ACS Environmental Pty Ltd

FLORA AND FAUNA ASSESSMENT

FOR

DEVELOPMENT APPLICATION FOR PROPOSED

CONSTRUCTION OF NEW INDUSTRIAL WAREHOUSE/OFFICE

COMPLEX BUILDING

AT

LOT A DP 402556

130 OLD PITTWATER ROAD,

BROOKVALE NSW 2100

PREPARED FOR
STEWART INVESTMENTS (NSW) PTY LTD

SEPTEMBER 2018

ACS Environmental Pty Ltd

Flora and Fauna Surveys, Biodiversity and Ecological Impact Assessment and Bushland Plans of Management Services

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EXECUTIVE SUMMARY

In September 2018, ACS Environmental P/L was commissioned by Stewart Investments (NSW) Pty Ltd to undertake a flora and fauna survey and biodiversity impact assessment for a small section of the vegetated rear portion of Lot A DP 402556 at 130 Old Pittwater Road, Brookvale. The section of the vegetated subject land proposed for development is estimated at about 2,130m^2 in area and included in the larger vegetated lot area of 0.604ha at DP 402556, the land zoned for industrial development within Locality G10.

The small eastern area of the vegetated section of the site is proposed to be developed in conjunction with a previous development at Lot 11 DP 1146661 at 140 Old Pittwater Road, Brookvale. Architectural plans should be consulted for detail.

The subject land contains a number of microhabitats including gradual to steep hillslopes, rocky outcrops and areas adjacent to a rock-lined drainage course.

The natural vegetation of the subject land is typical of that which occurs on Hawkesbury Sandstone substrates, described as 'Coastal Sandstone Gully Forest' (OEH 2013).

The general natural vegetation of the subject land is representative of that which occurs on Hawkesbury Sandstone substrates, described as 'Coastal Sandstone Gully Forest (OEH 2013 Code S_DSF09).

The low to medium tall forest ecological community at the small area of the subject site is dominated by trees of Forest Sheoak (*Allocasuarina torulosa*) and Sydney Red Gum (*Angophora costata*).

Typical species comprising a sparse small tree and understorey include Christmas Bush (*Ceratopetalum gummiferum*), Elderberry Panax (*Polyscias sambucifolus*), Spiny Leaf Podocarp (*Podocarpus spinulosus*), Blueberry Ash (*Elaeocarpus reticulatus*), *Hibbertia linearis* and Handsome Flat-pea (*Platylobium formosum*).

Common in the ground layer and twiner layer are Bracken (*Pteridium esculentum*), Soft Bracken (*Calochlaena dubia*), Twining Guinea Flower (*Hibbertia dentata*), False Sarsaparilla (*Smilax glyciphylla*), Lesser Flannel Flower (*Actinotus minor*), Saw-sedge (*Gahnia erythrocarpa*), Common Rapier Sedge (*Lepidosperma filiforme*), Spiny-headed Mat-rush (*Lomandra longifolia*), Blue Flax Lily (*Dianella caerulea var. producta*) and Forest Grass-tree (*Xanthorrhoea media*).

This ecological community is common on coastal sheltered hillslopes (Benson & Howell 2004, Smith & Smith 2002, OEH 2013) and is not listed as threatened under the BC Act or the EPBC Act.

A total of 43 indigenous plant species occurring at varying frequency and percentage cover was recorded over the range of habitats comprising the surveyed area. Some species are abundant over the entire surveyed area while other species are uncommon or occur in low frequency either scattered over the site or occurring in isolated sections of the site.

A total of 8 exotic, mainly High Threat Exotic (HTE) weed species (OEH 2018), including 3 species of Biosecurity Weeds (Biosecurity Weeds in 'Priority Weeds for the Greater Sydney Region', Dept of Primary Industries 2018), were recorded in the surveyed area. Biosecurity weed species occurring at the subject site include Lantana (*Lantana camara*), Pampas Grass (*Cortaderia selloana*) and Ground Asparagus Fern (*Asparagus aethiopicus*).

