22 August 2012

Grant Eckett
Project Manager, Commercial
Lend Lease
30 The Bond, 30 Hickson Road
Millers Point, NSW, 2000

UPDATED FLORA AND FAUNA IMPACT ASSSESSMENT TO SUPPORT A ENVIRONMENTAL ASSESSMENT FOR NO. 3 MURRAY ROSE AVENUE, HOMEBUSH

Dear Grant

Cumberland Ecology has been engaged to undertake an updated assessment of potential impacts to flora and fauna as a result of the proposed development of a new commercial building (Building B) within an existing mixed commercial and residential development precinct located at No. 3 Murray Rose Avenue (formerly Building B of No. 7 Parkview Drive), Homebush. The area of physical works subject to the current Environmental Assessment (EA) for No. 3 Murray Rose Avenue is referred to hereafter as the 'subject site'.

1. BACKGROUND

The proposed development of No. 7 Parkview Drive, and potential impacts to adjoining areas of Sydney Olympic Park (referred to as the 'study area'), was assessed in detail by Cumberland Ecology in 2009. The assessment of a Concept Plan for No. 7 Parkview Drive included the entire area subject to the current proposal on the subject site. A Flora and Fauna Impact Assessment was prepared under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) which also assessed Matters of National Environmental Significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). As the development is to take place in stages, GPT RE Limited is now seeking approval of its current development, pursuant to Section 75F of the EP&A Act.

It is understood that the proposed works are consistent with those described in the Concept Plan and assessed within the previous Flora and Fauna Impact Assessment (Cumberland Ecology, 2009). As the suitability of the subject site to provide habitat for native species has not changed in the last three years, the previous Flora and Fauna Impact Assessment is considered to appropriately address the requirements of the EP&A Act and EPBC Act for the current Environmental Assessment for the subject site. As a precautionary measure, updated database searches were undertaken for this report to determine whether any threatened species had

been recently listed or recorded from the study area since the previous report was prepared. This letter report provides an update to the existing Flora and Fauna Impact Assessment, and should be read in conjunction with the full report.

2. PROJECT DESCRIPTION

Development of the subject site will include the following works:

- Demolition of the remaining portion of the existing Networks Alliance building (& removal of any trees required to complete demolition);
- Construction of a commercial office building comprising 12,965m^2 of Net Lettable Area (NLA) over five levels with four levels of car park beneath with spaces for 249 cars;
- Provision of 84 bike spaces & associated showers;
- Completion of relevant landscaping; and
- Building will target 5 Star NABERS Energy & Water & 5 Star Green Star Office V3 Design rating.

Associated works that are not part of the EA, will be undertaken by the Sydney Olympic Park Authority (SOPA), and include:

- Construction of the Murray Rose Avenue eastern extension; and
- Construction of the Brickpit park to the North of the subject site.

Based on the information provided by Lend Lease, it is understood that the proposed works are consistent with those described and assessed within the Flora and Fauna Impact Assessment (Cumberland Ecology, 2009).

3. METHODS

This updated assessment is based on information provided by Lend Lease via email, including the description of works, as outlined above, and review of the landscape and design plans for the proposed development. The following documents and plans were reviewed during the preparation of this updated assessment:

- Landscape Report, Parkview Place - 3 Murray Rose Avenue - Drawing Type; Building B Plan (Turf Design 2012); and
- Aerial Photograph of existing site conditions at 7 Parkview Drive, provided by Lend Lease (email from Grant Eckett dated 27/07/2012).

Due to the time delay between the 2009 assessment, and the current proposal for the subject site, an updated search of threatened species, as listed under the *Threatened Species Conservation Act 1995* (TSC Act) and/or EPBC Act, that have been recorded in the locality (within 5km of the subject site) was conducted. This involved the analysis of search results from the Atlas of NSW Wildlife (OEH 2012) and the EPBC Protected Matters Search Tool (SEWPaC 2012).

4. RESULTS

The findings of the updated threatened flora and fauna database search indicate that several additional threatened species have been listed as Vulnerable under the TSC Act since 2009, including; Little Eagle (*Hieraaetus morphnoides*) (NSW Scientific Committee 2010a), Little Lorikeet (*Glossopsitta pusilla*) (NSW Scientific Committee 2009) and White-fronted Chat (*Epthianura albifrons*) (NSW Scientific Committee 2010b). These Vulnerable birds all have some potential habitat in the study area, but not within the subject site.

Of the aforementioned threatened bird species, only the White-fronted Chat is known to reside in the study area (SOPA 2007). The subject site falls within the known distribution of an endangered population of White-fronted Chats in the Sydney Metropolitan Catchment Management Authority (CMA) area. In the Sydney Metropolitan CMA, this species is associated with grassy habitats at the edge of Mangroves and Saltmarsh habitats, a habitat type that is present in the study area and locality. This population is known from the study area, and has been monitored by SOPA (2007) over a number of years.

The Little Eagle (DECCW (NSW) 2010a), may occur in the wider locality, but is not known, and is unlikely to reside in the study area. It has a very large home range and may forage in the study area occasionally, however suitable breeding habitat (tall trees in large remnant patches of vegetation) is not present.

The Little Lorikeet is a highly mobile nomadic species that travels large distances in search of flowering trees to feed on (DECCW (NSW) 2010b), and it has potential to forage in the wider locality, depending on the presence of blossoming tree species. However, it is unlikely to nest in the study area, given the general lack of hollow-bearing trees available that it requires for breeding.

Potential impacts to habitats in the study area adjoining the subject site have been assessed in detail in the Flora and Fauna Impact Assessment (Cumberland Ecology, 2009). As per the findings of the Flora and Fauna Impact Assessment (Cumberland Ecology, 2009), no threatened species or communities will experience direct habitat loss on the subject site as a result of the proposal. Development will occur in an existing commercial / industrial precinct, which has been previously cleared for past landuses, and is devoid of natural vegetation communities or habitat for native species. Known and potential habitat for threatened species populations and ecological communities that occurs in the study area will not be removed or substantially modified as part of the proposed development. As such, no direct impacts on threatened species habitats were anticipated as part of the Flora and Fauna Impact Assessment, and this is still considered to be the case.

Indirect impacts, such as potential decreases in water quality, as a result of proposed development, are considered to be adequately mitigated through measures described in the Flora and Fauna Impact Assessment. The potential indirect impacts to threatened species known to occur in the study area, including the recently listed White-fronted Chats, as a result of the current proposal, are considered to be negligible. Consequently, no significant impacts to threatened or migratory species, endangered populations or ecological communities are likely to occur as a result of the current proposal.

The study area however, is of high conservation significance, including the Brickpit and Badu Mangroves, as shown in Figure 3.1 of the Flora and Fauna Impact Assessment (Cumberland Ecology 2009). It is noted that the mitigation measures suggested as part of the Flora and Fauna Impact Assessment by Cumberland Ecology (2009), will be implemented as part of the current proposal, including landscaping with local provenance native plants, and minimising fertiliser use, so as to avoid an increase in nutrients entering the proximate wetlands and mangroves. This habitat in the study area will continue to provide habitat for threatened and migratory species, including the White-fronted Chat.

Further, the adjoining Brickpit, which is managed by SOPA, will continue to provide habitat for the TSC and EPBC Act listed Green and Golden Bell Frog (*Litoria aurea*). The continued maintenance of a frog fence between the proposed development and the Brickpit will be implemented by SOPA, although this does not form part of the current EA (as the Brickpit is managed by SOPA), and future landscaping in the Brickpit will be consistent with the requirements of the Green and Golden Bell Frog.

5. CONCLUSION

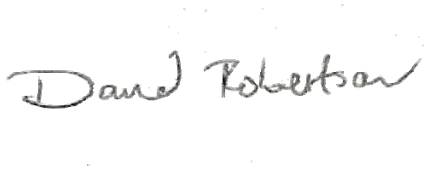
It is considered that the previous Flora and Fauna Impact Assessment (Cumberland Ecology, 2009) adequately assessed the potential impacts relating to the proposed development of the subject site. That assessment indicated that no significant impacts to species, populations or ecological communities listed under the TSC Act or EPBC Act were anticipated.

As the proposed works are consistent with those described and assessed within the Flora and Fauna Impact Assessment (Cumberland Ecology, 2009), it is not anticipated that the proposed development will result in any additional impacts to flora and fauna species, populations and ecological communities listed under the (TSC Act), other than the impacts described in the Flora and Fauna Impact Assessment of 2009.

Several threatened fauna species have been listed as Vulnerable under the TSC Act since 2009, including the Little Eagle, Little Lorikeet and White-fronted Chat. However, only the White-fronted Chat is known to occur in the study area, while the other birds are may utilise the habitats of the study area on occasion, but would be unlikely to reside there. The proposed development will not involve the removal or modification of habitat for these species, and the implementation of comprehensive mitigation measures will avoid indirect impacts to threatened species habitats in the study area. Consequently, no significant impacts to species, populations or ecological communities listed under the TSC Act or EPBC Act are anticipated for the current proposal and no further assessment under the TSC Act or EPBC Act is therefore required.

Please do not hesitate to contact myself or Vanessa Orsborn on 9868 1933 should you require any additional information.

Yours sincerely



David Robertson
Director
david.robertson@cumberlandecology.com.au

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7 PARKVIEW DRIVE, HOMEBUSH

Flora and Fauna Impact Assessment for a Part 3A Project Application

For:

BOVIS LEND LEASE

November 2009

Final Report

Cumberland Ecology
PO Box 2474, Carlingford Court 2118

Report No. 7109RP1

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology

Approved by:	David Robertson
Position:	Project Director
Signed:	
Date:	*13 November, 2009*

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Executive Summary

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Subsequent stages in the "Parkview" development, including extensions of Murray Rose Drive and Dawn Fraser Avenue to connect with Bennelong Parkway, have been considered for the purposes of this flora and fauna impact assessment, although these stages will for separate proposals.

BACKGROUND

The current SOP site at Homebush has a long history of agricultural and industrial uses; including a large area used as a State Abattoir in the early to mid 1900's. More recently, SOP has been used as a major sporting venue.

A suite of environmental studies and assessments have been conducted for SOP, which have fed into the SOP Master Plan 2030. These detailed background studies form the basis of the flora and fauna impact assessment of the subject site.

RESULTS

Important conservation areas occur in the study area, namely the Brickpit and Badu Mangroves. The Brickpit supports a large and established breeding population of the Green and Golden Bell Frog and provides habitat for bat species and a high diversity of bird species, including migratory birds protected under international agreements; JAMBA (Japan-Australia Migratory Birds Agreement) and CAMBA (China-Australia Migratory Birds Agreement) treaties. Badu Mangroves is known habitat for listed migratory waterbirds and is listed on the Register of the National Estate as a "Wetland of Ecological Significance'.

Swamp Oak Floodplain Forest and Coastal Saltmarsh EECs occurs in the study area adjoining Bennelong Parkway within Badu Mangroves. These EECs are approximately 200m from the subject site. Within the saltmarsh community, a listed flora species is known to occur; Narrow-leaf Wilsonia.

No habitat for any flora or fauna species will be removed by the proposal. Other than those mentioned above, the majority of fauna species groups have been disregarded for further

assessment include highly mobile threatened species which will not have any potential habitat removed by the proposal including the following.

IMPACTS

The development of the subject site will not result in direct impacts but will contribute to the increase in indirect impacts on these conservation areas, through the following:

- Potential increases in stormwater run-off and a decrease in water quality, with potential to impact Coastal Saltmarsh and Swamp Oak Floodplain Forest EECs and also Mangrove habitat for associated threatened fauna. However, such impacts will be managed sufficiently to result in no net increase in nutrient loads or stormwater volume;

- Modification to movement corridors for Green and Golden Bell Frogs, although the new parklands proposed for the SOPA lands to the north of the subject site will in fact increase the area of vegetated corridors; and

- Contribute to cumulative impacts from development of the study area, including increase shadowing and lightspill effects on Badu Mangroves, with the potential to disrupt roosting and foraging sites for EPBC listed migratory birds species. However, building heights are below or within height specifications of SOPA. Lightspill is not likely to be significantly increased from levels already experienced from existing development.

CONCLUSION

The proposed development occurs in a landscape which will be largely unaltered. Development will occur in an existing commercial / industrial precinct, and is devoid of natural vegetation communities. The study area however, is of high conservation significance, including the Brickpit and Badu Mangroves.

Mitigation measures have been proposed to ensure that the potential indirect impacts to habitat areas of high conservation value and listed flora and fauna species within. Such mitigation measures are considered adequate for each identified species and EECs.

The construction of Building A on the subject site is not likely to result in any direct impacts on flora and fauna. Associated impacts from all stages of the Parkview development are considered manageable in terms of the proposed mitigation measures. Hence, the indirect impacts described are not considered to result in significant impacts to threatened species, populations and endangered ecological communities listed under the TSC Act or EPBC Act.

Chapter 1

Introduction

1.1 Purpose

Cumberland Ecology Pty Ltd has been engaged to prepare a Flora and Fauna Assessment for the redevelopment of lands at 7 Parkview Drive, Sydney Olympic Park (the subject land). The proposal relates only to construction of Building A, commercial development, which will form part of staged redevelopment of Parkview Drive and surrounds, as designated in Sydney Olympic Park Master Plan 2030.

