Appendix 10

Ecological Assessment

EPS

GLENFIELD ECOLOGICAL ASSESSMENT

Prepared for JC & FW Kennett Pty Limited & Figela Pty Limited (Glenfield Waste Services)
Prepared by Environmental Property Services

Cambridge Avenue, Glenfield NSW 2167

ENVIRONMENTAL PROPERTY SERVICES
Reference No: 11009/11012
January 2016

Contact Information and Declaration		
Declaration:	The declaration relates to the submission of this Ecological Assessment Report prepared for JC & FW Kennett Pty Limited & Figela Pty Limited (Glenfield Waste Services) in respect to the Glenfield Waste Services southern parcel of land. The opinions and declarations in this Ecological Assessment are ascribed to Environmental Property Services (EPS) and are made in good faith and trust that such statements are neither false nor misleading. In preparing this Ecological Assessment, EPS has considered and relied upon information obtained from the public domain, supplemented by discussions between key EPS staff, representatives from JC & FW Kennett Pty Limited & Figela Pty Limited and other consultants.	
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Licences:	*National Parks and Wildlife Act 1974* Scientific Licence number: SL100772	

Quality Assurance & Version Control Table				
Project: Ecological Assessment – Glenfield Waste Services, Cambridge Avenue, Glenfield NSW				
Client:	Glenfield Waste Services			
Rev No.	**Date**	**Our Reference**	**Author**	**Reviewer**
V01	09/10/2014	11012 GWS Ecological Assessment	L. Gorrell	Steve McCall
V02	07/5/2015	11012 GWS Ecological Assessment	T. Lambert	Steve McCall
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EXECUTIVE SUMMARY

Environmental Property Services (EPS) was engaged by landowners JC & FW Kennett P/L & Figela P/L to prepare an Ecological Assessment Report (EA) for Glenfield Waste Services (GWS). This EA was prepared to provide a detailed assessment of the ecological characteristics of the GWS's southern parcel of land located in the Campbelltown LGA including the presence and/or likelihood of occurrence of threatened flora and fauna and their habitat.

There have been a number of previous ecological assessments of the investigation area and a number of ecological assessments within the Local Government Areas of Campbelltown and Liverpool.

The Ecological Assessment revealed that:

- No threatened flora species or endangered flora populations were recorded on site during surveys;
- Some portions in the Southern Parcel of the GWS site are Cumberland Plain Woodland CEEC (under the TSC Act and EPBC Act) and River-Flat Eucalypt Forest EEC (under the TSC Act). The Cumberland Plain Woodland will be subject to impacts by the SSD and Rezoning components, while the River-Flat Eucalypt Forest will be retained and protected as part of the future management of the site;
- A majority of the threatened species initially considered likely to occur or to have suitable habitat were not identified during any surveys and this is considered to be related to the high level of historical disturbance on a majority of the site;
- The threatened species recorded during the targeted surveys were threatened microchiropteran and megachiropteran bats species, being *Pteropus poliocephalus* (Grey-headed Flying-fox), *Saccolaimus flaviventris (*Yellow-bellied Sheathtail-bat), *Mormopterus norfolkensis* (East-coast Freetail-bat), *Miniopterus australis* (Little Bentwing bat) and *Miniopterus schreibersii oceanensis* (Eastern Bentwing bat)
- No threatened frog, waterbird, arboreal mammal, or fish species were identified during surveys and are considered unlikely to occur on the investigation area;
- The investigation area supported a farm dam which provided an area of open, deep water for common waterbird species;
- The investigation area had been regularly slashed and managed such that there was a paucity of leaf litter and fallen timber across the site and was likely to provide some foraging habitat for only common bird species such as the Common Myna, Magpie Lark, Eastern Rosella, Common Starling etc;
- The investigation area supported a relatively high number of hollow bearing trees; and
- The investigation area was bound by a number of significant barriers to fauna movement.

The woodland vegetation in the southern parcel of land on the GWS site has been assessed in detail by a number of ecological consultancies over a period of eight years. The overall conclusion drawn from these previous studies and the more recent work by EPS has determined that this site provides only limited suitable habitat requirements for threatened flora and fauna species due to historical and ongoing disturbance. The site does support partial habitat requirements for a number of common native and exotic flora and fauna species. The habitat characteristic of most value within the area to be impact by the project is the occurrence of numerous hollow-bearing trees. These are considered likely to provide suitable roosting habitat for the recorded threatened bat species and as such nest boxes are proposed to offset the impacts to these species.

The detailed considerations of vegetation within the subject site by SLR have determined that some of the woodland vegetation in these areas would constitute an example of the CPW community – as listed both at State and Federal level.

In regards to the potential future development opportunities on the site and the potential removal of CPW vegetation within the GWS, these activities would not have a direct significant impact that is likely to:

- Result in an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
- Substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

A biodiversity offset is proposed to provide compensation for the impacts to the Cumberland Plain Woodland. A Biodiversity Offset Strategy guiding the approach to implementing the biodiversity offset requirements has been provided in this report.

Further consultation and liaison with the Department of Planning & Environment and the Office of Environment and Heritage will continue to determine the best pathway for providing the best possible ecological outcomes whilst still enabling the State Significant Development – Recycling Facility and separate rezoning process to proceed.

An EPBC Referral was submitted to the Commonwealth Department of the Environment to enable impacts to Matters of National Environmental Significance (particularly Cumberland Plain Woodland) to be considered at a Federal level. The Commonwealth Department of the Environment has determined the projects are a controlled action in relation to the Cumberland Plain Woodland and as such the action is to be assessed under the bilateral assessment pathway with consideration of the Guidelines issued for the project in November 2015. This report has responded to the project-specific Guidelines and a biodiversity offset is to be provided in accordance with the Biodiversity Offset Strategy contained in this Ecological Assessment.

Mitigation and compensation measures consist of the following:

1. Site inductions will occur to ensure site worker awareness of ecological sensitivities;
2. Any construction management plans will have an ecological section to highlight the relevant issues;
3. Vegetation disturbance will be limited to the minimum possible footprint;
4. Clearing protocols will be implemented to ensure that clearing of vegetation and in particular the hollow-bearing trees occurs in a sensitive manner;
5. Where possible, storage of construction materials will be limited to disturbed cleared areas on the site;
6. Hygiene and weed management protocols will be implemented during construction on site to avoid pathogen and exotic species spread into retained areas;
7. Disturbance of aquatic habitats will be minimised and erosion and sediment will be managed in accordance with industry standards;
8. Nest boxes will be installed at a compensatory ratio of 2:1 for each tree hollow impacted by the project;
9. The River-Flat Eucalypt Forest EEC will be incorporated for ongoing management as part of the Biodiversity Offset Strategy; and
10. A Biodiversity Offset Strategy will be implemented in relation to the project impacts upon the Cumberland Plain Woodland ecological community.

Combined, the above measures will ensure that ecological impacts of the project will be adequately addressed.

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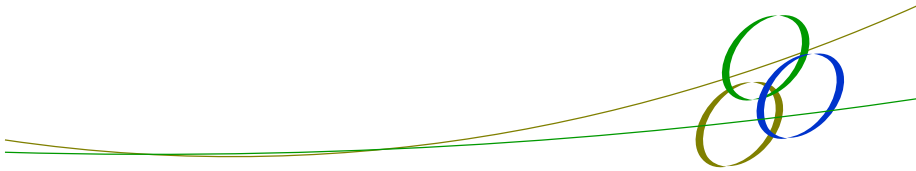

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1 BACKGROUND AND INTRODUCTION

1.1 Background

The Glenfield Waste Site straddles the Campbelltown City Council and Liverpool City Council's Local Government Area Boundary with the northern part of the site situated in the Liverpool Local Government Area (LGA) and the southern part of the site situated within Campbelltown LGA. Combined, the Glenfield Waste Site's northern and southern parcels of land function as the Glenfield Waste Services facility.

The primary land use on the Glenfield Waste Site's northern parcel of land are sandstone and sand extraction and non–putrescible solid waste landfill. To create the landfill cells, soil, sandstone and sand are extracted. The primary land use activity conducted on the Glenfield Waste Site southern parcel of land is recycling of waste.

Environmental Property Services (EPS) has been engaged by landowners JC & FW Kennett P/L & Figela P/L to prepare an Ecological Assessment Report (EA) for Glenfield Waste Services (GWS). This EA was prepared to provide a detailed assessment of the ecological characteristics of the GWS's southern parcel of land located in the Campbelltown LGA including the presence and/or likelihood of occurrence of threatened flora and fauna and their habitat.

The Campbelltown (Urban Area) Local Environmental Plan 2002 zoning map shows the majority of the Glenfield Waste Site's southern parcel of land is Zone 1(a) – Rural A Zone, a strip of land on the boundary of the Georges River is Zone 6(b) Regional Open Space Zone and part of the site adjoining Cambridge Avenue is Zone 5(b) Special Uses Arterial Roads Zone.

Detailed assessment of the likelihood of impacts of the proposal upon threatened species, populations and threatened ecological communities listed at a Commonwealth and State level is required. This EA outlines the results of this required assessment.

1.2 Licensing

Fieldwork was conducted in accordance with *National Parks and Wildlife Act 1974* (NP&W Act) Section 132 (c) Scientific Licence number SL100772. The licence permits the undertaking of biodiversity assessments, species impacts statements, ecological surveys and abiotic sampling as part of flora and fauna surveys.

1.3 Introduction, Local Context and Site Description

The GWS site is approximately 30km south west of the Sydney Central Business District. The Campbelltown LGA is situated within the Sydney Basin Bioregion which lies on the central east coast of NSW and covers an area of approximately 3,624,008 hectares. The bioregion occupies about 4.53% of NSW and is one of 17 bioregions contained within the state. The bioregion extends from just north of Batemans Bay to Nelson Bay, and almost as far west as Mudgee (OEH 2011).

Local Context

The local context has been examined at a radius of both 2km and 5km from the subject site (Figure 1-1). These areas form the boundary of the study area and are representative of the local occurrence of the Cumberland Plain Woodland and in particular the Shale Plains Woodland Critically Endangered Ecological Community (CEEC).

Within the 2km radius of the site the following vegetation areas occur:

- Shale Plains Woodland (CEEC) as mapped by OEH covers approximately 55ha; and
- Cumberland Plain Woodland Priority Recovery Areas cover approximately 256ha.

Within the 5km radius of the site the following vegetation areas occur:

- Shale Plains Woodland (CEEC) as mapped by OEH covers approximately 257ha; and
- Cumberland Plain Woodland Priority Recovery Areas cover approximately 1860ha.

The site is located adjacent to the North West corner of the Holsworthy Military Area. The Holsworthy Military Area is part of a contiguous vegetated area covering 18,000ha south of Sydney. The Georges River separates the Holsworthy Military Area from the GWS site, but likely still allows for the movement of some fauna species and the exchange of genetic material.