The NSW Office of Environment and Heritage (OEH) Bionet Atlas of NSW Wildlife (2018) records for an area of 5km radius around the subject site indicate that 16 plant species of conservation significance have been recorded within the last 25 years. According to the Commonwealth 'Department of Environment and Energy (DoEE) 'Protected Matters Environmental Reporting Tool', potential habitat for another 4 threatened species is deemed to occur within a 5km radius of the subject site.

The survey targeted all of these species of conservation significance, most of which have relatively large conspicuous life-forms, but none were found to occur in the subject area.

Two common species located on the subject land in very low frequency are regarded as 'biogeographically significant' in the Sydney region (Smith & Smith 2005). These species include Wax Flower (*Crowea saligna*) and Pine-leaved Geebung (*Persoonia pinifolia*). All of these species have been recorded in, and are well conserved in local National Parks at Garigal and Kuring-Gai Chase (Smith & Smith 1998).

The corridor within which the subject land occurs is mapped as 'Priority 2 Wildlife Corridor' in the locality (Smith & Smith 2005). The subject area links the medium-sized areas of bushland of Allenby Park to the north-west and Manly Dam Reserve to the south-east, which in turn have connectivity with areas of bushland along Wakehurst Parkway, including Garigal National Park to the west, through to Kuring-Gai Chase National Park to the north (Smith & Smith 2005).

The proposed development would result in the clearing of about 0.2ha of natural bushland with the retention of up to 0.39ha. The proposal is to excavate into the hillside for the construction of the warehouse/office complex and small areas of exposed rock ledges and boulders will be impacted. Bushland occurring to the south-west, in a small section of retained vegetation at the upper slope of an allotment, to the west in a dedicated bushland Reserve area, and to the north, is of similar structure and floristic composition and contains similar rock outcropping to that proposed for removal from the subject land.

As part of a biodiversity assessment, the fauna survey was undertaken to record fauna species currently utilising the site and to assess the habitat value for threatened species listed in the database for the area. The natural forest fauna habitat on the subject land varies in value across the site. To the west of the subject land, the fauna habitat value is good. The rating value at the small area of the subject land is not high due to the surrounding urban environment.

Fauna species utilising the subject land are common in the area. Whilst few bird species were recorded on the subject land, many were recorded flying overhead, due in part to the location of the site close to the Allenby Park and Manly Dam Reserve.

The presence of feral animals, in particular the cat, which appears by scat evidence to be prolific within the survey area, has likely reduced the terrestrial fauna diversity within the subject land. No small native terrestrial mammals were recorded in the area.

Database searches at a Local Government, State and Federal level were undertaken to identify threatened species of fauna that had been recorded previously in the area. A survey in 2009 recorded the presence of the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) foraging above the canopy. For this species, no caves or hollows that might provide potential roosting opportunities were recorded on the site however suitable habitat is known to occur in the reserves of the area. Eastern Bentwing Bats feed on moths and flying insects above the canopy of forested areas such as occurs locally in Allenby Park and Garigal National Park. It is considered that the proposal to develop the site would not impact upon the life cycle of this species or place the local population at threat of extinction.

Other threatened species identified as having potential to occasionally occur at the site include the Powerful Owl, Glossy Black-Cockatoo and the Grey-headed Flying Fox. Assessment of habitat in the woodland concluded that the Powerful Owl (*Ninox strenua*) may occasionally forage within the area if suitable prey species were in abundance and for the Grey-headed Flying Fox may occasionally forage in the area when particular tree species were fruiting or flowering.

No trees with large hollows were recorded that could provide nesting opportunities for the Glossy Black Cockatoo although a number of tree species listed as a food resource occur on site. One prime food resource for this species is seed from Forest Sheoak (*Allocasuarina torulosa).* Forest Sheoak, Black Sheoak and Scrub Sheoak are species common to sandstone vegetation communities in Garigal National Park and Ku-ringai Chase National Park as well as other smaller bushland reserves of the area. Most of the Forest Sheoak individuals observed onsite were male and do not bear fruit. The removal of the small area of Forest Oak from the site to accommodate the development is considered insignificant for the potential survival of local populations of the Glossy Black Cockatoo which have not been recorded in proximity to the site within the previous 20 years.

