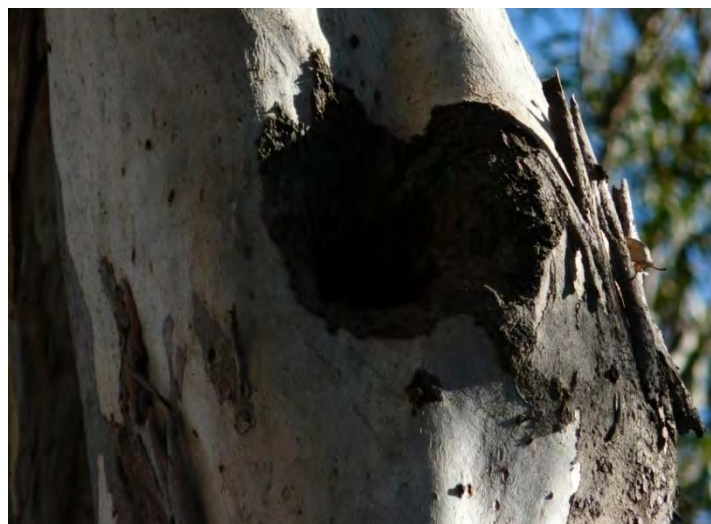




Ecological Assessment for the Eastern Creek Business Hub State Significant Development

Prepared for
Western Sydney Parklands Trust

August 2012



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Abbreviations

ABBREVIATION	DESCRIPTION
AW	Alluvial Woodland
BBAM	Biobanking Assessment Methodology
CEEC	Critically Endangered Ecological Community
CPW	Cumberland Plain Woodland, a CEEC listed under the TSC Act and EPBC Act
DCP	Development Control Plan
DEC	Former NSW Department of Environment and Conservation (now OEH)
DECC	Former NSW Department of Environment and Climate Change (now OEH)
DECCW	Former NSW Department of Environment, Climate Change and Water (now OEH)
DGRs	Director General Requirements
DSEWPAC	Commonwealth Department of Sustainability, Environment, Water, Populations and Communities
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
ELA	Eco Logical Australia
EPI	Environmental Planning Instrument
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
GGBF	Green and Golden Bell Frog
KTP	Key Threatening Process
LEP	Local Environmental Plan
MNES	Matters of National Environmental Significance
NW Act	<i>Noxious Weeds Act 1993 (NSW)</i>
OEH	NSW Office of Environment and Heritage
PSO	Planning Scheme Ordinance
RFEF	River-flat Eucalypt Forest, an endangered ecological community listed under the TSC Act
SMCMA	Sydney Metropolitan Catchment Management Authority
SPW	Shale Plains Woodland
SSD	State Significant Development
SSS	State Significant Site
TEC	Threatened Ecological Community

TSC Act	<i>Threatened Species Conservation Act 1995 (NSW)</i>
WM Act	<i>Water Management Act 2000 (NSW)</i>
WSPT	Western Sydney Parklands Trust

Executive Summary

The Western Sydney Parklands Trust is seeking approval from the NSW Department of Planning for a superlot subdivision and early stage site establishment works at its 'Eastern Creek Business Hub Site'. The site is situated at the intersection of the M7 Roadway and Great Western Highway, Eastern Creek. The development has been deemed to be State Significant Development.

The report examines the flora and fauna habitat on site and the potential impact of proposed works on the habitat. Despite the relatively low ecological condition of the site and the vegetation within it, the site does contain two (2) endangered ecological communities and several threatened and migratory fauna species have been recorded within the site. No threatened plant species have been recorded on site.

The Preferred Indicative Plan of the proposed superlot subdivision and eventual business hubs development has enabled the retention of the majority of native vegetation on site, concentrating development activities in the parts of the site that have been previously disturbed and contain non-native vegetation. Despite this, approximately 1.93 ha of Shale Plains Woodland vegetation will be cleared. Shale Plains Woodland a component of the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed, Cumberland Plains Woodland critically endangered ecological community.

The impact of these clearing activities and the impact on habitat of the recorded threatened and migratory fauna have been assessed in accordance with the State 'Draft Guidelines for Threatened Species Assessment' (DEC and DPI 2005) and the Commonwealth, 'Matters of National Environmental Significance – Significant Impact Guidelines 1.1' (DEWHA 2009). These have determined that the proposal will not have a significant impact on the threatened and migratory species, or the threatened ecological communities at the site. Safeguards to ensure this outcome will be contained in an Operational Environmental Management Plan for the site, along with a Biodiversity Offset Strategy.

Impacts that could not be avoided or mitigated included clearance of 1.93 ha of native vegetation and the loss of two hollow bearing trees. This ecological assessment includes a Biodiversity Offset Strategy (**Section 6**), which will result in the retirement of 46.3 ecosystem credits, of the same vegetation type that is being impacted within the development footprint within the Western Sydney Parklands at Chandos West (Biobank Site 70).

1 Introduction

The Western Sydney Parklands Trust (WSPT) is seeking approval for a staged approval, including early subdivision works to develop the Eastern Creek Business Hub. The proposal is State Significant Development under Part 4 (Division 4.1) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1 STUDY AREA

The study area is the 35 hectares (ha) of land known as the Rooty Hill Precinct of the Western Sydney Parklands. The study area is bound by the M7 Motorway to the East, the Great Western Highway to the South, Rooty Hill Road South to the West and Church Street to the North (**Figure 1**). The site lies within the suburb of Eastern Creek, in Blacktown Local Government Area. The study area forms part of the Western Sydney Parklands estate, which totals over 5,500 hectares of land at present.

The study area contains large areas of open grasslands, some stands of remnant and regrowth native vegetation, a constructed drainage channel running east and north through the site and several informal access roads entering from two of the street frontages.

Approximately 75% of the study area has been cleared and currently exists as modified grasslands, dominated by exotic species. Within the remainder of the study area, Cumberland Plain Woodland (sub community Shale Plains Woodland) is the predominant vegetation cover.

Parts of the study area are highly disturbed due to previous agricultural and development uses (a former school was located in the south-west corner of the site) and the influence of the adjacent urban development such as the M7 Westlink Motorway to the east and residential housing to the west.

Figure 1 shows the study area in the broader local context while **Figure 2** shows the study area in more detail.

1.2 DESCRIPTION OF THE PROPOSED PROJECT

The final development will consist of retail, tourism (such as a hotel / motel) and open space, together comprising a Business Hub. This initial application for approval to be submitted to NSW Department of Planning and Infrastructure (DoP & I) involves lot consolidation and superlot subdivision, with associated subdivision early works including parts of the internal road network and site drainage installations.

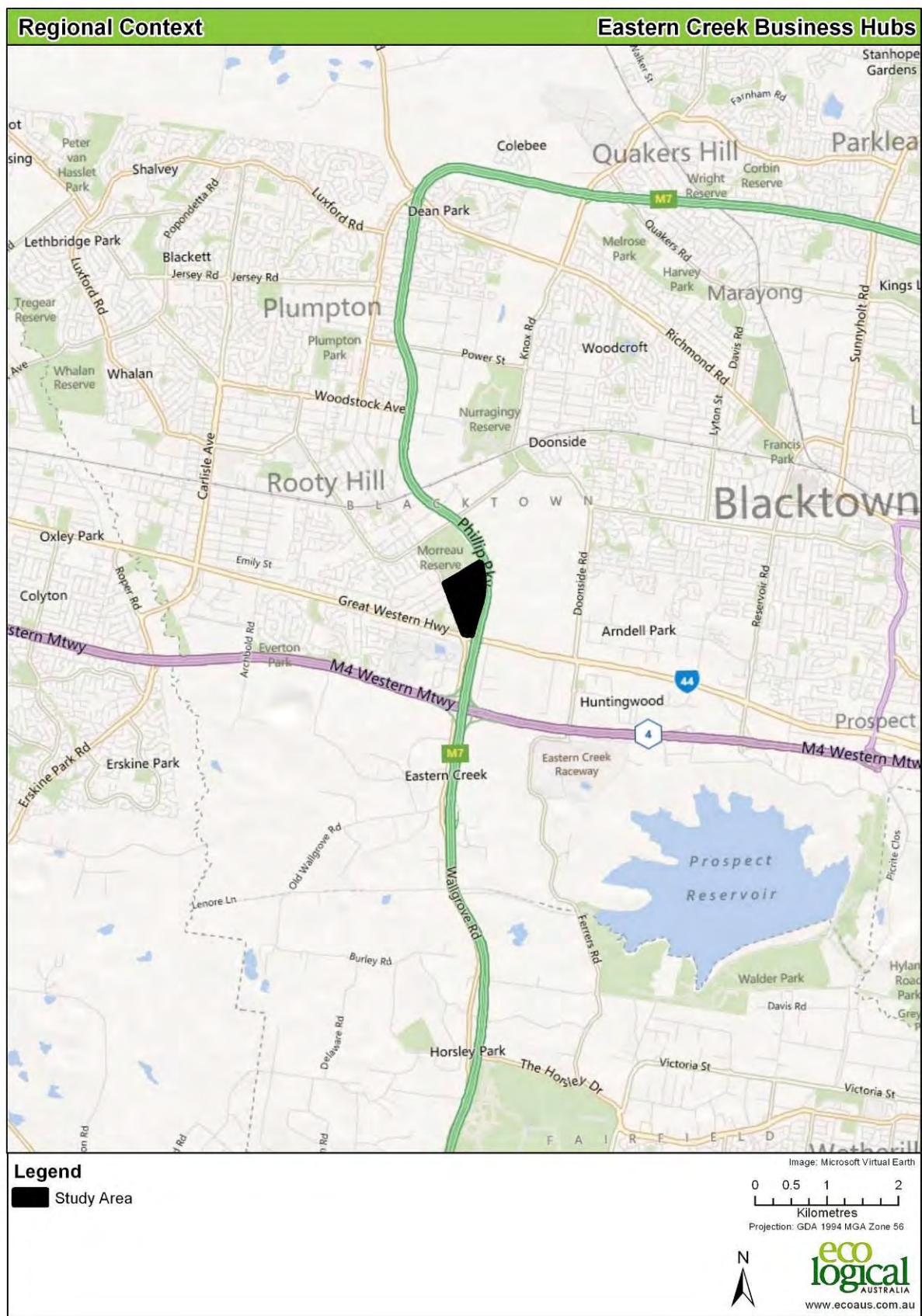


Figure 1: Location of the study area in the local context



Figure 2: Eastern Creek Business Hub study area

2 Legislation

2.1 COMMONWEALTH LEGISLATION

2.1.1 *Environment Protection and Biodiversity Conservation Act 1999*

The primary objective of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to 'provide for the protection of the environment, especially those aspects of the environment that are Matters of National Environmental Significance.'

Environmental approvals under the EPBC Act are required for an 'action' that is likely to have a significant impact on Matters of National Environmental Significance (known as 'MNES') including:

- World Heritage Areas
- National Heritage Places
- Ramsar wetlands of international importance
- Nationally listed threatened species and ecological communities
- Listed migratory species
- Commonwealth marine areas
- Nuclear actions, and
- Great Barrier Reef Marine Park.

In addition, the EPBC Act confers jurisdiction over actions that have a significant impact on the environment:

- Where the actions affect, or are taken on, Commonwealth land, and
- Are carried out by a Commonwealth agency (even if that significant impact is not on one of the eight matters of 'national environmental significance').

An 'action' is considered to include a project, development, undertaking, activity or series of activities.

MNES relevant to the study area are nationally listed threatened species and ecological communities and listed migratory species. MNES that were recorded or have the potential to be present or use the study area are listed in **Appendix A** and are assessed in **Appendix E**. Actions considered as likely to have a significant impact on MNES, as defined in the *EPBC Act Policy Statement 1.1 – Significant Impact Guidelines* (DEWHA 2009), require the preparation and submission of a referral to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).

2.2 NEW SOUTH WALES LEGISLATION

2.2.1 *Environmental Planning and Assessment Act 1979*

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for NSW. It provides a framework for land use control and assessment, determination and management of development. Part 4, Division 4.1 of the Act facilitates the assessment of State Significant Development (SSD), as identified in the State and Regional Development SEPP 2011.

Development being assessed under this part of the Act must be accompanied by an Environmental Impact Statement (EIS) and is assessed against the relevant matters for consideration listed under s79C of the EP&A Act 1979.

With regard to biodiversity issues, the following authorisations are not required for SSD:

- (b) A permit under section 201 205 or 219 of the *Fisheries Management Act 1994*
- (e) An authorisation referred to in section 12 of the *Native Vegetation Act 2003*, and
- (g) A water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000*.

Other assessment requirements for SSD are established by the Director-General Requirements (DGRs) for this proposed development. With regard to biodiversity, the DGRs for this project include:

1. A fauna and flora survey of the site shall be prepared in accordance with OEH Threatened Species Survey and Assessment Guidelines that addressed impacts of the proposed development on flora and fauna, including threatened species, populations and endangered ecological communities and their habitats and steps taken to mitigate any identified impacts to protect the environment.
2. Any impacts on threatened species, populations and endangered ecological communities that cannot be avoided or mitigates must be adequately offset in accordance with OEH Principles for the use of Biodiversity Offsets in NSW.

DGR 2 refers to relevant guidelines. This report uses two sets of guidelines to assess the ecological outcomes of the project and meet the requirements of Principles for the use of Biodiversity Offsets in NSW (**Appendix F**):

- Guidelines for Threatened Species Assessment (Draft DEC & DPI 2005), and
- Interim policy for assessing and offsetting biodiversity impacts of Part 3A developments (OEH 2011a).

An assessment of the potential impacts of the Project has been made (**Appendix D**). Key thresholds include:

- Whether or not the Project, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts, will maintain and improve biodiversity values,
- Whether or not the Project is likely to reduce the long-term viability of a local population of the species, population or ecological community,
- Whether or not the Project is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction, and
- Whether or not the Project will adversely affect critical habitat.