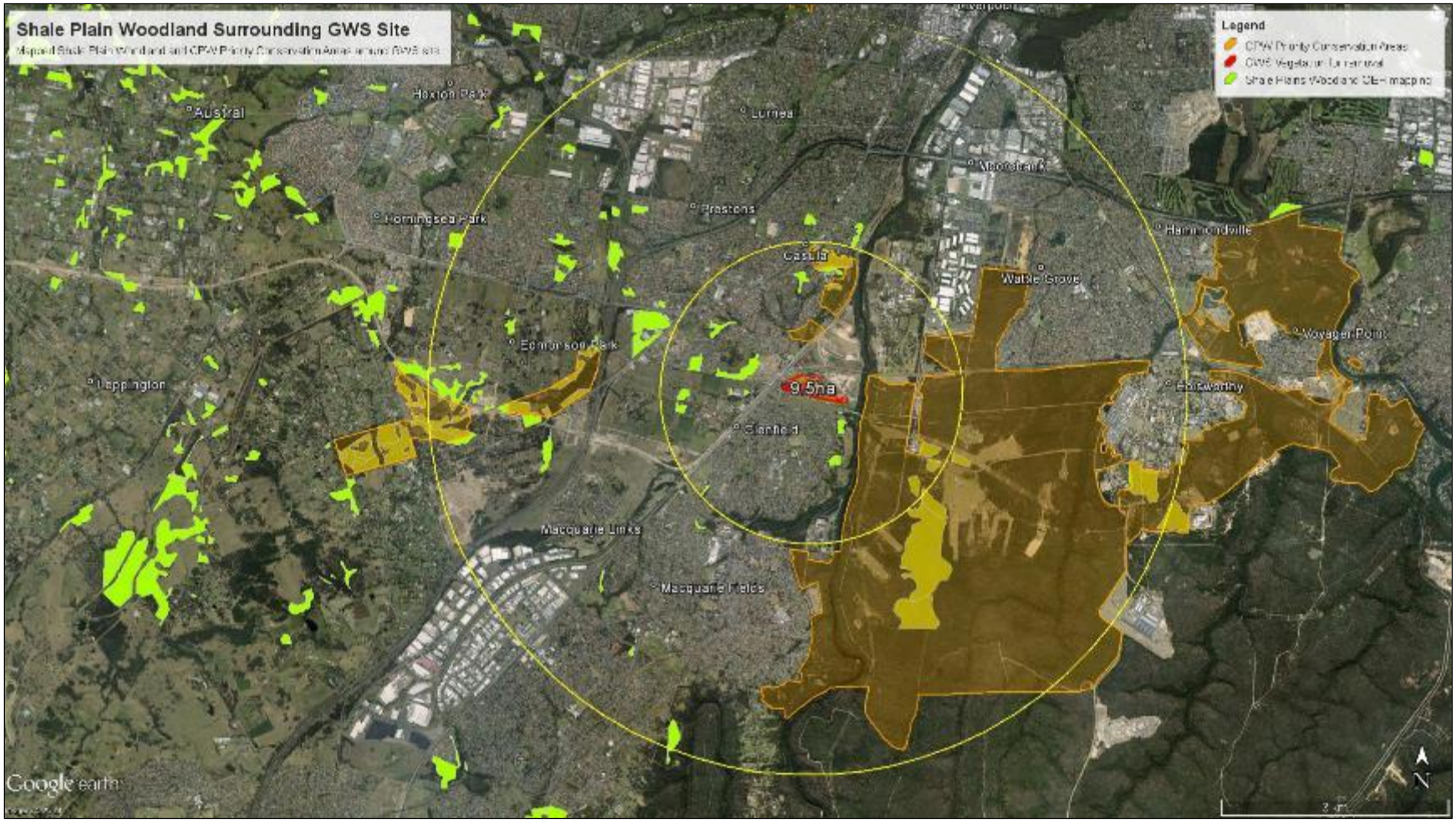

Figure 1-1: Study Area Covering 2km and 5km Radius
(Source: Google Earth Pro under Licence)

Site Description

The GWS southern parcel of land located within Campbelltown LGA, occupies an area of approximately 60 hectares (ha) bounded by the East Hills Railway Line, landfilling, sand and sandstone quarry to the north; the suburb of Glenfield to the south, Georges River to the east and the Southern Rail Line and Canterbury Road to the west.

The features of the southern parcel of land include significant electricity transmission lines and infrastructure impacting the whole of the land located south of Cambridge Avenue, forested riparian vegetation occurring along the river; the East Hills railway line, landfilled areas and non-landfilled areas and a stand of remnant woodland that is regularly underscrubbed for approved fire protection reasons.

A summary of the southern parcel of land details are shown in Table 1-1, while the aerial photograph in Figure 1-2 shows the southern parcel of land, the Glenfield Waste Site and the locality.

Table 1-1: Summary of the Southern Parcel of Land Details

Summary of southern parcel of land details	
Lot and Deposited Plans	Lot 91 DP1155962; Lot3 DP735524; Lot3 DP736881; Lot1 DP113201; Lot2 DP333578
Address	Cambridge Avenue, Glenfield NSW 2167
Topographic Map	1:25000 Campbelltown 9029-1N
Grid Reference	Zone 56, 306519E 6239570N
Local Government Area	Campbelltown
Catchment Management	Sydney Metropolitan
Primary existing Land Use	Landfill recycling of waste & rail and electricity infrastructure
Current Zoning	Zone1(a) Rural A Zone, Zone 6(b) Regional Open Space Zone & Zone 5(b) Special Uses Arterial Roads Zone

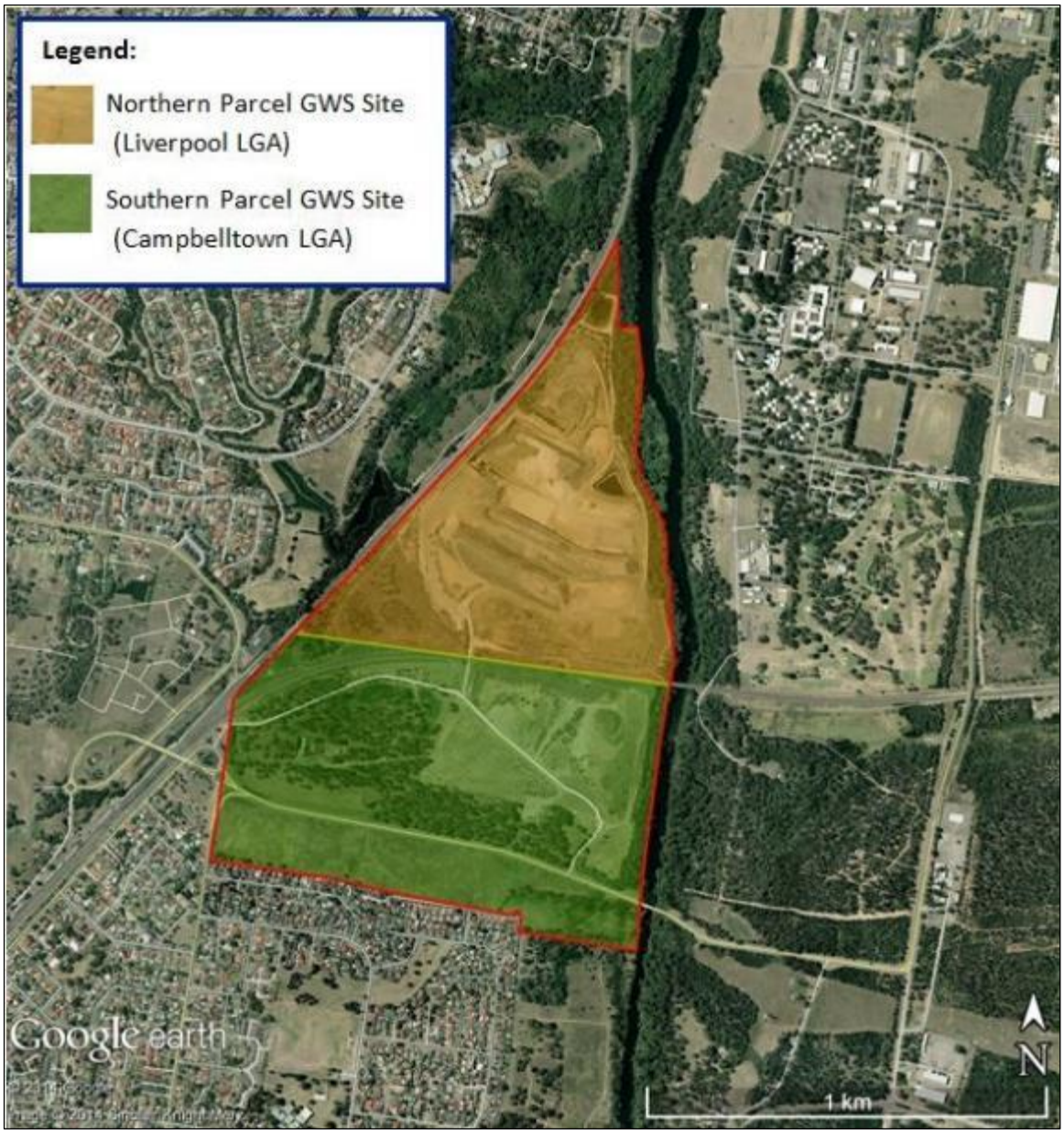

Figure 1-2: GWS site, showing northern and southern parcel of land and LGA boundaries.

The majority of the GWS site has been cleared of native vegetation. Native vegetation is primarily restricted to the Georges River riparian land and woodland on the southern parcel of land. An inspection of the historical aerial photographs (1951, 1961, 1970, 1978, 1986 and 1994) found that the woodland has been present since at least 1951. The understorey appears to have been disturbed by grazing and slashing throughout this period, with understorey clearing evident in 1978 (ACA 2006). Campbelltown City Council has directed the site owners through formal written advice on multiple occasions to maintain the understorey of the vegetation as an Asset Protection Zone to minimise bushfire risk.

1.4 Proposed Development

The proposed development of the GWS site consists of two concurrent projects consisting of firstly, the development of a portion of the site for the operation of a materials recycling facility and secondly, a Planning Proposal to Campbelltown Council to rezone the southern portion of the GWS site to facilitate industrial style employment-generating development. These two proposals are detailed as follows.

It should be noted that this EA assesses the likely impact of both the SSD and the rezoning aspects.

1.4.1 State Significant Development (SSD)

GWS is proposing to develop a materials recycling facility. The project is 'State Significant Development' (SSD) in accordance with Division 4.1 of Part 4 of the EP&A Act, as it is a type listed in Schedule 1 of the *State Environmental Planning Policy* (SEPP) - *State and Regional Development*. As such the proponent is seeking approval for the project under Section 89E of the EP&A Act.

The facility will have a capacity to process 450,000 tonnes per annum of non-putrescible waste, primarily commercial and industrial and construction and demolition waste for reuse in secondary markets. Figure 1-3 outlines the proposed SSD footprint.

Figure 1-3: Recycling Facility area (approximately 5ha).

1.4.2 Rezoning

The majority of the southern parcel of Glenfield Waste Services land located in the Campbelltown City Council's Local Government Area is Zoned 1(a) – Rural, which reflects the historical rural land uses. The local area is now an established urban area comprising residential, industrial, commercial, education, open space and major public infrastructure land uses. A planning proposal has been produced in order to consider what the site's future function and role should be for the local and regional area. Figure 1-4 below shows the site area outlined in yellow that is intended for rezoning within the boundary of the GWS site.

The rezoning of the southern parcel of land for employment lands is consistent with the regional, subregional and local strategies which strategically guide the management of future population growth in the Sydney Metropolitan area, the South Western Region of Sydney and the Campbelltown LGA.

Figure 1-4: Southern parcel of GWS and proposed rezoning site area.

1.5 Consideration of SEARs and Council Input

Director-General's Requirements (DGRs) were provided by the Department of Planning in December 2013. The Secretary's Environmental Assessment requirements (SEARs) were subsequently provided by DP&E on 26 November 2015. Specifically in relation to ecological issues, the DGRs required the following under the heading of Key Issues:

"Biodiversity – including an assessment of any potential impacts on any threatened species, populations, endangered ecological communities, groundwater dependent ecosystems or their habitats in the region."

The DGRs also referred to a number of guidelines for biodiversity considerations.

As part of the submission of an EPBC Referral, it was determined that the projects was likely to be a controlled action based on the predicted impacts on the Cumberland Plain Woodland. The Commonwealth Department of the Environment (DoE) provided Guidelines input into updated Secretary's Environmental Assessment Requirements (SEARs) as part of implementation of the Bilateral Assessment process.