It is considered that the development would be unlikely to have an adverse effect on the life cycle of any individual threatened flora or fauna species or their respective habitat. It is considered that for potential impacts to any threatened ecological communities, threatened populations or threatened flora or fauna, concurrence from the Director General of the Office of Environment and Heritage is not required, nor is a Species Impact Statement necessary for the proposed development.

The vegetation Integrity (VI) of the natural vegetation is estimated at 59.5.

Environmental criteria in relation to requirement for biodiversity offsets is assessed as follows:

- The area of property and area proposed for development is less than 1ha and less than 0.25ha respectively, areas too small to trigger offsets;
- The subject land is not marked on the Biodiversity Values Map as containing any significant biodiversity value (Figure 13) and so not triggering biodiversity offsets; and
- It is assessed and considered that no threatened ecological community, threatened species (of both flora and fauna) or threatened populations would be significantly impacted by the small area of the proposed development at the eastern vegetated section of the subject land.

A such, it is considered that biodiversity offsets in relation to the development are not required.

GLOSSARY

BAM - Biodiversity Assessment Method (2017) - supports the BC Act (2016).

BC Act - *Biodiversity Conservation Act (2016)* - legislation enacted in August 2017

CEEC - Critically Endangered Ecological Community

DoEE - Commonwealth Department of Environment and Energy

E (threatened species status) - Endangered species

EEC - Endangered Ecological Community as listed by the BC Act and EPBC Act

EPBC Act - Environmental Protection & Biodiversity Conservation Act (1999). Enacted to protect and manage nationally and internationally (migratory) flora, fauna and ecological communities, defined in the Act as matters of national environmental significance (NES)

Habitat - areas occupied, either territorially, periodically or occasionally, by a species, population or ecological community

KTP - Key threatening process, a process that threatens the survival, life cycle, abundance or potential evolutionary development of native species, populations or ecological communities (Dept of Environment and Conservation 2004). KTP's are listed under the BC Act and the EPBC Act.

Migratory species - listed under the EPBC Act and relating to international agreements to which Australia is a signatory. Includes the Japan-Australia Migratory Bird Agreement (JAMBA), Chine-Australia Migratory Bird Agreement (CAMBA) Republic of Korea Migratory Bird Agreement (ROKAMBA) and Bonn Convention on the Conservation of Migratory Species of Wild Animals (BCCMSWA).

OEH - State Office of Environment and Heritage

PCT - Plant Community Type identified as such using the Bionet Vegetation Classification system (OEH 2018)

RoTAP - Rare or Threatened Australian Plants

Threatened species, populations or ecological communities - Entities listed by the BC Act and EPBC Act as 'Vulnerable to decreasing population growth in time', Endangered as population growth decreasing rapidly leading to eventual extinction' or 'Critically Endangered, a more extreme rate of population decrease than the former'.

V (threatened species status) - Vulnerable

INTRODUCTION

1.1 Proposed development

In September 2018, ACS Environmental was commissioned by Stewart Investments (NSW) Pty Ltd to survey for flora and fauna and undertake a biodiversity impact assessment for a section of the vegetated rear portion of Lot A DP 402556 at 130 Old Pittwater Road, Brookvale. The section of the vegetated subject land proposed for development is estimated at about 2,130m^2 in area and zoned for industrial development within Locality G10. An adjoining property at Lot 11 DP 1146661, 140 Old Pittwater Road, Brookvale, had been surveyed earlier as part of a submission to Council to subdivide the undeveloped portion from the existing warehouse/office complex to the east (ACS Environmental 2015).

Stewart Investments (NSW) Pty Ltd propose to develop the lower section of this current allotment as an additional warehouse/industrial complex to adjoin the previous development at 140 Old Pittwater Road. Architectural plans submitted with this application should be consulted for detail.

The site has a north-easterly aspect with gradients up to 25^O.

Figure 1 is a site plan showing the subject vegetated land, the total area comprising about 0.604ha, of which about 0.391ha in the upper western section is to be retained in its natural state and the lower 2,130m^2 proposed for clearing, excavation and building construction.