The objectives of this report are to:

- Describe and map the vegetation communities on the subject land;
- Describe fauna habitats and fauna usage of the subject land;
- Assess the likelihood of threatened species as listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) occurring on the subject land;
- Formally assess the impacts of the proposed development in terms of the Director General's Requirements issued for the assessment of the Major Project under Part 3A of the *Environmental Planning and Assessment Act 1979*; and
- Where relevant, suggest mitigation measures to reduce the impacts of the proposed development on flora and fauna.

1.2 Site Description

The proposal is located at 7 Parkview Drive (the current Samsung Site), Sydney Olympic Park (SOP) and is owned by The GPT Group (GPT) who has been a major stakeholder at SOP since 2001. GPT intend to redevelop and integrate the site into the broader Master Plan 2030 currently under development by the Sydney Olympic Park Authority (SOPA).

The subject land slopes towards Parkview Drive in the south and is built up to form a tiered embankment to Bennelong Drive to the east. Culverts on the eastern embankment

transport stormwater and run-off from the subject land to the wetlands associated with the Badu Mangroves. North of the subject land, SOPA managed land is currently operating as a storage area for industrial materials. Further to the north, steep banks lead to an area known as The Brickpit. The Brickpit is an ecologically sensitive, permanent conservation area, of particular importance as habitat for State and Commonwealth listed threatened species, including the Green and Golden Bell Frog (*Litoria aurea*) and a range of waterbirds. West of the subject land a large carpark and the existing Bronson & Jacobs building occur.

1.3 Proposed Development

"Parkview" will be a mixed-use development targeting 36,000 m^2 NLA (3 x 12,000 m^2 NLA buildings) for commercial use, 13,000 m^2 NLA for residential use and approximately 500m^2 NLA for community use. Building 1 will be 12,000 m^2 NLA and will be the first of the three commercial buildings to be constructed. Landscape is a key element in the Parkview Master Plan.

The Parkview Master Plan development will be staged as follows:

- Stage 1: Construction of Commercial Building 1 and associated infrastructure – design development, approval and construction. Infrastructure includes the extension of Murray Rose Avenue to join with Parkview Drive and some of the public square/landscape to the east of the building.

- Stage 2: Construction of Commercial Building 2 and associated infrastructure – design development, approval and construction. Infrastructure includes the extension of Murray Rose Avenue to join Bennelong Street and create a pedestrian square. Paving and landscaping the square will also be included.

- Stage 3: Construction of Commercial Building 3, Residential Building 4 and mixed-use Building 5 and associated infrastructure –design development, approval and construction. Infrastructure includes the parking access road and loading facilities and landscape. Building 3 may have bridge links connecting to Building 2 and may be constructed at the same time. Infrastructure includes the extension of Dawn Fraser Avenue to join Bennelong Street and the southern area of the public square, service routes and landscaping.

This flora and fauna assessment relates directly to the impacts of Building A only, but has considered the cumulative impacts of all proposed works staged as part of the Parkview Master Plan.

1.4 Terminology

The following terminology is used throughout the report:

- Subject site is defined as the parcel of land on which development is proposed. This refers to the construction of Building A only;
- Subject land refers to the total parcel of land under the Parkview Master Plan;
- Study area refers to the subject land and immediate surrounds that may be indirectly affected by the proposal. This includes the Brickpit, SOPA managed lands to the north and Badu Mangroves;
- Locality refers to the land within a 5km radius of the subject site;
- TSC Act abbreviates the *Threatened Species Conservation Act 1995*;
- EPBC Act abbreviates the *Environment Protection and Biodiversity Conservation Act 1999*;
- EP&A Act abbreviates the *Environmental Planning and Assessment Act 1979*; and
- Threatened species refers to those flora and fauna species listed as vulnerable, endangered or critically endangered under the TSC Act or EPBC Act.

Chapter 2

Site Context

2.1 Sydney Olympic Park

The current SOP site at Homebush has a long history of agricultural and industrial uses; including a large area used as a State Abattoir in the early to mid 1900's. More recently, SOP has been used as a major sporting venue.

A number of planning documents have been prepared for SOP, including:

- Sydney Olympic Park Master Plan 2030: The preparation involved extensive stakeholder consultation to allow for greater development and access to SOP.
- Vision 2025: Released in 2005 to present further options for commercial use;
- Master Plan 2002: Prepared to address the use of the SOP site post Olympic and Paralympic games. Recreational uses were a focus, and some commercial uses incorporated; and
- Master Plan 1995: Prepared for the Olympic and Paralympic games.

A suite of environmental studies and assessments have been conducted for SOP, which have fed into the SOP Master Plan 2030. These detailed background studies form the basis of the flora and fauna impact assessment of the subject site.

Site context, including relevant waterways are shown in Figure 2.1.

Figure 2.1 Subject Site context

2.1.1 Brickpit

SOPA manages the Brickpit as a part of the Parklands, under the provisions of the *Sydney Olympic Park Authority Act 2001*. The 27 hectare Brickpit was formerly the quarry of the State Brickworks, and comprises a landscape of steep exposed slopes, shale and sandstone quarry pits, boulder, rubble and scree piles, and wetland and grassland habitats naturally formed or constructed since the cessation of quarrying. Parklands 2020 identified guidelines and principles to assist in the protection and enhancement of the Brickpit.

The Brickpit site was originally natural woodlands, with subsequent agricultural uses and, from 1911, excavation commenced as an industrial quarry. Freshwater wetlands and grasslands naturally developed in the Brickpit following cessation of the brickworks operations. The Brickpit was initially planned to be developed, however, a large population of the endangered Green and Golden Bell Frog (*Litoria aurea*) was identified in the Brickpit in 1993.

The Brickpit currently supports a large and established breeding population of the Green and Golden Bell Frog and provides habitat for bat species (including the Large Bent-Wing Bat that is listed as vulnerable) and a high diversity of bird species, including migratory birds protected under international agreements; JAMBA (Japan-Australia Migratory Birds Agreement) and CAMBA (China-Australia Migratory Birds Agreement) treaties. The lower levels of the Brickpit have been flooded to form a water storage reservoir for an innovative water-recycling project with national and international significance. Extensive areas of Green and Golden Bell Frog habitat have been constructed on the higher levels of the Brickpit to replace habitat lost with the flooding of the Reservoir (Young, 2003).

2.1.2 Badu Mangroves

The 65 hectare Badu Mangroves is an ecologically significant and diverse estuarine wetland system located on the southern side of Homebush Bay. The wetland has developed following a series of land reclamation and dredging works spanning several decades, and includes extensive mangrove stands, an open water waterbird refuge, a saltmarsh community and an estuarine creek system. A collection of platforms, towers, boardwalks, bird hides and pathways provide a variety of viewing opportunities from which the wetland systems can be enjoyed and studied. Badu Mangroves is listed on the Register of the National Estate as a “Wetland of Ecological Significance’.

The large saltmarsh area was created in 1950s, when the Maritime Services Board was realigning and back-filling the edges of Homebush Bay. The construction of sea walls resulted in the saltmarsh area being cut off from normal tides. The Badu Mangroves currently demonstrate a restored functioning wetland system, with pilot tidal flushing programs in a natural and modified framework.

The Badu Mangroves receive storm water and other runoff from Liberty Grove, City of Canada Bay, the Triangle Pond, Bicentennial Park and the nearby private lands on the western side.

Powells Creek and the foreshore of Homebush Bay provide an important interconnecting corridor, linking the Badu Mangroves and the wetlands of Haslams Reach and Wanngal Wetland and with the smaller wetland upstream in Bicentennial Park and Mason Park. The mangrove forest is dominated by Grey Mangrove, with pockets of River Mangrove (Young 2003).

The combination of saltmarsh, intertidal and freshwater wetlands around Homebush Bay, including the Badu Mangroves, provides one of the most important sites in the Sydney basin for native waterbirds, including migratory shorebirds covered by the JAMBA and CAMBA treaties.

The Badu Mangroves strengthens the regional network of habitat "stepping stones" that allows regionally nomadic birds to move between different parts of the region. New plantings in the area in recent years are now attracting additional species.

The mangrove forest to the south of the saltmarsh is classified as Supplementary Habitat for the Green and Golden Bell Frog by the SOPA Frog Management Plan (AMBS, 1999).

The east and west boundaries of the precinct are screened by intermittent plantings of Swamp Oak (*Casuarina glauca*) and a mixed native under-storey. The boundary plantings partially screen habitat areas including the Waterbird Refuge from movement and light spill from the adjacent road.

Storm water is currently discharged to Badu Mangroves and the Waterbird Refuge from Bennelong Road and from the Triangle Pond through a culvert under Bennelong Road. Increasing urbanisation has impacted on this habitat, although SOPA has implemented a number of management measures to reduce impacts on water quality, such as the installation of water quality control ponds, which double as Supplementary frog habitat (Young 2003).

Chapter 3

Assessment of Existing Environment

3.1 Methods

3.1.1 Literature Review and Database Analysis

A review of the NSW Government BioNet (NSW Government, 2009) database was carried out to list all threatened species which have been recorded within 10km of the site. An EPBC Protected Matters (DEWHA, 2009) search, within a 10km radius, was conducted to provide a list of Commonwealth listed threatened flora and fauna that may occur in the locality. Literature of ecological relevance to the subject land was also reviewed.

A suite of environmental studies and assessments have been conducted for SOP, which have been reviewed and form the basis of the flora and fauna impact assessment of the subject site including:

- Case Study: Waterbird Refuge Tidal Management;
- White-fronted Chat Survey Autumn 2007;
- Nocturnal Waterbird Survey 2007;
- The Brickpit Weed Removal and Habitat Replacement 2006-2007;
- Protecting and Restoring Green and Golden Bell Frog Habitat;
- Key Habitat Areas of Sydney Olympic Park;
- Threatened species and communities at Sydney Olympic Park;
- Winter Survey of Microchiropteran Bats of the Brickpit, Homebush Bay 2001;
- The Bicentennial Park Wetlands Management Plan, 2001;
- Wetland Management Plan, Homebush Bay 2000;
- Flora Survey of Homebush Bay for Olympic Co-ordination Authority, 1998; and
- Homebush Bay Mangrove and Saltmarsh Study Project 1998-99.

3.1.2 Field Survey

A field survey was conducted on the 25th September 2009 by ecologist Vanessa Orsborn. Survey methods used included the following:

- A random meander technique (Cropper, 1993) was used over the subject land, aimed at identifying any listed flora and fauna present while classifying the vegetation types present;
- Fauna habitat assessments were conducted in potential habitats. This included observations of key habitat features such as waterbodies, hollow-bearing trees, logs, leaf-litter, flowering and fruiting trees and shrubs, structured vegetation and connectivity to adjoining native vegetation; and
- Site observations were made, identifying site conditions, such as run-off and dumping of rubbish, which may impact on native vegetation in the locality.

Plant community units were generally classified according to structural details (Specht, 1970) and dominant canopy species. These were then compared to the community names used by Benson and Howell (Benson and Howell, 1994).

3.2 Results

3.2.1 Vegetation Communities

i. Subject Site

The subject is in the location of the existing Samsung building and a row of planted vegetation at the north western corner of the subject land.

ii. Subject Land

Native vegetation on the subject land is limited to planted eucalypts and landscaped garden beds, consisting of various local and non-local species. A small number of original trees are present, namely Moreton Bay Figs (*Ficus macrophylla)* which were planted as part of the abattoir landscaping.

No native plant communities are present on the subject land, although a stand of Swamp Oak (*Casuarina glauca*) has been planted on the eastern slope to slow run-off and increase stability of the bank. Although a structured native understorey is not present, these species form part of an endangered ecological community listed under the TSC Act, Swamp Oak Floodplain Forest. The location of this community is shown in Figure 3.1.

Figure 3.1 Vegetation in the Study Area

iii. Study Area

Directly adjoining the subject land to the north, a large, mostly vacant, lot is held under SOPA management, and appears to be used for storage of machinery and industrial materials, described in Figure 3.1 as a depot. The area does not contain a native plant community, although it does have scattered planted trees, predominantly Brush Box (*Lophostemon confertus*) and Cabbage Palms (*Livistona australis*).

Further north, the Brickpit contains man-made wetlands and ponds. The dominant vegetation within the Brickpit comprises mostly planted shrubs and aquatic macrophytes. Extensive weed removal and replanting has occurred in recent years (Young 2003). Species planted include: *Acacia ulicifolia, Acacia longifolia, Daviesia ulicifolia, Kunzea ambigua*; grasses and graminoids such as *Lomandra longifolia, Gahnia sieberana, Carex appressa, Dianella caerulea, Imperata cylindrical* and *Poa labillardieri*; and aquatic macrophytes such as *Juncus kraussii, Juncus prismatocarpus, Isolepis nodosa* and *Carex appressa (SOPA, 2007a)*.

To the east of the subject land are the Badu Mangroves. Badu Mangroves is listed on the Register of the National Estate as a "Wetland of Ecological Significance'. Badu Mangroves is a large area, including both saltmarsh and mangrove areas.

Dominant mangrove species are Grey Mangroves (*Avicennia marina*) and some areas of River Mangroves (*Aegiceras corniculatum*).