The NSW Office of Environment and Heritage (OEH) interim policy (OEH 2011a) requires that Part 3A and SSD projects adopt the use of the Biobanking Assessment Methodology (BBAM) for the purposes of:

- Quantifying and categorising the biodiversity values and impacts of these projects, and

- Establishing, for benchmarking purposes, the offsets that would be required if the projects had been expected to meet the “improve or maintain” standard.

The BBAM has been broadly adopted in this assessment to describe, quantify and categorise the biodiversity values and impacts of the proposed Eastern Creek Business Hub Project. The BBAM has been used to guide field survey and to identify, for benchmarking purposes, the potential offsets that would be required to meet the “like for like” and “improve or maintain” standards.

2.2.2 Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act* (TSC Act), as amended, aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. Generally, the interactions between the TSC Act and the EP&A Act requires consideration of whether a development (Part 4 of the EP&A Act), or an activity (Part 5 of the EP&A Act), is likely to significantly affect threatened species, populations, ecological communities or their habitats.

For SSD, the impacts on threatened species, populations and endangered ecological communities must be in accordance with the “Guidelines for Threatened Species Assessment (DEC & DPI 2005)”.

Appendix A details the threatened species, populations and communities relevant to this study, impacts are considered in **Appendix D**.

2.2.3 NSW Rural Fires Act (1997)

Section 89J of the NSW EP & A Act states that a bushfire safety authority under Section 100B of the *NSW Rural Fires Act 1997* (RF Act) is not required for State Significant Development.

However, the DGRs issued in March 2012 contain the following requirements with regards to Bushfire:

1. Provide an assessment in accordance with the requirements of Planning for Bushfire Protection 2006 that addresses the level of hazard posed to future development, identification and provision of asset protection zones, provision for access and water supply for fire fighting purposes and provision of appropriate landscaping.

The Bushfire Protection Assessment for the site is contained in a separate document (ELA 2012a) and the results of this assessment are drawn on this ecological assessment report where necessary.

2.2.4 Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* (NW Act) defines the roles of government, councils, private landholders and public authorities in the management of noxious weeds. The Act sets up categorisation and control actions for the various noxious weeds, according to their potential to cause harm to the local environment.

Under this Act, noxious weeds have been identified for Local Government Areas and assigned Control Categories (eg. 1, 2, 3, 4 and 5). Part 3 of the Act provides that occupiers of land (this includes owners of land) have responsibility for controlling noxious weeds on the land they occupy. Noxious weeds present on site are identified within Section 4.3.2 of the report and also in Appendix B.

2.2.5 Water Management Act 2000

The *Water Management Act 2000* (WM Act) provides principles for water management and identifies certain activities as Controlled Actions which require approval from the Office of Water. Whilst the principles of water management (and associated Guidelines for Controlled Activities) should generally

be followed, a Controlled Activity approval is not required as section 89J(g) of the EP&A Act states that Controlled Activity approvals are not required for SSD.

2.3 STATE ENVIRONMENTAL PLANNING POLICIES (SEPPs)

2.3.1 State Environmental Planning Policy (State and Regional Development) 2011

The aim of this policy, among other things, is to identify development that is SSD. Once identified as such, the provisions of Part 4.1 of the EP&A Act will apply. Schedule 2 (Clause 5) of the SRD SEPP 2011 defines State Significant Development as follows:

“Development in the Western Parklands: Development that has a capital investment value of more than \$10 million on land identified as being within the Western Parklands on the Western Sydney Parklands Map within the meaning of State Environmental Planning Policy (Western Sydney Parklands) 2009”.

All applications for SSD must be accompanied by an Environmental Impact Statement (EIS). This assessment is provided to address the Directors General’s Requirements for assessment of ecological issues within the EIS.

2.3.2 State Environmental Planning Policy (Western Sydney Parklands) 2009

This environmental planning instrument sets up the framework for the establishment and ongoing management of the ecological network of wildlife and habitat corridors that comprise the Western Sydney Parklands Estate.

The aim of this Policy is to put in place planning controls that will enable the Western Sydney Parklands Trust to develop the Western Parklands into a multi-use urban parkland for the region of western Sydney by:

- (a) allowing for a diverse range of recreational, entertainment and tourist facilities in the Western Parklands, and
- (b) allowing for a range of commercial, retail, infrastructure and other uses consistent with the Metropolitan Strategy, which will deliver beneficial social and economic outcomes to western Sydney, and
- (c) continuing to allow for and facilitate the location of government infrastructure and service facilities in the Western Parklands, and
- (d) protecting and enhancing the natural systems of the Western Parklands, including flora and fauna species and communities and riparian corridors, and
- (e) protecting and enhancing the cultural and historical heritage of the Western Parklands, and
- (f) maintaining the rural character of parts of the Western Parklands by allowing sustainable extensive agriculture, horticulture, forestry and the like, and
- (g) facilitating public access to, and use and enjoyment of, the Western Parklands, and
- (h) facilitating use of the Western Parklands to meet a range of community needs and interests, including those that promote health and well-being in the community, and
- (i) encouraging the use of the Western Parklands for education and research purposes, including accommodation and other facilities to support those purposes, and

(j) allowing for interim uses on private land in the Western Parklands if such uses do not adversely affect the establishment of the Western Parklands or the ability of the Trust to carry out its functions as set out in section 12 of the [Western Sydney Parklands Act 2006](#), and

(k) ensuring that development of the Western Parklands is undertaken in an ecologically sustainable way.

Land within the Parklands is unzoned under the Western Sydney Parklands SEPP, however Clause 11(1) identifies a range of uses within the Parklands Estate that can be carried out without development consent while Clause 11(2) allows consideration of other development types with development consent (except for residential development).

The overall proposed staged business Hub development, and this preliminary stage of superlot subdivision and associated early works is permissible with consent, subject to a merit assessment against the matters for consideration set out in Clause 12 of the SEPP. These matters for consideration include;

(a) the aim of this Policy, as set out in clause 2,

(b) the impact on drinking water catchments and associated infrastructure,

(c) the impact on utility services and easements,

(d) the impact of carrying out the development on environmental conservation areas and the natural environment, including endangered ecological communities,

(e) the impact on the continuity of the Western Parklands as a corridor linking core habitat such as the endangered Cumberland Plain Woodland,

(f) the impact on the Western Parkland's linked north-south circulation and access network and whether the development will enable access to all parts of the Western Parklands that are available for recreational use,

(g) the impact on the physical and visual continuity of the Western Parklands as a scenic break in the urban fabric of western Sydney,

(h) the impact on public access to the Western Parklands,

(i) consistency with:

i. any plan of management for the parklands, that includes the Western Parklands, prepared and adopted under Part 4 of the *Western Sydney Parklands Act 2006*, or

ii. any precinct plan for a precinct of the parklands, that includes the Western Parklands, prepared and adopted under that Part,

(j) the impact on surrounding residential amenity,

(k) the impact on significant views,

(l) the effect on drainage patterns, ground water, flood patterns and wetland viability,

(m) the impact on heritage items, and

(n) the impact on traffic and parking.

This ecological assessment specifically addresses Clauses (d) and (e) above.

2.4 LOCAL GOVERNMENT PLANS (LEPS)

2.4.1 Blacktown City Council Local Environmental Plan 1998

The Blacktown City Council Local Environmental Plan (LEP) 1998 is the principal planning instrument for the Blacktown LGA. The LEP applies to all land within the City of Blacktown, apart from land to which the Western Sydney Parklands SEPP (2009) applies, therefore the LEP is not applicable to this site.

2.5 WESTERN SYDNEY PARKLANDS FRAMEWORK

2.5.1 Western Sydney Parklands Plan of Management (2011)

The Western Sydney Parklands Plan of Management was adopted on 25 January 2011. The Plan of Management (POM) sets out the vision for the entire Western Sydney Parklands Estate and provides a road map to guide the future priorities over the next ten years. The key management priorities for Environment and Conservation within the plan include allowing for biodiversity links to the wider Parklands bushland corridor. The proposed Business Hub will need to be assessed against the POM.

The POM also acknowledges the actions developed under the Western Sydney Parklands Biodiversity Restoration Strategy. This strategy was developed in 2008 and identified the northern portion of the site as a “Priority 8” area. Priority 8 areas are categorised by core habitat, moderate or low conservation significance and in poor field condition (ELA 2008).

The Western Sydney Parklands Trust are currently reviewing the existing Biodiversity Restoration Strategy for the estate to ensure that it adequately reflects the strategic priorities for biodiversity identified in the more recent POM.

3 Methods

3.1 DATA AND LITERATURE REVIEW

3.1.1 Data reviewed

A number of key datasets, mapping, and mapping interpretation guidelines were reviewed to determine ecological values and constraints within the study area. These included:

- NPWS Bionet (Atlas of NSW Wildlife) (OEH 2012b). 5 km radius search area (accessed March 2012)
- EPBC Act Protected Matters Search Tool (DSEWPAC 2012). 10 km radius search area (accessed March 2012)
- NPWS Vegetation of the Cumberland Plain – Vegetation & Core Habitat Mapping (NSW NPWS 2002a, 2008)
- Native Vegetation Interpretation Guidelines for Western Sydney Vegetation (NSW NPWS 2002b)
- Department of Primary Industries (2012) Online search for noxious weeds in Blacktown City Council (Accessed 12 May 2012)
- Threatened Species Profiles Database, Biobanking Assessment Tool v2.0 (OEH 2012)
- Biometric Vegetation Types database (DECC 2008)
- Western Sydney Parklands Management Vision (DIPNR 2004)
- Western Sydney Parklands Biodiversity Restoration Strategy (ELA 2008)
- Western Sydney Parklands Biodiversity Strategy (ELA 2012 – in prep)

High resolution aerial photographs of the study area were also used to investigate the extent of vegetation cover and landscape features in the area.

3.1.2 Literature reviewed

A number of flora and fauna surveys conducted in the study area were reviewed for records of threatened ecological communities and flora and fauna species occurring in the study area. These flora and fauna assessments and surveys are listed below:

- ELA (2009a) & (2011) Preliminary Environmental Assessment – Ecology and Bushfire; Summary for Eastern Creek Business Hub
- ELA (2009b) Letter to WSPT – Targeted Surveys for Sub-Precinct 2.4 of Western Sydney Parklands.
- Cumberland Flora and Fauna Interpretive Services, LesryK Environmental Consultants (2000) *Proposed Western Sydney Orbital Species Impact Statement*.
- PPK Environment and Infrastructure, Sinclair Knight Merz (2000) *Proposed Western Sydney Orbital Environmental Impact Statement (Volume 2, Chapter 20: Flora and Fauna)*.

3.2 ASSESSMENT OF SPECIES, POPULATIONS AND COMMUNITIES LIKELY TO OCCUR IN THE STUDY AREA

Threatened and migratory species from key datasets and literature reviewed were combined to produce a list of threatened and migratory species that may occur within the study area, which can be found in **Appendix A**. Likelihood of occurrence tables for threatened species, populations and communities in the study area were then made based on location of database records, the likely presence or absence of suitable habitat in the study area, and knowledge of the species' ecology, to limit the list of threatened species to potentially affected species (those that were defined as "known", "likely" or having "potential" to occur in the study area – see below).

Five terms for the likelihood of occurrence of species are used in this report, as defined below:

- "known" = the species was or has been observed in the study area
- "likely" = a medium to high probability that a species uses the study area
- "potential" = suitable habitat for a species occurs in the study area, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the study area, and
- "no" = habitat in the study area and in the vicinity is unsuitable for the species.

3.3 FIELD SURVEY OVERVIEW

Field survey occurred over nine days between 4 April and the 9th May 2012, as well as several previous survey visits during 2009 for targeted species searches. The 2012 field survey focussed on validating vegetation communities, observational recording of flora and fauna species present, fauna habitat assessment and ultra-sonic microbat call detection (Anabat). Field survey was conducted by two ELA ecologists, Lucas McKinnon and Dr Rod Armistead (Scientific Licence SL 100243). Flora and fauna survey were undertaken over approximately 22 person hours (4 and 19 April; 9 May 2012) and Anabat surveys were undertaken for 13 Anabat nights over a five night period (3, 4, 20, 21, 22 April 2012).

During the survey period, traverses of the study area were undertaken, with survey effort focussing on areas where remnant vegetation and potential fauna habitat were present, to collect site-specific data pertaining to the vegetation communities and habitat values for threatened flora and fauna potentially occurring in the study area (see **Appendix A** for list of potentially occurring species, populations and communities).

All visible vascular flora within survey plots and fauna traces / evidence of fauna species across the subject site were recorded. Notes on habitat were also taken, with observations made for areas directly adjacent to the study area in order to determine the fauna and flora that could potentially occur. Flora species were identified to the lowest taxonomic level possible. Hollow-bearing trees were recorded and four Biobanking plots undertaken across the site to assist in determining offset requirements for the potential removal of vegetation. **Figure 3** shows the location of traverses across the site, biobanking plots, hollow bearing trees, asbestos dumping area and placement of Anabat recorders.

Four Anabat recorders equipped with ZCAIM devices were set for a total of five nights, within the vegetated areas of the site. All four recorders were used for five nights with Anabats turned on to time-delayed recording from 6pm and left to record overnight until 6am.

Anabat data were analysed by ELA Ecologist Peter Knock. Analysis assigned bat calls to four levels of confidence as per Mills *et al.* (1996): definite, probable, possible, and unknown. Definite calls were calls of bat species that were not in doubt, probable calls those calls of bat species with a low probability of

confusion with species of similar calls, possible calls were calls of bat species with a medium to high probability of confusion with species of similar calls, and unknown calls were calls of bat species which could not be identified to even a species group.

Temperatures were warm during the field survey with some rain experienced during the overall survey period. **Table 1** shows the weather conditions during and leading up to the survey periods.