Figure 2 indicates the proposed building platforms including the development at adjoining sections of lots at 140 and 130 Old Pittwater Road, Brookvale.

Figure 3 is an aerial depiction of the subject area showing the land in relation to established development in the local area.

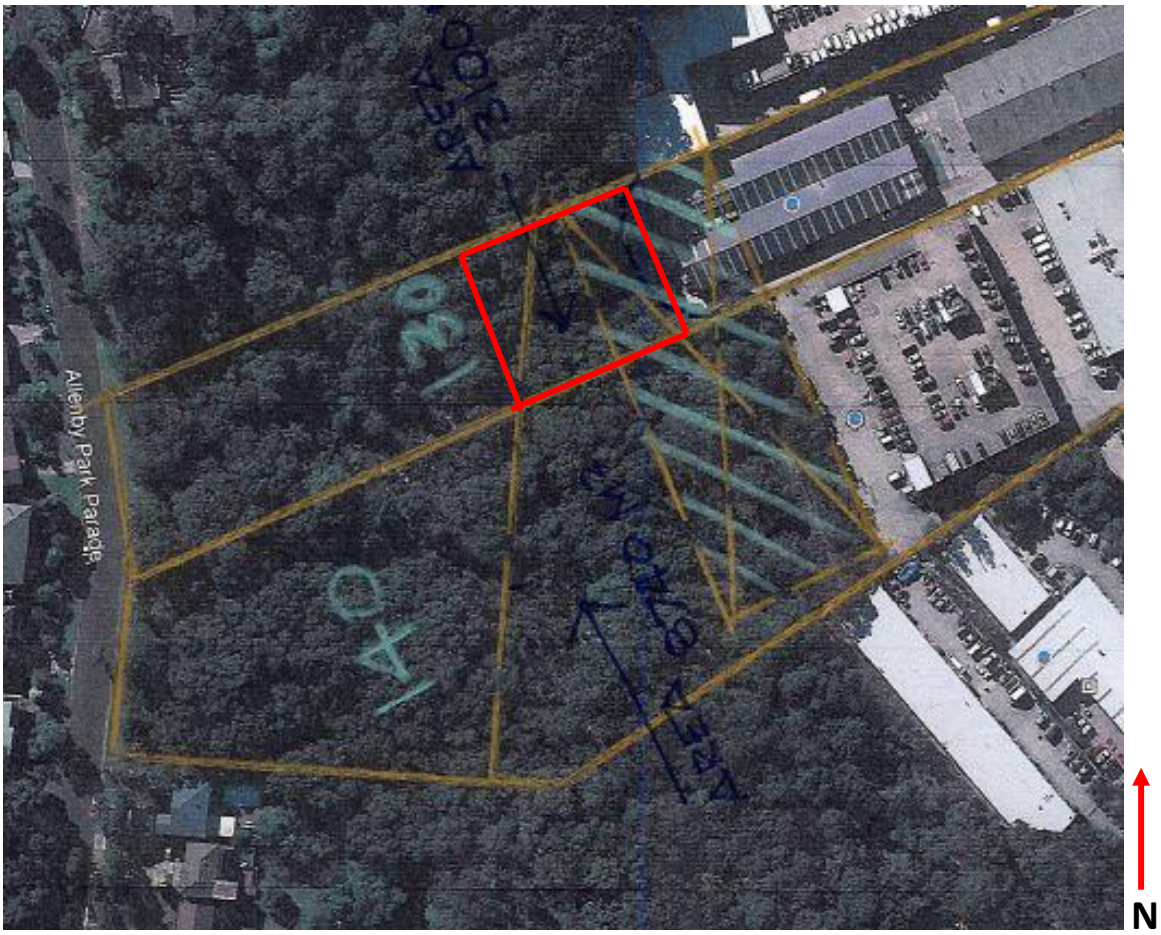

Figure 1A - Indicates the location of adjacent properties at 140 and 130 Old Pittwater Road, Brookvale, proposed extent of development at the adjacent properties and area that is the subject of this report at 130 Old Pittwater Road, Brookvale , outlined in red font.