The saltmarsh community is dominated by Samphire (or beaded glasswort; *Sarcocornia quinqueflora*) and the introduced species Spiny Rush (*Juncus acutus*). The community contains the locally significant saltmarsh species *Lampranthus tegens* and *Halosarcia pergranulata*, as well as Narrow-leaf Wilsonia (*Wilsonia backhousei*), a threatened species listed as vulnerable in NSW. The exotic freshwater fern species, *Salvinia molesta* is dominant in Lake Belvedere, south-east of the subject site.

3.2.2 Endangered Ecological Communities

The following EECs are present in the study area:

i. Coastal Saltmarsh

Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions is listed an endangered ecological community under the TSC Act. The community occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. Characteristic plants include *Baumea juncea, Juncus krausii, Sarcocornia quinqueflora, Sporobolus virginicus, Triglochin striata, Isolepis nodosa, Samolus repens, Selliera radicans, Suaeda australis* and *Zoysia macrantha*.

Occasionally mangroves are scattered through the saltmarsh. Tall reeds may also occur, as well as salt pans (DECCW, 2005).

This community occurs in the study area, north-east of the Brickpit, within the Badu Mangroves. This community occurs approximately 200m from the subject site.

ii. Swamp Oak Floodplain Forest

Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions is listed as an endangered ecological community under the TSC Act. The community is associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains (DEC (NSW), 2005).

Swamp Oak Floodplain Forest occurs in the study area between Bennelong Parkway and the Coastal Saltmarsh community, within Badu Mangroves. This EEC is approximately 300m from the subject site.

3.2.3 Rare or Threatened Plant Species

No threatened flora species as listed under the TSC Act or the EPBC Act were recorded on the subject site. Several threatened flora species have been recorded within a 10 km radius and Table 3.1 analyses the likelihood of occurrence on the subject land for each species.

Table 3.1 THREATENED FLORA SPECIES RECORDED IN A 10KM RADIUS OF THE SUBJECT SITE

Species	Legal Status	Presence of Suitable Habitat in the Study Area and Likelihood of Occurrence
Acacia flocktoniae	V (TSC Act)	No suitable habitat is present. Not known to occur in the study area.
Acacia pubescens	V (TSC and EPBC Acts)	No suitable habitat is present. Not known to occur in the study area.
Bothriochloa biloba	V (EPBC Act)	No suitable habitat is present. Not known to occur in the study area.
Callistemon linearifolius	V (TSC Act)	No suitable habitat is present. Not known to occur in the study area.
Dillwynia tenuifolia	V (TSC Act)	No suitable habitat is present. This species does not occur in the locality, but is known from the Penrith and north western Sydney areas, with the nearest record approximately 20km away. However, this species is listed for consideration in the DGRs and has therefore been considered.
Epacris purpurascens var. purpurascens	V (TSC Act)	No suitable habitat is present. Not known to occur in the study area.
Eucalyptus nicholii	V (TSC Act)	No suitable habitat is present. Not known to occur in the study area.
Eucalyptus scoparia	E (TSC Act)	No suitable habitat is present. Not known to occur in the study area.
Grammitis stenophylla	E (TSC Act)	No suitable habitat is present. Not known to occur in the study area.
Hypsela sessiliflora	E (TSC Act)	No suitable habitat is present. Not known to occur in the study area.
Melaleuca deanei	V (TSC and EPBC Acts)	No suitable habitat is present. Not known to occur in the study area.
Pimelea spicata	E (TSC Act)	No suitable habitat is present. Not known to occur in the study area.
Syzygium paniculatum	V (TSC and EPBC Acts)	No suitable habitat is present. Not known to occur in the study area.
Tetratheca glandulosa	V (TSC and EPBC Acts)	No suitable habitat is present. Not known to occur in the study area.
Tetratheca juncea	V (TSC Act)	No suitable habitat is present. Not known to occur in the study area.
Triplarina imbricata	E (TSC Act)	No suitable habitat is present. Not known to occur in the study

Table 3.1 THREATENED FLORA SPECIES RECORDED IN A 10KM RADIUS OF THE SUBJECT SITE

Species	Legal Status	Presence of Suitable Habitat in the Study Area and Likelihood of Occurrence
		area.
Wilsonia backhousei	V (TSC Act)	No suitable habitat on the subject site. Known habitat occurs in the study area within the Saltmarsh community in Badu Mangroves.

3.2.4 Fauna Habitats

A characteristic feature of SOP is the diversity of site uses including large recreational and commercial facilities, and also natural environments managed for conservation. The study area is a direct example of this, as the subject site provides limited and unnatural fauna habitats, while adjoining lands are sensitive natural ecosystems.

i. Subject Site

The subject site includes an existing commercial building, a carpark and landscaped vegetation as part of a Business Park located on Parkview Drive. Fauna habitats are limited to:

- Fruit, nectar and seed producing trees and shrubs;
- Cleared mown areas and planted gardens; and
- Buildings, which have been considered as birds and mammals are known to inhabit suitable structures, although these are unlikely to have suitable cavities for nesting or roosting habitat for such species.

The most notable fauna habitat resource present on the subject site is the large old figs at the perimeter of the subject site.

ii. Study Area

A range of fauna habitats are present throughout the study area and include:

- Fruit, nectar and seed producing trees and shrubs;
- Wetlands, mangroves and saltmarsh aquatic habitats;
- Moderately dense to dense understorey and groundcover, predominantly in the Badu Mangroves;
- Leaf litter and fallen logs;
- Cleared mown areas and planted gardens, predominantly surrounding the existing buildings on Parkview Drive, west and south west of the subject site; and
- Rubble and stockpiles creating refuge habitat, generally located in the SOPA managed land directly to the north of the subject site.

The study area supports a wide variety of habitat types ranging from highly disturbed areas of low quality habitat to areas of relatively low disturbance with high quality habitat.

The flower, nectar and seed producing tree and shrub species provide a seasonal foraging resource for a range of arboreal mammal and bird species.

The Brickpit and Badu Mangroves, with their associated aquatic habitats provide habitat for a number of bird, mammal, reptile and amphibian species, including a large number of TSC Act and EPBC Act listed fauna species.

The cleared areas and landscaped gardens associated with the Business Park provide habitat for mostly exotic bird and mammal species.

3.2.5 Corridors and Connectivity

Movement corridors exist for Green and Golden Bell Frogs and wetland birds, between the Brickpit, Badu Mangroves, and adjoining habitats in Bicentennial Park and also Powells Creek and the Parramatta River catchment. Monitoring surveys by Sydney Olympic Park Authority (SOPA, 2007b) indicate that the Parramatta River estuary provides an inter-related network of wetland habitats utilised by a range of waterbirds, including migratory species.

The limited areas of vegetation on the subject site form part of this movement corridor, although it is currently bissected by Bennelong Road. Wetland birds, most of which are migratory, are highly mobile and are expected to fly over the subject land and other structures. The Green and Golden Bell Frog, and other less mobile aquatic species such as reptiles and amphibians are more likely to utilise the grassy habitats on the subject site and connecting vegetation in the study area.

3.2.6 Threatened Fauna Species

A number of threatened fauna species were identified as occurring or having the potential to occur in the locality: details of these fauna species are supplied in Table 3.2 below. Oceanic species identified in the desktop review were not included in the table due to a lack of suitable habitat within the subject site.

A large number of listed fauna species are known to be present in the study area , including; migratory species Pacific Golden Plover, Lathams Snipe, Marsh Sandpiper, Common Sandpiper, Pectoral Sandpiper, Curlew Sandpiper, Eastern Curlew, Bar-tailed Godwit, Black-tailed Godwit, and Red-necked Stint (SOPA, 2007b). The Green and Golden Bell Frog, listed under both the TSC Act and EPBC Act is known from the study area.

In the study area, the Badu Mangroves is known to provide habitat for Little Bent-wing Bat and the Large Bent-wing Bat, recorded in surveys over 2001- 2002 (Hoye, 2001). The Little Bent-wing bat is not known to occur anywhere else within the Parklands, and previously was not known to occur south of the Hawkesbury River (Young 2003).

Table 3.2 THREATENED FAUNA RECORDED WITHIN A 10KM RADIUS OF THE SUBJECT SITE

Common Name	Scientific Name	Legal Status	Presence of Suitable Habitat in Study Area and Likelihood of Occurrence of Species
Green and Golden Bell Frog	*Litoria aurea*	V (TSC and EPBC Acts)	Known habitat occurs in the study area, primarily in the Brickpit. The perimeters of the subject land may act as part of a movement corridor between the Brickpit and Supplementary Habitat such as Badu Mangroves.
Great Egret	*Ardea alba*	M (EPBC Act)	Known to occur in the study area.
Cattle Egret	*Ardea ibis*	M (EPBC Act)	No habitat present on the subject site. Unlikely in the study area.
Australasian Bittern	*Botaurus poiciloptilus*	V (TSC Act)	Potential habitat may occur in the study area, in Badu Mangroves, although this is not ideal habitat as they prefer freshwater wetlands with dense reeds. This species has not been recorded during any surveys of SOP land.
Black-necked Stork	*Ephippiorhynchus asiaticus*	E1 (TSC Act)	Unlikely. This species is rarely recorded south of Sydney and has not been recorded in any surveys of SOP land.
Osprey	*Pandion haliaetus*	V (TSC Act)	No nest sites known from the study area, although this species is known from the Parramatta River Catchment. May occur in the study area.
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	M (EPBC Act)	No habitat present on the subject site. Potential habitat may occur in the study area.
Latham's Snipe	*Gallinago hardwickii*	M (EPBC Act)	Known to occur in the study area.
Black-tailed Godwit	*Limosa limosa*	M (EPBC Act)	Potential habitat may occur in the study area. Has not been recorded in recent surveys of SOP lands.
Bar-tailed Godwit	*Limosa lapponica*	M (EPBC Act)	Known to occur in the study area.

Table 3.2 THREATENED FAUNA RECORDED WITHIN A 10KM RADIUS OF THE SUBJECT SITE

Common Name	Scientific Name	Legal Status	Presence of Suitable Habitat in Study Area and Likelihood of Occurrence of Species
Little Curlew	*Numenius minutus*	M (EPBC Act)	Potential habitat may occur in the study area
Whimbrel	*Numenius phaeopus*	M (EPBC Act)	Potential habitat may occur in the study area
Eastern Curlew	*Numenius madagascariensis*	M (EPBC Act)	Known to occur in the study area.
Marsh Sandpiper	*Tringa stagnatilis*	M (EPBC Act)	Known to occur in the study area
Common Greenshank	*Tringa nebularia*	M (EPBC Act)	Known to occur in the study area.
Wood Sandpiper	*Tringa glareola*	M (EPBC Act)	Potential habitat may occur in the study area
Terek Sandpiper	*Xenus cinereus*	M (EPBC Act)	Potential habitat may occur in the study area
Common Sandpiper	*Actitis hypoleucos*	M (EPBC Act)	Known to occur in the study area
Grey-tailed Tattler	*Heteroscelus brevipes*	M (EPBC Act)	Potential habitat may occur in the study area
Ruddy Turnstone	*Arenaria interpres*	M (EPBC Act)	Known to occur in the study area.
Great Knot	*Calidris tenuirostris*	M (EPBC Act)	Potential habitat may occur in the study area
Red Knot	*Calidris canutus*	M (EPBC Act)	Known to occur in the study area.
Sanderling	*Calidris alba*	M (EPBC Act)	Potential habitat may occur in the study area
Red-necked Stint	*Calidris ruficollis*	M (EPBC Act)	Known to occur in the study area
Pectoral Sandpiper	*Calidris melanotos*	M (EPBC Act)	Known to occur in the study area
Sharp-tailed Sandpiper	*Calidris acuminata*	M (EPBC Act)	Known to occur in the study area
Curlew Sandpiper	*Calidris ferruginea*	M (EPBC Act)	Known to occur in the study area.
Broad-billed Sandpiper	*Limicola falcinellus*	M (EPBC Act)	Potential habitat may occur in the study area
Australian Painted Snipe	*Rostratula australis australis*	V & M (EPBC Act)	Potential habitat may occur in the study area
Pacific Golden Plover	*Pluvialis fulva*	M (EPBC Act)	Known to occur in the study area