Table 1: Weather observations at Quakers Hill Treatment Works (Station Number 067076) during the two days leading up to field survey and during field survey

DATE	MINIMUM TEMPERATURE (°C)	MAXIMUM TEMPERATURE (°C)	WIND SPEED AT 9AM (km/h)	RAIN (mm)
3 rd April	14.7	29.3	Calm	0
4 th April	15.4	27.8	4 NNW	0
19 th April	16.5	24.5	Calm	86.2
20 th April	15.4	25.2	Calm	1.1
21 st April	15.6	25.4	Calm	0
22 nd April	14.0	23.0	Calm	0
9 th May	8.0	24.9	4 NW	0

3.4 FIELD SURVEY METHODOLOGY

3.4.1 Vegetation Communities

The vegetation classification system employed in this report follows the BioMetric Vegetation Type Database (DECC 2008). Listed threatened ecological communities (TECs) may consist of a single BioMetric vegetation type or be made up of various BioMetric vegetation types.

3.4.2 Flora

Field survey targeted all locations of extant vegetation as well as cleared paddocks to determine condition and relative abundance of native flora species. Quadrats were surveyed following the DECCW Interim Vegetation Standard. Quadrat surveys were 0.04ha (20m x 20m) and recorded presence of all vascular flora species, along with cover and abundance for each species using a modified Braun-Blanquet scale (i.e. measures of cover and abundance to determine species dominating each stratum). Habitat features were determined over 0.1 ha survey (50m x 20m quadrat); measures including number of hollow bearing trees and length of fallen dead timber greater than 10 cm diameter. Within the 0.1 ha quadrats, projected foliage cover of each strata level and exotic flora was assessed along a 50m transect.

Transect habitat assessments were also undertaken following the NSW Biobanking Methodology (DECC 2008) in order to provide sufficient information to undertake the „improve or maintain’ test.

Quadrats and transects were conducted in the following previously mapped vegetation units (NPWS 2002):

- Shale Plains Woodland (MU10)
- Alluvial Woodland (MU11)

Random meander traverses focussed on „pastureland’ communities to identify any derived native grasslands that may conform with the NSW TSC Act threatened ecological community listings.

Random meanders for threatened flora species were undertaken in areas of suitable habitat, in accordance with DECCW guidelines (DEC 2004). The location of random meanders were determined in the field based on suitable habitat.

Potential species were identified through the literature and database review, including the Biobanking Tool, Atlas of NSW Wildlife, DSEWPaC Protected Matters Search Tool, previous survey as well as expert local knowledge. The locations of all flora survey undertaken are presented in **Figure 3**.

3.5 FAUNA

The locations of fauna survey undertaken within the study area are shown in **Figure 3**. Targeted surveys for microbats were undertaken as well as call playback for Green and Golden Bell frog by ELA (2009). Requirements were met for all threatened fauna expected to occur in the study area, with the exception of GGBF, and compliance with the TBSA Guidelines (DEC 2004) are summarised in **Table 2**. GGBF surveys methods were modified on the basis that there had been a considerably long period of time since the species was last recorded in the general area of the site, as discussed below.

3.5.1 Avifauna

Diurnal Birds

Survey for diurnal birds was opportunistic with observers moving through vegetation communities and grasslands supporting potential habitat for diurnal birds over the entire survey period. Previous observations had been made by ELA (2009).

Nocturnal Birds

Nocturnal bird survey focused on identifying potential roosting / nesting trees during the survey period, through the incidence of large hollow bearing trees, owl wash and faecal pellets. No stag watching was conducted as no large tree hollows or owl wash were observed during the survey period.

3.5.2 Mammals

Ground dwelling and arboreal mammals

Faunal habitat assessments were initially undertaken remotely using aerial photography, with waterbodies, woodland remnants, grasslands, rocky outcrops and man-made structures delineated in order to target survey accordingly. Additional habitat assessments and opportunistic surveys were undertaken continuously during daytime hours throughout the survey period whilst traversing suitable habitat within the study area. Any indirect evidence of fauna present was recorded including, fur, tracks, dens, scratches, and chew marks.

Microchiropteran bat species

Survey for microchiropteran (microbats) bat species included the use of ultrasonic Anabat detectors equipped with ZCAIM recording devices in 8 locations across the study area for two nights at each site in accordance with TBSA guidelines (DEC 2004) and DSEWPaC (2010) (**Figure 3**).

Survey locations focused on larger remnants of native vegetation, major watercourses and large hollow bearing trees. On each night of survey the Anabats were turned on at 1800 hours and then turned off the following morning between 0600 hours. Anabat calls were downloaded in the office and analysed by Peter Knock (Ecologist, Eco Logical Australia, Coffs Harbour).

Bat calls were analysed using the program AnalookW (Version 3.3q 03 October 2006, written by Chris Corben, www.hoarybat.com). Call identifications were made using regional based guides to the echolocation calls of microbats in New South Wales (Pennay *et al.* 2004); and south-east Queensland and north-east New South Wales (Reinhold *et al.* 2001) and the accompanying reference library of over 200 calls from north-eastern NSW (<http://www.forest.nsw.gov.au/research/bats/default.asp>).

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Reinhold *et al.* 2001). To ensure reliable and accurate results the following protocols (adapted from Lloyd *et al.* 2006) were followed:

- Recordings containing less than three pulses were not analysed (Law *et al.* 1999)
- Only search phase calls were analysed (McKenzie *et al.* 2002)
- Four categories of confidence in species identification were used (Mills *et al.* 1996):
 - Definite – identity not in doubt
 - Probable – low probability of confusion with species of similar calls
 - Possible – medium to high probability of confusion with species with similar calls
 - Unidentifiable – calls made by bats which cannot be identified to even a species group

Nyctophilus spp. are difficult to identify confidently from their calls and no attempt was made to identify this genus to species level (Pennay *et al.* 2004).

3.5.3 Amphibians

No threatened amphibians were known, likely or considered to potentially occur in the study area (**Appendix A**), though given the presence of potential habitat for Green and Golden Bell Frog at the site a precautionary survey was undertaken over one afternoon and one evening. Survey is documented in ELA (2009b) and summarised below.

The methods employed for the survey were an adaptation of the GGBF EIA guidelines (NPWS 2003) and based on the extent of potential habitat known on the site. The methods were modified on the basis that there had been a considerably long period of time since the species was last recorded in the general area of the site (last record 1973).

On 4th December 2009 a diurnal and nocturnal survey was undertaken to assess habitats available for the GGBF within the site. The diurnal survey provided an opportunity to search for tadpoles, basking adults and examine suitable ground cover and other potential shelter sites.

The nocturnal survey focused on the areas that appeared to have the best habitat attributes for the species that were identified as part of the diurnal survey. A reference site at Sydney Olympic Park, where the species is known to be regularly detected, was also checked for active individuals to ascertain the suitability of seasonal and climatic conditions for detection at the site. Nocturnal survey effort consisted of call play back, spot light and headlamp searches of the best habitat areas for 2 hours, also on 4th December 2009.

Additional opportunistic survey and call recognition was undertaken over 22 person hours during the 2012 survey period.

3.5.4 Reptiles

Opportunistic observations and habitat assessment for reptiles were undertaken throughout the survey period. The Atlas of NSW Wildlife provided no threatened reptile records within the study area and

none were identified during the likelihood assessment as potentially occurring in the study area, as such no targeted searches were undertaken.

3.5.5 Invertebrates

Targeted survey for Cumberland Land Snail was undertaken 25th November 2009, with potential habitat for the species on site occurring within the woodland areas (particularly in association with *E. tereticornis* and *E. moluccana* trees that have deep leaf/bark litter layers around their base), grass clumps in or near woodland areas, and dumped rubbish or sheet metal in or near woodland areas.

Table 2: Summary of field survey effort and compliance with NSW Threatened Biodiversity Survey and Assessment guidelines (DEC 2004)

GROUP	TARGET SPECIES OR TYPE	THREATENED BIODIVERSITY SURVEY AND ASSESSMENT GUIDELINES DEC (2004) (APPROPRIATE SURVEY OPTIONS)	SURVEY EFFORT (ELA 2009, 2012)	SAMPLING SATISFIES DEC (2004) GUIDELINES
Avifauna - Diurnal	All species	Opportunistic sightings - time unspecified	Opportunistic sightings over 6 days (22 person hours ELA 2012; ELA 2009 unspecified survey effort)	Yes
Avifauna - Nocturnal	All nocturnal birds	Day habitat search - search habitat for pellets and likely hollows.	Opportunistic sightings	N/A
Mammals (excluding microbats)	All mammals	Search for scats and signs - 30 minutes searching each relevant habitat, including trees for scratch marks per stratification unit up to 50 hectares, plus an additional effort for every additional 100 hectares.	Opportunistic over ~20 ha study area over 6 days (~8ha vegetated)	Yes
Mammals (microbats)	All species	Anabats - Two Anabats utilised for the entire night (a minimum of four hours), starting at dusk for two nights per 100 hectares of stratification unit in October to March.	8 sites, 2 nights/site (total 13* nights), 12hrs/night (ELA 2012)	Yes
Reptiles	All species	Habitat Search - 30-minute search on two separate days targeting specific habitat per stratification unit up to 200 hectares	Diurnal searches, including rock-rolling, tree bark removal, displacement of fallen timber and opportunistic sightings over 6 days	Yes
Amphibians	Green and Golden Bell Frog	Combination of call surveys and day/night active searching.	- Opportunistic sightings, call recognition - Call play back, spot light and headlamp searches over 2 hours	No**
Invertebrates	Cumberland Land Snail	Not specified	Targeted searches of potential habitat over one day (ELA 2009, person hours not specified)	N/A

* some nights recorded either no activity or Anabat devices failed to activate; ** discussion of survey effort provided in ELA 2009b and summarised in **Section 3.5.3**

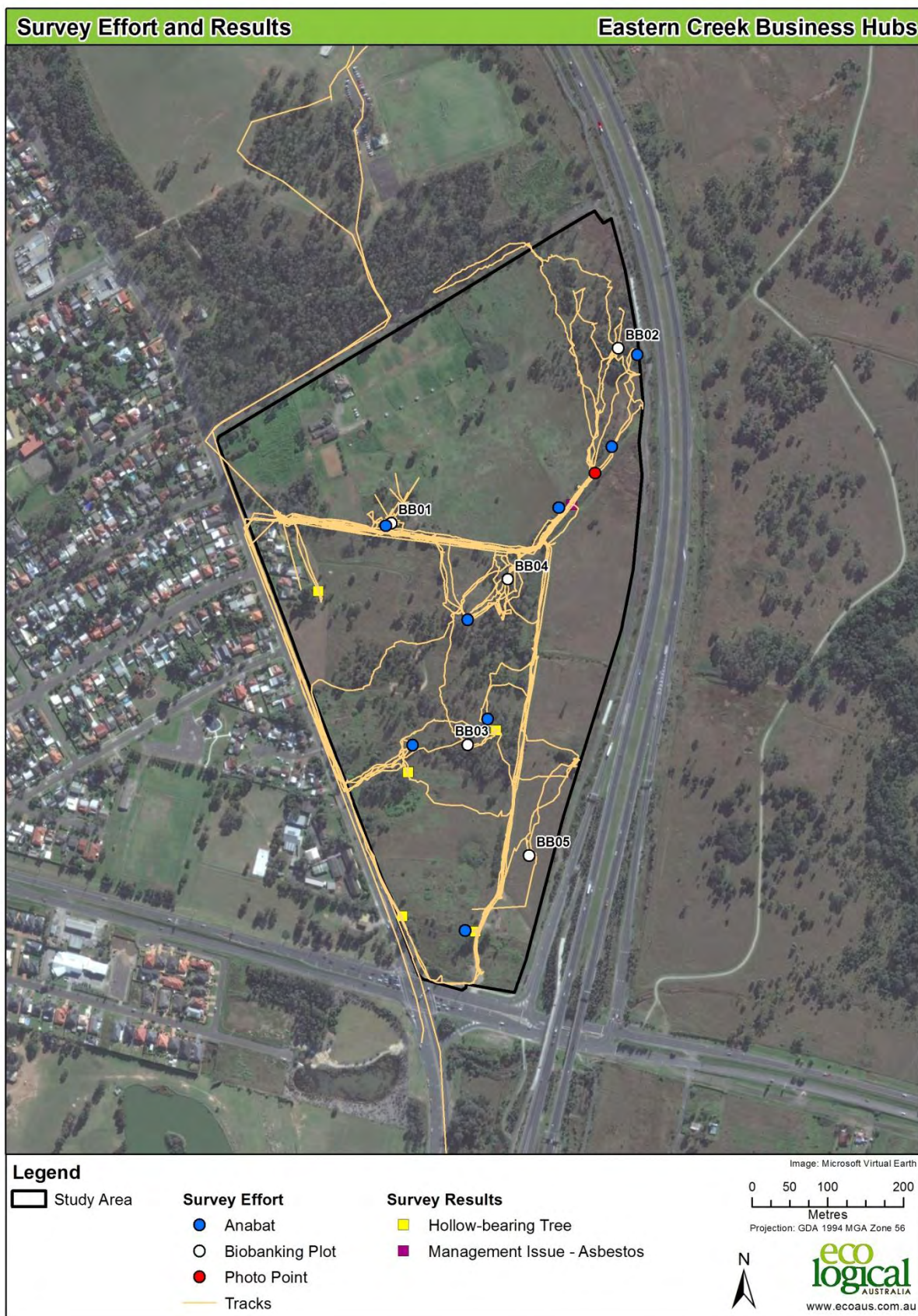


Figure 3: Survey effort, including tracks, plot and Anabat survey locations

4 Results

4.1 DATABASE AND LITERATURE REVIEW

4.1.1 Data review

Searches of the NSW Bionet and Commonwealth Protected Matters databases were undertaken. A total of 38 threatened fauna and 14 threatened flora species (or their required habitat) have previously been recorded within a 10km radius of the study area. Of the fauna species identified, 11 were mammals (including 7 microchiropteran bats), 11 diurnal birds, 1 nocturnal bird, and 10 migratory birds, 4 amphibian species, 2 fish species, and 1 reptile and 1 invertebrate species. In addition, 1 critically endangered ecological community and one endangered ecological community were recorded as occurring within the area.