Figure 1B - Indicates the location of adjacent properties at 140 and 130 Old Pittwater Road, Brookvale, proposed extent of development at 130 Old Pittwater Road, Brookvale , dashed outlined in red font and shaded in light green.

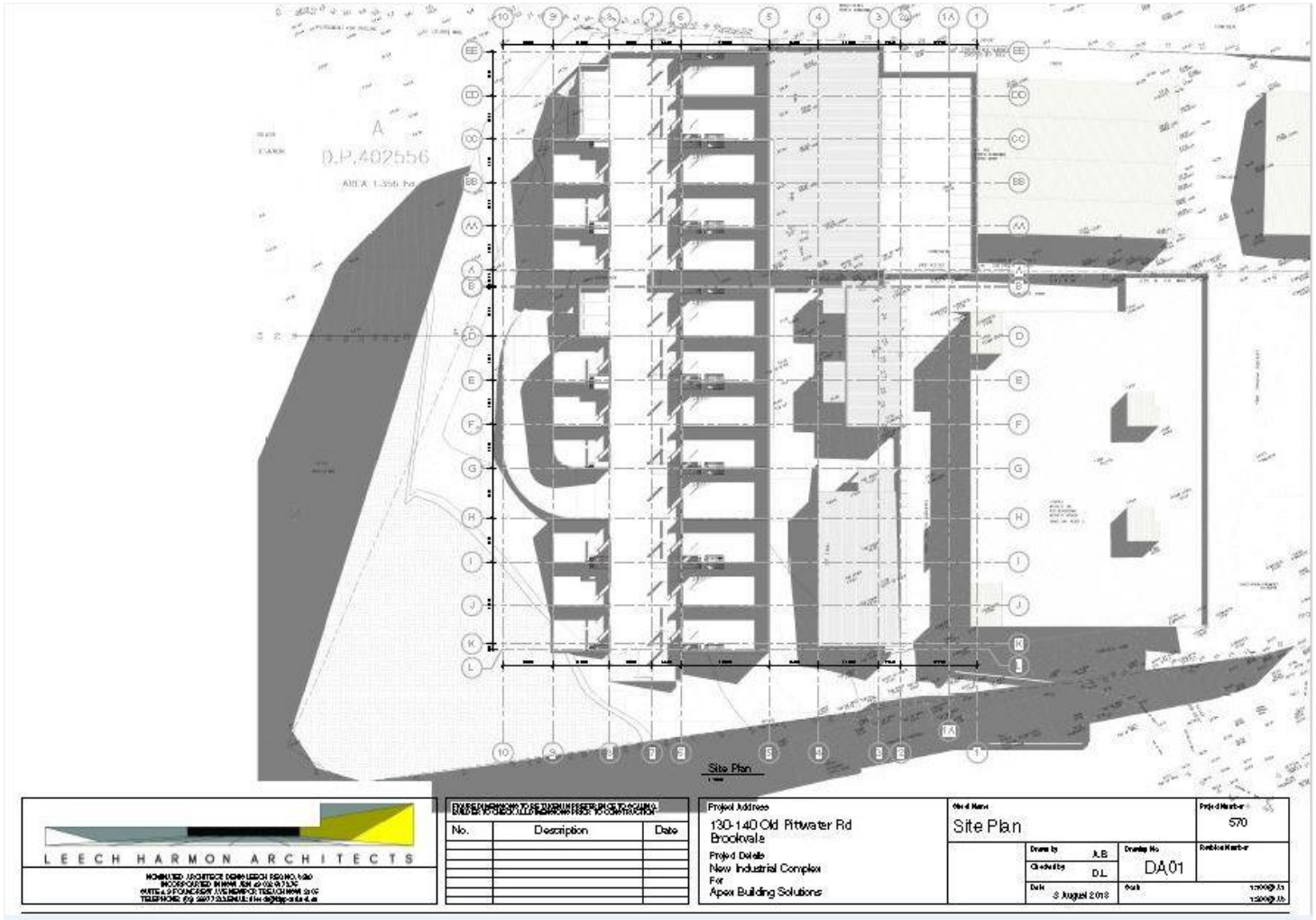

Figure 2 - Schematic architectural site plan for development at 130 - 140 Old Pittwater Road, Brookvale. Note that floor plans have been altered slightly resulting in slightly less footprint area (see ACS Environmental 2018).