This report has considered the original DGRs, the SEARs and the DoE project-specific Guidelines for the SSD in terms of survey methodology and assessment approach as and where required.

The report has also been updated from previous versions to consider various Campbelltown City Council comments on additional survey and assessment requirements.

2 GUIDELINES, POLICY AND LEGISLATION

This report has been prepared in consideration of the requirements of:

- NSW Office Environment Heritage (OEH) "Field survey methods" - http://www.environment.nsw.gov.au/threatenedspecies/
- OEH draft "Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities" – http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
- "Threatened species survey and assessment guidelines - field survey methods for fauna: amphibians" – http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- NSW *Environmental Planning and Assessment Act 1979* (EP&A Act);
- NSW *Threatened Species Conservation Act 1995* (TSC Act); and
- NSW *Fisheries Management Act 1994* (FM Act).

2.1 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Under an EPBC Act, an approval from the Commonwealth Department of Environment (DoE) is required for actions that are likely to have a significant impact on matters of national environmental significance. An action includes a project, development, undertaking, activity, or series of activities. When a proposal involves taking an action which may need approval under the EPBC Act, a referral for the proposal must be made to the Australian Government Minister for the Environment. The Act identifies the following matters of national environmental significance:

- World Heritage properties (sections 12 and 15A);
- National Heritage places (sections 15B and 15C);
- Wetlands of international importance (sections 16 and 17B);
- Listed threatened species and communities (sections 18 and 18A);
- Listed migratory species (sections 20 and 20A);
- Protection of the environment from nuclear actions (sections 21 and 22A);
- Commonwealth marine environment (sections 23 and 24A);
- Great Barrier Reef Marine Park (sections 24B and 24C);
- A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E);

- The environment, if the action involves Commonwealth land (sections 26 and 27A), including:
    - Actions that are likely to have a significant impact on the environment of Commonwealth land (even if taken outside Commonwealth land); and
    - Actions taken on Commonwealth land that may have a significant impact on the environment generally.
- The environment, if the action is taken by the Commonwealth (section 28); and
- Commonwealth Heritage places outside the Australian jurisdiction (sections 27B and 27C).

2.2 NSW Environmental Planning and Assessment Act 1979 (EP&A Act)

Threatened species impact assessment is an integral part of environmental impact assessment. The objective established by Section 5A of the EP&A Act (herein referred as the 'Assessment of Significance') is to improve the standard of consideration afforded to threatened species, populations and ecological communities, and their habitats through the planning and assessment process, and to ensure that the consideration is transparent. The Assessment of Significance is the first step in considering potential impacts.

2.3 NSW Threatened Species Conservation Act 1995 (TSC Act)

Schedules 1 and 2 of the TSC Act contain lists of flora and fauna species and communities, which have been determined by the NSW Scientific Committee as being under threat of serious decline that could ultimately lead to extinction. Schedule 3 of the TSC Act contains a list of 'Key Threatening Processes' which threatens, or could potentially threaten, the survival or evolutionary development of a species, population or ecological community.

2.4 NSW Fisheries Management Act 1994 (FM Act)

The FM Act covers threatened fish and marine vegetation and associated threatening processes and is administered by the Department of Primary Industries. In 2004, the NSW Government amended the FM Act through the introduction of the Threatened Species Legislation Amendment Act 2004. This report considers any impacts that might occur to listed threatened species of fish or aquatic organisms.

3 BACKGROUND RESEARCH

The methods undertaken to complete the EA are divided into two stages, including preliminary/desktop investigations and field surveys and assessments. Preliminary investigations included literature and database reviews. Field surveys included site inspections and targeted sampling of flora, fauna and habitat.

3.1 Database Review

A list of threatened species, populations and ecological communities that had been previously reported or modelled to occur within a defined radius of the subject site (the 'investigation area'), was obtained by undertaking a search of the following online and publicly accessible databases.

3.1.1 NSW Government

The investigation area, or defined radius in which the state search was undertaken included an search of all 'known', 'predicted' and 'recorded' species in both the Liverpool and Campbelltown Local Government Areas. As a result, the 'recorded' species information includes sightings/records from this entire search area and not solely from the Site.

- NSW BioNet - http://www.bionet.nsw.gov.au/
- Threatened Species, Populations, and Ecological Communities of NSW - http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx;
- SIX Spatial Information Exchange - http://maps.six.nsw.gov.au/apps/channels_3.5/?config=vegetation

Appendix 1 contains the BioNet search results.

3.1.2 Australian Government

- The investigation area or defined radius in which the federal search was undertaken included a 10km radius of the site using the Commonwealth Department of Environment Protected Matters search tool http://www.environment.gov.au/epbc/pmst/index.html.

Appendix 2 contains the EPBC Protected Matters Search Tool Results.

3.2 Literature Review

A review of literature pertaining to the study area, the investigation area and the proposed activity was undertaken. This included internet searches and a review of relevant reports. In this instance, there were a number of previous ecological assessments in the investigation area and a number of ecological assessments undertaken more broadly within the Local Government Areas of Campbelltown and Liverpool.

The vegetation of the Campbelltown LGA was described by Benson and Howell (1990) as a mix of rugged Hawkesbury Sandstone country and rolling hills of woodlands of Grey Box *Eucalyptus moluccana*, Forest Red Gum *Eucalyptus tereticornis*, and Narrow-leaved Ironbark *Eucalyptus crebra*, on the clay soils of the Wianamatta Shale.

The vegetation communities of the Cumberland Plain were mapped by National Parks and Wildlife Services (NPWS) (2002) at a scale of 1:25,000 using aerial photograph interpretation and limited ground survey. Two vegetation communities were mapped on the GWS site, in particular, Shale Plains Woodland and Riparian Forest. The dominant overstorey species were *Eucalyptus moluccana, E. botryoides and E. botryoides/saligna* hybrid. The understorey vegetation was predominantly comprised of exotic grass and weeds (NPWS 2002).

Tozer (2003) identified 21 vascular plant communities on and adjacent to the Cumberland Plain and Hornsby Plateau. Vegetation communities were described using structural features, habitat characteristics and diagnostic species. Contemporary vegetation cover was estimated from 1:16000 scale aerial photography (1997/98) and sorted into six categories based on cover of *Eucalyptus* species. These categories are only approximately related to vegetation condition.

The 1:100 000 scale vegetation mapping accompanying Tozer (2003) was a larger scale version of the 1:25 000 digital maps released on CD Rom by NPWS (2002). The Tozer (2003) and NPWS (2002) communities mapped on the GWS site were equivalent to Endangered Ecological Communities (EECs) listed under the TSC Act (see Table 3-1).

Table 3-1: Previously Mapped Vegetation Communities and Endangered Ecological Communities

Tozer(2003)/NPWS(2002)Communities	Endangered Ecological Communities
10–Shale Plains Woodland	Cumberland Plain Woodland
12–Riparian Forest	River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

3.2.1 Eco Logical Studies

In 2006, Eco Logical prepared a preliminary ecological assessment of the Glenfield Waste Site (Eco Logical 2006). The assessment involved a review of background literature and mapping and a field survey to validate the condition and recovery potential of the vegetation communities, followed by the application of an OEH (formerly the Department of Environment and Conservation (DEC)) approved ecological constraint analysis process and mapping of outcomes.

The review consisted of a consideration of the DEC Western Sydney Vegetation mapping, as described in NPWS (2002). The investigation area was inspected on 16 March 2006 and flora and fauna species were recorded. A total of 38 plant species were recorded in the forest and riparian vegetation, of which 20 were native and 18 exotic. A total of 23 fauna species (all birds) were recorded by Eco Logical during the March 2006 field survey, with no threatened species observed.

The Eco Logical 2006 report described the woodland vegetation in the western portion of the investigation area as containing more mature and dispersed trees than in the eastern portion, with tree hollows representing potential fauna habitat, a low level of leaf litter and high grass cover with evidence of grazing and slashing. The vegetation in the eastern portion of the investigation area was described as having younger trees with an understorey of scattered shrubs and ground cover, with less grass cover and deeper litter layers than in the west. The vegetation adjacent to the Georges River was described by Eco Logical as riparian forest with weedy banks and a mixed native understorey.

3.2.2 ACA Studies

A study conducted by ACA (2006) described the vegetation in the investigation area as woodland with three characteristic tree species, namely *Eucalyptus eugenioides, E. moluccana* and *E. tereticornis.*

It was concluded that the woodland vegetation recorded on the site meets the criteria for Cumberland Plain Woodland under both the EPBC Act and TSC Act. It was recommended that to come to a conclusive determination as to the classification of woodland vegetation on site further studies were required.

3.2.3 SLR Studies

As discussed in the ACA (2006) Report, further field studies were required in order to come to a conclusive determination as to the classification of woodland vegetation on site. As a result, SLR Consulting were engaged by EPS with the aim of producing a conclusive Cumberland Plain Woodland Assessment Report.

SLR Consulting were tasked with the following:

- To undertake background research regarding any existing vegetation mapping of the subject site;
- To undertake a site survey:
    - To verify the vegetation present;
    - To collect a detailed flora species list;
    - To undertake a series of flora survey quadrats; and
- To determine likely ecological constraints to future rezoning and development of the site.

From the survey work carried out in 2014, SLR has been able to determine the extent, nature and condition of native vegetation on the subject site. The SLR results concluded that significant portions of the subject site have long been cleared, modified and used as part of the existing recycling facility, however, the band of vegetation in the southern, central and western parts contain a canopy of eucalypts which are characteristic of the Cumberland Plain Woodland (CPW) community and would constitute an example of this community (SLR 2014).

As stated by SLR 2014 the CPW community is listed in the TSC Act as a "*critically endangered ecological community*" (CEEC), and is also listed as part of a CEEC in the EPBC Act.

SLR conducted a preliminary assessment on the condition state of the CPW community in accordance with the threshold levels under the EPBC Act. This preliminary assessment indicated that the subject site supports vegetation that meets the criteria for CPW which is listed as being a CEEC under Federal Legislation (SLR November 2015) (Appendix 16).

4 PRELIMINARY ECOLOGICAL INVESTIGATION

4.1 Overview

Preliminary studies and fieldwork were undertaken in the months of March through to July of 2012, refer to Appendix 14 for specific dates. Both flora and fauna surveys were conducted at varying times to assess the likelihood of any threatened flora, fauna or endangered ecological communities being present.

Field surveys were undertaken in consideration of OEH's: *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft, November 2004.*

Targeted field surveys were conducted for arboreal mammals, microchiropteran bats and birds (diurnal and nocturnal). The field surveys for diurnal birds were undertaken during the daylight hours (900hrs-1300hrs) on 30th May 2012 and 21st June 2012 (0800-1400hrs). Field surveys for arboreal mammals and microchiropteran bats were undertaken on the evenings of the 20th and 21st June 2012. General surveys included searches for the presence or signs of any fauna including the presence of tracks, scats (fecal pellets), hair, scratches etc.

4.2 Flora and Vegetation Community Survey

Preliminary floristic surveys of the site occurred on the 30th May and 12th July 2012. Vegetation was surveyed by using the targeted random meander method and by the collection of floristic data using quadrats and transects.

Floristic information was collected from 8 quadrats of 20 x 20 metres in size, distributed across the investigation area. The data recorded in the quadrats were consistent with the standards used by the Office of Environment and Heritage and the Royal Botanic Gardens for general survey as well as with the BioBanking/Biodiversity Certification methodology.

