subsp. viridiflora*	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	E2	-	6	Grows in vine thickets and open shale woodland.	Low quality potential habitat occurs but not found during field surveys. Unlikely to occur or be impacted.
Fabaceae (Faboideae)	*Dillwynia tenuifolia*		V	V	223	In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays.	Low quality potential habitat occurs but not found during field surveys. Unlikely to occur or be impacted.
	Pultenaea parviflora		E1		316	Occurs in scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. Eucalyptus fibrosa is usually the dominant canopy species.	Low quality potential habitat occurs but not found during field surveys. Unlikely to occur or be impacted.
Fabaceae (Mimosoideae)	*Acacia pubescens*	Downy Wattle	V		2	Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are	Not present on site. No impacts predicted.

Table 4.2 ANALYSIS OF THE LIKELY IMPACTS OF THE PROPOSAL ON THREATENED FLORA SPECIES RECORDED IN THE LGA

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	LGA Count	Habitat Requirements	Likely Impacts due to the proposal
						characteristically gravely soils, often with ironstone.Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland.	
Marsileaceae	*Pilularia novae-hollandiae*	Austral Pillwort	E1		1	Grows in shallow swamps and waterways, often among grasses and sedges.	Unlikely to occur.
Myrtaceae	*Melaleuca deanei*	Deane's Paperbark	V		1	The species grows in heath on sandstone. Occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas.	Not present on site. No impacts predicted.
	Micromyrtus minutiflora		E1		13	Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open	Low quality potential habitat occurs but not found during field surveys. Unlikely to

Table 4.2 ANALYSIS OF THE LIKELY IMPACTS OF THE PROPOSAL ON THREATENED FLORA SPECIES RECORDED IN THE LGA

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	LGA Count	Habitat Requirements	Likely Impacts due to the proposal
						forest on tertiary alluvium and consolidated river sediments.	occur or be impacted.
	Syzygium paniculatum	Magenta Lilly Pilly	V		1	Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State Forest.	Does not occur. No impact likely.
Orchidaceae	*Pterostylis saxicola*	Sydney Plains Greenhood	Endangered	Endangered	1	The species flowers anytime between August and November, although the flowering event can vary each season according to climatic conditions. Outside of the flowering period, this deciduous species persists as an underground tuberoid. Populations are highly localised and occur among shrubs on thin shale soils over sandstone sheets. Often occurs in pockets of soil on sandstone shelves above cliff lines.	No impact likely. Not likely to occur, and not identified during surveys. The subject site does not contain suitable habitat for this species and provides no refuge from regular management activities like mowing, or from occasional disturbances like horse grazing.
Proteaceae	*Grevillea juniperina subsp. juniperina*	Juniper-leaved Grevillea	V		712	Found in Castlereagh Woodland on more sandy soils the dominant canopy species are Eucalyptus fibrosa, E. sclerophylla, Angophora bakeri and Melaleuca decora.	Low quality potential habitat occurs but not found during field surveys. Unlikely to occur or be impacted
	Persoonia nutans	Nodding Geebung	E1		7	Confined to aeolian and alluvial	Low quality potential habitat

Table 4.2 ANALYSIS OF THE LIKELY IMPACTS OF THE PROPOSAL ON THREATENED FLORA SPECIES RECORDED IN THE LGA

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	LGA Count	Habitat Requirements	Likely Impacts due to the proposal
						sediments and occurs in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland.	occurs but not found during field surveys. Unlikely to occur or be impacted
Thymelaeaceae	*Pimelea curviflora var. curviflora*		V		1	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	Low quality potential habitat occurs but not found during field surveys. Unlikely to occur or be impacted
	Pimelea spicata	Spiked Rice-flower	E1		35	In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. On the inland Cumberland Plain sites it is associated with Grey Box and Ironbark.	Low quality potential habitat occurs but not found during field surveys. Unlikely to occur or be impacted

4.3 Threatened Fauna

Two threatened fauna species were detected on the subject site. The Large-footed Myotis is a microchiropteran bat species that is listed as Vulnerable under the TSC Act and was recorded flying over the subject site. The Cattle Egret is a protected migratory species under the EPBC Act and was also detected visually on the subject site. These species are very mobile and are likely to forage only occasionally on the subject site. They are not expected to rely on the subject site for roosting. The potential development of the whole site is not expected to significantly impact these species.

The following table (**Table 4.3**) provides an assessment of the likely impacts to threatened fauna known from the locality. Several threatened fauna species have been recorded from the locality including birds, microbats and non-flying mammals. Some of these are bat and bird species that also have potential to forage on site. All such species are likely to lose some foraging habitat as a result of clearing for the proposed development. However, the site does not represent locally or regionally significant foraging habitat and impacts on threatened birds and bats are not expected to be significant.

The grassland communities do not provide quality of habitat such that threatened species are likely to occur; however the regenerating woodland and forest communities represent suitable habitat. Impacts from any proposed development are most likely to be through the loss of potentially regenerating woodland and woodland communities. Additional impacts will include the removal of riparian and aquatic habitat and a few hollow-bearing trees.

Proposed development of the subject site will not remove any major wildlife corridors. Mobile fauna that move between remnant patches can be vulnerable to predation if vegetated links are impacted and sedentary species can be isolated if distances between patches are significantly increased. As the current vegetation is already isolated and fragmented, the proposed clearing of vegetation on the subject site is unlikely to increase the isolation of habitat for fauna species.

Table 4.3 ANALYSIS OF THE LIKELY IMPACTS OF THE PROPOSAL ON THREATENED FAUNA SPECIES RECORDED IN THE LGA

Family	Scientific Name	Common Name	TSC Act Status	LGA Count	Habitat Requirements	Likely Impacts due to the proposal
Amphibia						
Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E1	12	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.).	Not detected during surveys. Unlikely to occur.
Myobatrachidae	*Heleioporus australiacus*	Giant Burrowing Frog	V	1	Found in heath, woodland and open forest with sandy soils.	No habitat present Unlikely to occur.
Aves						
Acanthizidae	*Pyrrholaemus saggitatus*	Speckled Warbler	V	4	A wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies.	Not detected during surveys. Unlikely to occur.
Accipitridae	*Lophoictinia isura*	Square-tailed Kite	V	1	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Known from Western Sydney. May forage on the site on rare occasions. May lose minimal amount of foraging habitat, but not nest sites.
Anatidae	*Oxyura australis*	Blue-billed Duck	V	2	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation.	Not detected during surveys. Unlikely to occur.