Table 3.2 THREATENED FAUNA RECORDED WITHIN A 10KM RADIUS OF THE SUBJECT SITE

Common Name	Scientific Name	Legal Status	Presence of Suitable Habitat in Study Area and Likelihood of Occurrence of Species
Grey Plover	*Pluvialis squatarola*	M (EPBC Act)	Potential habitat may occur in the study area
Double-banded Plover	*Charadrius bicinctus*	M (EPBC Act)	Potential habitat may occur in the study area
Lesser Sand Plover	*Charadrius mongolus*	M (EPBC Act)	Potential habitat may occur in the study area
Greater Sand Plover	*Charadrius leschenaultii*	M (EPBC Act)	Potential habitat may occur in the study area
Oriental Pratincole	*Glareola maldivarum*	M (EPBC Act)	Potential habitat may occur in the study area
Superb Fruit-Dove	*Ptilinopus superbus*	V (TSC Act)	Unlikely to occur in the study area.
Superb Parrot	*Polytelis swainsonii*	V (TSC & EPBC Acts)	Unlikely to occur in the study area.
Swift Parrot	*Lathamus discolor*	E1 (TSC and EPBC Acts)	Unlikely to occur in the study area
Orange-bellied Parrot	*Neophema chrysogaster*	CE (TSC and EPBC Acts), M (EPBC Act)	Unlikely to occur in the study area
Ground Parrot	*Pezoporus wallicus*	V (TSC Act)	Unlikely to occur in the study area
Powerful Owl	*Ninox strenua*	V (TSC Act)	Unlikely to occur in the study area
Grass Owl	*Tyto capensis*	V (TSC Act)	Unlikely to occur in the study area
White-throated Needletail	*Hirundapus caudacutus*	M (EPBC Act)	Unlikely to occur in the study area
Rainbow Bee-eater	*Merops ornatus*	M (EPBC Act)	Unlikely to occur in the study area
Regent Honeyeater	*Xanthomyza phrygia*	E1 (TSC & EPBC Acts)	Unlikely to occur in the study area
Black-faced Monarch	*Monarcha melanopsis*	M (EPBC Act)	Unlikely to occur in the study area

Table 3.2 THREATENED FAUNA RECORDED WITHIN A 10KM RADIUS OF THE SUBJECT SITE

Common Name	Scientific Name	Legal Status	Presence of Suitable Habitat in Study Area and Likelihood of Occurrence of Species
Satin Flycatcher	*Myiagra cyanoleuca*	M (EPBC Act)	Unlikely to occur in the study area
Rufous Fantail	*Rhipidura rufifrons*	M (EPBC Act)	Unlikely to occur in the study area
Mammals			Potential habitat may occur in the study area
Grey-headed Flying-fox	*Pteropus poliocephalus*	V (TSC Act)	Known to occur in the study area. May forage on scattered trees on the subject site, such as Figs.
Little Bentwing-bat	*Miniopterus australis*	V (TSC Act)	Known habitat occurs in the study area. Is likely to forage over the subject site.
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V (TSC Act)	Known habitat occurs in the study area. Is likely to forage over the subject site.
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V (TSC Act)	Potential habitat may occur in the study area. However, this species has not been recorded during any surveys on SOP.
Spotted-tailed Quoll	*Dasyurus maculatus*	V (TSC Act)	Unlikely to occur in the study area
Brush-tailed Phascogale	*Phascogale tapoatafa*	V (TSC Act)	Unlikely to occur in the study area

3.2.7 Summary of Threatened Species Determination

Tables 3.1 and 3.2 provide an assessment of the likelihood of threatened flora and fauna species recorded within ten kilometres of the subject site, occurring at the subject site (Obligate marine species recorded within the ten kilometre radius have been excluded from the assessment). Several of the threatened species listed in Tables 3.1 and 3.2 may utilise habitats presenting the study area however, they are considered unlikely to occur on the subject site due to the highly modified vegetation and lack of important resources such as intact and structured vegetation for shelter. Indirect impacts, such as run-off from the proposed development, on good quality habitats in the study area are therefore the main focus of this assessment, as detailed in Chapter 4.

Terrestrial flora species which are known to occur in native vegetation areas have all been disregarded, as no habitat will be removed by the proposal.

Fauna species groups which have been disregarded for further assessment include highly mobile threatened species which will not have any potential habitat removed by the proposal including the following.

Terrestrial birds which may visit the study area on occasion to forage on planted and native vegetation, the removal of plantings on the subject land will be of little consequence to these species;

Bats, including the Large Bentwing-bat, Little Bentwing-bat and Grey-headed Flying-fox which occur in the study area, are not considered likely to be affected in a negative way by the proposal. In fact, the inclusion of outdoor lighting and the potential for some lightspill has the potential to increase the concentration of insects drawn to the light. In this regard, there is the possibility for the proposal to have a positive or neutral affect on microchiropteran bat species. No habitat for these bats will be removed, and the planting of fruiting and flowering trees, particularly figs as part of landscaping will increase habitat for Grey-headed Flying-fox.

Arboreal Mammals not considered likely to be present on the subject land due to a complete lack of important habitat features such as hollow-bearing trees for shelter.

Ground-dwelling Mammals are not considered likely to occur on the subject land due to a lack of native understorey vegetation for shelter and habitat.

Chapter 4

Assessment of Impacts

This chapter provides an assessment of the likely impacts of the proposal on threatened species and addresses **Step 3** of the Draft Guidelines for Threatened Species Assessment (DEC and DPI , 2005). This step involves identifying not only the magnitude and extent of impacts, but also the significance of the impacts as related to the conservation importance of the habitat, individuals and populations likely to be affected. Impacts will be more significant if:

- Areas of high conservation value are affected;
- Individual animals and/or plants and/or subpopulations that are likely to be affected by the proposal play an important role in maintaining the long-term viability of the species, population or ecological community;
- Habitat features that are likely to be affected by the proposal play an important role in maintaining the long-term viability of the species, population or ecological community;
- The duration of impacts are long-term; and
- The impacts are permanent and irreversible.

Measures to avoid and mitigate these impacts have been outlined in Chapter 5 of this document. Formal assessment of significance, for both species and communities listed under both the TSC Act and EPBC Act, are provided in Appendix A, with consideration of the impacts outlined in this chapter, and the mitigation measures in Chapter 5.

4.1 Key Impacts of the Proposal

4.1.1 Direct Impacts

i. Vegetation Clearance

Direct impacts from the proposed development will include the clearing of native vegetation which is listed as a Key Threatening Process (NSW Scientific Committee, 2004) and has been identified as a direct cause in the decrease in biodiversity. However,

the vegetation on the subject site consists of planted native and exotic trees, shrubs and ground-cover species, restricted to landscaped garden beds and road verges. In such landscaped environments, natural regeneration does not occur as there is no native seedbank. This vegetation is not structured as a functioning ecological community and lacks the majority of resources for flora and fauna habitat, and is therefore of very low conservation value. Hence, this KTP is not expected to be exacerbated by the removal of vegetation on the subject site.

The flowering trees and shrubs do however provide limited food resources for some native fauna species, although due to the highly fragmented nature of the plantings, and urban environment, theses are predominately urban specialists, such as common native and exotic birds, which are not listed species and are low conservation priority.

ii. Reduced Area of Movement Corridors

The subject land is currently identified as being part of a movement corridor for Green and Golden Bell Frogs, broadly linking the Brickpit and Badu Mangroves. The increased building area on the subject site will reduce the movement corridor area available.

Presently however, movement between the subject land, SOPA lands to the north and Badu Mangroves is fragmented by Bennelong Parkway. A preferred movement corridor for Green and Golden Bell Frogs is likely to be via the existing underpasses between the Brickpit and Badu Mangroves, under Bennelong Parkway.

The landscaping design as part of the proposal includes linear garden beds which will be planted with suitable grasses for sufficient cover to allow for movement by Green and Golden Bell Frogs. It is not anticipated that the proposed development will significant reduce the movement of this species between areas of adjoining habitat.

4.1.2 Indirect Impacts

The greatest potential indirect impacts from the proposed development is the potential increased flow and decreased quality of stormwater and construction related run-off from the proposed development, which would enter Badu Mangroves downslope and to the east of the subject site.

i. Hydrology

The construction of roads and buildings on the subject site is likely to have an impact on soils by increasing levels of nutrients via rainwater runoff. Whilst some nutrients are more readily dispersed through soil strata, phosphorus is largely retained and can be expected to favour growth of exotics in preference to most native species.

Hydrological changes have already occurred on and around the subject site in the past due to the previous development. Consequently, Badu Wetlands is already impacted by high nutrient loading and subsequent algal blooms.

As proposed development will occur upslope of the wetlands, the mangroves in particular will receive elevated nutrients in overland rainwater and subsurface flows. A Concept Design of a Stormwater Drainage System for the subject site has been prepared by Hughes Trueman (2009). The study indicates the following:

- An on site stormwater detention structure is not required; and
- The velocity of stormwater flow existing the culvert into Bennelong Creek is 1.6m/s which is below the scour

A review of control measures required to maintain and improve water quality will be conducted as part of the detailed design phase. All drainage works will be in accordance with SOPA requirements and relevant legislation. Water quality will be maintained by the establishment of silt fences around the development site and filtration of stormwater outlets, in compliance with SOPA and ANZEC requirements.

Increased levels of runoff from stormwater could result in increased weed invasion through seed transferral within stormwater as well as increased nutrient levels. However, weed dispersal will be limited by limiting stormwater runoff through measures outlined in Chapter 5.

ii. Altered light regimes

The proposed development will alter the current light regime within the Badu Mangroves, due to the increased area and height of the buildings. This effect can result in a change in species composition within communities as light sensitive or light dependent species die out from over- or under-exposure. However, Building A will not shadow the mangroves and the height specifications for all buildings associated with Parkview have been addressed in SOP Master Plan 2030.

There is also the potential for “light spill” effects from building and street lighting at night. However, the heights of the buildings have been considered by SOPA in the Master Plan 2030 and the main source of light spill with potential to reach the mangroves is future street lighting near Bennelong Parkway. Building A will not contribute significantly to light spill on the mangroves.

iii. Increased access

The proposed development will increase the number of people working in the study area. Increased road and pedestrian access in an around the subject land will subject sensitive conservation areas, such as the Brickpit, to increased human access potentially resulting in vegetation trampling and rubbish dumping.

Increased accessibility to the Brickpit and Badu Mangroves may increase the risk to vegetation communities from pests and disease for both flora and fauna. However, SOPA manages and restricts access to these parklands through established tracks. Feral animals such as cats and foxes may be more likely to use the area thereby impacting upon native fauna, and weeds will have more vectors (humans, animals, vehicles) for transfer into the area.

4.2 Impacts on Endangered Ecological Communities

Two endangered ecological communities occur in the study area, and have the potential to be indirectly impacted by the proposal, including:

- Coastal Saltmarsh, which occurs as part of the Badu Mangroves, north east of the subject site; and
- Swamp Oak Floodplain Forest, which adjoins the Coastal Saltmarsh area, to the north east of the subject site.

The EECs and mangrove ecosystems are linked as one waterway downstream to Powells Creek and Parramatta River. Water quality impacts and the potential increase in weed abundance have the potential to modify these communities, as described in Section 4.2.1 below. Mitigation measures, such as the establishment of water detention ponds and filtration will be implemented, and hence are not expected to impact on the EECs in the study area.

4.2.1 Increased Run-off and Decrease in Water Quality

The proposal has the potential to increase the quantity of stormwater run-off and decrease the water quality in Badu Mangroves and associated habitats, such as the downstream area of Coastal Saltmarsh. However, a preliminary Concept Design for a Stormwater Drainage System has determined that no significant increase in stormwater run-off flow will be experienced from the subject site.

Factors which can influence changes in mangrove and saltmarsh vegetation coverage include sea level rise, land clearing, urbanisation, industrialisation, sedimentation and nutrients. The decline of saltmarsh is noted to be associated with invasion of mangroves, under conditions which favour mangroves establishment.

Impacts of urban development on mangrove and saltmarsh wetlands are generated through freshwater runoff, higher nutrient content via stormwater discharge and the effect of lower soil and water salinities all acting in a cumulative manner to facilitate increased and invasive mangrove growth, as found in a study of Brisbane Waters NSW (Harty and Cheng, 2003).

Impacts associated with a decrease in water quality have the potential to influence fish breeding sites and to lesser extent wading bird habitat through the reduction in invertebrates, which are a primary food source.

Through implementation of mitigation measures such as water detention basins, as described in Chapter 6, no significant decrease in water quality is predicted.

4.3 Impacts on Flora Species Listed Under the TSC Act and the EPBC Act

No State or Commonwealth listed threatened flora species have been recorded on the subject site during the current site investigation, or during previous surveys.

One threatened flora species is known to occur in the study area; Narrow-leaf Wilsonia which is a saltmarsh species and occurs in Badu Mangroves.

As described in more detail above, the mangrove and saltmarsh communities are not likely to be significantly impacted by the proposal. Narrow-leaf Wilsonia is tolerant of varying quantities of freshwater, although this is not predicted to increase significantly from existing levels.

Narrow-leaf Wilsonia has the potential to be affected by the proposal, and has therefore been assessed further in Appendix A. No significant impacts to this species are predicted as a result of the proposal.

Potential habitat for additional threatened flora species in the broader study area will not be impacted by the proposal and have not been considered further.

4.4 Impacts on Fauna Species Listed Under the TSC Act and the EPBC Act

The greatest potential impacts to fauna species listed under the TSC Act or EPBC Act are due to indirect impacts from the proposed development, including the following:

- Decrease in water quality in Badu Mangroves from run-off, impacting on the habitat of TSC Act wading birds and EPBC Act listed Migratory birds and supplementary Green and Golden Bell Frog habitat (described in Section 4.2.1);
- Reduction in connectivity;
- Shadowing of the mangroves and lightspill disturbances to listed bird species; and
- Increased bird strikes with the new building

These impacts are described in more detail below.

Species considered to have potential to be affected by the proposed development are:

- Green and Golden Bell Frog; and
- Waterbirds (including migratory birds).