The data recorded included:

- Geographical information (MGA, location, topographic map);
- Physical features (topographic position, elevation, slope, aspect, general soil type);
- Disturbance history (including grazing, clearing/logging, weeds and fire);
- Structural features of the vegetation according to Specht *et al.* (1995) (numbers and types of layers present, their heights, canopy cover, and three most dominant species in each layer); and
- Species and their cover abundance using the following modified Braun-Blanquet seven point scale:
    - 1: <5% cover – rare, 3 or fewer individuals;
    - 2: <5% cover – uncommon, >3 individuals and sparsely scattered;
    - 3: <5% cover – common, individuals consistent throughout the plot;
    - 4a: <5% cover – abundant, many individuals throughout the plot;
    - 4b: 5%-25% cover;
    - 5: 25%-50% cover;
    - 6: 50%-75% cover; and
    - 7: 75%-100% cover.

Specimens of plants were collected for later identification if they were not readily identifiable in the field. Such specimens were identified according to Harden (1990, 1991, 1992, 1993) and the interactive flora (Flora Online) provided online by NSW National Herbarium of the Royal Botanic Gardens (http://plantnet.rbgsyd.nsw.gov.au/floraonline.htm).

4.3 Fauna Survey

Field surveys were undertaken to ascertain the presence, distribution and quality of fauna habitat and a range of fauna including arboreal and terrestrial mammals, bats, birds, amphibians and reptiles. The expectation of the types of animals (and habitats) potentially present on the site, and the design and implementation of field surveys, were based on the review of literature.

During an inspection on 28th March 2012 it was evident that the vegetation supported a disturbed understory comprised of predominantly native and exotic groundcover and grasses. There was no mid-storey nor logs, rocks or leaf litter. It was concluded that the investigation area was unlikely to provide habitat for ground dwelling/terrestrial mammals and as such targeted fauna trapping and reptile searches were not considered applicable or necessary.

Arboreal and Terrestrial Mammals

Mammal surveys were conducted in the evenings of 20th and 21st June 2012. The technique employed involved a person surveying on foot with a spotlight for two separate one hour searches over two consecutive nights. The transect walked during each period, was approximately one kilometre long (Figure 4-1). During the search, the spotlight was shone into the vegetative canopy with the light placed at eye height of the surveyor so that any eye-shine was detected. The weather on the evenings of the surveys was fine with little or no wind.

Bats

Microchiropteran bat surveys were conducted in the evenings of 20th and 21st June 2012 using a commercially available ultrasonic recorder (Anabat) situated within a number of locations, (Figure 4-2) in particular, potential roost sites or flyways as well as near the dam. Surveys were conducted during optimal conditions with little or no wind or rain. Any echolocation calls emitted by bats and detected by the Anabat microphone were recorded (Appendix 11) and sent for identification and interpretation.

Birds

Diurnal bird surveys were conducted on 30th May 2012 from 0900hrs-1300hrs and 21st June 2012 (0800-1400hrs) by an experienced ornithologist in the woodland. All birds were identified by observation or by call. Targeted surveys were undertaken during optimal conditions in the morning with little or no wind or rain. Other bird observations occurred as opportunistic sightings whilst undertaking other assessments.

Nocturnal bird surveys were conducted on evenings of 20th and 21st June 2012. Surveys were undertaken in conjunction with spotlighting and bat detection assessments whereby an ornithologist would detect the presence of any nocturnal birds by either observations or call. Surveys were only undertaken during optimal conditions, such as little or no rain.

Amphibians and Reptiles

Amphibian and reptile surveys were conducted on 30th May 2012 (0900hrs-1300hrs) and 21st June 2012 (0800-1400hrs) as well as on evenings of 20th and 21st June 2012. Surveys were conducted by an experienced ecologist undertaking an area search of the woodland and associated aquatic environs. Other observations occurred as opportunistic sightings whilst undertaking other assessments.

4.4 Habitat Assessment

Habitat is defined under the TSC Act, as an area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community and includes any biotic or abiotic component. The investigation area was surveyed on the 30th May and 21st June 2012 for the presence of fauna habitats, including:

- Nectar and seed producing trees and shrubs;
- Leaf litter and fallen timber;
- Open water, wetlands and soaks;
- Hollow bearing trees; and
- Cleared areas.

The survey for these habitat characteristics was conducted across the investigation area in order to ascertain the type, distribution and abundance of these resources. The location (coordinates) of all nectar and seed producing trees and shrubs, leaf litter and fallen timber, hollow-bearing trees and cleared areas was obtained using a hand-held Global Positioning System (GPS) and recorded on a data sheet. Other habitat data, such as the species of tree, the number and size of hollows, height/density (structure) of vegetation layers, leaf litter, fallen timber, stags, rock shelves, soil type, presence of water and any human-made habitats were also recorded.

Figure 4-1: Aerial photo of investigation area showing spotlighting transect/survey route.

Figure 4-2: Investigation area showing the two locations chosen for Anabat recordings.

4.5 Results, Discussion and Conclusions from Preliminary Ecological Investigations

This section details the results of desktop assessments, database reviews, and field surveys and provides a brief interpretation and discussion of these results.

4.5.1 Vegetation Survey Results

Eighty six species of flora were observed in the investigation area. Of these, 47 were native and 39 exotic. They were represented by 38 families, the most species being within the Poaceae (15 species). No threatened species or endangered populations were recorded on site during the survey. The flora list can be found in Appendix 9.

The floristic pattern exhibited is typical of grassy woodland and the canopy trees are principally *Eucalyptus moluccana* (Grey Box) with *Eucalyptus tereticornis* (Forest Red Gum) being co-dominant. The canopy trees are in general of an even age and are regrowth estimated no older than 60 years. There were a total of 38 hollow bearing trees with hollows of various sizes present across the investigation area.

4.5.2 Fauna Survey Results

A total of 22 fauna species were recorded, which comprised 19 birds, two frogs and one mammal. In addition, Anabat recordings were undertaken with a number of microchiropteran bat species recorded including two species being the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) listed as Vulnerable under the TSC Act.

All bird species recorded are common in urban/semi-urban habitats on the east coast of Australia and are of low conservation significance. Bird species were observed either in trees, on the ground and/or in flight either in or adjacent to the woodland vegetation. Other bird species, mostly waterbirds were observed either in or on the edge of the open water/dam north of the homestead. The fauna list can be found in Appendix 10.

4.5.3 Fauna Habitat

The investigation area supported woodland vegetation with an overstorey predominantly of one age class and strata, with no mid-storey and no juvenile understory or immature tree species present. There was no understory shrub layer present, and as such, the understory lacked any structural complexity, supporting only groundcover and grass species which had been subject to regular mowing and provided some minor foraging habitat for predominantly common fauna species only. The investigation area and study area did not support any declared critical habitat in NSW, listed under the TSC Act.

Nectar and Seed Resources

Fauna habitat comprised of nectar and seed producing Eucalypts, such as Grey Box *Eucalyptus moluccana* and to a lesser extent, Forest Red Gum *E. tereticornis* and Narrow-leaved Ironbark *E. crebra*. Other nectar and seed producing trees comprised White Feather Honey myrtle *Melaleuca decora* and one Broad-leaved Apple *Angophora subvelutina*. The investigation area was dominated by the occurrence of *E. moluccana* and consisted of scattered trees predominantly of one age and strata (canopy) with no mid-storey of juvenile species. As such, the vegetation lacked structural complexity. Other potential seed resources present were from native and exotic grasses as well as River She-Oak *Casuarina cunninghamiana*, which had been planted on the edges of the woodland.

Leaf Litter and Fallen Timber

The investigation area had been regularly slashed and managed and there was a paucity of leaf litter and fallen timber. Two piles of timber occurred at two locations within the woodland and appeared to provide habitat for the European Rabbit *Oryctolagus cuniculus*, with burrows and scats being observed in these areas.

Open Water, Wetlands and Soaks

The investigation area supported an area of open water, which was a farm dam situated directly north of the homestead. This open water provided suitable habitat for common waterbird species such as the Eurasian Coot, Australian White Ibis and Australian Wood Duck. A soak or wet area was observed on the northeast margin of the woodland. Some Common Eastern Froglets and Whistling Tree Frogs were heard calling from this location.

Hollow Bearing Trees

The investigation area supported a relatively high number of hollow bearing trees across most of the investigation area (Appendix 12). The location of these across the investigation area can be seen in Figure 4-3. The dominant hollow bearing tree was *E. moluccana* with hollows occurring either in dead horizontal branches, vertical spouts and dead trunks and/or dead branches or trunk hollows and live and/or dead trees. There was little evidence of these hollows being used by fauna, other than two trees which were supporting Galahs at the time of survey. Hollows were also present in five *E. tereticornis* and one *A. floribunda*.

Cleared Areas

The Glenfield Waste Site has been in single family ownership since the 1800's with the understorey and groundcover being continually maintained for a number of purposes over that period. From aerial photography dating back to the 1930's it is clear that the GWS site was previously used for orchards and farming. In photographs dating from the 1950's through to the 1970's it is evident that the vegetated portion of the site has had the understorey and groundcover managed throughout the woodland. Much of the site, including the woodland portion, has been used for grazing, general agricultural purposes and more recently, slashed for fire hazard reduction at Campbelltown City Council's request. As the investigation area has been regularly slashed and otherwise managed such that a predominantly cleared understorey comprised of native and exotic grasses and herbs occurs across the entire investigation area, the understorey was not likely to provide habitat for threatened bird or mammal species, moreover, the cleared understorey was likely to provide foraging habitat for common bird species such as Common Myna, Magpie Lark, Eastern Rosella, Common Starling etc.

4.5.4 Habitat Connectivity

The investigation area is bounded by a number of significant barriers to fauna movement, including Cambridge Avenue, the Main Southern Railway Line, the Southern Sydney Freight Line, East Hills Railway Line, internal roads, the Georges River and the operational quarry, landfill and recycling areas within the GWS precinct. Similarly, the study area (within 10km) is subject to disturbance and isolation of vegetative areas, thus reducing the potential movement of small and terrestrial mammals, reptiles, amphibians and birds and bats into and through the investigation area. Larger terrestrial mammals that may occur in the locality would be excluded from much of the study area as a result.

Habitat connectivity within the study area is greatest within the riparian vegetation associated with Georges River, which maintains connectivity with riparian vegetation to the north and south. This riparian corridor would facilitate the movement of less mobile species, including cover-dependent species, larger terrestrial mammals and arboreal mammals.

South east and east of the Georges River is the adjacent Holsworthy Military Area. Hyder Consulting (2012) reported that this site supports approximately 18,000 hectares of continuous native vegetation. The diversity of vegetation communities within the Military Area includes forests, woodlands, heath and swamp communities, which in turn provide important habitat to threatened flora and fauna. Highly mobile fauna such as birds and some mammals may predominantly reside within the Holsworthy Military Area and use the limited resources offered by the subject site on a transient basis.

Figure 4-3: Aerial photo of investigation area showing locations of hollow bearing trees.

4.6 Preliminary Study Conclusions

The preliminary studies revealed that:

- A total of 86 species of flora were observed in the investigation area. Of these, 47 were native and 39 exotic. They were represented by 38 families, the most species being within the Poaceae family (15 species);
- No threatened flora species or endangered flora populations were recorded on site during surveys;
- The abiotic characteristics of the investigation area revealed that the site could support some Cumberland Plain Woodland. These include the soil landscape, altitude, topographic position and geographic location;
- The site supports Grey Box and some areas of native understorey consistent with Cumberland Plain Woodland;
- Though none were identified, the investigation area was assessed as having suitable habitat for a total of 16 threatened and migratory fauna species. Of these, there were ten bird species (eight passerines/perching birds and two shorebirds) and six mammal species (bats);
- No threatened frog, threatened waterbird, threatened arboreal mammal, or threatened fish species were considered likely to have habitat within the investigation area or occur on the investigation area;
- Fauna habitat present comprised of nectar and seed producing Eucalypts, such as Grey Box *Eucalyptus moluccana* and to a lesser extent, Forest Red Gum *E. tereticornis* and Narrow-leaved Ironbark *E. crebra*;
- The investigation area supported a farm dam which provided an area of open, deep water for common waterbird species;
- The investigation area had been regularly slashed and managed such that there was a paucity of leaf litter and fallen timber across the site and was likely to provide some foraging habitat for only common bird species such as the Common Myna, Magpie Lark, Eastern Rosella, Common Starling etc;
- The investigation area (woodland) supported a relatively high number of hollow bearing trees; and
- The investigation area is bounded by a number of significant barriers to fauna movement, including Cambridge Avenue, the Main Southern and East Hills Railway Lines, internal roads, and the tip site within the GWS precinct, which would limit the potential use of and movement through the investigation area by threatened fauna.