Table 4.3 ANALYSIS OF THE LIKELY IMPACTS OF THE PROPOSAL ON THREATENED FAUNA SPECIES RECORDED IN THE LGA

Family	Scientific Name	Common Name	TSC Act Status	LGA Count	Habitat Requirements	Likely Impacts due to the proposal
Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	V	1	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (Typha spp.) and spikerushes (Eleoacharis spp.).	Unlikely to occur. Insufficient habitat along stream. Not detected during surveys.
Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	1	Generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas.	Unlikely to occur – habitat inappropriate.
Meliphagidae	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V	2	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (Eucalyptus albens), Grey Box (Eucalyptus microcarpa), Yellow Box (Eucalyptus melliodora) and Forest Red Gum (Eucalyptus tereticornis). Also inhabits open	Unlikely to occur – habitat inappropriate.

Table 4.3 ANALYSIS OF THE LIKELY IMPACTS OF THE PROPOSAL ON THREATENED FAUNA SPECIES RECORDED IN THE LGA

Family	Scientific Name	Common Name	TSC Act Status	LGA Count	Habitat Requirements	Likely Impacts due to the proposal
					forests of smooth-barked gums, stringybarks, ironbarks and tea-trees.	
	Xanthomyza phrygia	Regent Honeyeater	E1	8	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak.	Unlikely to occur – habitat inappropriate.
Psittacidae	*Lathamus discolor*	Swift Parrot	E1	16	Occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations.	Has low potential to forage in the eucalypts on site on occaision.
	Neophema pulchella	Turquoise Parrot	V	1	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	Unlikely to occur – habitat inappropriate.
Strigidae	*Ninox connivens*	Barking Owl	V	1	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting.	Unlikely to occur – habitat inappropriate.
	Ninox strenua	Powerful Owl	V	1	Inhabits a range of vegetation types,	Unlikely to occur – habitat

Table 4.3 ANALYSIS OF THE LIKELY IMPACTS OF THE PROPOSAL ON THREATENED FAUNA SPECIES RECORDED IN THE LGA

Family	Scientific Name	Common Name	TSC Act Status	LGA Count	Habitat Requirements	Likely Impacts due to the proposal
					from woodland and open sclerophyll forest to tall open wet forest and rainforest.	inappropriate.
Gastropoda						
Camaenidae	*Meridolum corneovirens*	Cumberland Plain Land Snail	E1	167	Primarily inhabits Cumberland Plain Woodland. This community is a grassy, open woodland with occasional dense patches of shrubs. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	Appropriate habitat occurs on site to sustain this invertebrate species. It has not been found on site but can be difficult to detect. Mowing and other disturbances may have eliminated this species from the site but it is possible that is sill occurs, as yet undetected.
Mammalia						
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	7	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small	Unlikely to occur – habitat inappropriate.

Table 4.3 ANALYSIS OF THE LIKELY IMPACTS OF THE PROPOSAL ON THREATENED FAUNA SPECIES RECORDED IN THE LGA

Family	Scientific Name	Common Name	TSC Act Status	LGA Count	Habitat Requirements	Likely Impacts due to the proposal
					caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V	3	Roosts in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	Has low potential to forage across site but generally no roosting habitat on site.
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V	12	Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost maily in tree hollows but will also roost under bark or in man-made structures.	Low potential to occur on site but generally no roosting habitat present.
Phascolarctidae	*Phascolarctos cinereus*	Koala	V	2	Inhabit eucalypt woodlands and forests.	Does not occur on site.
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	28	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Individuals are likely to forage on site on occasion. No roost sites occur.
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	3	Found in well-timbered areas containing gullies. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of	Unlikely to occur. No suitable habitat.

Table 4.3 ANALYSIS OF THE LIKELY IMPACTS OF THE PROPOSAL ON THREATENED FAUNA SPECIES RECORDED IN THE LGA

Family	Scientific Name	Common Name	TSC Act Status	LGA Count	Habitat Requirements	Likely Impacts due to the proposal
					the Fairy Martin (Hirundo ariel), frequenting low to mid-elevation dry open forest and woodland close to these features.	
	Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	4	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows.	Unlikely to occur. No suitable habitat.
	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	48	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures	Likely to forage across the woodland and open forest remnants of the site.
	Myotis adversus	Large-footed Myotis	V	12	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.	Detected foraging on site. Likely to forage over the dams on site, though the opportunities for roosting are very limited by the lack of tree hollows.
	Scoteanax rueppellii	Greater Broad-nosed Bat	V	5	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. This species usually roosts in tree hollows.	Not detected during surveys. Low potential to forage on site but potential roosting habitat very limited.

Chapter 5

Mitigation Measures and Offsets

5.1 Introduction

The subject site is zoned for industrial development. In developing the Concept Plan for the subject site, the proponent has considered a range of options for mitigating the projected clearance of EECs and subsequent loss of potential habitat for flora and fauna.

One of the options was to conserve a portion of the existing vegetation on site and to manage this vegetation according to an approved Vegetation Management Plan. After consultation with DoP and DECCW, it was decided that there was limited scope to conserve native vegetation *in situ*. Consequently, the Concept Plan was redesigned to maximise the industrial potential of the subject site and to locate an offset for the proposed development entirely off site.

5.2 Discussion of Feasibility of *In Situ* Conservation

If a proportion of the existing vegetation was to be retained on site, a high level of investment in the rehabilitation of this vegetation would be necessary to achieve any valuable conservation outcome.

Since the vegetation on the subject site exists as small, disconnected fragments of highly altered remnant bushland, extensive work would need to be carried out to establish woodland vegetation in the cleared areas between fragments, so as to increase the overall patch size and reduce the edge:area ratio of the existing vegetation. Large patch sizes are desirable as they increase the resilience of the community to disturbance, and increase the habitat value of remnant fragments. Small edge:area ratios reduce the susceptibility of vegetation to weed and feral fauna invasion.

Furthermore, connectivity to native vegetation in surrounding properties is largely absent and dual carriage-way roads to the south and east prevent offsite connections to other significant areas of remnant vegetation. This limits the scope for improvement to local biodiversity values and means that on site conservation will have little bearing on regional biodiversity values.

Thus, the subject site is considered to have low conservation potential; that is, protecting vegetation *in situ* will not readily deliver a good conservation outcome.

Conversely, the subject site is located on valuable industrial land and has good development potential. It is situated at the intersection of two major arterial roads, the M7 and the M4 and has been slated for complete industrial development under the SEPP (WSEA) 2009. Based on all of the above, it was decided that the proposed development should maximise the industrial potential of the subject site and a completely off site offset be sought, which delivered better conservation outcomes than what could be feasibly achieved on site.

5.3 Offset Options

The subject site contains 5.10 hectares of native vegetation that is protected under environmental legislation, albeit in a highly modified and degraded form of the original vegetation communities. This vegetation also has some habitat value for native flora and fauna. If the whole site is developed for industrial purposes, off site compensatory measures will be required to offset the loss of 5.10 hectares of EEC and fauna habitat values.