The detailed assessment of impacts to the threatened fauna species identified above is provided in Appendix A. The results of the impact assessment indicate that no significant impact to these fauna species is likely as a result of the proposed development, or future stages of the development.

Other species with potential to occur in the study area, as identified in Table 3.2 are not considered to be affected by the proposal and have not been considered further.

4.4.1 Reduction in Connectivity

Although the subject site is currently developed, there is some connectivity from north to south between the Brickpit, SOPA lands and Badu Mangroves to the south-east and also a small southern water quality control pond. The proposal will increase the area of physical buildings, however, these will be spaced and landscaped between buildings in a north-south direction, and hence will maintain a level of connectivity.

Connectivity is especially important for the SOP Green and Golden Bell Frog population. Supplementary habitat has been identified to the north of the subject site, in SOPA depot area and in Bennelong Pond, within Badu Mangroves to the south-east. An existing underpass occurs under Bennelong Parkway, to vegetation in the vicinity of Parkview Drive, just south of the subject site. The location of this habitat and the connecting underpasses, suggest that this species moves through the subject site on occasion towards the northern area of supplementary habitat and primary habitat in the Brickpit (Young, 2003). Further development of the subject site will therefore interrupt this connectivity for Green and Golden Bell Frogs.

However, the landscape design include vegetation suitable for mobile species to use as “stepping stones” and suitable for less mobile species to move through the area with shelter provided by long grasses and shrubs.

4.4.2 Shadowing and Lightspill

There is potential for the proposed development to shadow the mangroves, which can result in dieback. However, the buildings are spaced with garden beds and small parks between buildings, and they occur to the west of the mangroves, and hence will only cause shadowing in the late afternoon.

Lightspill is of greater concern, as migratory waders have been recorded to be disturbed by lights impacting on roosting and foraging nocturnal wetland habitats.

In a recent monitoring program by Sydney Olympic Park Authority (2007) it was found that; "Some birds appeared to be easily disturbed at night by low levels of human activity that could be considered normal during the day – behaviour varied from moving away from the edge of the water to taking flight. Ducks and gulls in particular appeared to be very 'flighty' at night and it was apparent that one disturbed bird could cause the whole flock to take flight."

At Sydney Olympic Park, the Waterbird Refuge is the most important nocturnal roost site for waterbirds, including the migratory Bar- tailed Godwit and Sharp-tailed Sandpiper Sydney Olympic Park Authority (2007). This habitat will not be impacted by lightspill from the proposal, as the Waterbird Refuge is more than 1km north east of the subject site and outside the range of light shine. Lightspill already occurs in various locations in the study area from streetlights and large buildings and facilities. These impacts are pronounced in areas such as the mangroves adjoining Homebush Bay Drive.

The proposed development of Building A is not likely to contribute greatly to the existing lightspill effect in Badu Mangroves, due to its proximity, although future stages of the Parkview development will contribute to cumulative effects in this regard. Bennelong Pond may experience some increased lightspill, although this is not known to be a prominent roost site for migratory birds, and furthermore, the continuation of plantings of tall screening vegetation, as currently exists, will greatly reduce this impact, as well as the implementation of additional measures, such as light timers in the buildings at night.

These issues have been addressed in the Master Plan 2030.

4.4.3 Bird Strike on Buildings

The window strike hazard is likely to increase for resident and migrant birds as the construction of new buildings will contain large expanses of glass. Any factor that increases the density of birds near windows is known to increase strike rate (Klem Jr., 1990a, Klem Jr., 1990b). Consequently, the incorporation of water features close to the buildings and planting of aesthetic vegetation in front of or near to windows increases the hazard.

There is the possibility that the staged building construction will exacerbate the impacts as resident birds using the study area as part of their regular flight path will adapt to the first building and then later collide with subsequent buildings as they are erected. This is highly unlikely however, as birds are likely to be scared off by the working on site, and are more likely to adapt to avoiding the area completely.

Birds strikes with windows in the long-term are likely to increase, however these are not predicted to be significant and specific mitigation measures have been incorporated into the design to reduce these impacts.

4.5 Cumulative Impacts

The proposed works are staged, and as such have the potential to compound impacts such as bird strikes, due to the constant changes to the structure height and layout, which may further interrupt flight paths.

The increased access, including proposed new roads linking the more industrial western side of SOP with Bennelong Parkway, through Parkview Drive will likely result in further development in the remaining vacant or development potential lands. Impacts to threatened flora, fauna and ecological communities in the study area, as already discussed, will therefore be increased cumulatively. It is expected that these impacts can be managed to reduce impacts, and are not likely to threaten the survival of these species and communities in the future.

4.6 Additional Legislative Requirements

4.6.1 SEPP 14 State Significant Wetlands

State Environmental Planning Policy No 14 – Coastal Wetlands (SEPP 14) applies to many wetlands on the coast of NSW. The Policy is designed to protect wetlands from ad hoc clearing, draining, filling and levee construction. The proposal does not involve the activities under which this policy applies. No EIS is required.

4.6.2 State Environment Planning Policy (SEPP 44) – Koala Habitat

The SEPP 44 requires that any development proposal affecting one hectare or more of a property must be evaluated for potential and core Koala habitat. Potential Koala habitat is defined as 'areas of native vegetation where the trees listed in Schedule 2 (of SEPP 44) constitute at least 15% of the total number of trees in the upper and lower strata of the tree component'. Should potential Koala habitat be found, further investigation for the existence of core Koala habitat should be undertaken. Core Koala habitat is defined as 'an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population'. If such habitat is found, then a detailed Plan of Management should be prepared for the Koala colony in the area (Department of Planning, 1995).

Koalas may use several different tree species as feed trees within their home ranges. Those Eucalyptus species frequently used by Koalas as feed tree are listed in Schedule 2 and provided in Table 5.

None of the listed Schedule 2 Koala feed tree species were found at the subject site, therefore no further investigation was undertaken.

Table 4.1 SEPP 44, SCHEDULE 2 – KOALA FEED TREE SPECIES

Scientific Name	Common Name
Eucalyptus tereticornis	Forest Red Gum
Eucalyptus microcorys	Tallowwood
Eucalyptus punctata	Grey Gum
Eucalyptus viminalis	Ribbon or Manna Gum
Eucalyptus camaldulensis	River Red Gum
Eucalyptus haemastoma	Broad-leaved Scribbly Gum
Eucalyptus signata	Scribbly Gum
Eucalyptus albens	White Box
Eucalyptus populnea	Bimble Box or Poplar Box
Eucalyptus robusta	Swamp Mahogany

4.6.3 NSW Fisheries Management Act 1994

The *Fisheries Management Act, 1994* (FM Act) aims to conserve, develop and share the fishery resources of the state for the benefit of present and future generations. The Act, which is administered by NSW Fisheries, incorporates the principles of the TSC Act regarding the assessment of significance of impacts on threatened species and their habitat with respect to listed aquatic species.

None of the threatened fish species or endangered populations currently listed pursuant to the FM Act is of relevance to the aquatic habitats in the study area. Consequently, the proposed development is not considered likely to impose a significant impact on any of these species, populations or their habitats.

4.6.4 Consultation

As required by the DGRs, the preparation of this Ecological Assessment has included consultation with SOPA Manager Environment & Ecology, Kerry Darcovich. Ms Darcovich supplied detailed maps and information on the locations of Green and Golden Bell Frog habitats and underpasses, as well as vegetation community maps and also extracts from the Sydney Olympic Park Authority Biodiversity Management Plan (2007). Ms Darcovich suggested issues for consideration should include; potential impacts on the wetlands in

Badu Mangroves - through runoff, changes to hydrology, shadowing, lightspill and disturbance to birds.

As previously mentioned, a large number of planning and management documents exist for SOP relating to biodiversity, including management of threatened species and endangered ecological communities, all of which have been reviewed and incorporated into this report. The NSW Department of Environment, Climate Change and Water online information was also consulted, such as the Threatened Species Profiles.

Chapter 5

Mitigation Measures

5.1 Introduction

This chapter proposes mitigation measures and management strategies to minimise the impacts of the development on threatened species, endangered ecological communities (EECs) for incorporation in the detailed design phase.

No specific mitigation measures were incorporated into the Masterplanning work previously completed by SOPA. As each threatened species or EEC issue arose, careful consideration was given to the most appropriate action to be taken to minimise any impacts the development may have.

This section discusses further measures to address and minimise impacts of the proposal on threatened species and addresses **Step 4** of the Draft Guidelines for Threatened Species Assessment (DEC and DPI 2005). This step involves:

i. Step 4. Avoid, mitigate and then offset

This step requires the description and justification of measures to mitigate any adverse effects. Consideration is to be given to measures to avoid or minimise the impacts. The measures must be practical, must be implemented and there needs to be a reasonable level of confidence in their effectiveness. Acknowledged authorities with particular species or conservation practices should be consulted to determine if the measures proposed constitute appropriate management.

Where measures to avoid and mitigate are not possible, then offset strategies need to be considered. These may include offsite or local area proposals that contribute to the long term conservation of the threatened species.

Offset strategies are a last resort and should only be considered where the impacts cannot be avoided or mitigated.

Considerable research indicates that relocation of flora or fauna is not successful in the medium or longer term.

The extent to which measures avoid, mitigate or offset impacts upon threatened species must reflect the conservation value of the feature including its formal status as a critically endangered, endangered or vulnerable species, population or ecological community.

5.2 Avoidance of Impacts

Avoidance of impacts is considered to have been completed as part of the strategic masterplanning process by SOPA. The placement and height specifications of buildings were considered, and resulted in no clearing of native vegetation or direct impacts to threatened species and EEC habitats.

Certain indirect impacts cannot be avoided entirely, such as increased run-off and nutrient loading. Where the impacts could not be further avoided, mitigation measures are proposed, as described below:

5.3 Mitigation of Impacts

5.3.1 Endangered Ecological Communities

i. Management of Run-off

The following measures are proposed to reduce the construction and operational impacts on EECs associated with Badu Mangroves.

- Soil erosion and sedimentation control measures implemented, as per a Construction Management Plan to reduce the amount of sediment reaching estuaries and providing excessive substrate for mangrove colonisation;
- Stormwater management, detailed in a Stormwater Control Plan focusing particularly on water quality and quantity discharging through and into mangrove and saltmarsh wetlands; and
- Nutrient management and control through water detention, re-use and filtration from both urban and rural areas.

5.3.2 Threatened Fauna Species

Impacts on threatened fauna can predominantly be managed through the implementation of measures listed above, which will protect their habitats. Species specific measures are described below:

i. Bird Strike Management

Experimental evidence indicates that complete or partial covering of windows will eliminate bird strikes. Eliminating bird attractants from the vicinity of windows will reduce or prevent strikes by reducing the number of birds near the glass hazard.

Windows can be installed at an angle such that the pane reflects the ground instead of the surrounding habitat and sky. Studies (Klem 1990) indicate that at a single building with windows angled in at their base, birds avoid flying into an illusion of the ground, but are easily deceived by and strike reflected images of habitat and sky on windows installed in the conventional vertical position.

Covering glass surfaces uniformly with objects or patterns, separated by 5 to 10 cm, also helps to effectively prevent bird strikes at windows (Klem 1990).

These principles have been adopted in the design of the buildings on the subject site. Architectural Plans (Turner & Associates 2009) indicate that brightly coloured strips will be used to break up the glass window segments and vegetation or other bird attractants will not be located close to the buildings.

ii. Movement Corridors

The Concept Landscape Plan has incorporated connective gardens and parks between the buildings in a general north-south and east-west orientation. The landscaping has been specifically designed to include frog friendly passages, using long grasses in broad garden-beds with clumps of shrubs providing shelter, to optimise use as a movement corridor by Green and Golden Bell Frogs. These connected garden beds will not include pedestrian pathways and will generally aim to deter people from accessing these areas. Plant species used in these corridor gardens will be as recommended by DECCW in the Best Practise Guidelines – GGBF Habitat (DECC (NSW), 2008b).

a. Relationship to other proposals

Future works are proposed by others, and have a relationship to the mitigation measures for the subject site. The SOPA managed lands to the north of the subject site are proposed for redevelopment as a natural landscaped park, connecting to the Brickpit. Movement by Green and Golden Bell Frogs between the Brickpit, the new park, north of the subject site and Badu Mangroves would likely be encouraged through new underpasses. It is therefore recommended that underpasses be created in the new sections of Murray Rose Drive and Dawn Frazer Ave, with relation to existing ones.

Other fauna species which utilise both the Brickpit and Badu Mangroves are more mobile species, such as birds, which will pass through the new parks, but do not require continuous vegetation to do so.

iii. Green and Golden Bell Frog Protection

A site specific Green and Golden Bell Frog Sub-Plan will be prepared as part of the Construction Management Plan, prior to the start of works. This sub-plan will be prepared in conjunction with SOPA and with regard to Best Practice Guidelines –GGBF Habitat (DECC (NSW), 2008b) and the Frog Hygiene Protocols recommended by DECCW. Additionally, the following principles will apply during construction:

- If Green and Golden Bell Frogs are detected, works would cease immediately and the Green and Golden Bell Frog response provisions of the Environmental Management Plan would be implemented;
- The Green and Golden Bell Frog response provisions would include detailed instructions for the management of the species and its habitat during the project; and
- Cleaning of equipment used for works to minimise the likelihood of the transmission of any frog pathogens (e.g. Amphibian Chytrid Fungus *Batrachochytrium dendrobatidis*).