A detailed table of the results can be found in **Appendix A**.

4.1.2 Literature review

Review of previous ecological reports prepared on the site found that no threatened flora species have previously been recorded on site. Targeted searches have been undertaken for threatened flora species *Grevillea juniperina* subsp. *juniperina* (Juniper-leaf Grevillea) and *Pimelea spicata* (Spiked Rice Flower), which are both listed as vulnerable species under the TSC Act, with *Pimelea spicata* also being listed as vulnerable under the EPBC Act.

Fauna searches undertaken during 2009 recorded one definite and one potential sighting of *Gallinago hardwickii* (Latham's Snipe), listed as a migratory bird under the EPBC Act. No individuals of *Meridolum corneovirens* (Cumberland Land Snail) or *Litoria aurea* (Green and Golden Bell Frog) were recorded despite targeted searches.

4.2 VEGETATION COMMUNITIES

Field surveys identified two vegetation communities and one disturbed landscape in the study area:

- Cumberland Plain Woodland (sub-community Shale Plains Woodland),
- Alluvial Woodland, and
- Weeds and Exotics.

Figure 4 and **Figure 5** shows the locations of the vegetation communities in the study area as mapped by NPWS in 2002 and 2008, while **Figure 6** shows the extent of vegetation communities validated on site by ELA through fieldwork. Descriptions of the vegetation communities are provided in the following sections.

Nomenclature follows NPWS (2002) for the majority of this report, though Biometric Vegetation Types (BVTs) are used in **Section 6**, Biodiversity Offset Strategy, as required to employ Biobanking Assessment Methodology (DECC 2009). The correlation between NPWS (2002), BVT's (DECC 2008) and listed threatened ecological communities under the TSC Act and EPBC Act are presented in **Table 3**.

Table 3: Vegetation community nomenclature

VEGETATION COMMUNITY (NPWS 2002)	BIOMETRIC VEGETATION TYPE (DECC 2008)	THREATENED ECOLOGICAL COMMUNITIES
Shale Plains Woodland (SPW)	Grey Box - Forest Red Gum (GB-FRG) grassy woodland on flats of the Cumberland Plain, Sydney Basin	Cumberland Plain Woodland (TSC Act) Cumberland Plain Woodland and Shale- gravel Transition Forest (EPBC Act)
Alluvial Woodland (AW)	Forest Red Gum - Rough-barked Apple (FRG-RA) grassy woodland on alluvial flats of the Sydney Basin	River-flat Eucalypt Forest on Coastal Floodplains (TSC Act)



Figure 4: Native vegetation communities onsite as mapped by NSW NPWS (2002)



Figure 5: Native vegetation communities as mapped by NSW NPWS (2008)



Figure 6: Vegetation communities on site as validated by ELA (2012)

4.2.1 Shale Plains Woodland (SPW)

The canopy is dominated by Forest Red Gum (*Eucalyptus tereticornis*), with scattered occurrences of Grey Box (*Eucalyptus moluccana*) and Narrow-leaved Ironbark (*Eucalyptus crebra*). The shrub layer over large parts of the study area has been and is currently subject to grazing (horses). Native Blackthorn (*Bursaria spinosa* subsp. *spinosa*) is the most common shrub layer species throughout the study area, with the exotic shrub Paddy's Lucerne (*Sida rhombifolia*) dominating to co-dominating throughout the SPW.

Groundcover vegetation is typically dominated by a mixture of native and exotic grasses and herbs. Native groundcover was mostly dominated by the native grasses Paddock Lovegrass (*Eragrostis leptostachya*), Weeping Rye Grass (*Microlaena stipoides*), and the exotic Panic Veldt Grass (*Ehrharta erecta*), *Setaria parviflora*, with the native herb Kidney Weed (*Dichondra repens*), and the exotic Greater Beggars Ticks (*Bidens subalternans*) and Fleabane (*Conyza* spp.).

Approximately 5.53 ha of SPW has been mapped and validated as being present on site, though limitations on mapping the extent of this community has been discussed further below (see **Section 4.2.3**).

Condition

The SPW at the subject site is found in a highly stressed state, suffering from severe psyllid induced dieback, which has likely been exacerbated by years of drought followed recent heavy rains and consequent waterlogging. In particular the north eastern remnant is currently enduring semi-permanent inundation due to restricted drainage from the site under the M7 Motorway.

Whilst not dominant in cover and abundance, the following noxious species were recorded in the SPW, Alligator Weed (*Alternanthera philoxeroides*), Bridal Creeper (*Asparagus asparagoides*) and *Xanthium* sp..

Conservation significance

Shale Plains Woodland is a sub-community of the:

- Cumberland Plain Woodland (CPW) in the Sydney Basin Bioregion, which is listed as a critically endangered ecological community under the NSW TSC Act; and
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest, which is listed as a critically endangered ecological community under the Commonwealth EPBC Act.



Figure 7: Shale Plains Woodland, looking north along transect BB01



Figure 8: Shale Plains Woodland, looking north along BB02



Figure 9: Shale Plains Woodland, looking north along BB03

4.2.2 Alluvial Woodland (AW)

Alluvial Woodland (AW) has been mapped in close proximity to a waterlogged area along the main drainage line of the subject site (**Figure 6**). The most common canopy species found within Alluvial Woodland is Cabbage Gum (*Eucalyptus amplifolia*) and *E. tereticornis*, with Rough-barked Apple (*Angophora floribunda*) occurring less frequently. The shrub layer was mostly absent with the only native present being Dogwood (*Jacksonia scoparia*), which is not a typical observation in this vegetation type (Tozer et al 2003), with the exotic shrub Paddy's Lucerne (*Sida rhombifolia*) assuming dominance in the shrub layer at the subject site.

Groundcover vegetation was heavily dominated by *M. stipoides*, with Native Wandering Jew (*Commelina cyanea*) common throughout the plot though in low abundance. Exotic groundcovers include Bridal Creeper, Asparagus (*Asparagus officinalis*), and the grasses Narrow-leaved Carpet Grass (*Axonopus fissifolius*), Fleabane (*Conyza* spp.), African Lovegrass (*Eragrostis curvula*) and *Setaria parviflora*.

Approximately 1.49 ha of alluvial woodland has been mapped and validated as being present on site, though limitation on mapping the extent of this community have been discussed further below (see **Section 4.2.3**).

Condition

Similarly to the SPW, Alluvial Woodland is suffering from severe psyllid induced dieback, possibly as a result of being in a weakened state from enduring years of drought followed by recent waterlogging due to heavy rains experienced on the east coast over the past 12 months.

A number of noxious weeds were recorded within the AW, including Bridal Creeper, African Boxthorn (*Lycium ferocissimum*) and Blackberry.

Conservation significance

Alluvial Woodland is one form of the endangered ecological community “River Flat Eucalypt Forest on the Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner Bioregion” listed on Schedule 1 of the NSW TSC Act. This community is not listed under Commonwealth EPBC Act.



Figure 10: Alluvial woodland mapped in the subject area, looking south along BB04

4.2.3 Weeds and Exotics

The vegetation type mapped as, ‘weeds and exotics’, occurs across the majority of the subject site. While some native species occur within these patches, generally they occur as isolated canopy trees and some individual Forest Red Gum juveniles were observed in grasslands to the east of the Jemena gasline easement.

The vast majority of the mapped weeds and exotic vegetation includes pasture grasses *Paspalum* (*Paspalum dilatatum*), Quaking Grass (*Briza minor*), Panic Veldtgrass (*Ehrharta erecta*) and *Setaria parviflora* (**Figure 11**), including a number of unidentified horticultural plantings and noxious weeds (see **Section 4.2.5**).

The weeds and exotics vegetation has little structural diversity or integrity, with limited overstorey and shrub layers present and the grassed areas representing a relatively homogenous height and type of habitat element. An exception to this is a long hedge of the noxious weed, Blackberry (*Rubus fruticosus*) towards the centre of the site (**Figure 12**), which provides shelter for small passerines such as Superb Fairy Wrens (*Malurus cyaneus*), seen roosting and foraging in this vegetation throughout the survey. Approximately 27.85 ha of the study area is covered in weeds and exotic vegetation.



Figure 11: Exotic grassland (weeds and exotics) in the study area, looking north along BB05



Figure 12: A long hedge running along the left of the picture of the noxious weed species, Blackberry (*Rubus fruticosus*)

4.2.4 Limitations of the vegetation mapping

Vegetation boundaries are dynamic and vary in time via fluctuations in biotic and abiotic factors, as well as changes in anthropogenic land management practices (e.g. mechanical disturbance and underscrubbing, grazing, selective logging, pasture improvement). As such, boundaries in vegetation types and vegetation zones are only indicative of what is actually found in situ at that point in time, with each community gradually changing across an „ecotone‘.

The state of the Eucalypts onsite is such that it is difficult to differentiate between Cabbage Gum, Forest Red Gum and Grey Box, all superficially similar species usually distinguishable through leaf, fruit and budding materials, as well as some bark characteristics. Cabbage Gum generally has a larger (and Cabbage like) leaf, though due to the poor health of the individuals onsite, canopy foliage could be mistaken as epicormic leaf growth from Forest Red Gum or Grey Box, species which both exhibit large ovate to orbicular juvenile leaves.

In response to the aforementioned poor health they do not appear to have flowered in recent years and fruiting material was not readily available on the ground across the subject site. The mapping of AW in the centre of the site was in response to the presence of characteristic canopy species, Cabbage Gum and Rough-barked Apple, correlation with regional vegetation mapping (NPWS 2002, 2008, SMCMA 2010) and landscape attributes (i.e. depression in the landscape and proximity to the drainage line). The remnant to the north of the site was similarly difficult to separate between AW or SPW, as it was found in a heavily inundated state and suffered from severe psyllid induced dieback. It was classified as SPW for the purposes of the assessment due to the absence of characteristic AW species (e.g. Rough-barked Apple), correlation with regional vegetation mapping (NPWS 2002, 2008, SMCMA 2010), review of historic aerial imagery (**Figure 13**) and comparison with vegetation to the north of Church St in the Rooty Hill and Morreau reserve area (**Figure 5**).



Figure 13: Historic photo of the subject site from 1943 (Source Land and Property Management Authority; courtesy of AHMS P/L, 2012)*

* numbers are of no significance to this report

4.2.5 Threatened ecological communities

Cumberland Plain Woodland

Shale Plains Woodland is a sub-community of the:

- Cumberland Plain Woodland (CPW) in the Sydney Basin Bioregion, which is listed as a critically endangered ecological community under the NSW TSC Act; and
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest, which is listed as a critically endangered ecological community under the Commonwealth EPBC Act.

CPW is the most widely distributed community on the Cumberland Plain, predominantly occurring on soils derived from Wianamatta Shale. CPW present within the study area consists of a mixture of poor to moderate condition vegetation due to the varying levels of disturbance to the site over recent times (i.e. clearing, grazing, drought, inundation, psyllid attack).

In 2009 Commonwealth and State governments „up-listed’ Cumberland Plain Woodland (CPW) to a **Critically** Endangered Ecological Community (CEEC) under the EPBC Act and TSC Act respectively. The criterion that must be met for vegetation to be captured by the new CEEC listing has changed under both the EPBC Act and TSC Act.

Under the EPBC Act, changes to both the vegetation characteristics and the assigning of condition classes have been introduced. Smaller scale changes, such as the inclusion of derived native grassland in areas of CPW, have been made under the TSC Act. Consequently, vegetation mapping to represent areas that meet the TSC Act criteria and areas that meet the EPBC Act criteria have been mapped separately (refer to **Figure 14** and **Figure 15** respectively).

Condition classes have also been assigned based on the relevant criteria, represented in **Table 4** and **Table 5**.

Table 4: Disturbance / polygon classification codes used in NPWS 2002 and 2008

Code	Description		
	Area (ha)	CCPD(%)	Other descriptions of indigenous species
A	> 0.5	> 10	Dominant canopy species, understorey characteristics, disturbance and reliability all coded.
B	> 5	< 10	Tree cover species only with some overstorey and/or understorey integrity. Dominant canopy species and reliability coded. May have understorey code.
C			As for “A” or “B” except the dominant canopy species are non-eucalypts species.
Tx	> 0.5	< 10	Tree cover only with agriculture but no major urban or suburban development. Most have dominant canopy species coded.

Table 5: Condition thresholds for patches of native vegetation that meet the description for the Cumberland Plain Shale Woodlands and Shale - Gravel Transition Forest critically endangered ecological community, under the EPBC Act

CATEGORY AND RATIONALE	THRESHOLDS
A. Core Thresholds that apply under most circumstances: patches with an understorey dominated by natives and a minimum size that is functional and consistent with the minimum mapping unit size applied in NSW.	Minimum patch ¹ size is ≥ 0.5 ha AND $\geq 50\%$ of the perennial understorey vegetation cover is made up of native species
OR	
B. Large patches which are inherently valuable due to their rarity	The patch size is ≥ 5 ha AND $\geq 30\%$ of the perennial understorey vegetation is made up of native species
OR	
C. Patches with connectivity to other large native vegetation remnants in the landscape	The patch size is ≥ 0.5 ha; AND $\geq 30\%$ of the perennial native vegetation cover is made up of native species; AND the patch is continuous with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) that is ≥ 5 ha in area.
OR	
D. Patches that have large mature trees or trees with hollows (Habitat) that are very scarce on the Cumberland Plain.	The patch size is ≥ 0.5 ha; AND $\geq 30\%$ of the perennial understorey vegetation cover is made up of native species; AND the patch has at least one tree with hollows per hectare or at least one large tree (≥ 80 cm dbh) per hectare from the upper tree layer species outlined in the Listing Description.