There are two offset alternatives considered to be appropriate for the proposed concept development. The first is the acquisition of land containing a sufficient area of remnant vegetation to provide a net increase in the area of the EECs that will be affected by the development. This land would need to be subject to a management plan to ensure that the biodiversity values of the land improve over time. The second alternative is to offset the loss of EECs and habitat values by purchasing and "retiring" BioBanking biodiversity credits. Both of these offset options are discussed in further detail below.

5.3.1 Land Purchase and Vegetation Management

Acquiring land as an offset can deliver good conservation outcomes because the proponent has control over where the offset will be located and the outcomes of the management of this land. This would allow the proponent to ensure that compensation measures are properly directed to address the biodiversity loss of the development site. However, the time spent to negotiate the size of the offset can often be lengthy and is not necessarily guided by precedence; which is to say that there is no method or formula for determining what the size of an offset should be.

Opportunities for land purchase in Western Sydney are expensive and not readily available. A minimum area of 10 hectares of vegetation or land that could be returned to viable woodland would need to be sourced to satisfy at least a 2:1 offset ratio. This would likely cost upwards of $1 million to purchase. Furthermore, if adequate areas of EECs cannot be sought on a single property, offsets may then need to be split over several properties. This would be undesirable in term of good conservation principles, *i.e.* large patch size and connected vegetation, and would be even more costly to acquire.

In addition to this, a Vegetation Management Plan would need to be prepared to manage and improve the biodiversity values of the land. Quotes obtained from professional

contractors indicate that initial costs for the management of Cumberland Plain Woodland could be in the order of $150,000 per hectare for the first three to four years of management. For 10 hectares (which is roughly a 2:1 offset ratio), this would be approximately $1.5 million for management costs alone.

The landowner would need to consider whether the gain from development of the entire subject site would provide for the purchase and management of an area of land offsite for the first three to four years from establishment of the offset.

5.3.2 Retirement of Biodiversity Credits

The BioBanking methodology is a standardised and prescriptive means of determining the offsets required for a development. To offset biodiversity loss at a development site, the BioBanking Scheme relies on the purchase and "retirement" of like-for-like biodiversity credits that have been generated by the improvement and maintenance of biodiversity values on someone else's land (a "Biobank" site). The funds from the sale of biodiversity credits should generate an annuity that will pay for the ongoing management of the Biobank site.

The option to offset through the BioBanking scheme provides a simple process to determining appropriate offsets for the development. It reduces the time spent in sourcing and negotiating an appropriate offset package because the BioBanking methodology states what types and number of credits should be retired to sufficiently offset the development. It is a one-off transaction that negates the need for the proponent to buy land or be involved in the management of this land.

A BioBanking assessment was conducted over the subject site to determine the likely number and types of credits that would be required to compensate for the loss of EECs and threatened species habitat. This report has been appended to this ecological assessment and can be reviewed at **Appendix C**. The subject site will require the retirement of a total of 76 biodiversity credits. This is a relatively low number of credits; larger developments often require hundreds or thousands of credits to offset biodiversity loss.

Whilst no credits are available at present for Cumberland Plain Woodland, Shale Gravel Transition Forest and Swamp Oak Floodplain Forest, the option to purchase the appropriate credits appears to be imminent. The current risks with the BioBanking pathway of offsetting is firstly, that there is no certainty as to when biodiversity credits will be available; and secondly, there is no information at present regarding how much credits will cost. This is simply due to the novelty of the scheme. Despite this, the condition to retire credits can still be incorporated into the Statement of Commitments to guarantee that credits are purchased and retired prior to the commencement of development on the subject site.

5.4 Other Recommendations

5.4.1 Landscaping

To maintain the natural scenic values of the subject site, locally occurring species are recommended for use in landscape design. All landscaping and visual screening works on the subject site should use species endemic to the Cumberland Plain to suit the existing landscape character. A planting list comprising Cumberland Plain Woodland, Shale Gravel Transition Forest and Swamp Oak Floodplain Forest species will be referred to. Utilisation of endemic Cumberland Plain species will also provide potential habitat for native fauna species.

5.4.2 Stormwater Detention

One of the design options to address stormwater quality and waterway stability involves the construction of an on site detention wetland in the north western corner of the subject site. The proposed stormwater wetland will largely be dry but may provide occasional foraging habitat for species depending on periods of inundation. It is recommended that macrophytes endemic to the Cumberland Plain be planted throughout the wetland to provide an opportunity to create habitat for native species, as some potential foraging habitat will be lost when the existing wetland and settling pond are decommissioned.

Chapter 6

Conclusion

If the maximum industrial potential of the subject site is realised, then 5.10 hectares of EEC and some habitat for native flora and fauna will be impacted by future development of the subject site. Future development of the site will require compensatory measures to offset the loss of EEC and fauna habitat values.

Conservation of a proportion of the existing vegetation on the subject site will not deliver a good conservation outcome because of the size of the existing fragments and their isolation from larger areas of remnant vegetation. A better conservation outcome can potentially be achieved by seeking offsets off site.

The appropriate offset options include land acquisition or the retirement of BioBanking credits. Both alternatives carry benefits and risks. Land acquisition can be an expensive option, whilst BioBanking relies on biodiversity credits being available to purchase. BioBanking may be a more attractive option at the present time because despite the absence of an active credit market, the availability of suitable credits appears to be imminent. Furthermore, there is a possibility of incorporating the retirement of BioBanking credits into the Statement of Commitments, giving the proponent some flexibility to wait for the credit market to mature.

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Appendix A

Flora Species List

Table A.1 FLORA SPECIES RECORDED ON THE SUBJECT SITE

Family		Scientific Name	Common Name
Trees			
Casuarinaceae		*Casuarina glauca*	Swamp Oak
Myrtaceae		*Eucalyptus eugenioides*	Thin-leaved Stringybark
		Eucalyptus moluccana	Grey Box
		Eucalyptus tereticornis	Forest Red Gum
		Eucalytus sideroxylon	Mugga Ironbark
		Melaleuca decora	
Shrubs			
Asparagaceae	*	*Asparagus densiflorus* syn. *A. aethiopicus*	Asparagus Fern
Chenopodiaceae		*Atriplex semibaccata*	Creeping Saltbush
Pittosporaceae		*Bursaria spinosa*	Blackthorn
Proteaceae	*	*Grevillea banksii* x *cv*	Grevillea hybrid
Solanaceae	*	*Lycium ferocissimum*	African Boxthorn
Solanaceae	*	*Solanum nigrum*	Blackberry Nightshade
	*	*Solanum pseudocapsicum*	Madeira Winter or Jerusalem Cherry
Herbs - Dicots			
Acanthaceae		*Brunoniella australis*	Blue Trumpet
Amaranthaceae		*Alternanthera nodiflora*	Common Joyweed
Apiaceae		*Centella asiatica*	Indian Pennywort
	*	*Foeniculum vulgare*	Fennel
Asteraceae	*	*Bidens pilosa*	Cobblers Pegs
	*	*Bidens subalternans*	Greater Beggar's Ticks
		Calotis cuneifolia	Purple Burr-daisy
		Calotis lappulacea	Yellow Burr-daisy
	*	*Cirsium vulgare*	Spear Thistle
	*	*Conyza* sp.	Fleabane
		Epaltes australis	Spreading Nut-heads
	*	*Gnaphalium* sp.	a Cudweed
	*	*Hypochaeris radicata*	Flatweed
	*	*Senecio madagascariensis*	Fireweed
	*	*Sonchus asper*	Prickly Sowthistle
		Vittadinia cuneata	Fuzzweed