5.4 Offsetting of Impacts

Offset strategies are not considered necessary as mitigation and amelioration measures are likely to adequately minimise impacts of the proposal on threatened species known to occur on the subject land.

Chapter 6

Conclusions and Recommendations

6.1 Summary

The proposed development occurs in a landscape which will be largely unaltered. Development will occur in an existing commercial / industrial precinct, which has been previously cleared for past landuses, including as an abattoir last century, and is devoid of natural vegetation communities. The study area however, is of high conservation significance, including the Brickpit and Badu Mangroves. The development of the subject site will not result in direct impacts but will contribute to the increase in indirect impacts on these conservation areas, through the following:

- Potential increases in stormwater run-off and a decrease in water quality, with potential to impact Coastal Saltmarsh and Swamp Oak Floodplain Forest EECs and also Mangrove habitat for associated threatened fauna. However, such impacts will be managed sufficiently to result in no net increase in nutrient loads or stormwater volume;

- Modification to movement corridors for Green and Golden Bell Frogs, although the new parklands proposed for the SOPA lands to the north of the subject site will in fact increase the area of vegetated corridors; and

- Contribute to cumulative impacts from development of the study area, including increase shadowing and lightspill effects on Badu Mangroves, with the potential to disrupt roosting and foraging sites for EPBC listed migratory birds species. However, building heights are below or within height specifications of SOPA. Lightspill is not likely to be significantly increased from levels already experienced from existing development.

The construction of Building A on the subject site is not likely to result in any direct impacts on flora and fauna. Associated impacts from all stages of the Parkview development are considered manageable in terms of the proposed mitigation measures. Hence, the indirect impacts described are not considered to result in significant impacts to threatened species, populations and endangered ecological communities listed under the TSC Act or EPBC Act.

6.2 Key Thresholds

As required by the Draft Guidelines for Threatened Species Assessment (DEC and DPI 2005), a statement relating to **Step 5** is required. This step involves:

i. Step 5. Key thresholds

The development application needs to contain a justification of the preferred option based on whether:

- *The proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts, will maintain or improve biodiversity values;*
- *The proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community;*
- *The proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction; and*
- *The proposal will adversely affect critical habitat.*

The proposal, including actions to avoid or mitigate impacts on threatened species and maintain water quality will maintain biodiversity values in the area. It is not likely to reduce the long-term viability of a local population of any of the threatened species found to occur on the site, firstly, because no habitat will be removed and secondly, because the potential indirect impacts to habitats can be adequately managed. Consequently, the proposal is unlikely to accelerate or increase the likelihood of extinction of any species or population. Furthermore, the proposed development will not adversely affect critical habitat as no critical habitat identified by the Director General of the National Parks and Wildlife Service occurs on the subject land.

Of the threatened species found to occur in the study area, all except the Green and Golden Bell Frog are highly mobile. Mitigation measures have therefore been specifically tailored to reduce risks to these frogs during construction and maintain Green and Golden Bell Frog habitat and connectivity in the long-term.

The proposed development, including future staging will satisfy these key thresholds.

6.3 Conclusion

Formal Assessments of Significance, using criteria outlined in Appendix 3 of the Draft Guidelines for Threatened Species Assessment and also the EPBC Act tests of significance are provided in Appendix A. These assessments find that no significant impacts to any NSW or Commonwealth listed species or communities are likely to occur as a result of the proposed development. A referral to the Minister for the Environment,

due to potential impacts on matters of National Environmental Significance is not considered necessary.

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Appendix A

Assessments of Significance

Significance Assessments

For threatened biodiversity listed under the TSC Act, this section details the heads of consideration for threatened species assessment as suggested in the Department of Environment, Climate Change and Water / Department of Industry and Investments *Draft Guidelines for Threatened Species Assessment* (DEC and DPI , 2005). The guidelines present methods to consider the impacts on biodiversity listed under the TSC Act from proposals under Part 3A of the EP&A Act, including presenting heads of consideration for determining the significance of impacts. This test of significance is in replacement of Part 5A Assessments, known as "7 Part Tests".

For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the Department of the Environment, Water, Heritage and the Arts *Environment Protection and Biodiversity Conservation Act 1999 Significant Impact Guidelines* (DEH, 2006).

Species listed under both the TSC Act and EPBC Act have been assessed using both assessment guidelines separately. Groups of species with similar ecological and habitat requirements or life-cycle patterns can be assessed within a single assessment. Hence a combined assessment has been prepared for microchiropteran bats (listed under TSC Act) and migratory wading birds (listed under EPBC Act).

A.1 Coastal Saltmarsh EEC

A.1.1 Impact Assessment – TSC Act

Coastal Saltmarsh occurs in the study area, north-east of the Brickpit, within the Badu Mangroves, approximately 300m from the subject site. No area of Coastal Saltmarsh will be removed by the proposal.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

N/A

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

No Coastal Saltmarsh vegetation will be removed or directly affected.

There is a potential for the proposed development to impact on water quality from run-off during construction and operation of the proposed commercial building. All surface water run-off is either discharged or diffuses in to Badu Mangroves, downslope of Parkview Drive. Stormwater run-off post construction has been predicted to result in a negligible

increase in volume and velocity, as demonstrated by the stormwater assessment (Hughes and Trueman 2009). Water quality changes are expected to be minimal through the implementation of measures such as installation of Water Sensitive Urban Design (WSUD) detention ponds. The row of Swamp Oaks and tiered garden beds on the slope between the subject site and Bennelong Parkway below, will be retained for filtration of surface water run-off and the maintenance of water quality. Water quality guidelines will be adhered to, including the implementation of a monitoring program.

With such measures in place, it is not expected that habitat for Coastal Saltmarsh will be impacted by any stage of the proposal.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Coastal Saltmarsh is not at the limit of its known distribution in the study area.

How is the proposal likely to affect current disturbance regimes?

As described above, there is the potential for current stormwater loads to experience a decrease in water quality entering Badu Mangroves and the Coastal Saltmarsh EEC. However, through the implementation of mitigation measures described in Chapter 6, including the detention and filtration of run-off, the current disturbance regime is not likely to be exacerbated.

How is the proposal likely to affect habitat connectivity?

Proximate areas of Coastal Saltmarsh will remain connected along the Parramatta River and Powells Creek. The proposal will not affect this connectivity.

How is the proposal likely to affect critical habitat?

No critical habitat for Coastal Saltmarsh has been declared by the NSW Scientific Committee or DECCW.

CONCLUSION

No habitat for this EEC will be removed or modified. Mitigation measures proposed as part of the development are sufficient to minimise potential impacts on water quality which may affect its habitat. No further assessments are required.

A.2 Swamp Oak Floodplain Forest EEC

A.2.1 Impact Assessment – TSC Act

Swamp Oak Floodplain Forest occurs in the study area, north-east of the Brickpit, within the Badu Mangroves, approximately 200m from the subject site, adjoining the Coastal Saltmarsh. No area of Swamp Oak Floodplain Forest will be removed by the proposal.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

N/A

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

No Swamp Oak Floodplain Forest vegetation will be removed or directly affected.

There is a potential for the proposed development to impact on water quality from run-off during construction and operation of the proposed commercial building. All surface water run-off is either discharged or diffuses in to Badu Mangroves, downslope of Parkview Drive. Stormwater run-off post construction has been predicted to result in a negligible increase in volume and velocity, as demonstrated by the stormwater assessment (Hughes and Trueman 2009). Water quality changes are expected to be minimal through the implementation of measures such as installation of Water Sensitive Urban Design (WSUD) detention ponds. The row of planted Swamp Oaks and tiered garden beds on the slope between the subject site and Bennelong Parkway below, will be retained for filtration of surface water run-off and the maintenance of water quality. Water quality guidelines will be adhered to, including the implementation of a monitoring program.

With such measures in place, it is not expected that habitat for Swamp Oak Floodplain Forest will be impacted by any stage of the proposal.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Swamp Oak Floodplain Forest is not at the limit of its known distribution in the study area.

How is the proposal likely to affect current disturbance regimes?

As described above, there is the potential for current stormwater loads experience a decrease in water quality entering Badu Mangroves and the Swamp Oak Floodplain Forest EEC. However, through the implementation of mitigation measures described in Chapter 6, including the detention and filtration of run-off, the current disturbance regime is not likely to be exacerbated.

How is the proposal likely to affect habitat connectivity?

Proximate areas of Swamp Oak Floodplain Forest will remain connected along the Parramatta River and the undeveloped areas of the floodplain, to areas of Swamp Oak Forest in Nuwi Wetlands and Newington Nature Reserve to the north of the study area. The proposal will not affect this connectivity.

How is the proposal likely to affect critical habitat?

No critical habitat for Swamp Oak Floodplain Forest has been declared by the NSW Scientific Committee or DECCW.

CONCLUSION

No habitat for this EEC will be removed or modified. Mitigation measures proposed as part of the development are sufficient to minimise potential impacts on water quality which may affect its habitat. No further assessments are required.

A.3 Narrow-leaf Wilsonia

A.3.1 Impact Assessment – TSC Act

In NSW Narrow-leaf Wilsonia is found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney (Nelson's Lake, Potato Point, Sussex Inlet, Wowly Gully, Parramatta River at Ermington, Clovelly, Voyager Point, Wollongong and Royal National Park). It occurs at the margins of salt marshes and lakes, both coastal and inland (DEC (NSW), 2006).

Narrow-leaf Wilsonia has been recorded in Badu Mangroves area, within the Coastal Saltmarsh EEC. No habitat will be removed by the proposal.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No areas of habitat will be removed by the proposal. There is the potential for water quality to be altered, however, this species is tolerant to fluctuations in freshwater and a nutrients. Through implementation of water quality controls, the proposal is not expected to decrease water quality, and hence will not affect the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

No areas of habitat will be removed for this species.

There is a potential for the proposed development to impact on water quality from run-off during construction and operation of the proposed commercial building. All surface water run-off is currently either discharged or diffuses in to Badu Mangroves, downslope of Parkview Drive. Stormwater run-off post construction has been determined to result in a

negligible increase in volume and velocity, as demonstrated by the stormwater assessment (Hughes and Trueman 2009). Water quality changes are expected to be minimal through the implementation of measures such as installation of Water Sensitive Urban Design (WSUD) detention ponds. The row of planted Swamp Oaks and tiered garden beds on the slope between the subject site and Bennelong Parkway below, will be retained for filtration of surface water run-off and the maintenance of water quality. Water quality guidelines will be adhered to, including the implementation of a monitoring program.

With such measures in place, it is not expected that habitat for Narrow-leaf Wilsonia will be impacted by any stage of the proposal.

How is the proposal likely to affect current disturbance regimes?

As described above, there is the potential for current stormwater loads experience a decrease in water quality entering Badu Mangroves and connected waterbodies. However, through the implementation of mitigation measures described in Chapter 6, including the detention and filtration of run-off, the current disturbance regime is not likely to be exacerbated.

How is the proposal likely to affect habitat connectivity?

Proximate areas of Coastal Saltmarsh habitat will remain connected along the Parramatta River and Powells Creek. The proposal will not affect this connectivity.

How is the proposal likely to affect critical habitat?

No critical habitat for Narrow-leaf Wilsonia has been declared by the NSW Scientific Committee or DECCW

CONCLUSION

No habitat for this species will be removed or modified. Mitigation measures proposed as part of the development are sufficient to minimise potential impacts on water quality which may affect its habitat. No further assessments are required under the TSC Act.

A.4 Green and Golden Bell Frog

Green and Golden Bell Frog habitat typically consists of four functional types:

- Breeding habitat: shallow, sunlit water bodies, either permanent or temporary, natural or artificial, particularly those with emergent vegetation (typically *Typha* and *Eleocharis* spp.), which lack predatory fish such as the Plague Minnow *Gambusia holbrooki*.

- Foraging habitat: areas of low vegetation, typically dominated by grasses and other grass-like plants usually within one kilometre of breeding habitat,

- Overwintering habitat: features such as rocks, logs and other debris, including non-natural materials that provide moist conditions and a relatively stable temperature range during winter when the frogs are inactive,

- Corridor habitat: areas with appropriate environmental conditions (e.g. moisture, temperature) that act as movement corridors between breeding, foraging and overwintering habitat where these are not adjacent to one another – typically streams, ditches and drainage depressions (DEC 2005).

The Green and Golden Bell Frog is often considered to be a colonising species that is tolerant of a wide range of environmental conditions but does not compete favourably with other frog species and tends to be displaced from newly created or disturbed habitats in a form or ecological succession as environmental conditions change and additional frog species establish in such areas (DEC 2005).

A large and viable population of Green and Golden Bell Frogs occurs at the SOP site. Extensive areas of Green and Golden Bell Frog habitat have been constructed in the Brickpit, which has become a strong hold primary breeding site. Supplementary and "Overwintering" habitat occurs close to the subject site, north in SOPA managed lands adjoining the Brickpit, east in Bennelong Pond within Badu Mangroves. Additional Primary habitat occurs further north of the Brickpit including Wentworth Common and Kronos Hill, which are large and well connected areas, and also smaller Supplementary Habitat areas to the south, including the Southern Water Quality Control Pond and Lake Belvedere.