5 RECENT ECOLOGICAL INVESTIGATIONS

5.1 Background

The following section outlines additional fieldwork undertaken to provide a complete and robust picture of the ecological values of the southern parcel of the GWS site.

Subsequent to the preliminary studies, further assessment has occurred that addresses the comments raised by the Office of Environment and Heritage (OEH) in their letter received November 2013. This has included addressing:

- The likelihood of Cumberland Plain Woodland, listed as a Critically Endangered Ecological Community under the *Threatened Species Conservation Act 1995* (TSC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* being present on site;
- The likelihood of two bat species Eastern Bentwing-bat (*Minioptera schreibersii*) and the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) both listed as Vulnerable under the TSC Act being present on site;
- The likelihood of the site being suitable habitat for 16 threatened and migratory fauna species;
- The presence of koala food trees on site; and
- The likelihood of the threatened flora species *Pimelea spicata* (Spiked-rice flower) being present.

Additional surveys were also undertaken in 2015 to ensure that Campbelltown City Council's concerns about previous surveys occurring in cooler seasons were addressed. The 2015 surveys occurred in February and targeted:

- Green and Golden Bell Frog (in accordance with Commonwealth and State guidelines) over four nights;
- Additional microbat surveys over four nights; and
- Opportunistic surveys for all other species of flora and fauna in the surveyed areas, with a focus on threatened species.

These were also the species that Council considered warranted further surveys.

Appendix 14 includes the times and dates of all fieldworks undertaken for recent survey work.

Appendix 9 and 10 includes flora and fauna species respectively recorded during these and previous surveys.

5.2 Database Review

Raw data obtained from the more recent searches of NSW and Commonwealth databases are shown in Appendices 1 and 2 and are summarised below:

- A total of 87 threatened fauna species listed under TSC Act and / or EPBC Act had either been recorded, known or predicted to occur within the Liverpool/Campbelltown Local Government Area / EPBC 10km radius;
- A total of 90 threatened flora species listed under TSC Act and / or EPBC Act had either been recorded, known or predicted to occur within the Liverpool/Campbelltown Local Government Area/ EPBC 10km radius;
- A total of 27 Endangered Ecological Communities (EEC) listed under TSC Act and / or EPBC Act had either been recorded, known or predicted to occur within the Liverpool/Campbelltown Local Government Area/ EPBC 10km radius;
- A total of 34 Listed Migratory species, listed under EPBC Act may occur within the investigation area;
- No critical habitat listed under the TSC Act occurred within the investigation area;
- A total of 34 Key Threatening Processes (KTP's) listed under the TSC Act were predicted to occur within the investigation area;
- A total of 53 invasive species listed under the EPBC Act were predicted to occur within the investigation area; and
- No threatened species or communities as listed under the FM Act have been recorded in the Campbelltown LGA (Department of Primary Industries – Fishing and Aquaculture Threatened & protected species - records viewer).

Each of these species, EEC, KTPs and invasive species were thoroughly considered and assessed to ascertain whether they were likely to occur on the subject site and/or be impacted by the proposed activity (Appendices 3-6).

5.3 Targeted Flora and Vegetation Community Surveys

5.3.1 Plants

In addition to the previous numerous flora surveys, a targeted flora survey was conducted on the 17th (1000-1600) December 2013 to determine the presence or absence of the flora species *Pimelea spicata* (Spiked-rice flower) listed as Endangered under the EPBC Act and TSC Act. In accordance with the OEH *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft, November 2004* the random meander technique was conducted on the southern parcel of the GWS site to search for this particular species. All other threatened flora were also considered during this survey. The search area consisted of those areas primarily within the most suitable habitat. Survey efforts included one hour of targeted surveys per hectare of suitable habitat, or 12 hours for the entire 12 ha of suitable habitat. *Pimelea spicata* was not observed during the field survey. No other threatened flora species were recorded. Further detailed information can be obtained in the Threatened Species Survey Report in Appendix 8. No threatened flora species are therefore known to occur on the southern portion of the GWS site.

5.3.2 Vegetation Communities

SLR (refer to Appendices 15 and 16) undertook further assessments of the vegetation on the site, including vegetation community mapping, BioBanking plot field surveys and assessment of the status of the vegetation communities at a State and Federal level. Refer to these Appendices for detailed information.

Figure 7 in Appendix 15 provides a map of the vegetation communities on the site, including their condition. The occurrence of Cumberland Plain Woodland (EPBC Act CEEC and TSC Act CEEC) and River-Flat Eucalypt Forest (TSC Act EEC) is discussed in detail in those documents. This report includes as assessment of the likely impacts to occur to these vegetation communities as a result of the projects.

5.4 Targeted Fauna Survey

Further detailed field surveys were undertaken in the southern portion of the GWS site to ascertain the presence of certain fauna species considered 'likely' to occur on site. This involved using a range of methods such as targeted random meander surveys and spotlighting. To determine which threatened fauna species to target during surveys, a map was created using recorded sightings from the OEH threatened species database. This provided EPS's ecologist with an indication as to those species considered likely to occur on the site. This map can be found in Appendix 18. The records on this map was used in conjunction with the known threatened species records from the locality.

5.4.1 Arboreal and Terrestrial Mammals

Arboreal mammal surveys were conducted on the evenings of 29th of April (1800-2000hrs) and 25th June 2014 (1730-2030hrs). The technique employed involved surveying on foot with a spotlight (for two separate one hour searches over two separate nights). The area walked during each searching period was approximately one kilometre. During the search, the spotlight was shone into the vegetative canopy with the light placed at eye height of the surveyor so that any eye-shine was detected. The weather on the evenings of the surveys was fine with no wind. Subsequent targeted Green and Golden Bell Frog and bat surveys in February 2015 also included some additional opportunistic spotlighting of trees within the woodland area.

5.4.2 Bats

Microchiropteran bat recordings were initially conducted on the evenings of 29th of April and 25th, 26th and 27th June 2014 using a commercially available ultrasonic recorder (Anabat). Surveys were conducted during optimal conditions, during times of little or no wind or rain and were for a period of dusk to dawn. Follow-up microbat surveys using an Anabat were undertaken on the nights of 24th, 25th, 26th and 27th February 2015. See Appendix 14 for details on these surveys.

Recorded echolocation calls were recorded and were sent to Dr Anna McConville at Echo Ecology for interpretation and identification. This Bat Call Identification Report is provided in Appendix 13.

The Bat Call Identification Report confirms that from the May 2014 survey a total of 303 call sequences were able to be analysed and of this number 106 call sequences (35%) were able to be confidently identified to species level. The February 2015 survey resulted in a total of 1,372 call sequences being able to be analysed. Of these bat calls, 326 call sequences (24%) were able to be confidently identified to species level.

The following microbat species were confidently recorded during the EPS surveys:

- *Chalinolobus gouldii* (Gould's wattled bat)
- *Chalinolobus morio* (Chocolate wattled bat)
- ***Miniopterus australis*** **(Little bentwing bat)**
- ***Miniopterus schreibersii oceanensis*** **(Eastern bentwing bat)**
- ***Mormopterus*** **(*Micronomus*)** ***norfolkensis*** **(East-coast freetail bat)**
- *Mormopterus* (*Ozimops*) *ridei* (Eastern freetail bat)
- ***Saccolaimus flaviventris*** **(Yellow-bellied sheathtail bat)**
- *Tadarida australis* (White-striped freetail bat)
- *Vespadelus pumilus* (Eastern forest bat)

Threatened bats recorded are those denoted by bold text in the list above.

Seven other microbat species were considered to potentially occur within the site, however could not be confidently identified. Three of the seven species potentially occurring are threatened species including the Eastern false pipistrelle (*Falsistrellus tasmaniensis*), Large-footed myotis (*Myotis macropus*) and Greater broad-nosed bat (*Scoteanax rueppellii*). These species have been assessed in Appendix 3 and if considered likely to occur on site, they were further assessed through the Seven-part test in Appendix 7.

5.4.3 Koala

The dominant tree species on site consist of Grey Box (*Eucalyptus moluccana*) and to a lesser extent, Forest Red Gum (*E. tereticornis*) and Narrow-leaved Ironbark (*E. crebra*). *Eucalyptus tereticornis* is listed under SEPP 44 Schedule 2 as being a Koala Feed Tree and *Eucalyptus moluccana* is determined to be a 'Secondary' Koala feed tree species as listed under the NSW OEH Koala Recovery Plan in the Sydney Metropolitan Catchment Management Area (DECC 2008).

The City of Campbelltown Koala Habitat Planning Map shows the remnant woodland on the site that would be impacted by the projects to be Marginal Koala habitat quality, with proposed retained habitats along the Georges River being shown as Unknown habitat quality for Koalas. The Draft CCC Koala Plan of Management (KPoM) was prepared in 2003 and Council's website notes that it is in the process of being finalised. It is not known to be publically available at the timing of writing this report.

Campbelltown City Council provided an additional undated and unsourced koala habitat map which was at odds with the Campbelltown Koala Habitat Planning Map, which shows the remnant woodland on the site to be marginal Koala habitat. The other plan shows many small disjunct areas of native vegetation isolated within extensive industrial and residential developments, as preferred habitat, notwithstanding their obvious lack of connectivity, which seems to indicate that the reliability of that mapping is poor. The City of Campbelltown Koala Habitat Planning Map (http://www.campbelltown.nsw.gov.au/Assets/1519/1/KoalaHabitatPlanningMap.pdf) is provided in The Campbelltown (Sustainable City) DCP 2014, which is noted to be "Council's primary DCP". EPS presumes it to be more representative of the koala's habitat in vicinity of the site.

In any case the site is bound by a number of potential barriers to larger terrestrial mammal movement including Cambridge Avenue and Moorebank Avenue, the main south passenger and Southern Sydney Freight railway lines to the west, the East Hills railway line traversing the site and significant residential sprawl surrounding the GWS site. The site is also bounded by a combination of both chain mesh fencing and colourbond fencing that, in combination with the above roads, rail and residential areas, would severely limit Koala movement into the site. The site is exposed, on a daily basis, to considerable anthropogenic disturbance from the operation of the waste facility including noise and dust from truck movement. The site is considered highly degraded and partially fragmented from larger tracts of vegetation that may be used by this species as part of a larger home range.

No anecdotal records or indications of the presence of Koalas were recorded and it is considered unlikely that the remnant woodland on the site is important for the local Koala population.

SEPP 44 core koala habitat is defined as having a resident population of koalas, (breeding females and recent sightings of, and historical records of a population). No koalas or signs of their presence were recorded during the surveys. No records exist on the site. Application of the SEPP 44 guidelines concludes that the development area is not core habitat and therefore that a site specific individual koala plan of management is not required under SEPP 44. Similarly, given the likely absence of Koalas from the site, detailed EPBC Act assessment is not considered to be necessary.