Table A.1 FLORA SPECIES RECORDED ON THE SUBJECT SITE

Family		Scientific Name	Common Name
Brassicaceae	*	*Lepidium bonariense*	
Caryophyllaceae	*	*Spergularia levis*	
Chenopodiaceae		*Einadia hastata*	Berry Saltbush
		Einadia polygonoides	
		Einadia trigonos	Fishweed
Clusiaceae		*Hypericum gramineum*	Small St John's Wort
Convolvulaceae		*Dichondra repens*	Kidney Weed
Fabaceae - Faboideae		*Desmodium varians*	Tick Trefoil
	*	*Trifolium* sp.	a Clover
Goodeniaceae		*Goodenia hederacea*	Ivy Goodenia
Malvaceae	*	*Modiola caroliniana*	Red-flowered Mallow
	*	*Sida rhombifolia*	Paddy's Lucerne
Oxalidaceae		*Oxalis* sp.	
Phyllanthaceae		*Phyllanthus virgatus*	
Plantaginaceae		*Plantago debilis*	
	*	*Plantago lanceolata*	Lamb's Tongue
Polygonaceae	*	*Persicaria* sp.	
	*	*Rumex crispus*	Curled Dock
Rubiaceae		*Asperula conferta*	Common Woodruff
Thymelaeaceae		*Pimelea curviflora* ssp. *subglabrata*	Rice Flower
Verbenaceae	*	*Verbena bonariensis*	Purple Top
Herbs - Monocots			
Anthericaceae		*Arthropodium* sp.	
		Tricoryne elatior	Yellow Rush-lily
Cyperaceae		*Cyperus exaltatus*	
		Cyperus gracilis	Slender Flat-sedge
Juncaceae	*	*Juncus acutus*	Sharp Rush
		Juncus usitatus	
Lomandraceae		*Lomandra filiformis*	Wattle Matrush
Grasses			
Poaceae		*Aristida vagans*	Threeawn Speargrass
		Austrodanthonia bipartita	Wallaby Grass
		Austrodanthonia sp.	Wallaby Grass

Table A.1 FLORA SPECIES RECORDED ON THE SUBJECT SITE

Family		Scientific Name	Common Name
		Austrostipa scabra	Corkscrew Grass
		Bothriochloa decipiens	Red-leg Grass
	*	*Bromus catharticus*	Prairie Grass
	*	*Chloris gayana*	Rhodes Grass
		Chloris truncata	Windmill Grass
		Chloris ventricosa	Tall Chloris
		Cymbopogon refractus	Barb-wire Grass
		Cynodon dactylon	Couch Grass
		Dichelachne sp.	Plume Grass
		Eragrostis brownii	Brown's Lovegrass
	*	*Eragrostis curvula*	African Lovegrass
		Eragrostis leptostachya	Paddock Lovegrass
		Microlaena stipoides	Weeping Meadow Grass
		Panicum effusum	Hairy Panic
		Paspalidium distans	
	*	*Paspalum dilatatum*	Paspalum
	*	*Setaria gracilis*	Pigeon Grass
		Sporobolus creber	Rats Tail Grass
		Themeda australis	Kangaroo Grass
Vines and Creepers			
Asparagaceae	*	*Asparagus asparagoides*	Bridal Creeper
Fabaceae - Faboideae		*Glycine clandestina*	
		Glycine tabacina	
Ferns and Allies			
Adiantaceae		*Cheilanthes sieberi*	Poison Rock Fern

Table A.2 QUADRAT DATA

Family		Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6
Trees									
Casuarinaceae		*Casuarina glauca*	Swamp Oak						3
Myrtaceae		*Eucalyptus moluccana*	Grey Box	3	+	1			
		Eucalyptus tereticornis	Forest Red Gum			1	+		+
		Melaleuca decora		1				+	
Shrubs									
Chenopodiaceae		*Atriplex semibaccata*	Creeping Saltbush						1
Myrtaceae		*Eucalyptus moluccana*	Grey Box	+					
Pittosporaceae		*Bursaria spinosa*	Blackthorn	2					x
Solanaceae	*	*Lycium ferocissimum*	African Boxthorn						+
Herbs - Dicots									
Acanthaceae		*Brunoniella australis*	Blue Trumpet	1	+	+		+	
Amaranthaceae		*Alternanthera nodiflora*	Common Joyweed						
Apiaceae		*Centella asiatica*	Indian Pennywort						x
Asparagaceae	*	*Asparagus densiflorus* syn. *A. aethiopicus*	Asparagus Fern						+
Asteraceae	*	*Bidens pilosa*	Cobblers Pegs						x
		Calotis cuneifolia	Purple Burr-daisy	+					
		Calotis lappulacea	Yellow Burr-daisy		+				
	*	*Cirsium vulgare*	Spear Thistle			+	+		

Table A.2 QUADRAT DATA

Family		Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6
	*	*Conyza* sp.	Fleabane	+	+	+	+		x
		Epaltes australis	Spreading Nut-heads						1
	*	*Gnaphalium* sp.	a Cudweed			+		+	
	*	*Hypochaeris radicata*	Flatweed						x
	*	*Senecio madagascariensis*	Fireweed	+	+	+	+		+
	*	*Sonchus asper*	Prickly Sowthistle				+		
		Vittadinia cuneata	Fuzzweed	+	+				
Caryophyllaceae	*	*Spergularia levis*							+
Chenopodiaceae		*Einadia hastata*	Berry Saltbush	+	+				1
		Einadia polygonoides			+			+	+
		Einadia trigonos	Fishweed	1				+	
Clusiaceae		*Hypericum gramineum*	Small St John's Wort		+				
Convolvulaceae		*Dichondra repens*	Kidney Weed	1	+	+	+	+	x
Fabaceae - Faboideae		*Desmodium varians*	Tick Trefoil	+					
	*	*Trifolium* sp.	a Clover				+		
Malvaceae	*	*Modiola caroliniana*	Red-flowered Mallow				+	+	
	*	*Sida rhombifolia*	Paddy's Lucerne	+	+		+		+
Oxalidaceae		*Oxalis* sp.		+	+	+	+	+	
Phyllanthaceae		*Phyllanthus virgatus*		+	+			+	
Pittosporaceae		*Bursaria spinosa*	Blackthorn	+	+				
Plantaginaceae		*Plantago debilis*		+	+	+		+	