The proposed development will not remove any area of Primary or Supplementary habitat for Green and Golden Bell Frogs. It is likely that these species move through the subject land and study area on occasion, due to the proximity to an underpass located south of the subject site. This underpass links Bennelong Pond with the vegetation on the western slope of Bennelong Parkway. This connective vegetation will remain along Bennelong Parkway towards the SOPA lands north of the subject site and further north to the Brickpit.

Landscaping has been designed with this species in mind, and will contribute to the north-south connectivity via long garden beds with appropriate grasses and shrubs, as recommended by DECCW (DECC (NSW), 2008a).

A.4.1 Impact Assessment – TSC Act

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No areas of breeding habitat will be modified or removed by the proposal. Therefore no impacts on the lifecycle of this species are expected.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

No areas of habitat will be removed for this species. The proposal involves construction of new buildings in the location of an existing one.

There is a potential for the proposed development to impact on water quality from run-off during construction and operation of the proposed commercial building. All surface water run-off is currently either discharged or diffuses in to Badu Mangroves, downslope of Parkview Drive. Stormwater run-off post construction has been determined to result in a negligible increase in volume and velocity, as demonstrated by the stormwater assessment (Hughes and Trueman 2009). Water quality changes are expected to be minimal through the implementation of measures such as installation of Water Sensitive Urban Design (WSUD) detention ponds. The row of planted Swamp Oaks and tiered garden beds on the slope between the subject site and Bennelong Parkway below, will be retained for filtration of surface water run-off and the maintenance of water quality. Water quality guidelines will be adhered to, including the implementation of a monitoring program.

With such measures in place, it is not expected that habitat for the Green and Golden Bell Frog will be impacted be any stage of the proposal.

How is the proposal likely to affect current disturbance regimes?

As described above, there is the potential for current stormwater loads experience a decrease in water quality entering Badu Mangroves. However, through the implementation of mitigation measures described in Chapter 6, including the detention and filtration of run-off, the current disturbance regime is not likely to be exacerbated.

How is the proposal likely to affect habitat connectivity?

All Primary Habitat for Green and Golden Bell Frogs will remain connected. Supplementary Habitat to the south and east of the subject site will experience a decrease in connectivity, by the increase in development and hard surfaces. The eastern areas of habitat will remain connected through Bicentennial Park and also to primary habitat via existing underpasses.

The future landscaping by SOPA of their lands directly to the north of the subject site, will occur within identified Supplementary Habitat for Green and Golden Bell Frog. Currently the existing rubble and stored industrial materials provides suitable foraging habitat for this species. It is assumed that this landscaping will encourage Green and Golden Bell Frogs, and the landscaping of the subject site will complement this area with similar types of vegetation linked in garden beds. In this regard, connectivity of habitat areas will be improved by the proposal.

Connectivity of habitat areas will impacted by the extension of Murray Rose Avenue and Dawn Fraser Avenue from west of the subject site to link with Bennelong Parkway. These

works are not included in the current proposal, and will form part of later stages, as described in Chapter 1. This will effectively add additional hard surface obstacles to movement in a north-south direction from primary and supplementary habitat areas. It is proposed that culvert or underpasses be designed under the new road sections, to help maintain north-south connectivity for this species.

Overall, it is not believed that connectivity for Green and Golden Bell Frogs will be greatly affected by the proposed development. The strategic installation of underpasses in future roads will retain connectivity of Supplementary Habitat areas while also reducing the risk of road kill.

How is the proposal likely to affect critical habitat?

No critical habitat for Green and Golden Bell Frog has been declared by the NSW Scientific Committee or DECCW.

CONCLUSION

No habitat for this species will be removed or modified. Habitat connectivity will be altered marginally, although to no greater extent than is already the case. Mitigation measures proposed as part of the development are sufficient to minimise potential impacts on water quality which may affect its habitat. No further assessments are required under the TSC Act.

A.4.2 EPBC Act - Significant Impact Criteria

Lead to a long-term decrease in the size of a population

The proposal is not likely to reduce the size of the important population of Green and Golden Bell Frogs at SOP.

Reduce the area of occupancy of the species

The proposed works would not involve the removal of any known Primary or Supplementary habitat for Green and Golden Bell Frog. The proposed works may alter the area of Supplementary Habitat in Badu Mangroves due to an alteration to the environmental conditions such as water quality from run-off. However, due to the mitigation measures proposed, it is not expected that water quality will be reduced to any significant level. The area of occupancy for this species will therefore not be reduced by the proposal.

Fragment an existing population into two or more populations

The Green and Golden Bell Frog is a relatively mobile frog species that forages and seeks shelter at distances of up to 1 km or more from breeding sites during favourable weather conditions. In doing so, individuals may move through and forage within highly cleared and

fragmented landscapes. Major roads may act as barriers to the movement of the species particularly if walls and culverts limit access to ground-dwelling fauna.

Connectivity of habitat from north-south is already fragmented by urban infrastructure, including roads. Although the increase in development may make the Supplementary Habitat on SOPA lands to the north of the subject site less desirable, connectivity will not be significantly altered. The local population will not be fragmented into multiple populations as a result of any stage of the proposed development.

Adversely affect habitat critical to the survival of a species

No critical habitat has been listed for the Green and Golden Bell Frog. The subject land is not considered to contain habitat critical to the survival of the species.

Disrupt the breeding cycle of a population

The proposed works would not involve the removal of any breeding habitat for this species. The further fragmentation of Supplementary Habitat and potential overwintering sites due to the cumulative effects of development in the study area has the potential to disturb the movements of this population, although with implementation of proposed mitigation measures, it is not considered likely that this will impact on their breeding cycle.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

No areas of habitat will be removed for this species. The proposal involves construction of new buildings in the location of an existing one.

There is a potential for the proposed development to impact on water quality in Green and Golden Bell Frog Supplementary Habitat, from run-off during construction and operation of the proposed commercial building. All surface water run-off is currently either discharged or diffuses in to Badu Mangroves, downslope of Parkview Drive. Stormwater run-off post construction has been determined to result in a negligible increase in volume and velocity, as demonstrated by the stormwater assessment (Hughes and Trueman 2009). Water quality changes are expected to be minimal through the implementation of measures such as installation of Water Sensitive Urban Design (WSUD) detention ponds. The row of planted Swamp Oaks and tiered garden beds on the slope between the subject site and Bennelong Parkway below, will be retained for filtration of surface water run-off and the maintenance of water quality. Water quality guidelines will be adhered to, including the implementation of a monitoring program.

As previously discussed, the proposal will further fragment areas of Supplementary Habitat for this species, however, the species sensitive landscaping will reduce this impact. Although not part of the current proposal, future road upgrades should include underpasses, to design specifications advised by SOPA.

With such measures in place, it is not expected that habitat for the Green and Golden Bell Frog will be impacted by any stage of the proposal.

Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;

A number of invasive fauna species exist within the study area. Of these species, only the Plague Minnow *Gambusia holbrooki* are considered to be likely to affect the Green and Golden Bell Frog. A number of Gambusia-free waterbodies are maintained at SOP, including the Brickpit and the Southern Water Quality Control Pond. The proposal will not increase the risk of Gumbusia to these water bodies.

With the use of equipment in wet weather or moist environments in several locations within the subject site, there is a risk that juvenile Plague Minnow could be spread in wet mud. With the implementation of the proposed mitigation measures, as will be outlined in the site specific Green and Golden Bell Frog Management Strategy, the spread of this species is however unlikely.

The proposed works do have some potential to result in the introduction to the locality of invasive exotic plant species and plant diseases that may detrimental to habitat of the Green and Golden Bell Frog. With the implementation of the proposed measures to minimise the likelihood of spreading weeds and plant diseases the likelihood of introducing these species is however considered to be low.

Introduce disease that may cause the species to decline;

With the use of equipment in wet environments in several locations within the study area, there is a risk that Amphibian Chytrid Fungus *Batrachochytrium dendrobatidis* could be spread in wet mud. Chytridiomycosis caused by Amphibian Chytrid Fungus has been implicated in severe population declines and species extinctions of frogs in the past 20 years. With the implementation of the proposed mitigation measures, this risk of spreading this disease to uninfected water bodies is considered to be low.

Interfere substantially with the recovery of the species.

The following measures have been identified as being required for the recovery of the species:

- Maintain captive bred populations for future possible re-introduction programs.
- Initiate community awareness programs that highlight the presence of populations and catchment management approaches to improving stormwater quality, habitat retention and management.
- Develop measures to control or eradicate the introduced Plague Minnow.
- Establish protocols for handling of frogs and educational strategies to minimise the inadvertent spread of fungal pathogens from site to site.

- Develop strategies to provide for the development or enhancement of frog habitat to improve reproductive success and recruitment at known sites.
- Develop site specific plans of management to improve conservation outcomes for targeted populations.
- Develop strategies to provide disease-free and fish-free breeding habitat (DEC 2005).

No recovery plans have been finalised for this species. A draft recovery plan has been prepared (DEC 2005).

Most of these recovery objectives relate to research and management activities carried out by universities and government agencies and the proposed works would neither contribute to nor detract from their implementation.

CONCLUSION

No habitat for this species will be removed or modified. Habitat connectivity will be altered marginally, although to no greater extent than is already the case. Mitigation measures proposed as part of the development are sufficient to minimise potential impacts on water quality which may affect its habitat. No referral to the Minister for the Environment under the EBPC Act is required for this species.

A.5 Water Birds

A large number of waterbirds inhabit in the study area. The combination of saltmarsh, intertidal and freshwater wetlands around Homebush Bay, including the Badu Mangroves, provides one of the most important sites in the Sydney basin for native waterbirds, including migratory shorebirds covered by the JAMBA (Japan-Australia Migratory Birds Agreement) and CAMBA (China-Australia Migratory Birds Agreement) treaties.

Two of the bird species known to occur in the Homebush area, and are likely in the study area, are listed under the TSC Act. Those species which are of relevance to both the TSC Act and EPBC Act are addressed in both assessments below.

A.5.1 Impact Assessment – TSC Act

This assessment is for water birds listed under the TSC Act, namely;

- Australia Painted Snipe (endangered); and
- Australian Bittern (vulnerable)

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No areas of breeding or roosting habitat will be removed by the proposal. Therefore no impacts on the lifecycle of these species are expected.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

No areas of habitat will be removed for these species. The proposal involves construction of new buildings in the location of an existing one.

There is a potential for the proposed development to impact on water quality from run-off during construction and operation of the proposed commercial building. All surface water run-off is currently either discharged or diffuses in to Badu Mangroves, downslope of Parkview Drive. Stormwater run-off post construction has been determined to result in a negligible increase in volume and velocity, as demonstrated by the stormwater assessment (Hughes and Trueman 2009). Water quality changes are expected to be minimal through the implementation of measures such as installation of Water Sensitive Urban Design (WSUD) detention ponds. The row of planted Swamp Oaks and tiered garden beds on the slope between the subject site and Bennelong Parkway below, will be retained for filtration of surface water run-off and the maintenance of water quality. Water quality guidelines will be adhered to, including the implementation of a monitoring program.

With such measures in place, it is not expected that habitat for these water birds will be impacted by any stage of the proposal.

How is the proposal likely to affect current disturbance regimes?

As described above, there is the potential for current stormwater loads experience a decrease in water quality entering Badu Mangroves and connected waterbodies. However, through the implementation of mitigation measures described in Chapter 6, including the detention and filtration of run-off, the current disturbance regime is not likely to be exacerbated.

How is the proposal likely to affect habitat connectivity?

The proposal is not likely to affect connectivity for these species. The proposal is in the location of an existing building and will therefore not reduce the area of connective vegetation.

How is the proposal likely to affect critical habitat?

No critical habitat for either bird species has been declared by the NSW Scientific Committee or DECCW.

A.5.2 EPBC Act - Significant Impact Criteria

The national list of migratory species consists of species listed under the following International Conventions:

- Japan-Australia Migratory Bird Agreement (JAMBA)
- China-Australia Migratory Bird Agreement (CAMBA)
- Convention on the Conservation of Migratory Species of Wild Animals - (Bonn Convention)

Species assessed include:

Great Egret, Cattle Egret, **Latham's Snipe**, **Black-tailed Godwit**, **Bar-tailed Godwit**, Little Curlew, Whimbrel, **Eastern Curlew**, **Marsh Sandpiper**, **Common Greenshank**, Wood Sandpiper, Terek Sandpiper, **Common Sandpiper**, Grey-tailed Tattler, Ruddy Turnstone, Great Knot, **Red Knot**, Sanderling, **Red-necked Stint**, **Pectoral Sandpiper**, **Sharp-tailed Sandpiper**, **Curlew Sandpiper**, Broad-billed Sandpiper, Australian Painted Snipe, **Pacific Golden Plover**, Grey Plover, Double-banded Plover, Lesser Sand Plover, Greater Sand Plover and Oriental Pratincole.

Species highlighted in bold have been recorded in the study area, generally within the area known as Waterbird Refuge (SOPA, 2007c).

Lead to a long-term decrease in the size of a population

The proposal is not likely to reduce the size of the important population of any waterbirds in the study area or locality.