¹ A patch is defined as a discrete and continuous area that comprises the ecological community, outlined in the Description. Patches should be assessed at a scale of 0.04 ha or equivalent (i.e. a 20 m x 20 m plot). The number of plots (or quadrats or survey transects) per patch must take into consideration the size, shape and condition across the site. Permanent man-made structures such as roads and buildings, are typically excluded from a patch, however a patch may include small scale disturbances such as tracks or breaks or other small-scale variations in native vegetation that do not significantly alter the overall functionality of the ecological community, for instance the easy movement of wildlife or dispersal of spores, seeds and other plant propagules.

River-flat Eucalypt Forest on Coastal Floodplains

Alluvial Woodland is one form of the endangered ecological community, River Flat Eucalypt Forest on the Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner Bioregion, listed on Schedule 1 of the NSW TSC Act. This community is not listed under Commonwealth EPBC Act.

Condition classifications for this community are as per NPWS (2002 and 2008), as provided in **Table 4**.



Figure 14: Cumberland Plain Woodland at the subject site as described under the TSC Act



Figure 15: Cumberland Plain Woodland, as described under the EPBC Act

4.2.6 Summary of vegetation community extents

Area calculations of each vegetation community within the study area are provided in **Table 6**. The extent of the different vegetation condition classes (Tables 3 and 4) for CPW vegetation communities are mapped in **Figure 14** and **Figure 15**.

Table 6: A summary of area occupied by vegetation communities and their condition class.

Vegetation community	Condition		
	A, B, C (>50% native understorey)	A, B, C (<50% native understorey)	Total (ha)
Shale Plains Woodland	3.73 ¹	1.80 ²	5.53
Alluvial Woodland	1.49	-	1.49
Weeds and Exotics	27.85		27.85

¹ EPBC and TSC Act listed Cumberland Plain Woodland

² TSC Act listed Cumberland Plain Woodland only

4.3 FLORA

A total of 82 flora species were identified within the subject site, 43 were native and 39 species were exotic or introduced. Twenty-nine (29) species characteristic of Cumberland Plain Woodland CEEC were recorded. A full list of all of these species can be found in **Appendix B**.

No threatened flora species were observed during the field survey, and although there are a number of records in the broader locality, the subject site is unlikely to provide habitat for any of these threatened flora species due to the disturbed condition of the patches of remnant vegetation and changed hydrologic conditions on site.

Previous targeted searches during peak detection times have failed to find any individuals of *Pimelea spicata* (Spiked Rice Flower) and *Grevillea juniperina* subsp. *juniperina* (Juniper-leaf Grevillea).

4.3.1 Potential Threatened Flora

Pimelea spicata (Spiked Rice Flower)

Pimelea spicata is listed as endangered under both the Commonwealth EPBC Act and NSW TSC Act. It is an erect shrub to 50cm tall, with opposite and elliptical leaves. Tubular white, pink-tinged flowers may appear at anytime of the year given favourable conditions, but are mostly seen in spring and summer. The species is typically found on well structured soils within CPW vegetation (both Shale Plains and Shale Hills Woodland), in association with Grey Box, Forest Red Gum and Narrow-leaved Ironbark (DEC 2005).

Once widespread on the Cumberland Plain, the Spiked Rice Flower now occurs in two disjunct areas: the Cumberland Plain (Narellan, Marayong, Prospect Reservoir areas) and the Illawarra (DEC 2005).

Potential habitat for this species on site is limited and occurs on the fringe of the woodland patches. The dense grassland areas on site, which are dominated by aggressive introduced species, are not considered suitable habitat for this species. No individuals were found on site during 2009 or 2012 fieldwork.

Grevillea juniperina subsp. *juniperina* (Juniper-leaf Grevillea)

Grevillea juniperina subsp. *juniperina* is listed as vulnerable under the NSW TSC Act. It is a broadly erect shrub to 2.5m high, with prickly, narrow, often bright green leaves which are clustered along short lateral branches. The species is endemic to Western Sydney. It has been recorded previously within Cumberland Plain Woodland, amongst characteristic species such as *Eucalyptus moluccana*, *E. tereticornis*, *Bursaria spinosa*, *Themeda australis* etc (DECCW 2009), all species which occur within the study area.

Potential habitat for the species on site occurs within the woodland areas and grassland areas on the fringe of remnant woodland patches. No individuals were found on site during 2009 or 2012 fieldwork.

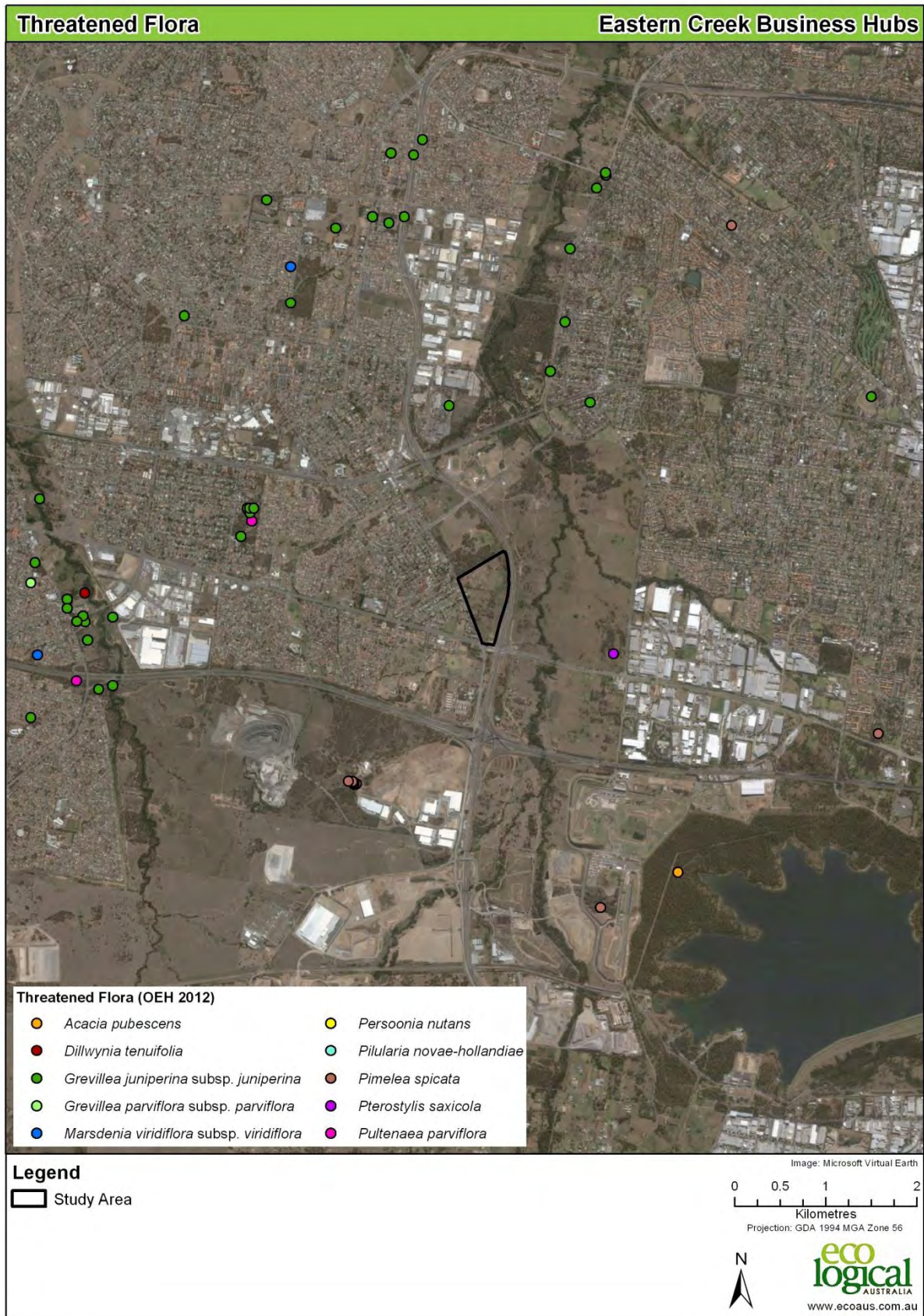


Figure 16 : Threatened Flora recorded within the locality (i.e. 5km from the subject site)

4.3.2 Noxious Weeds

Of the 39 exotic species recorded on site, 9 are listed as noxious in the Blacktown City Council Local Government Area under the *Noxious Weeds Act 1993* (NSW DPI 2012). Five of these noxious weeds along with Fireweed (*Senecio madagascariensis*) are considered Weeds of National Significance (WONS) (AWC 2012). Details of noxious weeds present on site have been listed below in **Table 7** together with each weed's control class and whether the weed is listed on the Weeds of National Significance List.

Table 7: Noxious weeds present in the subject site

SCIENTIFIC NAME	COMMON NAME	NOXIOUS WEED CONTROL CLASS ¹	WONS ²
<i>Alternanthera philoxeroides</i>	Alligator Weed	3	Yes
<i>Asparagus asparagoides</i>	Asparagus fern	4	Yes
<i>Cortaderia selloana</i>	Pampas Grass	3	-
<i>Hypericum perforatum</i>	St John Wort	4	-
<i>Lantana camara</i>	Lantana	4	Yes
<i>Ligustrum sinense</i>	Narrow-leaf Privet	4	-
<i>Lycium ferocissimum</i>	African Boxthorn	4	Yes
<i>Opuntia stricta</i>	Common Prickly Pear	4	Yes
<i>Senecio madagascariensis</i>	Fireweed	-	Yes
<i>Xanthium sp.</i>	Noogoora Burr	4	-

¹Control Class 3: The plant must be fully and continuously suppressed and destroyed.; Control Class 4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed.

²Weeds of National Significance

4.4 FAUNA HABITAT

A range of fauna habitat features are present in the study area which provide potential foraging, roosting, breeding and nesting resources for fauna species. **Table 8** outlines the habitat features present for fauna groups and indicates where these were located in relation to the areas comprising the study area. The locations of hollow-bearing trees are shown in **Figure 17**.

Table 8: Habitat features present in the study area for fauna groups

HABITAT FEATURE	VEGETATION TYPE	FAUNA GROUP USING HABITAT FEATURE	ABUNDANCE OF FEATURE
Hollow-bearing Tree / Stag	SPW, Isolated individual trees	Birds, mammals, micro-chiropteran bats	Only 5 HBTs on site, 3 within development footprint, recommended for retention and protection
Fallen timber	SPW, AW	Small mammals, reptiles, and insects	Low level of fallen timber and most timber of small dimensions
Leaf litter	SPW, AW Weeds and exotics	Amphibians, reptiles, ground-dwelling mammals	Small amount of leaf litter which is heavily covered by dense exotic grass growth
Decorticating bark	SPW	Micro-chiropteran bats, reptiles	Some suitable species on site, but small size of most standing trees reduces potential habitat
Psyllid infested tree species	SPW	Common lerp feeding birds	Overabundant, though common lerp foraging birds (Bell and Noisy Miners) not recorded onsite
Drainage channel and impeded drainage areas with wetland flora	SPW, AW, Weeds and Exotics	Amphibians, birds, reptiles, micro-chiropteran bats	One formalised channel through site but vast majority of north-eastern portion affected by overland flow and frequent standing water
Dense exotic grasslands	Weeds and Exotics	Small birds and birds common to urban environments.	Majority of study site
Aquatic Habitat	AW, Weeds and Exotics	Amphibians	Drainage channel and north-eastern portion of site due to urban drainage patterns
Blackberry hedge	AW, Weeds and Exotics	Small passerines and ground dwelling mammals	Scattered infestations across site, largest patch adjacent to AW at centre of site

Note: SPW = Shale Plains Woodland, AW = Alluvial Woodland,

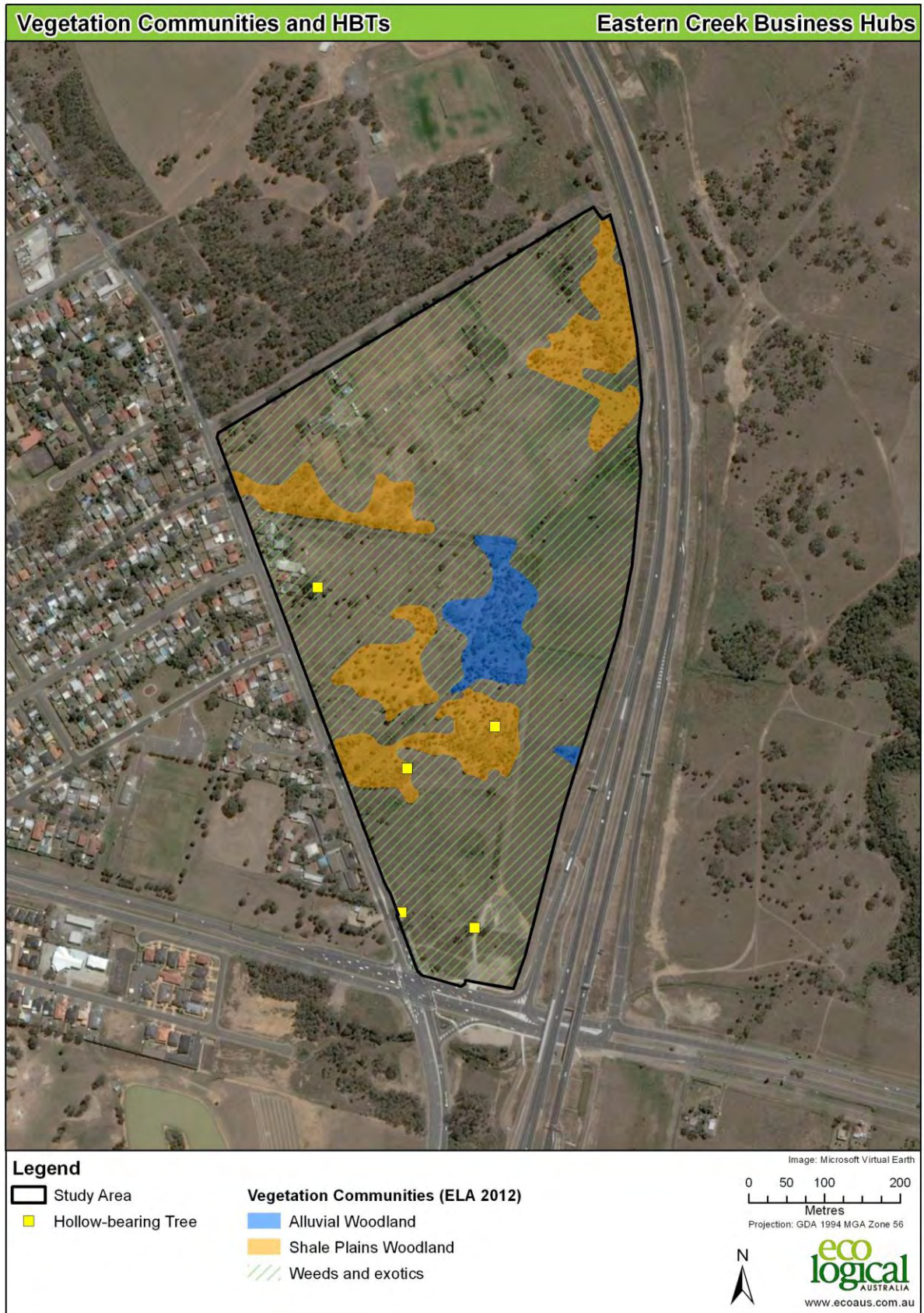


Figure 17: Location of habitat features within the subject site

4.5 FAUNA

A total of 36 birds, three (3) non-flying mammals, eight (8) microbats, five (5) amphibians, one (1) reptile and one (1) fish species were recorded during the survey (**Appendix B**). Of the birds, thirty-two were native species, including a potential sighting of one threatened species (Diamond Firetail) under the TSC Act and two confirmed sightings of the a migratory species (Latham's Snipe and Cattle Egret) listed under the EPBC Act (further discussed below).