Table A.2 QUADRAT DATA

Family		Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6
	*	*Plantago lanceolata*	Lamb's Tongue		+	+	+		+
Polygonaceae	*	*Persicaria* sp.							x
	*	*Rumex crispus*	Curled Dock						x
Rubiaceae		*Asperula conferta*	Common Woodruff		+				
Solanaceae	*	*Solanum nigrum*	Blackberry Nightshade	+					
Thymelaeaceae		*Pimelea curviflora* ssp. *subglabrata*	Rice Flower	+					
Verbenaceae	*	*Verbena bonariensis*	Purple Top		+	+			
Herbs - Monocots									
Anthericaceae		*Arthropodium* sp.		+	+				
		Tricoryne elatior	Yellow Rush-lily						
Cyperaceae		*Cyperus exaltatus*							x
		Cyperus gracilis	Slender Flat-sedge		+			+	
Juncaceae	*	*Juncus acutus*	Sharp Rush						x
Lomandraceae		*Lomandra filiformis*	Wattle Matrush	+	+				
Grasses									
Poaceae		*Aristida vagans*	Threeawn Speargrass					+	
		Austrodanthonia bipartita	Wallaby Grass						+
		Austrodanthonia sp.	Wallaby Grass			+			
		Austrostipa scabra	Corkscrew Grass						x

Table A.2 QUADRAT DATA

Family		Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6
		Bothriochloa decipiens	Red-leg Grass					+	
	*	*Chloris gayana*	Rhodes Grass			+			
		Chloris truncata	Windmill Grass		+			+	
		Chloris ventricosa	Tall Chloris	+	+	+		+	
		Cymbopogon refractus	Barb-wire Grass	2	1			+	
		Cynodon dactylon	Couch Grass	1	1	1	2	1	2
		Dichelachne sp.	Plume Grass			x			
	*	*Eragrostis curvula*	African Lovegrass	+	1		+		
		Eragrostis leptostachya	Paddock Lovegrass						+
		Microlaena stipoides	Weeping Meadow Grass	+	+				
		Paspalidium distans		+			+	1	+
	*	*Paspalum dilatatum*	Paspalum	+	+	+	1	+	x
	*	*Setaria gracilis*	Pigeon Grass				+		+
		Sporobolus creber	Rats Tail Grass					+	
		Themeda australis	Kangaroo Grass			+			x
Vines and Creepers									
Fabaceae - Faboideae		*Glycine clandestina*				+			
		Glycine tabacina		+	+	+		+	

Table A.2 QUADRAT DATA

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6
Ferns and Allies								
Adiantaceae	*Cheilanthes sieberi*	Poison Rock Fern	+					

KEY

**indicates an exotic species*

x indicates a species found adjacent to a quadrat but not within

Cover-abundance rating: see table A.3 below

Table A.3 MODIFIED BRAUN BLANQUET COVER ABUNDANCE SCORES FOR QUADRAT SAMPLING

Class	Cover-abundance	Notes
+	Rare (less than 1% cover)	Herbs, sedges and grasses: within $4m^2$ Shrubs and small trees: less than 5 individuals
1	Few Individuals (less than 5% cover)	Herbs, sedges and grasses: within $20m^2$ Shrubs and small trees: 5 or more individuals medium - large overhanging tree
2	5 - less than 25% cover	-
3	25 - less than 50% cover	-
4	50 - less than 75% cover	-
5	75 - 100% cover	-

Table A.4 QUADRAT STRUCTURAL DATA

Structural Data	Q1	Q2	Q3	Q4	Q5	Q6
Height (m)						
Tree	10-12	10-12	10-12	10	7	10-12
Shrub	0.5-1.5	-	-	-	-	1.5-2.0
Ground	0.15	0.15-0.2	0.2	0.2	0.1	0.3
Cover (%)						
Tree	55	5	5-10	1	5	60-65
Shrub	5	-	-	-	-	5
Litter	50	5	5	50	5	45
Bare	10	5	5	-	10	10
Ground	40	90	90	50	85	45

Appendix B

Fauna Species List

Table B.1 FAUNA SPECIES RECORDED ON THE SUBJECT SITE

Family	Scientific Name	Common Name	Status	Count
Amphibians				
Hylidae	*Litoria peronii*	Peron's Tree Frog	P	13
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet	P	64
	Limnodynastes peronii	Brown-striped Frog	P	21
	Limnodynastes tasmaniensis	Spotted Grass Frog	P	10
Aves				
Anatidae	*Anas castanea*	Chestnut Teal	P	13
	Chenonetta jubata	Australian Wood Duck	P	33
Ardeidae	*Ardea ibis*	Cattle Egret	P	22
	Egretta novaehollandiae	White-faced Heron	P	23
Artamidae	*Cracticus torquatus*	Grey Butcherbird	P	77
	Gymnorhina tibicen	Australian Magpie	P	85
	Strepera graculina	Pied Currawong	P	33
Cacatuidae	*Cacatua sanguinea*	Little Corella	P	5
	Eolophus roseicapillus	Galah	P	33
Charadriidae	*Vanellus miles*	Masked Lapwing	P	37
Columbidae	*Ocyphaps lophotes*	Crested Pigeon	P	58
Corcoracidae	*Struthidea cinerea*	Apostlebird	P	2
Corvidae	*Corvus coronoides*	Australian Raven	P	102
Dicruridae	*Grallina cyanoleuca*	Magpie-lark	P	98
	Rhipidura leucophrys	Willie Wagtail	P	68
Falconidae	*Falco sp.*			
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	P	45
Meliphagidae	*Manorina melanocephala*	Noisy Miner	P	123
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush	P	34
Psittacidae	*Platycercus adscitus eximius*	Eastern Rosela	P	68
	Psephotus haematonotus	Red-rumped Parrot	P	47
	Trichoglossus haematodus	Rainbow Lorikeet	P	53
Rallidae	*Porphyrio porphyrio*	Purple Swamphen	P	36
Sturnidae	*Acridotheres tristis**	Common Myna	U	76
	*Sturnus vulgaris**	Common Starling	U	60
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis	P	12