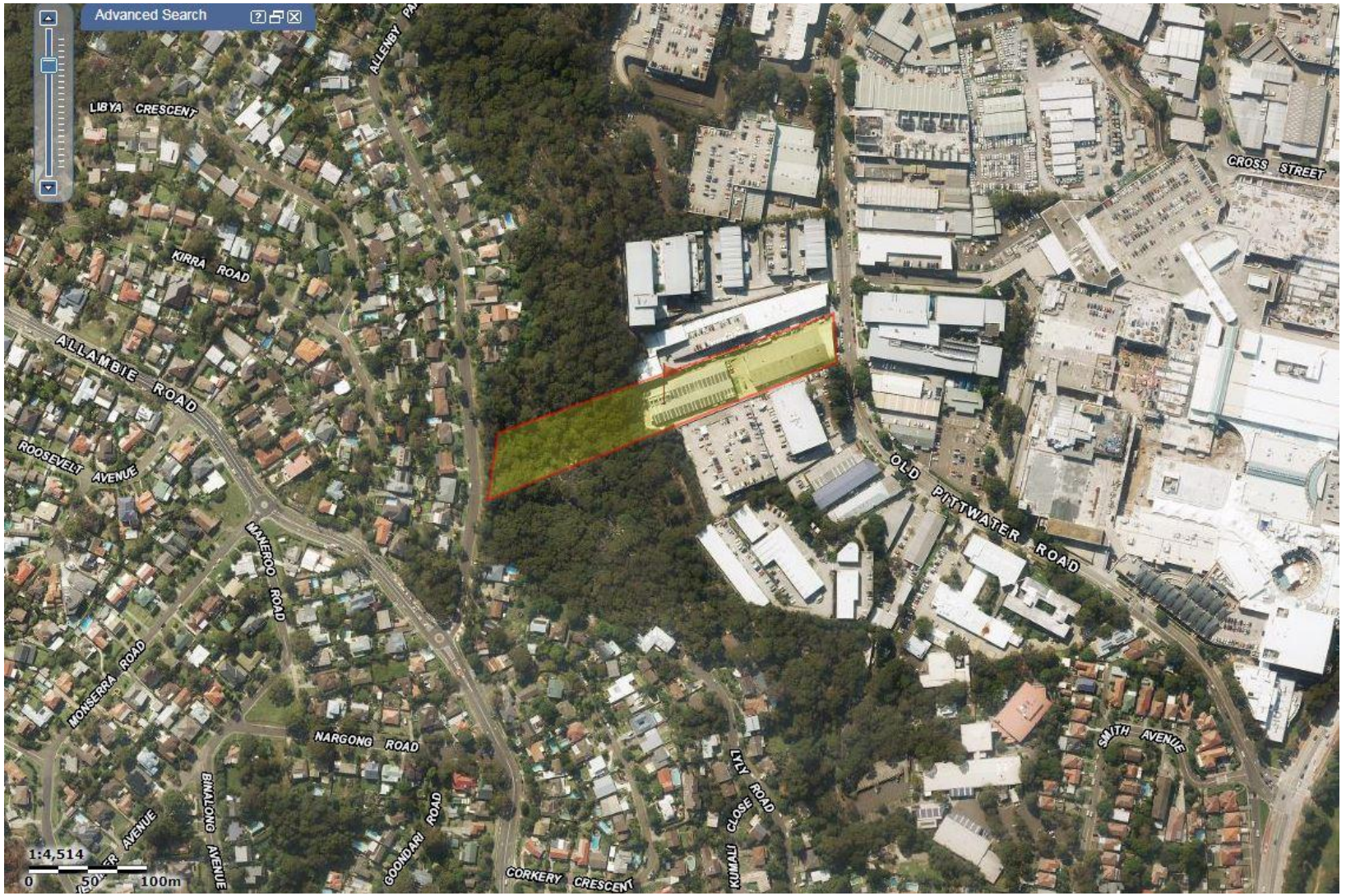

Figure 3 - Indicating aerial view of natural and developed landscape at 130 Old Pittwater Road, Brookvale (red outlined polygon) and surrounds.