Four (4) bird species, three (3) mammals and the one (1) fish species recorded onsite are introduced species.

4.5.1 Threatened and migratory species

Threatened fauna species known from the locality are presented in **Figure 18**. **Table 9** shows those species considered to be 'known', 'likely' or 'potentially' to occur onsite from an assessment of Likelihood of Occurrence prior to survey, as well one species (Diamond Firetail) not previously 'known' from the locality (**Appendix A**). Following survey, the Likelihood of Occurrence was revised with discussion of these changes provided below where considered appropriate. Assessments of Significance have been completed for those species highlighted in bold text in accordance with the relevant State and Commonwealth guidelines in **Appendix D** and **E**.

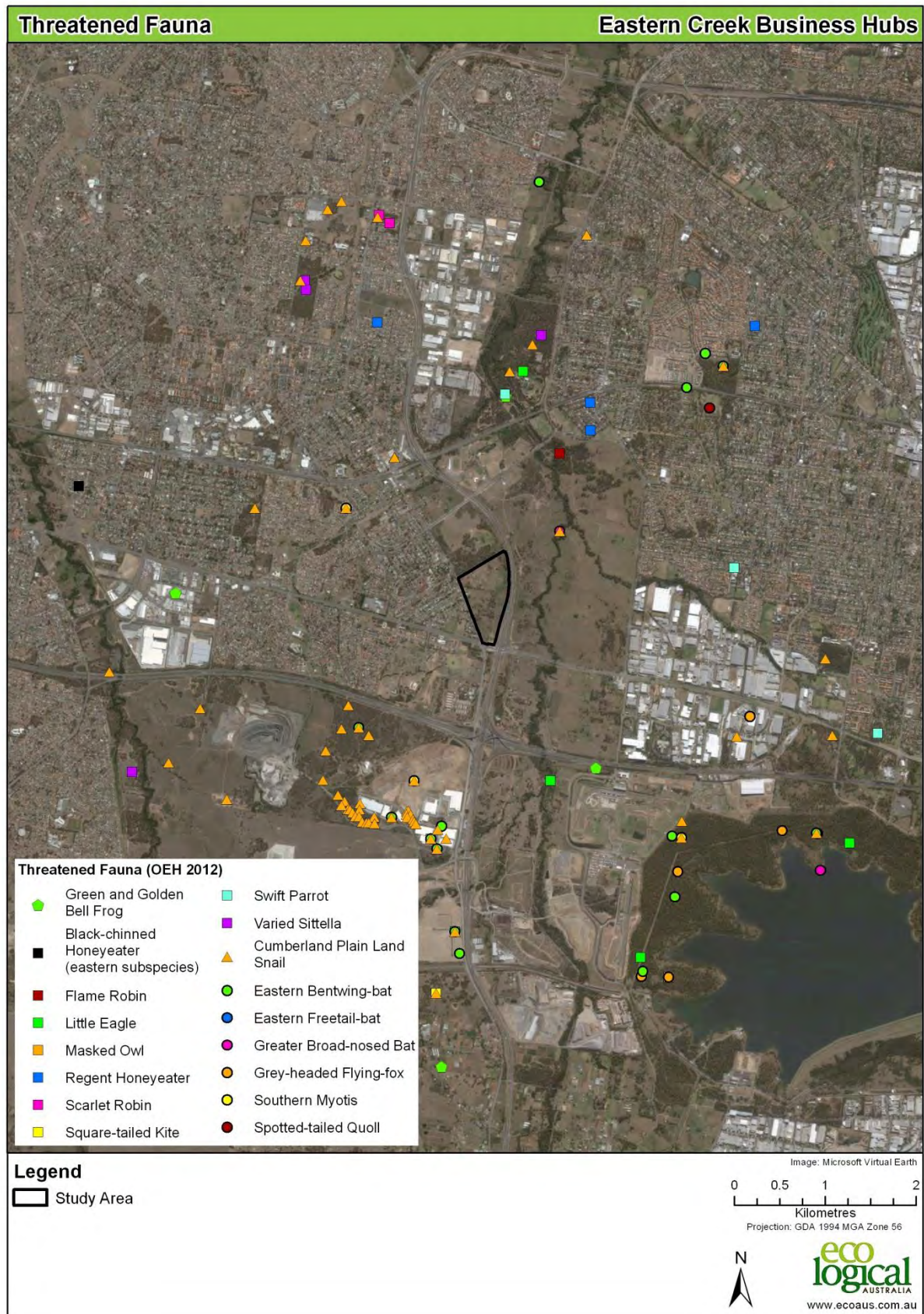


Figure 18 : Previously recorded threatened fauna species within 5km of the study area

Table 9: Revised 'likelihood' assessments of threatened and migratory fauna post survey

Scientific Name	Common Name	TSC Act	EPBC Act	Likelihood of Occurrence	
				Before surveys	Post surveys
Amphibians					
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	Unlikely	Unlikely
Aves					
<i>Ardea alba</i>	Great Egret	-	M	Potential	Unlikely
<i>Ardea ibis</i>	Cattle Egret	-	M	Potential	Known
<i>Gallinago hardwickii</i>	Latham's Snipe	-	M	Known	Known
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	Potential	Unlikely
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	No	Unlikely
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	Unlikely	No
Invertebrata					
<i>Meridolum corneovirens</i>	Cumberland (Large) Land Snail	E	-	Unlikely	No
Mammalia (Chiroptera)					
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Potential	Known
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	V	-	Potential	Known
<i>Mormopterus norfolkensis</i>	East Coast Freetail Bat	V	-	Potential	Known

E = Endangered; V = Vulnerable; M = Migratory.

* not recorded in database searches for locality

Amphibians

A targeted diurnal and nocturnal survey for Green and Golden Bell Frogs (GGBF) was undertaken by ELA in December 2009. The survey assessed habitats available on site for the GGBF. The diurnal survey provided an opportunity to search for tadpoles, basking adults and examine potential suitable groundcover vegetation and other potential shelter resources. The nocturnal survey concentrated on

those areas that appeared to have the best habitat features and attributes required by the species. All water bodies and drainage lines within the study area were inspected.

No GGBF were detected during the targeted surveys of the subject site and surrounding areas. This was despite good weather patterns and seasonality being suitable. A reference site at Sydney Olympic Park recorded activity at that site during the 3 weeks prior to, and including the survey period at Eastern Creek (K. Darkovich, pers. Comm.). Previous records of the GGBF have been detected within the vicinity of the site (within 5km), where they have been recorded both upstream and downstream within Eastern Creek, in the vicinity of Prospect Reservoir and near Mt Druitt.

Most of these records are from the 1960s and 1970s, prior to the broadscale urban development of the area. Only the records from the Mt Druitt area are more recent, recorded during the 1990s (Richard Wells pers comm.; DEC 2005). As such, no current or recent records of the GGBF are known from the locality of the site although historically the species would have inhabited the area.

No GGBF were recorded on site during this survey or previous survey work despite survey along key potential habitat areas on site such as the drainage line, ephemeral drainage depressions, bunded areas receiving regular overland flows, stormwater structures and piles of debris. The non-detection of GGBF during the survey effort does not enable a conclusion that the species is absent from the site, though for the above reasons it is considered highly 'unlikely' to be present. Recommendations have been provided to avoid 'potential' habitat areas and incorporate them into the offset area in **Section 5 and 6**.

Avifauna

Little Eagle (*Hieraaetus morphnoides*) was considered to potentially utilise the site prior to survey, due to a number of records in the locality (9 between 1992 and 2011), and the expected prevalence of favoured prey species the European Rabbit (*Oryctolagus cuniculus*) prey expected to be occupying the site. With no evidence of rabbits detected onsite and a general absence of quality roosting and nesting habitat, this likelihood was changed to 'unlikely'.

Masked Owl (*Tyto novaehollandiae*) was considered 'unlikely' to utilise the site for foraging or roosting given there was only one record of this species within the locality, approximately 4.9 km to the south east in 2008. After site inspection it was considered that this species would not to utilise the site given the general poor condition of the roosting habitat and general absence of decent foraging resources (i.e. small terrestrial and arboreal mammals).

A pair of Latham's Snipe (*Gallinago hardwickii*) were recorded onsite during 2009 (ELA 2009). Cattle Egrets (*Ardea ibis*) were recorded during survey of 2012.

A possible sighting was made of one threatened bird species, Diamond Firetail (*Stagonopleura guttata*), listed as vulnerable under the TSC Act. This sighting was not recorded as a definite during survey and consequent review of the Atlas of NSW data found no records for the locality (i.e. within 5 km), one record within 10 km (from 2006) and only two additional records within the entire Penrith 1:100,000 mapsheet (1986 and 1990). This sighting is not considered to constitute a definitive record and this species is considered 'unlikely' to occur at the site.

Invertebrates

In 2009 a targeted survey was undertaken to determine the presence of Cumberland Land Snail (CLS) across the site. Further searches were conducted as part of the current survey work. The CLS is an obligate feeder on fungi that is associated with the roots of *Eucalyptus tereticornis* (Forest Red Gum) and several Ironbark species. The snail's typical habitat occurs under woody debris, leaf litter, bark accumulations around trees and very occasionally within grassy clumps (NPWS 2000). Where possible it will burrow into loose soil and the species will occasionally shelter under rubbish and debris.

Current knowledge of CLS suggests that it is restricted to the Cumberland Plain and Castlereagh Woodlands of Western Sydney and also along fringes of the River-Flat Eucalypt Forest in the Cumberland Plain (NPWS 2000).

Limited potential habitat occurs on site for the CLS given the density of exotic grassland, even within the stands of CPW. Individual trees of *E. tereticornis* and *E. moluccana* that had deep leaf / bark litter layer at their base were searched, as were areas of grass clumps near woodland areas and areas of dumped rubbish. No individuals of CLS were found during any field work. Habitat on site is not considered to be critical habitat for this species given the low levels of leaf litter and density of exotic grasses. This species is considered „unlikely’ to occur and not discussed further in this assessment.

Microbats

Three threatened mammal species, *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat), *Mormopterus norfolkensis* (East Coast Free-tail Bat) and *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), were recorded during the field survey through the use of Anabat recorders. Eastern Bentwing Bat, East Coast Freetail Bat and Eastern False Pipistrelle are listed as vulnerable species under the TSC Act but not listed under the EPBC Act. Results from Anabat analysis are provided in **Appendix C**.

5 Impact Assessment

The design of the Eastern Creek Business Hub overall development has followed Step 4 of the *Guidelines for threatened species assessment* (DEC and DPI 2005), which identifies important factors that must be considered when assessing the potential impacts on threatened species, populations, or ecological communities, or their habitats for development applications assessed as State Significant Development; namely to avoid, mitigate and finally offset any residual impacts.

5.1 AVOIDANCE MEASURES

5.1.1 Footprint Re-design

Preliminary field investigations by ELA in 2009 highlighted the existence of two threatened ecological communities, Cumberland Plain Woodland (SPW sub-community) and River-flat Eucalypt Forest (AW sub-community), on site in varying ecological condition. Subsequent design work of the development footprint has focussed on reducing both the direct and indirect impacts to these communities through minimising the area of native vegetation to be cleared and by formalising the management of stormwater drainage.

Original development footprints proposed involved the clearance of approximately 3.41 ha of SPW vegetation and 0.11 ha of AW vegetation. Redesign of the development layout has reduced the requirements for vegetation clearance to 1.93 ha of CPW and 0ha clearance of AW.