Table B.1 FAUNA SPECIES RECORDED ON THE SUBJECT SITE

Family	Scientific Name	Common Name	Status	Count
Mammalia				
Canidae	*Vulpes vulpes**	Fox	U	42
Leporidae	*Oryctolagus cuniculus**	Rabbit	U	59
Reptilia				
Scincidae	*Eulamprus quoyii*	Eastern Water-skink	P	19
	Lampropholis delicata	Dark-flecked Garden Sunskink	P	39

Appendix C

BioBanking Assessment

60 WALLGROVE ROAD, MINCHINBURY NSW 2770
BIOBANKING ASSESSMENT REPORT

For:

AFTERON LTD

November 2009

Final Report

Cumberland Ecology
PO Box 2474, Carlingford Court 2118

Report No. 9001RP3

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 Cumberland Ecology

Approved by:	David Robertson
Position:	Project Director
Signed:	
Date:	*17 November, 2009*

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Chapter 1

Introduction

1.1 Purpose

Cumberland Ecology has undertaken a BioBanking assessment on behalf of Afteron Limited for land at 60 Wallgrove Road, Minchinbury 2770 (the 'study site') within the Western Sydney Employment Hub. This report presents the findings of the BioBanking assessment.

Specifically, the purpose of the BioBanking assessment is to:

- Determine the number of credits that are required to offset the impacts of the proposed future development of the study site; and
- Determine the factors driving the generation of credits at the study site.

1.2 Background

New BioBanking legislation has recently been introduced and the NSW Department of Planning (DoP) have made recent requests to proponents of Part 3A projects to informally consider the offsets required to compensate for impacts under a BioBanking assessment.

Discussions are currently in progress with DoP and the Department of Environment, Climate Change and Water (DECCW) regarding the nature and size of offsets that would be suitable to compensate for the projected impacts of future development of the study site. These offset options include the retirement of appropriate biodiversity credits under the BioBanking Scheme.

This BioBanking assessment has been prepared to support offset discussions that are currently in progress. Earlier, informal assessments were prepared prior to this assessment to explore the application of the BioBanking Methodology to the development proposal. As such, some data sets were derived from existing field data sets to meet the minimum number of plots required for the BioBanking Credit Calculator. At the request of DECCW, the BioBanking study has been reassessed to include additional field collected data so that only empirical data is applied to the assessment.

It is not the intention of this document to investigate the offset alternatives for the development proposal. An ecological assessment has been completed to support the Environmental Assessment prepared for the development proposal, which presents and discusses a number of offset options for the project.

i. Location

The proposed development project to be assessed under BioBanking methodology will be located on 22 hectares at 60 Wallgrove Road, Minchinbury (Lot 1 DP 1040948). The subject site is situated at the intersection of two motorways, the M7 Westlink and M4 Western Motorway and is bounded on the northern and western sides by Pinegrove Memorial Park Lawn Cemetery.

The subject site is situated within the Blacktown Local Government Area (LGA) and is proposed to be zoned IN1 General Industrial under the *draft State Environmental Planning Policy (Western Sydney Employment Hub) 2008* (the 'draft SEPP'). It is currently zoned for Special Uses under *Blacktown Local Environmental Plan 1988* (BLEP 1988) and is being used as the Australian Quarantine Inspection Service (AQIS) Animal Quarantine Station.

ii. The Development Proposal

The landowner, Afteron Limited, is seeking to amend the existing zoning ahead of the draft SEPP to permit industrial development of the subject site. A concept plan is in preparation; this BioBanking assessment considers the rezoning of the entire study site to IN1 General Industrial to allow for industrial development of approximately 22 hectares.

Under this proposed concept plan, approximately 4.01 ha of Cumberland Plain Woodland, 0.35 ha of Swamp Oak Floodplain Forest and 0.73 ha of Shale Gravel Transition Forest will be removed for industrial development. All communities are State-listed endangered ecological communities (EECs). Cumberland Plain Woodland is also a Commonwealth-listed EEC and has recently been nominated as a critically endangered ecological community (CEEC).

iii. Assessment Pathway

The development project is being assessed via the Part 3A assessment process under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). As part of the Part 3A process, an Environmental Assessment (EA) has been prepared.

Chapter 2

Methodology and Assumptions

2.1 Introduction

The BioBanking assessment methodology follows that outlined in the *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (March 2009) and uses the Credit Calculator Version 1,1. This methodology is very specific and differs from the standard requirements for survey outlined in the Department of Environment, Climate Change and Water's (DECCW, formerly the Department of Environment and Climate Change) biodiversity survey guidelines (DECC 2004). Therefore, in order to complete the BioBanking assessment, new vegetation and habitat sample plots were completed across the subject site.

The BioBanking Credit Calculator is computer software that calculates "biodiversity credits", which are effectively the units of BioBanking transactions. Biodiversity credits are ecosystem or species credits required to offset the loss of biodiversity values on development sites or created on Biobank sites from management actions that improve biodiversity values. It is important to understand that such credits are not directly equivalent to unit areas (i.e. acres or hectares), and the credits generated for an area of impact will vary based upon the quality and types of vegetation present; threatened species present or likely to occur; and the connectivity of vegetation in the landscape.

The BioBanking methodology must be applied separately for proposed development sites and for proposed Biobank sites. The methodology can be divided into three distinct phases:

1. Preliminary Assessment;
2. Field Data Collection; and
3. Generating the Site Credits

2.2 Preliminary Assessment

2.2.1 Assessment Circles

Within the preliminary assessment, information about geographic location, physiography and vegetation connectivity is entered into the Biobanking Credit Calculator. This is done using two types of assessment circles: a 1000 hectare "landscape" circle and a 100 hectare "site" circle. Geographic Information System (GIS) mapping is used to draw these circles and make assessments of the areas and connectivity of patches of native vegetation across the subject land and in adjacent areas.

These assessment circles must be centred over the area with the most impact. Percentage native vegetation cover, adjacent remnant vegetation size, and condition and width of connecting corridors of native vegetation are measured or estimated before and after the proposed development or land management works to assess the landscape value of the site.

Where development areas exceed 1000 ha, multiple but overlapping 1000 ha circles are generated. The locations of the circles determine the outcome of critical information that substantially influences the generation of credits in the subsequent assessment. The study site required only one 100 hectare and one 1000 hectare assessment circle, which were centred over the whole site.

2.2.2 Vegetation Types

Ecological communities are used in the methodology as a surrogate for general biodiversity values. They are referred to as Vegetation Types.