Reduce the area of occupancy of the species

The proposed works would not involve the removal of any habitat for these waterbird species. The proposed works may alter habitat in Badu Mangroves due to an alteration to the environmental conditions such as water quality from run-off. This effect would likely be more pronounced at the stormwater discharge points, including Bennelong Pond. This pond is already impacted by high nutrient levels from run-off and is not considered a particularly important waterbird habitat area, mainly due to existing disturbances from Bennelong Parkway.

Nonetheless, due to the mitigation measures proposed, it is not expected that water quality will be reduced to any significant level in Badu Mangroves. The area of occupancy for this species will therefore not be reduced by the proposal.

Fragment an existing population into two or more populations

Habitat connectivity will not be impacted by the proposal. All areas of Badu Mangroves and adjoining areas associated with Parramatta River will remain unaltered. The local

population will not be fragmented into multiple populations as a result of any stage of the proposed development.

Adversely affect habitat critical to the survival of a species

No critical habitat has been listed for these waterbirds. The subject site is not considered to contain habitat critical to the survival of the species.

Disrupt the breeding cycle of a population

The proposed works would not involve the removal of any habitat for these species. There is the potential for lightspill from the proposed buildings and future street lighting (although not part of the current proposal) to impact on nocturnal foraging and roosting habitat for these waterbirds. However, this will be restricted to Bennelong Pond and dense mangroves adjoining Bennelong Parkway in the vicinity of the subject site. Mitigation measures proposed include the installation of timed lights so as to reduce the impacts of lightspill.

No important habitat areas for these waterbirds will be impacted and hence the breeding cycle of such species will not be disrupted. Furthermore, the majority of these waterbirds do not breed in Australia.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

No areas of habitat will be removed for these species. The proposal involves construction of new buildings in the location of an existing one.

There is a potential for the proposed development to impact on water quality in Badu Mangroves, from run-off during construction and operation of the proposed commercial building. All surface water run-off is currently either discharged or diffuses in to Badu Mangroves, downslope of Parkview Drive. Stormwater run-off post construction has been determined to result in a negligible increase in volume and velocity, as demonstrated by the stormwater assessment (Hughes and Trueman 2009). Water quality changes are expected to be minimal through the implementation of measures such as installation of Water Sensitive Urban Design (WSUD) detention ponds. The row of planted Swamp Oaks and tiered garden beds on the slope between the subject site and Bennelong Parkway below, will be retained for filtration of surface water run-off and the maintenance of water quality. Water quality guidelines will be adhered to, including the implementation of a monitoring program.

With such measures in place, it is not expected that habitat for the waterbirds will be impacted by any stage of the proposal.

Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;

A number of invasive fauna species exist within the study area. Of these species, foxes and feral cats are of greatest threat to these waterbirds. There is the potential for the proposed development to increase the opportunity for pest species to forage in the urban environment and move into the parklands and mangroves. However, SOPA implement pest management, as directed by the *Parklands Plan of Management 2003 MP14* and the future management of the Parkview Drive area

Construction and operational phase environmental management plans will be consistent with the protocols and objectives of the SOPA plans.

Introduce disease that may cause the species to decline;

No known diseases with potential to cause theses waterbirds to decline are of relevance to the proposal.

Interfere substantially with the recovery of the species.

No recovery plans have been finalised for this species. A draft recovery plan has been prepared (DEC 2005).

The establishment and continued support of CAMBA, JAMBA and the Bonn Convention are the greatest mechanism for protection migratory bird habitat and the recovery of these species.

CONCLUSION

No habitat for these species will be removed or modified. Mitigation measures proposed as part of the development are sufficient to minimise potential impacts on water quality which may affect their habitat. No referral to the Minister for the Environment under the EBPC Act is required for this species.

Appendix B

Qualifications and Licences

All flora work was carried out under New South Wales Department of Environment and Climate Change Scientific Licence number 11164 and New South Wales Department of Primary Industries Animal Research Authority Trim File No. 08/135 by Vanessa Orsborn.

Qualifications of ecologists involved in the survey and preparation of this assessment are provided below.

Dr David Robertson

Director

Dr David Robertson is a senior ecologist with more than 20 years experience in ecological survey and research. David is the director of Cumberland Ecology. He has a bachelor of science with majors in botany and zoology and a PhD in ecology.

Recent consultancy work has included:

- Participation as senior ecological consultant for Department of Planning on the South Coast Environmental Panel;
- Provision of expert testimony, acting as a Court appointed expert for the Land and Environment Court;
- Management of high level flora and fauna investigations for Environmental Impact Assessments;
- Development of ecological management plans;
- Habitat reconstruction;
- Development of packages for compensatory habitats; and
- Management of negotiations about the level of mitigation measures required for flora and fauna impacts.

David is also very experienced at public speaking and has regularly provided expert testimony in court concerning ecological issues.

In previous work David was employed as the senior ecologist in charge of the Ecological Services Practice for ERM Australia. He also lectured in ecology and aquatic biology at Charles Sturt University, and was employed as a senior ecologist with the Australian Museum.
David has skills that allow him to work in both aquatic and terrestrial flora and fauna inventory, management of threatened species, ecological risk assessment, wetland rehabilitation and management, and ecological research for environmental impact assessment.

Fields of Competence

Biodiversity issues, flora and fauna field surveys, aquatic ecology, biological monitoring and environmental impact assessment.

- Bushfire assessments.
- Provision of strategic advice relating to the ecological issues that must be considered for land purchase, development and management.

Key Industry Sectors

- Mining
- Power
- Water
- Transport

Education

Bachelor of Science (Honours), Ecology, University of Melbourne, 1980.

Doctor of Philosophy, Ecology, University of Melbourne, 1986.

Key Projects

Environmental Impact Assessment

David has directed numerous large ecological assessments for major EIA projects in a variety of service sectors. These include the power industry, water supply, road construction and mining. Experience in ecological impact assessment for the power industry includes work done for Pacific Power, Transgrid, Powercoal, NorthPower and Powerlink.

Threatened species assessments

David has directed or managed numerous threatened species assessments in Australia and overseas on threatened species.

Across Australia, he has completed numerous projects on threatened species in response to state and commonwealth threatened species legislation. Such legislation includes the *NSW Threatened Species Conservation Act 1995*,

Queensland Nature Conservation Act 1994 and the *Victorian Flora and Fauna Conservation Guarantee 1998* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. International threatened species assessments have been completed in Hong Kong, China and Sri Lanka.

Work on threatened species has included preliminary survey and impact assessment, detailed impact assessment and mitigation, monitoring and plans of management.

Provision of Strategic Ecological Advice

Strategic ecological advice has been provided to aid the selection of potential development sites in Australia, Hong Kong, Sri Lanka and China. Examples include: a model to help minimise problems with threatened species issues developed for use by Landcom. Strategic advice about habitat reconstruction and monitoring in the Kam Tin Valley, Hong Kong.

Bushfire Assessments

A range of bushfire assessments have been prepared for sites ranging from small allotments for single dwellings to bushfire management plans for large sites (eg the ADI site at St Marys and Majura Field Firing Range in the ACT).

Aquatic Assessments

Dr Robertson has written, directed the writing or reviewed numerous wetland ecology projects that involve aquatic habitat assessment, creation and management. Some recent examples include the wetland creation and management projects at the Homebush Olympic Games Venue sites, Coffs Clarence Regional Water Supply Project, the Parramatta Chatswood Rail Link, the proposed extension to Ravensworth East Coal Mine and the Karuah to Buladelah Pacific Highway Upgrade.

He has worked on a wide range of large EIS projects that have included assessment of impacts, mitigation and monitoring of wetlands. Currently David is preparing ecological habitat reconstruction of wetlands for the Cooks Cove Redevelopment in Sydney. He has also conducted research into wetland ecology and artificial wetland design while he lectured in aquatic ecology at Charles Sturt University.

Dr Robertson has worked extensively throughout Australia on freshwater ecological projects and has considerable experience with macroinvertebrate biomonitoring following the AUSRIVAS protocol.

Statements of evidence and expert testimony

Dr David Robertson is a highly experienced and credible expert witness and is capable of providing expert evidence in both terrestrial and aquatic areas of ecology. David has provided expert evidence for Senate Select Committees, Australian Heritage Commission, Commissions of Inquiry, Land and Environment Court hearings and at Mining Wardens inquiries.

He has written numerous affidavits and technical reports for court and regularly presents in court for cross examination. He also assists barristers by writing questions for cross examining expert witnesses in ecology and by taking Judges and Assessors on field inspections of proposed development sites.

Vanessa Orsborn

Project Manager / Ecologist

Vanessa Orsborn has worked as an ecologist for five years and has excellent communication skills and relations with clients and government bodies. Vanessa primarily manages flora and fauna assessments and related Section 5A and Part 3A State Significant Project Assessments under the EP&A Act as well as under the EPBC Act.

Fields of Competence

- Commonwealth and State environmental legislation,
- Ecological survey and monitoring, particularly assessment of threatened species and ecological communities,
- Report writing and liaison with government departments for development applications.

Key Industry Sectors

- *Urban development*
- *Natural Resource Management*
- *Power & Renewable Energies*

Education

Bachelor of Environmental Science. Australian Catholic University 2004.

Key Projects

Emirates Wolgan Valley Resort

In 2006 Vanessa project managed the EPBC Act assessment process for Emirates Wolgan Valley Resort, Lithgow. This involved the production of a Public Environment Report including community and government consultation and associated documentation.

Since construction approval, Vanessa has prepared an Operational Environmental Management Plan which outlines all future environmental works, monitoring and reporting, while demonstrating compliance with Consent Conditions.

Dept of Defence, Ecological Management

Vanessa prepared a Pest Animal Management Strategy for Shoalhaven Defence Estate and conducted surveys and monitoring for the preparation of a threatened species database for Defence Estate Orchard Hills. Vanessa has also worked on a number of kangaroo management projects for Defence Estate. Her experience with the methods used for kangaroo census have allowed for adaptation to other macropod species in other projects, such as Brush-tailed Rock-wallabies.

Windfarm and Powerline Projects

Vanessa conducted surveys and prepared impact assessment reports for the Gunning Wind Farm 330kV Transmission Line and Bamarang 330kV Transmission line extension projects. These projects involved issues specific to the industry, such as assessing bird and bat strikes and developing mitigation measures for these impacts.

Pacific Highway Upgrade, RTA

Vanessa participated in fauna surveys for the Warrell Creek to Urunga Pacific Highway Upgrade and contributed to the comprehensive Environmental Impact Statement for the total project.

Aquatic and riparian monitoring, Sydney Catchment Authority

Vanessa was involved with riparian vegetation condition monitoring and water quality assessments for the Avon Dam Environmental Flows Study.

St Marys Development Site

Vanessa has been involved with the progression of the former ADI site at St Marys, Western Sydney, mainly in the preparation of impact assessments and also constraints analysis during Precinct Planning.

Martin Elin

GIS Specialist / Ecologist

Martin Elin is a Sydney based ecologist and GIS specialist at Cumberland Ecology (CE). Martin has a Bachelor of Science degree with a major in marine biology and a Masters of Applied Science degree in tropical marine ecology and fisheries biology.

Martin has detailed technical knowledge and experience in the interpretation and production of mapping products, including topographic modelling as well as classification and feature extraction using aerial photography and satellite imagery. At CE, Martin is closely involved in all major projects and responsible for GIS development, mapping and analyses as well as the training of staff in GIS and is a valued team member, in particular for his problem solving skills and timely delivery.

Recent consultancy work has included:

- Preparation of GIS mapping and analysis for a *Referral* under the EPBC Act. This involved detailed mapping of vegetation communities using field data, literature, soil mapping and the use of image analysing software for feature extraction. The end product was a complex mosaic of vegetation on different land-parcels and definitions of impacts. Throughout the project, Martin demonstrated his data management and technical skills by rapidly altering figures and analysing how a change to the proposed development would affect the vegetation.
- Mapping and credit calculation under the *Biodiversity Banking and Offsets Scheme (BioBanking)*. Based on field data and aerial photography, Martin generated data layers to represent the so-called *threatened species subzones* across an area of approximately 1260ha and calculated the value of the land as a *BioBank* offset site.
- GIS mapping and analysis for a Species Impact Statement (SIS). This involved mapping of native vegetation, threatened species records and land use for an impact site and the land within a 5km radius. As is the case for most projects, Martin worked with a wide range of different data sources such as field collected data, surveyors, internet resources, literature and data layers originating from GPS units and different types of software.
- GIS mapping and analysis for a large scale project in the Philippines. By developing a topographic model and combining it with soil mapping, field data and aerial- and satellite imagery, Martin is mapping the vegetation and land use across an area of approximately 10,000ha. Martin has also produced detailed topographic maps of the area for use by field teams for navigation as well as data collection for further mapping.

Fields of Competence

- Geographic Information Systems (GIS)
- Image analysis
- Biodiversity Banking Assessment Scheme.
- Ecological field surveys and monitoring
- Statistical data analyses, Mathematical / Ecological modelling and Computer programming
- Coastal and estuarine ecology
- Information Management Systems

Education

Bachelor of Science (Marine Biology), James Cook University (2004)

Master of Applied Science (Tropical Marine Ecology & Fisheries Biology), James Cook University (2007)