5.4.4 Birds

Diurnal bird surveys were conducted on 29th April 2014 from 1430hrs-1630hrs and 30th April 2014 from 0800-1000hrs. Additional diurnal bird surveys were also completed on the 24th, 25th, 26th and 27th February 2015. See Appendix 14 for details on these surveys and refer to Appendix 10 for the recorded species list.

All birds were identified by observation or by call interpretation. Targeted surveys were undertaken during the morning and afternoon period with little or no wind or rain, thus during optimal conditions for detecting the presence of bird species. Other bird observations occurred as opportunistic sightings whilst undertaking other assessments.

Nocturnal bird surveys were conducted on the evening of 29th April (1800-2000hrs) and 25th June 2014 (1730-2030hrs). Surveys were undertaken in conjunction with spotlighting and bat detection assessments by either visual observations or call interpretation. Surveys were only undertaken during optimal conditions, such as little or no rain.

Recorded diurnal and nocturnal bird species were species either highly tolerant to disturbance or those associated with the aquatic environs contained in the dam. No threatened bird species were recorded.

5.4.5 Amphibians and Reptiles

Additional amphibian and reptile surveys were conducted on 29th (1430hrs-1630hrs) and 30th (0800-1100hrs) of April 2014 as well as on the evening of 29th April (1800-2000hrs) and 25th June 2014 (1730-2030hrs). Surveys were conducted by the EPS ecologist in the woodland and adjoining dam. Other observations occurred as opportunistic sightings whilst undertaking other assessments.

A targeted survey was conducted on 29th (1430hrs-1630hrs) and 30th (0800-1100hrs) of April 2014 to determine the presence or absence of *Litoria aurea* (Green and Golden Bell Frog) which is listed as Endangered in the schedules of the TSC Act and Vulnerable under the EPBC Act. In accordance with the OEH *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft, November 2004* the random meander technique was conducted on the southern parcel of the GWS site to search for this species. The edges and surrounding area of the artificial dam/s were examined thoroughly for any evidence of the Green and Golden Bell Frog. Night time spotlighting surveys using call playback technique were also employed.

Due to Council comments on the previous surveys being undertaken in cooler month, follow-up targeted Green and Golden Bell Frog surveys were undertaken in February 2015. Refer to Appendix 14 for details, although surveys were undertaken over total of five days. Survey methodology was in accordance with the Commonwealth and State surveys guidelines for this species and included both diurnal and nocturnal searches, spotlighting, call playback and dip netting for tadpoles.

Figure 5-1 includes targeted fauna survey locations.

Results of all of these combined comprehensive surveys revealed no evidence of the presence of Green and Golden Bell Frog. Eastern Gambusia (*Gambusia holbrooki*) was recorded in high numbers in the main dam and it is a known predatory fish of Green and Golden Bell Frog eggs. The habitat quality was considered to be relatively low for Green and Golden Bell Frog, with limited fringing aquatic vegetation including Typha which covered about 5% of the dam water surface. Numerous surveys over a number of years and seasons have not recorded this species and it is considered unlikely that it is present on the site. Common frogs recorded during surveys included Common Eastern Froglet, Striped Marsh Frog and Whistling Tree Frog and these are generally known to be tolerant of disturbed aquatic habitats.

5.4.6 Cumberland Plain Land Snail

A targeted survey was conducted on 29th (1430hrs-1630hrs) and 30th (0800-1100hrs) of April 2014 to determine the presence or absence of *Meridolum corneovirens* (Cumberland Plain Land Snail), which is listed as Endangered in the schedule of the TSC Act. In accordance with the OEH *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft, November 2004* the random meander technique was conducted on the southern parcel of the GWS site to search for this species (Figure 5-1), particularly being focussed on the remanent woodland area.

Searches involved targeting habitat features likely to provide shelter for these two species such as in and around trees with focus on loose or shedding bark, under manmade objects such as tin sheets, old tyres and wood piles.

No evidence of Cumberland Plain Land Snail (including empty shells) was located during the targeted survey. This is likely linked to the ongoing underscrubbing of the woodland over a number of years for bushfire protection purposes, which has significantly reduced the microhabitat features (such as bark, logs etc) that would otherwise provide habitat for this species.

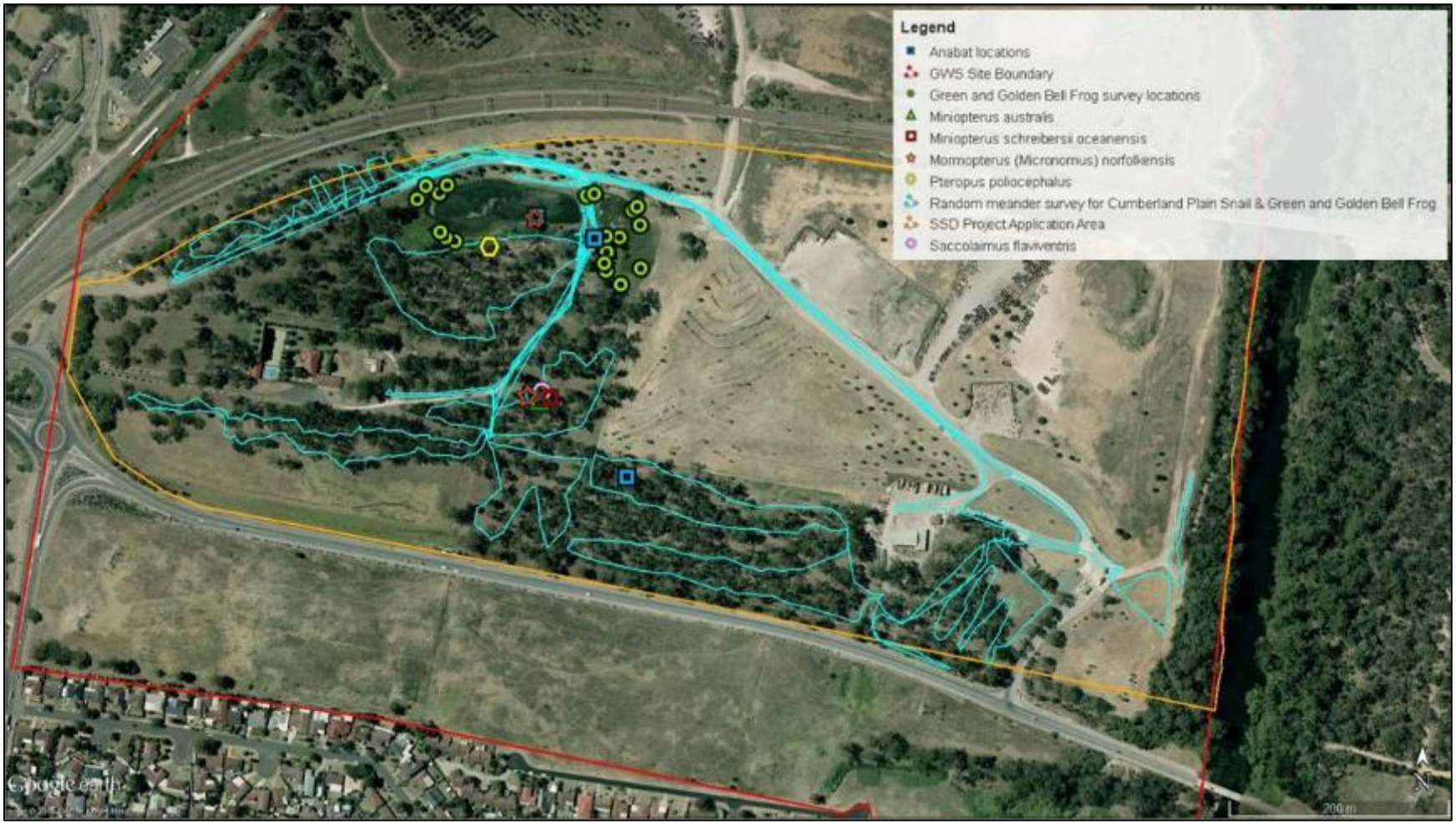

Figure 5-1: Targeted fauna surveys for the Threatened Species Locations.

5.4.7 Opportunistic Observations

A single Grey-headed Flying Fox was observed in a tree at the edge of the dam on the nights of the 24th and 25th February. This species is listed as Vulnerable under both the EPBC Act and TSC Act.

It is likely that this woodland forms part of this species greater foraging habitat in the region.

No permanent camp is known to occur on the site or considered likely. The nearest known camp is located approximately 3.5km to the south at Macquarie Fields and the Commonwealth DoE has identified that the Macquarie Fields camp is Nationally Important.

6 IMPACT ASSESSMENT

6.1 Threatened Species Assessment

Appendix 3 contains the threatened species assessment table. The table provides an analysis of all threatened species and populations recorded or considered likely, to determine those that require further assessment under a 7 part test or EPBC assessment. Similarly, Appendix 4 contains an assessment of likely threatened ecological communities to determine those that require further detailed impact assessment.

Detailed impact assessment was considered to be warranted for those species, populations and ecological communities known to be present, or with a moderate or higher chance of potential impact or those species that could not be discounted via the targeted surveys.

The following threatened species, populations or ecological communities were recorded on the site and required detailed assessments:

Species

- *Miniopterus australis* (Little bentwing bat) (TSC Act Vulnerable);
- *Miniopterus schreibersii oceanensis* (Eastern bentwing bat) (TSC Act Vulnerable);
- *Mormopterus* (*Micronomus*) *norfolkensis* (East-coast freetail bat) (TSC Act Vulnerable);
- *Saccolaimus flaviventris* (Yellow-bellied sheathtail bat) (TSC Act Vulnerable); and
- *Pteropus poliocephalus* (Grey-headed Flying-fox) (TSC Act Vulnerable, EPBC Act Vulnerable).

Populations

- None

Threatened Ecological Communities

- Cumberland Plain Woodland (TSC Act Critically Endangered) / Cumberland Plain Shale;
- Woodlands and Shale-Gravel Transition Forest (EPBC Act Critically Endangered); and
- River-Flat Eucalypt Forest on Coastal Floodplains (TSC Act Endangered).

In additional, as a precautionary measure, impact assessments have been completed for the following species that are considered to have some potential habitat on the site. It should be noted that none of these species were recorded during targeted surveys:

Species

- *Pimelea spicata* (Spiked Rice-flower) (TSC Act Endangered, EPBC Act Endangered);
- *Phascolarctos cinereus* (Koala) (TSC Act Vulnerable, EPBC Act Vulnerable);
- *Litoria aurea* (Green and Golden Bell Frog) (TSC Act Endangered, EPBC Act Vulnerable);
- *Meridolum corneovirens* (Cumberland Plain Land Snail) (TSC Act Endangered);
- *Scoteanax rueppellii* (Greater Broad-nosed Bat) (TSC Act Vulnerable);
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) (TSC Act Vulnerable); and
- *Myotis macropus* (Large-footed myotis) (TSC Act Vulnerable).

The following sections summarise the results of the detailed assessments under the TSC Act and EPBC Act, which are provided in Appendix 7.

6.2 Environmental Protection and Biodiversity Conservation Act 1999

It is considered that the Matters of National Environmental Significance are well understood on the site as a result of the numerous previous and current investigations. The investigations have revealed the following:

- The Critically Endangered Ecological Community Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest is present within the subject site and is considered to be the main Matter of National Environmental Significance requiring consideration;
- Individual Grey-headed Flying Fox (Vulnerable under EPBC Act) were recorded at the edge of the woodland next to the dam;
- No other threatened species or truly migratory species were recorded; and
- Potentially occurring species such as Green and Golden Bell Frog, Koala and Spiked Rice Flower were not considered likely to actually occur following specific targeted surveys. The primary reason for this was the isolation of the habitats on the site combined with the high level of historical disturbance being evident in the habitats that do remain.