The names used for Vegetation Types in a Biobanking Assessment are selected from a database within the Credit Calculator itself. The names available differ to some extent from ecological community names used in the National Parks and Wildlife Service (NPWS) mapping project for the Cumberland Plain (2003) and also from names used for Commonwealth and State endangered ecological communities (EECs). The translation of common ecological community names to BioBanking Vegetation Type names influences the outcome of the assessment because some plant communities are rarer and/or support more threatened fauna species than others.

i. Vegetation Types of the Subject Site

There were three ecological communities that were identified on the subject site (**Figure 2.1**). The dominant community identified was Cumberland Plain Woodland. There were two less prevalent communities present on the subject site and these were Shale Gravel Transition Forest and Swamp Oak Floodplain Forest. All three are listed as endangered under legislation. Cumberland Plain Woodland is currently nominated for listing as being Critically Endangered.

Cumberland Plain Woodland is recognised within the Vegetation Types Database as *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin*. It is a community that is characterised by tree species *Eucalyptus moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum), and sub-dominant tree species *E. eugenioides* (Thin-leaved Stringybark) and *E. crebra* (Narrow-leaved Ironbark).

Shale Gravel Transition Forest is recognised within the Vegetation Types Database as *Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin*. This community occurred on the study site as a highly modified form of the original community; however it was dominated by *Melaleuca decora*, which is a dominant sub-canopy species that characterises this community. Other characteristic sub-canopy trees that are present nearby include Grey Box, Forest Red Gum and Thin-leaved Stringybark. This community often grades into the above community where shale influences in the soil decreases in favour of gravel influences.

Swamp Oak Floodplain Forest is recognised within the Vegetation Types Database as *Swamp Oak - Prickly Tea-tree - Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin and South East Corner*. This riparian community also occurred on the study site as a highly modified form of the original community. It was dominated by *Casuarina glauca* (Swamp Oak) and was restricted to drainage lines.

ii. Vegetation Condition

BioBanking methodology has strict definitions for native vegetation condition that must be applied. The two condition types that the BioBanking assessment recognises are **Low** and **Moderate-Good**. The BioBanking definition for Low Condition vegetation is:

- *Woody native vegetation with:*
  - *Native over-storey percent foliage cover less than 25% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, and*
    - *Less than 50% of groundcover vegetation is indigenous species, or*
    - *Greater than 90% of groundcover vegetation is cleared.*
- *Native grassland, wetland or herbfield, where:*
  - *Less than 50% of groundcover vegetation is indigenous species, or*
  - *Greater than 90% of groundcover vegetation is cleared.*

All native vegetation that does not meet the Low Condition criteria above is considered to be in Moderate-Good condition under the BioBanking assessment methodology. The present study includes Vegetation Types that are in Moderate-Good condition.

Figure 2.1 Vegetation Types Present on the Study Site

CUMBERLAND ECOLOGY

2.3 Field Data Collection

2.3.1 Site Attributes

The BioBanking assessment requires collection of field data from 50 x 20 metre plots. In each plot there are 10 site attributes for which data is collected:

1. Indigenous plant species richness;
2. Native overstorey cover;
3. Native mid-storey cover;
4. Native ground cover (grasses);
5. Native ground cover (shrubs);
6. Native ground cover (other);
7. Exotic plant cover;
8. Number of trees with hollows;
9. Regeneration of overstorey species; and
10. Total length of fallen logs.

2.3.2 Numbers of Plots

Once the preliminary data is entered, the Credit Calculator generates a prescription for the number of plots from which field data should be collected.

Table 2.1 NUMBER OF PLOTS REQUIRED BY THE CREDIT CALCULATOR

Vegetation Type	Required number of plots
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	3
Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin	1
Swamp Oak - Prickly Tea-tree - Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin and South East Corner	1

2.3.3 Threatened Species Surveys

The BioBanking assessment provides an analysis of credits required for vegetation to be cleared (i.e. ecosystem credits) and can also give a number of credits required for selected threatened species (i.e. species credits). The majority of threatened fauna species are simply dealt with by modelling and are incorporated into the ecosystem credits. However, threatened plants and some fauna (e.g. frogs) must be surveyed and counted separately and species credits given for them.

The BioBanking assessment of this subject site assumes that the Cumberland Land Snail (*Meridolens corneovirens*) and the Swift Parrot (*Lathamus discolor*) are present within Cumberland Plain Woodland and Shale Gravel Transition Forest. Hence, potential impacts to these species are considered in the ecosystem credits for these two EECs. No surveys are required for these species.

The threatened species that require specific surveys comprise a list of threatened plants that have not been detected during previous surveys of the subject site. These include a number of small trees, shrubs and herbs that are reasonably conspicuous, such as *Dillwynia tenuifolia*, *Grevillea juniperina* subsp. *juniperina* and *Acacia pubescens*. The only cryptic species requiring survey is *Pterostylis saxicola*. This deciduous orchid flowers anytime between August and November, although the flowering event can vary each season according to climatic conditions. Outside of the flowering period, the species persists as an underground tuberoid. Populations are highly localised and occur among shrubs on thin shale soils over sandstone sheets, often in pockets of soil on sandstone shelves above cliff lines. It is therefore unlikely that this species is present on the site. Nevertheless, targeted searches were conducted for this species and it is assumed that surveys were adequate to assess for the presence of threatened plant species.

A small list of fauna species requiring survey includes Green and Golden Bell Frog (*Litoria aurea),* Australasian Bittern (*Botaurus poiciloptilus*) and Adam's Emerald Dragonfly (*Archaeophya adamsi*). These species are generally associated with the wetlands found in Swamp Oak Floodplain Forest but have not been detected during surveys of the study site. The drainage lines and riparian vegetation on the subject site is greatly modified from the original community and offer limited habitat for these species. Hence, it is assumed that surveys were adequate to assess for the presence of threatened fauna species.

2.4 Generation of BioBanking Credit Points

2.4.1 Assessing the change in Site Value at a Development Site

The "Site Value" represents the overall condition of the vegetation at a site compared to the benchmark values for that vegetation community. The Site Value score is calculated from 10 site attributes that are scored against benchmark values and is used to determine the number of Ecosystem Credits that are created at the development or the Biobank site.

The Site Value score is calculated from the field survey data collected against the 10 site attributes. The results of this field data is compared against benchmark values and is used to determine how disturbed the vegetation is in comparison to estimates of vegetation condition prior to European disturbance. This Site Value score comparison is made for each area of vegetation of differing type and condition prior to the development being undertaken. These Site Value scores are then compared to the expected Site Value as a result of the proposed impact.

The impacts within the proposed IN1 General Industrial zone is assumed to reduce the site value of this area to zero, as future industrial development of the site will necessitate the removal of existing vegetation in this area.

Chapter 3

Results and Discussion

3.1 Biodiversity Credit Summary for the Development

The Credit Calculator generates a detailed "Credit Assessment" Report. The Credit Assessment Report for the subject site is provided in full within **Appendix A**.