5.1.2 Retention of hollow bearing trees

The site contains five (5) hollow bearing trees, two (2) of which are located directly within the proposed development footprint. There may be potential to retain either or both of these two (2) hollow bearing trees given final designs and layouts of various development stages. The remaining three (3) are located along the boundaries of the site and with detailed design of carparks, buildings etc will not be impacted. They have been identified as significant trees and will be identified for retention in the final biobanking agreement to be developed for the offset area in the east of the site

5.2 MITIGATION MEASURES

5.2.1 Stormwater Drainage

At present, stormwater from urban development along the western side of the study area as well as road pavement runoff from Rooty Hill Road South enters the study area and traverses the constructed drainage channel which runs east and then north through the site. This stormwater is untreated and carries a potential pollutant load from the residential areas (fertilisers, chemicals etc) as well as the road pavement (oils, fuel, grease etc).

A significant amount of overland flow currently affects the remnant vegetation in the north-eastern corner of the study area from the development along the eastern side of Rooty Hill Road South and also from the M7 road pavement. The health of the vegetation in this portion of the site is affected by this unmanaged stormwater runoff.

The current proposal for superlot subdivision and associated early works proposes two formalised stormwater channels through the site. In the southern half of the site, an open channel will run beside the new access road from its junction with Rooty Hill Road South and continue to a biofiltration device and stormwater detention basin. The biofiltration device and stormwater detention basin are designed to improve water quality downstream and to slow the volume of water exiting the site. The detention basin

will be vegetated with wetland and aquatic species and will contribute to the amount of aquatic habitat currently present on site for wetland birds and amphibians.

In the northern half of the site, a similar grass lined channel will be installed to direct water off site through the culvert under the M7 roadway. This will substantially reduce the current volume and frequency of overland flows through the CPW vegetation and therefore reduce the current waterlogged state of this vegetation.

Formalisation of the stormwater drainage and reduction in the overland flow volumes and frequency in the northern portion of the site will reduce the current negative impacts on the CPW vegetation in the north-east corner.

5.2.2 Operational Environmental Management Plan (OEMP)

An Operational Environmental Management Plan (OEMP) will be prepared for the Project prior to any construction works. The OEMP will incorporate all mitigation measures required in both the 'impact area' and 'offset area', focusing on those listed below. It will also detail how ecological management procedures integrate with each other and construction procedures:

- Pre-clearing survey procedures
- Vegetation clearing procedures
- Injured animal responses
- Stop work incidents and procedures
- Erosion and sediment control
- Topsoil management
- Weed management
- Various monitoring procedures

Further, it will span the entire Project duration, from the pre-construction period through to the construction and post-construction period.

5.2.3 Installation of habitat boxes for microbats

Due to the potential loss of two (2) HBTs, which provide potential roosting and nesting habitat for threatened microbats and non-threatened fauna recorded onsite, it is proposed that habitat boxes be installed in the retained remnants in the Biodiversity Offset Area (**Section 6**). Where HBTs cannot be retained, habitat boxes should be installed at a minimum replacement level for all hollows to be lost, and salvaging of hollows from fallen trees should be undertaken and re-emplaced on retained trees in the Biodiversity Offset Area (BOA).

5.2.4 Biodiversity Offset Strategy (BOS) and subsequent Biobanking Agreement

Habitat fragmentation is the division of a single area of habitat into two or more smaller areas, with a new habitat type occurring in the area between the remaining fragments. The habitat patches present at the subject site are currently highly fragmented by stretches of open exotic grassland. The proposal will not increase fragmentation of these habitat patches, but with the provision of a BOS and subsequent development and implementation of a Biobanking Agreement for this offset area, the state of connectivity for these remnant patches will be significantly improved.

The BOS is outlined in **Section 6**, and a biobanking agreement for the eastern portion of the site will be developed in the near future by WSPT.

5.3 DIRECT AND INDIRECT IMPACTS

This section of the assessment outlines the anticipated direct and indirect impacts from the Project on the ecological values of the study area following avoidance and mitigation of impacts (see **Section 5.1** and **5.2**).

5.3.1 Direct impacts

Vegetation clearing

The study area currently contains 5.5 ha of SPW vegetation and 1.49 ha of AW vegetation. The overall Business Hub project would result in the removal of 1.93 ha of CPW (SPW sub-community) vegetation. The proposal would also result in the loss of approximately 14.8 ha of exotic- dominated grasslands, which do provide some level of habitat for small fauna species, which in turn provide food resources for larger, native species (both threatened and non-threatened) in the area.

Shale Plains Woodland is estimated as 92% cleared of its pre-1750 extent (NSW NPWS, 2002), and Alluvial Woodland is estimated as 87% cleared of its pre-1750 distribution (NSW NPWS 2002).

Loss of flora habitat

Potential habitat for a number of significant flora species is present across the study area, however targeted survey of potential habitat to be cleared was assessed and no threatened flora species were recorded or considered likely to occur, due to the high level of previous and current site disturbance (see **Appendix A**). Therefore, only 'potential' habitat for threatened flora species will be lost.

Loss of fauna habitat

The study area provides habitat for a range of threatened and non-threatened fauna species. The removal of vegetation, would result in the removal of potential foraging, roosting/sheltering, and breeding habitat for fauna species in the study area that are associated with grassy woodland communities.

Threatened and migratory fauna known or considered likely to utilise the site area:

- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*)
- East Coast Free-tail Bat (*Mormopterus norfolkensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Latham's Snipe (*Gallinago hardwickii*)
- Cattle Egret's (*Ardea ibis*)

The site contains five (5) hollow bearing trees, two (2) of which are located within the overall development footprint, although there may be potential to retain either or both of these two (2) hollow bearing trees given final designs and layouts of various development stages.

Due to the currently flooded nature of some parts of the site, these areas have consequently begun to colonise with wetland flora such as *Typha* spp., *Persicaria* spp. and various sedges. This wetland habitat will be modified due the proposed changes in drainage regime, to the detriment of the fauna at the site. As these wetland areas are located in the proposed offset area, it is planned to retain some of this habitat in the final offset area as habitat for watering fauna and amphibians (See Figure 19 – Impact Footprint and Offset Area).

The vegetation and habitat to be retained on site is all located on the eastern portion of the study area. This area is proposed to be restored as per the BOS developed (**Section 6**) and the subsequent biobanking agreement and will concentrate on replacing both fauna habitat extent and habitat components within the eastern portion of the study area. This will form a continuous band of vegetation

and habitat between the southern boundary at the Great Western Highway and continuing north to join with the existing vegetation in the Morreau Reserve on the northern side of Church Street.

5.3.2 Indirect impacts

The Project would indirectly impact on vegetation communities and flora and fauna species present in the study area through changing microclimates and increased human activity, introducing potential impacts from rubbish, dumping and encouraging weed incursion through increased vehicle and pedestrian traffic.

The areas subject to indirect impacts from the Project are difficult to quantify. Some impacts may be confined to discrete areas, or can spread for varying distances from a source point (such as artificial light impacts). Other impacts can be of greater intensity at a source point (such as noise), with indirect impacts on surrounding flora or fauna species extending to an undefined distance (flora and fauna species will have species specific responses to various disturbances). For example, sediments and dust may impact on a small area through direct deposition, but may also enter waterways, moving into downstream areas (and even offsite areas) during a large rainfall event.

Potential indirect impacts have been discussed below and reduced through the provision of avoidance and mitigation measures outlined in **Section 5.1** and **5.2**, along with a BOS (**Section 6**) and subsequent biobanking agreement. It is noted that a number of the indirect impacts from the development are actually positive when considered against the current site condition and existing land management practices.

Weed invasion

The site is highly disturbed and currently retains eight (8) noxious weed species, along with a further thirty-one (31) exotic species known to occur on site. In the development area these weeds will be removed using appropriate weed handling techniques outlined in the VMP for the offset area. Whilst there is some potential for an increase in the number and density of weed species in the offset area, particularly if inappropriate species were used in the landscaping areas onsite, the VMP will include initial establishment tasks as well as ongoing maintenance tasks such as weed treatment and removal. The in-perpetuity nature of the covenant to be placed over the offset areas will require the offset area to be permanently and effectively managed to ensure they deliver adequate biodiversity values. The nature of the covenant and funding arrangements proposed are documented in the BOS (**Section 6**).

Noise pollution and vibration

Due to the use of echo-location by microchiropteran bat species, they are potentially sensitive to changes (particularly increases) in noise and vibration levels. However, given that the study area is located at the intersection of two major roadways (the M7 Motorway and the Great Western Highway), which generate a substantial level of ambient or background noise, it is highly unlikely that the increase in vehicle movements resulting from the business Hub development would increase the current noise and vibration levels on site.

Light pollution

The study area is currently located between existing urban development areas of residential housing and significant road infrastructure. Both of these landuses are associated with high levels of unnatural night time light through street lighting, vehicle headlights and external lights on residences. It is unlikely that any new lighting associated with the business Hub development will significantly change the level of ambient light levels during night time.

5.4 ASSESSMENT OF IMPACTS TO THREATENED SPECIES AND ECOLOGICAL COMMUNITIES

Individual assessments of the potential impacts of the proposal for each threatened species and ecological community recorded at the Project Site have been completed in accordance with *Appendix 3* of the Draft Guidelines for Threatened Species Assessment (DEC & DPI 2005) and are included as **Appendix D**.

Impact Assessments for all matters of NES indicated in the study area have also been completed and are included at **Appendix E**.

These assessments have concluded that with the implementation of the Biodiversity Offsets Strategy and subsequent biobanking agreement, there would be no significant impacts to threatened species or ecological communities.

6 Biodiversity Offset Strategy

This section provides a detailed description of the proposed offset strategy which addresses 'maintain or improve' principles as required by the DGRs and the OEH's Interim Offset Policy for Major Projects (OEH 2011). In summary the proposed Biodiversity Offset Package (BOP) provides for:

- A 'maintain or improve' quantification of the impacts of the project using the Biobanking Assessment Methodology
- In perpetuity protection of managed lands on title where existing biodiversity values would be enhanced to meet the calculated offset requirement
- In perpetuity biodiversity management of this property under Western Sydney Parklands Management Plan, regulated under SEPP

An outline of the NSW and Commonwealth Offset Principles, offset options available, an assessment of the potential area of offset required and the potential offset opportunities are provided.

6.1 OFFSET PRINCIPLES

Principles that must be considered when proposing an offset strategy are defined by the State (DECC 2008) and the Commonwealth (CoA 2008). The following principles are outlined in these documents.

NSW (DECC 2008)

1. Impacts must be avoided first by using prevention and mitigation measures.
2. All regulatory requirements must be met.
3. Offsets must never reward ongoing poor performance.
4. Offsets will complement other government programs.
5. Offsets must be underpinned by sound ecological principles.
6. Offsets should aim to result in a net improvement in biodiversity over time.
7. Offsets must be enduring and they must offset the impact of the development for the period that the impact occurs.
8. Offsets should be agreed prior to the impact occurring.
9. Offsets must be quantifiable and the impacts and benefits must be reliably estimated.
10. Offsets must be targeted.
11. Offsets must be located appropriately.
12. Offsets must be supplementary.
13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

Commonwealth (CoA 2008 and CoA 2011)

1. Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted.
2. A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents.
3. Environmental offsets should deliver a real conservation outcome.
4. Environmental offsets should be developed as a package of actions - which may include both direct and indirect offsets.
5. Environmental offsets should, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'.
6. Environmental offsets should be located within the same general area as the development activity.
7. Environmental offsets should be delivered in a timely manner and be long lasting.
8. Environmental offsets should be enforceable, monitored and audited.

The Commonwealth policy identifies two kinds of biodiversity offset, 'direct offsets' including such measures as long-term protection of existing habitat, and 'indirect offsets' for such measures as implementing recovery plan actions or contributions to relevant research.

Recently the Commonwealth Government has released a consultation draft of the environmental offsets policy under the EPBC Act (CoA 2011), which includes much of the information above but also some key additions and changes relating to offsets policy. The policy focuses on providing high-quality conservation outcomes for Matters of NES while also allowing proponents more flexibility to find and secure offsets. The consultation draft of the policy has four main aims, including:

1. Ensuring the efficient, effective, transparent, proportionate, scientifically robust and reasonable use of offsets under the EPBC Act;
2. Providing proponents, the community and other jurisdictions with greater certainty and guidance on how offsets are determined and applied under the EPBC Act;
3. Delivering improved environmental outcomes by consistently applying offsets policy;
4. Explaining the Government's position on a range of issues, including:
 - a) When it is appropriate to consider offsets as part of a project;
 - b) The appropriate nature and scale of offsets;
 - c) The use of market-based instruments for the delivery of offsets.

The proposed offset strategy has been designed to meet the principles of both the NSW and Commonwealth policies.

6.2 OFFSET STRATEGY

For those impacts that could not be avoided or mitigated, a Biodiversity Offset Strategy (BOS) has been developed. An indicative Biobanking assessment was conducted for the proposed impacts at the subject site to determine the offset status of the proposal due to unavoidable impacts. The assessment was performed following the Biobanking Assessment Methodology (BBAM) (DECC 2009), consistent with the requirements of the OEH Interim policy on assessing and offsetting biodiversity impacts of Part 3A developments (DECCW 2010). *(NB: While the system of development assessment for Part 3A projects is no longer in force and has effectively been replaced by the assessment procedures established for State Significant Development and State Significant Infrastructure, the OEH Interim Policy has not yet been updated to reflect this change.)*

Other than the BBAM, there is no standardised quantitative method of assessing whether a proposal meets the „maintain or improve’ standard specified in the DGRs. Accordingly, an indicative Biobanking Assessment has been conducted for the proposal to inform the “quantum” of biodiversity offsets required to meet an „maintain or improve’ outcome.

The OEH Interim Policy specifically acknowledges that proposals assessed under Part 3A of the EP&A Act do not have to meet the „maintain or improve’ standard which is required under the Biobanking Scheme. The approach taken by WSPT is consistent with this policy. The BBAM has been used to inform the quantum of offset required, and whilst it is OEHs preference that a Tier 1 „maintain or improve’ outcome is achieved, the policy provides a structured approach for assessing proposals that meet one or two alternative standards (Tier 2 “no net loss” and Tier 3 “mitigated loss”), which take into consideration the environmental, social and economic benefits provided by the project.