In terms of the Grey-headed Flying Fox, no camps are present on the site. A camp is known to occur 3.5km to the south at Macquarie Fields. It is likely that this species only uses the eucalypts on the site as part of a greater foraging range throughout the region. The expansive habitats throughout areas such as Holsworthy defence lands mean that it is unlikely that this species would be impacted to any significant degree by the proposals. Based on the EPBC Act guidelines for this species, an EPBC Referral would not be required as the proposal is unlikely to impact the viability of a camp.

Assessments of the occurrence of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community have been undertaken and are provided in Appendices 4, 7 and 15.

These assessments concluded that a Referral under the EPBC Act should be submitted in relation to the irreversible impacts upon the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. This is primarily due to the total area of the community that is to be removed (despite the condition of the community being disturbed by underscrubbing).

DoE agreed that the projects were likely to result in a controlled action, following submission of the Referral. Provided as an attachment to the 26 November 2015 SEARs, Attachment A outlined the following:

"The Department of the Environment considers that the proposed action is likely to have a significant impact on:

- *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (critically endangered)*

The Department of the Environment considers that the following species are possibly at risk of a significant impact, requiring further assessment at this stage.

- *Yellow Gnat-orchid (Genoplesium bauera) (endangered)*
- *Illawarra Greenhood (Pterostylis gibbosa) (endangered)*
- *Leafless Tongue-orchid (Cryptostylis hunteriana) (vulnerable)*
- *Austral Toadflax (Thesium australe) (vulnerable)"*

The impact of the projects upon Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest has been further assessed in Appendix 7. The Biodiversity Offset Strategy in Chapter 8 outlines the framework that will guide provision of biodiversity offsets for this ecological community in accordance with Framework for Biodiversity Assessment (as required under the Bilateral Assessment process).

The four species above were assessed in Appendix 3 of this Ecological Assessment and considered unlikely to be impacted by the projects. EPS considers that the four species are not likely to occur on the site and highlight that they were not observed on the site following detailed surveys. Additional to the aforementioned, the reasons EPS considers that these four species are not likely to occur are as follows.

The Yellow Gnat-orchid grows in dry sclerophyll forest and moss gardens over sandstone, which is not present on the site. The site is on clay soils of the Cumberland Plain. The species was also not recorded during numerous ecological surveys on the site and the remnant low quality habitat is highly disturbed.

Leafless Tongue-orchid is not generally thought by the NSW Office of Environment and Heritage (OEH) and DoE to occur in the Cumberland Subregion, within which the site is located. OEH also indicates that larger populations typically only occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*), which is not present on the site. The species was also not recorded during numerous ecological surveys on the site and the remnant low quality habitat is highly disturbed.

The Illawarra Greenhood is not generally thought by OEH to occur on the Cumberland Plain in Sydney as it is apparently extinct in western Sydney (which is the area where it was first collected in 1803). It is still known to occur in the Illawarra and Hunter regions of NSW. The species was also not recorded during numerous ecological surveys on the site and the remnant low quality habitat is highly disturbed.

The Austral Toadflax is described by OEH as "Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time". Austral Toadflax is a parasitic plant that grows in association with *Themeda australis. T. australis* was identified within a small portion of the site. However, the area and condition of *T. australis* was not sufficient to support a population of this parasitic species and this species was not identified on site.

Accordingly, these four species have not been further assessed in this Ecological Assessment. No other Matters of National Environmental Significance were considered to warrant further detailed assessment other than the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest and the Grey-headed Flying Fox.

6.3 State Legislation

In accordance with the TSC Act and EP&A Act, an assessment of the SSD and rezoning impacts has been completed via seven-part tests for the following species and communities (those recorded on-site are in bold text):

Threatened Ecological Communities

Cumberland Plain Woodland
River-Flat Eucalypt Forest on Coastal Floodplains

Fauna

Phascolarctos cinereus	Koala
Litoria aurea	Green and Golden Bell Frog
Meridolum corneovirens	Cumberland Plain Land Snail
Pteropus poliocephalus	**Grey-headed Flying-fox**

Hollow/shelter dependent microbats

Saccolaimus flaviventris	**Yellow-bellied Sheathtail-bat**
Mormopterus norfolkensis	**East-coast Freetail-bat**
Scoteanax rueppellii	Greater Broad-nosed Bat
Falsistrellus tasmaniensis	Eastern False Pipistrelle
Miniopterus australis	**Little Bentwing bat**
Miniopterus schreibersii oceanensis	**Eastern Bentwing bat**
Myotis macropus	Large-footed myotis

Flora

Pimelea spicata	Spiked Rice-flower

It was considered unlikely that a significant impact on these threatened species and communities would occur (see Appendix 7).

Mitigation and compensatory measures for those threatened species to be impacted are outlined in Section 7 and a Biodiversity Offset Strategy chapter for Cumberland Plain Woodland impacts is provided in Section 8 of this report.

6.4 Fisheries Management Act

The Department of Primary Industries (Fishing and Aquaculture) Records Viewer indicated that there were no know records of threatened species or ecological communities listed under the FM Act. It is considered unlikely that any species listed under the FM Act would be impacted by the proposal.

6.5 Key Threatening Processes

As outlined in Appendix 5 the proposal is likely to contribute to a number of key threatening processes (KTPs) listed under TSC Act in some form, however the KTPs of particular consideration are “clearing of native vegetation” and “loss of hollow-bearing trees”.

The contribution of the proposal to these KTPs is considered to be moderate and as a result, mitigation measures are proposed such as biodiversity offsets and installation of nest boxes.

In addition, equipment hygiene protocols will be enforced during construction and dead wood considered potential habitat will be moved to outside the impact zone to provide ongoing habitat to fauna. Additionally, provided the recommended equipment wash-down and hygiene protocols are followed to minimise weed spread, the proposed activity will not contribute to or enhance the presence of any invasive species listed under the EPBC Act. Refer to Appendix 6 for relevant considered species.

6.6 BioBanking Assessment

In 2014 SLR prepared two documents that inform the BioBanking and offsetting considerations for the site. These are:

- Proposed Rezoning and Expansion – Cumberland Plain Woodland Assessment Report
- BioBanking Credit Assessment (Field Work Report) EPBC Act Cumberland Plain Shale Woodlands Assessment

The earlier Cumberland Plain Woodland Assessment Report included a vegetation type and condition map and identified the classification of the vegetation on the site at a State level. This included identification of the Cumberland Plain Woodland CEEC and River-Flat Eucalypt Forest EEC.

The later report included detailed BioBanking plots being undertaken in the field to inform BioBanking calculations that outline biodiversity credit requirements. It also included an assessment of the presence of Cumberland Plain Shale Woodlands at a Commonwealth level and concluded that it was present and that an EPBC Referral should be made to the DoE, which has now occurred.

This information will be considered in developing a biodiversity offset approach for the GWS projects as outlined in Chapter 8, including the ecosystem credit requirements for the projects.

7 MITIGATION AND COMPENSATION MEASURES

As the SSD and Rezoning projects will result in unavoidable impacts to ecological values, a number of mitigation and compensation measures are proposed.

These measures consist of the following:

- Site inductions will occur to ensure site worker awareness of ecological sensitivities;
- Any construction management plans will have an ecological section to highlight the relevant issues;
- Vegetation disturbance will be limited to the minimum possible footprint;
- Clearing protocols will be implemented to ensure that clearing of vegetation and in particular the hollow-bearing trees occurs in a sensitive manner;
- Where possible, storage of construction materials will be limited to disturbed cleared areas on the site;
- Hygiene and weed management protocols will be implemented during construction on site to avoid pathogen and exotic species spread into retained areas;
- Disturbance of aquatic habitats will be minimised and erosion and sediment will be managed in accordance with industry standards;
- Nest boxes will be installed at a compensatory ratio of 2:1 for each tree hollow impacted;
- The River-Flat Eucalypt Forest EEC will be incorporated for ongoing management as part of the Biodiversity Offset Strategy; and
- A Biodiversity Offset Strategy will be implemented in relation to impacts upon the Cumberland Plain Woodland ecological community.

Combined, the above measures will ensure that ecological impacts will be adequately addressed.

8 BIODIVERSITY OFFSET STRATEGY

8.1 Background

This Ecological Assessment has outlined the threatened species, populations or ecological communities that are considered likely to be impacted by the SSD and Rezoning projects. The EIS outlines how avoidance has been considered as part of the consideration of alternative projects.

Alternative locations within the GWS site were considered for the proposed facilities. Originally GWS's preference was to situate the recycling infrastructure on a previously filled portion of the site. However discussion with the Environmental Protection Authority indicated that their strong preference was for the development to occur on non-filled land to enable management of potential land contamination delineation and EPL issues. As such, the project is situated on remaining non-filled land, which contains disturbed remnant vegetation.

To address the residual impacts, following consideration of the potential for avoidance and for implementation of mitigation measures, GWS recognises that a biodiversity offset will be required and the approach to determining the offset is outlined in this Biodiversity Offset Strategy (BOS) chapter of the Ecological Assessment.

8.2 Biodiversity Offsets Regulations

8.2.1 Commonwealth

The Guidelines issued in November 2015 by DoE specify the following:

"11. For each of the relevant EPBC Act listed threatened species and community likely to be significantly impacted by the development the EIS must provide:

- *Identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account.*
- *details of how the current published NSW Framework for Biodiversity Assessment (FBA) has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts;*
- *details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the development in accordance with the FBA and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset; "*

As outlined in this Ecological Assessment, the project is considered likely to significantly impact upon Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. This BOS implements the broad principles of the NSW FBA process to a greater degree than is even necessary in NSW as the proposed offset required to be protected will need to be:

- Like for like (i.e. offset will be Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest as defined by DoE, wherever possible); and
- Identifies the credit profiles required to offset the development in accordance with the FBA.

8.2.2 State

The SSD and Rezoning projects both ultimately fall under State legislative requirements. The combined ecological impacts of the projects have been assessed in this Ecological Assessment. The approach of this BOS is to assess requirements for biodiversity offsetting as would be required under the SSD Major Projects requirements.

Originally, Director-General Requirements (DGR's) were received for the SSD project in December 2013. The biodiversity offset framework at that time was for biodiversity offsets to be developed in consideration of the NSW offset principles for major projects.

Subsequent to the original DGR's being received and addressed, new Secretary's Environmental Assessment Requirements (SEARs) were issued in November 2015 as part of the Bilateral Assessment approach being implemented following determination by DoE of likely significant impacts at a Commonwealth level. The SEARs refer to the updated requirement of biodiversity offsets to be developed with consideration of the FBA process that was adopted in October 2014.

Essentially, the FBA process requires biodiversity offsets, following avoidance and mitigation of impacts, to be determined utilising the BioBanking methodology and the NSW Biodiversity Offsets Policy for Major Projects.

Following confirmation of the project impacts on Cumberland Plain Woodland as amounting to 9.5 hectares, it was determined that BioBanking calculations should be undertaken. Toby Lambert (Accredited Assessor 0034), with initial input from Jeremy Pepper of SLR (Accredited Assessor 0107), undertook BioBanking calculations to determine required ecosystem credits to offset the impacts of the project. Purchase or retirement of the required credits would effectively address biodiversity offset requirements for the project at the State, but also the Commonwealth level.

8.3 Consultation with OEH

The BioBanking calculation for the Development impact was submitted to Ray Giddins of OEH in order to ascertain whether the calculations were considered to have been undertaken appropriately.

Following feedback from Mr Giddins, Toby Lambert revised the calculation and resupplied the calculation for comment by Mr Giddins, who indicated that the revised BioBanking calculations were acceptable for the project moving forward to the exhibition stage. Further detail on the actual outcomes of the calculation is provided in this BOS chapter.