The credit report indicates that the proposed development will require 76 credits to offset the impacts on approximately 5.01 hectares of EEC. The highest proportion of this requirement is to compensate for the loss of Cumberland Plain Woodland, which is the most extensive Vegetation Type on the study site.

The Vegetation Type that generates the most credits per unit area is *Swamp Oak - Prickly Tea-tree - Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin and South East Corner* but it is the community with the least area on the study site. Its intrinsic values are likely to be due to its riparian qualities, and to the higher understorey scores it attained compared to the remaining two communities.

Table 3.1 provides a summary of the credits required for the development of the study site. There were no species credits generated for this development.

Table 3.1 CREDIT SUMMARY FOR THE DEVELOPMENT PROPOSAL

Vegetation Type	EEC	EEC Name	Area (ha)	Credits
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Yes	Cumberland Plain Woodland	4.1	60
Swamp Oak - Prickly Tea-tree - Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin and South East Corner	Yes	Swamp Oak Floodplain Forest	0.4	5
Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin	Yes	Shale Gravel Transition Forest	0.7	11
Total				**76**

The total credits required by this development are relatively low and this could be due to the low landscape score for the site (landscape score = 3). This landscape score is most likely attributable to the fragmented nature of the remnant vegetation and also to the low vegetation connectivity to other vegetation in surrounding areas.

Chapter 4

Conclusion

The proposed development of the subject site will clear approximately 4.1 ha of Cumberland Plain Woodland, 0.4 ha of Swamp Oak Floodplain Forest and 0.7 ha of Shale Gravel Transition Forest. All communities are State-listed endangered ecological communities. Cumberland Plain Woodland is also a Commonwealth-listed EEC.

The BioBanking assessment of the proposed development of the study site demonstrates that the site will require 76 credits to offset the impacts on approximately 5.01 hectares of EEC. The highest proportion of this requirement is to compensate for the loss of Cumberland Plain Woodland, which is the most extensive community type on the study site.

References

DEC (NSW) (2004) **Threatened Biodiversity Survey and Assessment: Guidelines for developments and activities (working draft)** New South Wales Department of Environment and Conservation, Hurstville, NSW.

DECC (NSW) (2009) **BioBanking Assessment Methodology and Credit Calculator Operational Manual** New South Wales Department of Environment and Climate Change, Sydney, NSW.

NSW NPWS (2002) **Native Vegetation Maps of the Cumberland Plain Western Sydney** NSW National Parks and Wildlife Service, Sydney.

Appendix A

BioBanking Credit Report: Development

BioBanking
Biodiversity Banking and Offsets Scheme

Biobanking Credit Report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 16/11/2009 Time: 15:08 Tool Version: 1.1

Development Details

Proposal ID: 0057/2009/D001

Development Name: Minchinbury Employment Park
Development Location: Western Sydney Employment Hub
Development Address: 60 Wallgrove Road, Minchinbury NSW 2770

Lot: 1 **Section:** **DP:** 104094

CMA: Hawkesbury/Nepean

Proponent Name: Afteron Ltd.
Proponent Address: Level 12, Grosvenor Place, 225 George Street, Sydney NSW 2000
Proponent Phone: +61 2 9257 0222

Assessor Name: Dr. David Robertson
Assessor Address: PO Box 2474, , Carlingford Court, NSW 2118
Assessor Phone: +61 2 9868 1933
Assessor Accreditation Number 0057

The following information is required to be submitted with this BioBanking Statement (where ticked)

Local reference data is required for the following vegetation zones

☐ **An Expert Report for the following species**

☐ **The minimium number of plots were not entered for the following vegetation zones**

Department of Environment & Climate Change NSW

Improving or maintaining biodiversity values

The proposal has 1 or more Red Flag areas, as listed below:

Red Flag	Reason
Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin	Vegetation type being > 70% cleared; Vegetation type contains an endangered ecological community;
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Vegetation type being > 70% cleared; Vegetation type contains an endangered ecological community;
Swamp Oak - Prickly Tea-tree - Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin and South East Corner	Vegetation type being > 70% cleared; Vegetation type contains an endangered ecological community;

The development does not improve or maintain biodiversity values and a biobanking statement cannot be issued.

Ecosystem Credits

Vegetation Type	Area (ha)	Credits Required	Red Flag
Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin [HN512]	0.7	11	Yes
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin [HN528]	4.1	60	Yes
Swamp Oak - Prickly Tea-tree - Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin and South East Corner [HN594]	0.4	5	Yes

Credit Profiles

Group: 1 Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin

Ecosystem credits: 11 credits

Total area of vegetation(s): 0.73 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.	Description: Minimum area of contiguous vegetation in which credits must be obtained.
Minimum percent cover: 0%	**Minimum area: 0 ha**

3. CMA subregion & vegetation types

Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

Hawkesbury/Nepean

CMA Sub-Region(s)	Veg Type(s)
Burragorang (Part A)	Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin (HN512)
Cumberland	Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin (HN513)
Wollemi	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)
Yengo	Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin (HN604)

Sydney Metro

CMA Sub-Region(s)	Veg Type(s)
Cumberland	Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin (ME004)
Sydney Cataract	Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin (ME002)
	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (ME021)
	Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin (ME041)

Group: 2 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin

Ecosystem credits: 60 credits

Total area of vegetation(s): 4.07 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.	Description: Minimum area of contiguous vegetation in which credits must be obtained.
Minimum percent cover: 0%	**Minimum area: 0 ha**

3. CMA subregion & vegetation types
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

Hawkesbury/Nepean

CMA Sub-Region(s)	Veg Type(s)
Burragorang (Part A)	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin (HN526)
Cumberland	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin (HN528)
Wollemi	
Yengo	

Sydney Metro

CMA Sub-Region(s)	Veg Type(s)
Cumberland	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin (ME018)
Sydney Cataract	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin (ME020)

Group: 3 Swamp Oak - Prickly Tea-tree - Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin and South East Corner

Ecosystem credits: 5 credits

Total area of polygon(s): 0.35 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.	Description: Minimum area of contiguous vegetation in which credits must be obtained.
Minimum percent cover: 0%	**Minimum area: 0 ha**

3. CMA subregion & vegetation types
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

Hawkesbury/Nepean

CMA Sub-Region(s)	Veg Type(s)
Bathurst	Swamp Oak - Prickly Tea-tree - Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin and South East Corner (HN594)
Bungonia	Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner (HN595)
Burragorang (Part A)	
Burragorang (Part B)	
Capertee (Part A)	
Capertee (Part B)	
Crookwell	
Cumberland	
Hawkesbury/Nepean - marine zone	
Kanangra	
Monaro	
Moss Vale	
Oberon	
Pittwater	
Sydney Cataract	
Wollemi	
Yengo	

Species Credits