6.2.1 Biobanking Assessment

The indicative assessment utilised the following Biometric Vegetation Types (BVT) (DECC 2008). The equivalence between NPWS (2002) mapping units and BVT’s are presented in **Table 10**.

Table 10: Vegetation classification equivalence between NPWS (2002) and Biometric Vegetation Types (DECC 2008)

VEGETATION COMMUNITY (NPWS 2002)	BIOMETRIC VEGETATION TYPE (DECC 2008)
Shale Plains Woodland (SPW)	Grey Box - Forest Red Gum (GB-FRG) grassy woodland on flats of the Cumberland Plain, Sydney Basin
Alluvial Woodland (AW)	Forest Red Gum - Rough-barked Apple (FRG-RA) grassy woodland on alluvial flats of the Sydney Basin
Weeds and exotics (pastureland)	Cleared land

The assessment was performed using data gathered from 20 x 50 m plots (**Section 3.4**). Three plots were performed in the proposed impact area and one plot in the proposed offset area. The number of plots for the impact and offset areas are consistent with Table 4 of BBAM, and thus consistent with a Biobanking Assessment (see **Table 11**). An additional plot was undertaken in the exotic pasture to determine the landscape score and consequent improvement expected utilising the BBAM.

Table 11: Minimum number of plots required to meet BBAM

BIOMETRIC VEGETATION TYPE	VEGETATION ZONE AREA (ha)	MINIMUM NUMBER OF PLOTS REQUIRED	ACTUAL NUMBER OF PLOTS CONDUCTED
Grey Box - Forest Red Gum grassy woodland	5.5	3	3
Forest Red Gum - Rough-barked Apple grassy woodland	1.5	1	1
Cleared land	27.5	N/A	1
Totals	34.5	4	5

6.2.2 Impacts – Credits required

The total loss of these vegetation types due to the proposal will be 1.93ha, all of which is to be completely cleared and all clearing will be in GB-FRG grassy woodland vegetation.

Table 12 displays the offset credit requirements calculated using the BBAM. The assessment identified **46.3 ecosystem credits** of GB-FRG grassy woodland would be required to fully offset these impacts. No **species credits** species were recorded at the subject site and such no species credits are required for impacts at the subject site.

Table 12: Total ecosystem credit requirement and credits generated in the offset area

VEGETATION TYPE	CONDITION CLASS	CREDITS REQUIRED / ha	AREA OF IMPACT (ha)	CREDITS REQUIRED (a)
Grey Box - Forest Red Gum grassy woodland	Mod-good	24	1.93	46.32
Totals			1.93	46.32

6.3 FINAL OFFSET PACKAGE PROPOSED**6.3.1 Retirement of ecosystem credits**

The preferred offset option to mitigate and counterbalance the loss of 1.93 ha of existing GB-FRG grassy woodland is to retire 46.3 ecosystem credits from the Chandos West Biobank Site (Biobank Site 70), which is currently owned and managed by Western Sydney Parklands Trust (WSPT) and identified in CHANDOS West Biobank Site (See Figure 19). This offsetting option would meet the requirements of a Tier 2 Offset Outcome.

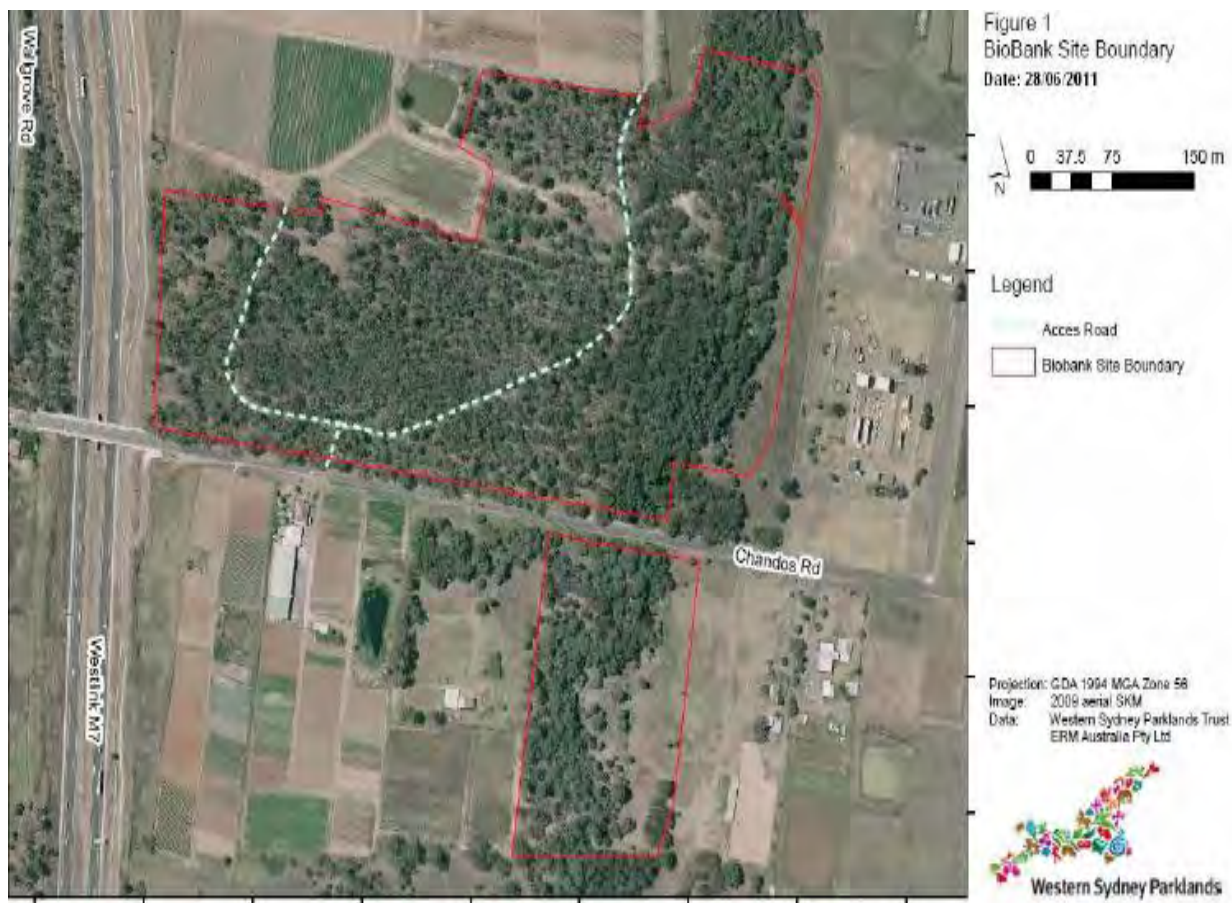


Figure 19 : Biodiversity Offset Site for Business Hubs - Chandos West Biobank Site (Map Extract from Biobank Agreement 70)

6.3.2 Long Term Security for Offset

The WSP Estate consists of approximately 5,280 ha of land in Western Sydney and the WSPT is required to manage these lands under the *Western Sydney Parklands Act 2009*. Therefore, the offset area when established will be protected by WSPT ownership of the land. The offset area associated with the 1.93 ha impacts to existing vegetation is a currently operating Biobank owned and managed by WSPT. Biobank sites are managed in-perpetuity through management fund provided by the Biobanking Trust Fund.

6.3.3 Additional site specific measures

Whilst not included as part of this offset package, WSPT also intend to create a Biobank site adjacent to the impact area in the future, within the eastern portion of the subject site. Ideally, the credits created at the proposed Eastern Creek Biobank site would be utilised in this offset package, however when considered against the timeframes for this proposed development (likely to spread over 20 years) it has been considered as a more expedient outcome to retire credits already in the ownership of WSPT until such times as the proposed Eastern Creek Biobank site can come online. It is envisaged that the proposed Eastern Creek Biobank site will be made up as provided in **Table 13**.

Table 13: Area of proposed Biodiversity Offset Area and potential vegetation communities restored

VEGETATION TYPE	AREA (ha)
Grey Box - Forest Red Gum grassy woodland	3.24
Forest Red Gum - Rough-barked Apple grassy woodland	1.35
Revegetation – Woodland	9.25
Revegetation – DNG	1.85
Revegetation – Wetland	1.42
Total	17.11

The proposed Biobank Site would form an extension of the existing bushland area which forms the conserved community lands to the north at Morreau Reserve and The Rooty Hill, on the northern side of Church Street (**Figure 20**). The Morreau Reserve and the Rooty Hill currently contain remnant GB-FRG grassy woodlands in a similar state to that found at the impact and offset sites, and incorporates existing woodland vegetation onsite that is currently experiencing severe threats from waterlogging and consequent poor health and psyllid infestation at the site.

Since its formation in 2008, the WSPT has engaged specialist bush regeneration contractors to rehabilitate the Parklands in accordance with principles and priorities set out in a Biodiversity Strategy (currently being updated, ELA in preparation). The bush regeneration and threat abatement works have resulted in significant improvements, particularly within the ecological corridor of the Parklands.

The offset area was identified by ELA utilising the OEH interim policy for offsets of Part 3A development (DECCW 2010) and achieves the Tier 2 offset outcome of „No net loss’. A Tier 1 outcome is not achievable as the vegetation type being impact upon, being a Critically Endangered Ecological Community (CEEC), is „red flagged’.

The proposed offset area provides the following benefits:

- the lands are in WSPT ownership, providing long-term security and commitment to management of Cumberland Plain as regulated under the SEPP
- an offset package that provides a surplus of ecosystem credits for each BVT, as calculated using the BBAM
- introduces conservation management to an area of extant GB-FRG grassy woodland currently under threat from dieback due to psyllid invasion and inadequate drainage of the site
- provides a vegetated corridor of ~14 ha, incorporating an additional ~3 ha of constructed wetland habitat and derived native grassland
- the area builds on an existing extant vegetation to the north within community lands currently under the management of Blacktown Council.



Figure 20 : Future Biodiversity Offset area, Western Sydney Parklands, Eastern Creek

7 Conclusions

This flora and fauna assessment identified 5.5 ha of Shale Plains Woodland and 1.49 ha of Alluvial Woodland (AW). SPW is a component of the listed critically endangered ecological community, Cumberland Plain Woodland, under the NSW TSC Act and the Commonwealth EPBC Act. AW is listed as an endangered ecological community under the NSW TSC Act, but is not nationally listed.

Threatened and migratory fauna recorded onsite include three (3) microbats, Eastern Bentwing Bat, Eastern False Pipistrelle and East Coast Freetail Bat, and two migratory birds Cattle Egret and Latham's Snipe were recorded on site.

No threatened flora were recorded onsite.

Where possible, impacts were avoided in the first instance through project redesign and then mitigated through construction management and the implementation of an Operational Environmental Management Plan. Impacts that could not be avoided included a loss of native vegetation of 1.93ha of SPW, along with habitat for threatened microbats through the potential loss of two of five hollow bearing trees.

In order to offset unavoidable impacts, a Biodiversity Offset Strategy was developed that meets „Tier 2' of DECCW (2011), i.e. „no net loss', calculated using the BioBanking Assessment Methodology (DECC 2009). The BOS (**Section 6**) proposes the retirement of 46.3 ecosystem credits of „Grey Box – Forest Red Gum (GB-FRG) woodland' (the BioMetric Vegetation Type equivalent of SPW), which has been calculated as the correct quantum utilising the BBAM.

Whilst not included as a component of the offset package for this development, WSPT will enter into a Biobanking Agreement in the near future for the non-impacted lands immediately adjacent to (on the eastern side) the development site. This will enable the further rehabilitation, revegetation and bush regeneration of approximately 18 ha immediately adjacent to the impact site. This proposed Biobank Site will extend a patch of reserved remnant CPW to the north of the impact site, as well as retaining wetland habitat along the north eastern boundary as a watering point for avifauna and microbats and a breeding, basking and foraging resource for amphibians recorded onsite.

Impacts to threatened and migratory species, and threatened ecological communities are considered against relevant guidelines in **Appendix F** and **G**. Given the currently highly degraded state of the vegetation found onsite and the retirement of equivalent Biodiversity Credits within the greater WSP management area – providing in-perpetuity conservation and management of the appropriately quantified amount of GB-FRG woodland less than 6 km away – impacts from the proposal were not considered to be significant and meet a „no-net loss' outcome as outlined in DECCW (2011).

Whilst the impacts to the Cumberland Plain Woodlands are considered to be adequately offset as to not constitute a significant impact, a referral under the EPBC Act is currently being prepared.

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Appendix A: Threatened Species Likelihood of Occurrence

Summary of initial assessment to determine the likelihood of occurrence of threatened species, populations and ecological communities in the proposal site.

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

- “yes” = the species was or has been observed on the site
- “likely” = a medium to high probability that a species uses the site
- “potential” = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- “unlikely” = a very low to low probability that a species uses the site
- “no” = habitat on site and in the vicinity is unsuitable for the species.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	
					Before surveys	Post surveys
FISH						
<i>Macquarie australasica</i>	Macquarie Perch	E (under FM Act)	E	Habitat for the Macquarie perch is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods.	No	No
<i>Prototroctes maraena</i>	Australian Grayling	-	V	Historically, this species occurred in coastal streams from the Grose River southwards through NSW, VIC and TAS. On mainland Australia, this species has been recorded from rivers flowing east and south of the main dividing ranges. This species spends only part of its lifecycle in freshwater, mainly inhabiting clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops but has also been found in muddy-bottomed, heavily silted habitat. Grayling migrate between freshwater streams and the ocean and as such it is generally accepted to be a diadromous (migratory between fresh and salt waters) species.	No	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	
					Before surveys	Post surveys
AMPHIBIANS						
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Forages in woodlands, wet heath, dry and wet sclerophyll forest (Ehmann 1997). Associated with semi-permanent to ephemeral sand or rock based streams (Ehmann 1997), where the soil is soft and sandy so that burrows can be constructed (Environment Australia 2000).	No	No