8.4 Communities and Species Requiring Offsetting

BioBanking credits can be categorised as either ecosystem credits or species credits.

As outlined in the BioBanking Assessment Methodology (2014) ecosystem credits are:

"a measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biobank site."

and species credits are:

"the class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Species Profile Database."

The results of this Ecological Assessment concluded that, despite targeted surveys occurring for threatened species, no species credit species were recorded. The threatened species recorded were all ecosystem credit species, being *Pteropus poliocephalus* (Grey-headed Flying-fox), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat), *Mormopterus norfolkensis* (East-coast Freetail-bat), *Miniopterus australis* (Little Bentwing bat) and *Miniopterus schreibersii* oceanensis (Eastern Bentwing bat). Offsets for these species are considered to be satisfied by the ecosystem species that will be required to be retired for the impacts upon the Cumberland Plain Woodland. This applies for the Grey-headed Flying Fox which is also listed under the EPBC Act.

Ecosystem credits generated by the impacts of the project relate to the Cumberland Plain Woodland CEEC as it is the only remnant native vegetation type being impacted by the projects.

8.5 Existing Calculations and Credit Requirements

The latest version of the BioBanking calculation undertaken to assess the ecosystem credit requirements of the combined impacts of the projects was undertaken by Toby Lambert (Accredited Assessor 0034) on 2 October 2015, following the receipt of OEH comments on the draft BioBanking calculation as supplied. The calculation was run as a typical Development scenario and also as a Major Project scenario to determine whether there were any impacts on credit requirements using the different approaches. The credit requirements under both scenarios were exactly the same. This is considered to be an important observation as it indicates that whether a standard Development BioBanking calculation is undertaken or a FBA Major Project calculation is undertaken, the credit (i.e. offset requirements) do not differ. Hence the biodiversity offset commitments being proposed to offset the impacts on the Cumberland Plain Woodland at both the State level and the Commonwealth level can be demonstrated to be in compliance with both the older DGR's (offset mechanism not prescribed) and the newer SEARs (prescribes compliance with FBA process).

The current Development / Major Project calculation specifies the following ecosystem credit requirements as outlined in Table 8-1 below.

Table 8-1: Ecosystem credit requirements under BioBanking and FBA calculators

Plant Community Type	Endangered Ecological Communities	Area (ha)	Ecosystem Credits Required	Offset options Vegetation types	Offset options CMA subregions
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion, (ME020)	Cumberland Plain Woodland	9.5	284	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion, (ME020)	Cumberland - Sydney Metro and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

The credit calculator output presented above prescribes what is considered to be an appropriate biodiversity offset for the projects, i.e:

- 284 ecosystem credits are required to be purchased and / or retired;
- These ecosystem credits must be "like for like", which in any event is also a DoE requirement; and
- The credits purchased must be from the Cumberland – Sydney Metro CMA subregions and any IBRA subregion that adjoins the IBRA subregion in which the development occurs.

Sourcing and retiring such ecosystem credits would satisfy both State and Commonwealth offset requirements under the Bilateral Assessment framework.

8.6 Potential Offset Measures

Historically there have been a variety of options available for biodiversity offsetting, which have included:

Direct Offsets

- On-site offsets - protection and rehabilitation of on-site ecological communities and species;
- Off-site offsets - sourcing and conserving off-site properties containing suitable ecological communities and species, including dedication to National Parks or Councils where deemed appropriate; and
- Third party off-site offsets – purchasing credits or funding a third party to provide offsets in an off-site location.

Indirect (Supplementary) Offsets

- Funding land management activities by others; and
- Funding threatened species research and recovery.

The FBA indicates that supplementary measures can only be used in lieu of offsets when offsets are not feasible and other options are needed.

NSW Biodiversity Offsets Fund

The FBA process has introduced an option of payment into a dedicated Biodiversity Offset Fund as an additional option for Major Projects. This Offsets Fund is currently in the development stage and is due for release at the end of the 18 month transition phase (approximately April 2016).

8.7 Proposed Offset Strategy

The complexity of required offsetting outcomes for the projects is relatively uncomplicated as a single ecological community is required to be offset.

It is recognised that at both a State and Commonwealth level, direct biodiversity offsets are preferred as the primary option for offsetting. It is also recognised that the preferred mechanism for this to occur is BioBanking. All avenues should be explored in sourcing the required offset land and ecosystem credits before considering other options such as indirect offsets or payment into the Biodiversity Offsets Fund (when it becomes active and available).

It is also recognised that the River-flat Forest on the site along the Georges River, while not providing like for like offsetting for the project, is of conservation importance and is to be protected and managed as part of resultant conservation outcomes. This could occur under a number of mechanisms such as creation of a BioBank site and/or transfer to government. The exact outcome for the River-flat Forest is not known, although it will not be impacted negatively, only positively. The future Biodiversity Offset Package (BOP) documentation will finalise the agreed outcome for this ecological community following additional consultation with all levels of government.

In preliminary discussions with OEH it has been identified that the other proposed on-site offsets as shown in Appendix 16 are considered unlikely to be acceptable to offset the predicted impacts of the projects. This is primarily as a result of their relatively small size and the location of some of the areas on previous landfill. While GWS reserves the right to argue for some of these areas to be considered for inclusion in any future BOP, the conservation of these areas is now recognised as not being likely to comprise the majority (or indeed any significant component) of any future BOP for the projects.

The preference of GWS is for a direct off-site offset site to be located, purchased and BioBanked. Where any candidate offset lands might be of interest to the National Parks and Wildlife Service, State Government generally or Council for reserve additions, GWS has investigated and is prepared to progress an option of that nature.

Indirect offsets or consideration of payment into the Biodiversity Offset Fund would only be considered where suitable direct offsets on a like for like basis cannot be sourced.

8.8 Direct Offset Search Criteria

Having already committed to prioritising like for like offsets, the search for biodiversity offsets will be guided by the NSW Biodiversity Offsets Policy for Major Projects. Reasonable steps for sourcing like for like offsets, include:

- checking the biobanking public register and having an expression of interest for credits on it for at least six months;
- liaising with an OEH office (or Fisheries NSW office for aquatic biodiversity) and relevant local councils to obtain a list of potential sites that meet the requirements for offsetting;
- considering properties for sale in the required area; and
- providing evidence of why offset sites are not feasible – suitable evidence may include:
    - The unwillingness of a landowner to sell or establish a biobank site; and

- The cost of an offset site itself should not be a factor unless it can be demonstrated the landowner is charging significantly above market rates.

For these projects, OEH has indicated a preference that any off-site offset be at a site where regeneration of a vegetation remnant is possible and that the offset site should be a remnant (or part(s) of a remnant) of sufficient size that the remnant is viable (i.e. preferably over 10ha).

Specifically, the principles that will guide sourcing the offset land/s will include the following:

- To be able to generate sufficient credits to meet the offset requirement for the projects;
- To be located as close as possible to the impact area;
- To have like for like Plant Community Type;
- To have potential for improvement and / or regeneration;
- To be large remnants (preferably over 10ha) with low edge to area ratio;
- To be located in an appropriately zoned location (i.e. BioBanking would not significantly conflict with other pre-existing zoning objectives);
- To be additional to any existing conservation and management requirements;
- To be preferably connected via habitat linkages to other intact protected remnant areas; and
- To provide demonstrated or predicted habitat for threatened species.

A desktop assessment considering all of the above factors and including review of available vegetation mapping, zoning, background ecological reports and wildlife databases would be undertaken to assist in identifying preliminary candidate sites for further consideration.

8.9 Project Commitment

GWS commits to working with DPE, OEH and DoE towards producing a BOP that addresses previous advice and which provides an improved conservation outcome as a result of the impacts of the project. The primary commitments in developing the BOP are:

1. Direct offsets conserving like for like vegetation is the first preference;
2. The preferred conservation mechanism for the offset site is BioBanking;
3. The River-flat Forest area along the Georges River will be protected and conserved;
4. Supplementary measures or payment into the Biodiversity Offset Fund will only be considered if all other avenues in sourcing appropriate offsets have been exhausted; and
5. The BOP will be developed in accordance with the criteria outlined in this Biodiversity Offset Strategy chapter of the Ecological Assessment.

9 CONCLUSION

The Ecological Assessment has assessed the ecological attributes of the Glenfield Waste Site, Glenfield NSW and revealed that:

- No threatened flora species or endangered flora populations were recorded on site during surveys;
- Some portions in the Southern Parcel of the GWS site are Cumberland Plain Woodland CEEC (under the TSC Act and EPBC Act) and River-Flat Eucalypt Forest EEC (under the TSC Act). The Cumberland Plain Woodland will be subject to impacts by the SSD and Rezoning components, while the River-Flat Eucalypt Forest will be retained and protected as part of the future management of the site;
- A majority of the threatened species initially considered likely to occur or to have suitable habitat were not identified during any surveys and this is considered to be related to the high level of historical disturbance on a majority of the site;
- The threatened species recorded during the targeted surveys were threatened microchiropteran and megachiropteran bats species, being *Pteropus poliocephalus* (Grey-headed Flying-fox), *Saccolaimus flaviventris (*Yellow-bellied Sheathtail-bat), *Mormopterus norfolkensis* (East-coast Freetail-bat), *Miniopterus australis* (Little Bentwing bat) and *Miniopterus schreibersii oceanensis* (Eastern Bentwing bat);
- No threatened frog, waterbird, arboreal mammal, or fish species were identified during surveys and are considered unlikely to occur on the investigation area;
- The investigation area supported a farm dam which provided an area of open, deep water for common waterbird species;
- The investigation area had been regularly slashed and managed such that there was a paucity of leaf litter and fallen timber across the site and was likely to provide some foraging habitat for only common bird species such as the Common Myna, Magpie Lark, Eastern Rosella, Common Starling etc;
- The investigation area supported a relatively high number of hollow bearing trees; and
- The investigation area was bound by a number of significant barriers to fauna movement.

The woodland vegetation in the southern parcel of land on the GWS site has been assessed in detail by a number of ecological consultancies over a period of eight years. The overall conclusion drawn from these previous studies and the more recent work by EPS has determined that this site provides only limited suitable habitat requirements for threatened flora and fauna species due to historical and ongoing disturbance. The site does support partial habitat requirements for a number of common native and exotic flora and fauna species. The habitat characteristic of most value within the area to be impact by the project is the occurrence of numerous hollow-bearing trees. These are considered likely to provide suitable roosting habitat for the recorded threatened bat species and as such nest boxes are proposed to offset the impacts to these species.

The detailed considerations of vegetation within the subject site by SLR have determined that some of the woodland vegetation in these areas would constitute an example of the CPW community – as listed both at State and Federal level.

In regards to the potential future development opportunities on the site and the potential removal of CPW vegetation within the GWS, these activities would not have a direct significant impact that is likely to:

- Result in an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or

- Substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

A biodiversity offset is proposed to provide compensation for the impacts to the Cumberland Plain Woodland.

Further consultation and liaison with the Department of Planning & Environment and the Office of Environment and Heritage is required to determine the best pathway for providing the best possible ecological outcomes whilst still enabling the State Significant Development – Recycling Facility and separate rezoning process to proceed.

An EPBC Referral was submitted to the Commonwealth Department of the Environment to enable impacts to Matters of National Environmental Significance (particularly Cumberland Plain Woodland) to be considered at a Federal level. The Commonwealth Department of the Environment has determined the projects are a controlled action in relation to the Cumberland Plain Woodland and as such the action is to be assessed under the bilateral assessment pathway with consideration of the Guidelines issued for the project in November 2015. This report has responded to the project-specific Guidelines and a biodiversity offset is to be provided in accordance with the Biodiversity Offset Strategy contained in this Ecological Assessment.

10 REFERENCES

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