1.2 Purpose of biodiversity impact assessment report

The purpose of the flora and fauna surveys and ecological impact assessment is to document existing and expected biota and to ensure all necessary safeguards are described and complied with in relation to the proposal as required by WLEP 2011 and WDCP 2011.

1.3 Statutory and legislative requirements

Planning controls provided by State and Commonwealth Legislation include the following:

- Environmental Planning and Assessment Act (EP & A Act) (1979),
- Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act) (1999),
- Biodiversity Conservation Act (BC Act) (2016). The BC Act (2016) includes Preliminary Determinations of the NSW Scientific Committee (to September 2018) as well as Provisional Listings of Endangered Species on an emergency basis (to September 2018),

  The objectives of this Act are:

  - to provide for the conservation of threatened species, populations and ecological communities of animals and plants. The Act sets out a number of specific objects relating to the conservation of biological diversity and the promotion of ecologically sustainable development.
- Planning for Bushfire Protection (2006).
- Biosecurity Weeds Act 2015 (NSW)

  The objectives of this Act are:
  - to reduce the negative impact of weeds on the economy, community and environment of this State by establishing control mechanisms to:
  - prevent the establishment in this State of significant new weeds, and
  - restrict the spread in this State of existing significant weeds, and
  - reduce the area in this State of existing significant weeds,
  - to provide for the monitoring of and reporting on the effectiveness of the management of weeds in this State

Local Council planning controls include the:

- Warringah Council Local Environmental Plan (WLEP) (2011) and Warringah Development Control Plan (WDCP) (2011)

This flora and fauna assessment report includes an account of:

- Threatened flora and fauna species, populations, endangered ecological communities and their habitats, as listed under the Biodiversity Conservation Act (BC Act), 2016;

- Nationally significant flora species, as listed under the Environment Protection and Biodiversity Conservation Act (EPBC Act), 1999;
- Rare or threatened Australian plants (RoTAP) as listed in Briggs and Leigh (1996); and
- Any regionally or locally significant species in the Warringah Council LGA.

1.4 Objectives of the study

- To carry out detailed flora and fauna surveys on the subject land;
- To prepare a comprehensive report qualifying potential impacts and describing mitigation measures in relation to the above assessments.

1.5 Scope of the study

The survey work was undertaken to provide Apex Building Solutions with current and detailed information on the following:

- Identification of the flora and fauna that occur at the subject sites including documentation of species lists and mapping of identifiable plant communities;
- Identification of Threatened (Endangered and Vulnerable) species, populations, communities and habitats as listed in Schedules 1 & 2 of the Biodiversity Conservation Act 2016 (BC Act) including Preliminary Determinations of the NSW Scientific Committee, and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), ROTAP species (Briggs & Leigh 1996) and regionally and locally significant species that could potentially be impacted upon by the proposed development;
- Identify listed migratory species (as listed in international treaties referred to in the EPBC Act);
- Identification of fauna species, including species of amphibians, reptiles, birds or mammals, not directly recorded during surveys but that could potentially occur in the study area as indicated by the presence of associated habitat;
- Preparation of a report describing vegetation communities on the subject land indicating their current condition and level of degradation;
- Recording of the area and extent of Biosecurity (and other significant High Threat Exotic) weed species in the study area;
- Assessment of potential impacts of the proposal on existing flora and fauna within the study area;
- Submission of draft report;
- Incorporation of relevant review comments and amendment of draft report; and
- Submission of a final report within 1 week of receiving review comments.

1.6 Study methodology

Currently existing information on 'Threatened Flora and Fauna of the Locality', defined as a 10km x 10km area centred around the site, was accessed from the OEH Atlas of NSW Wildlife (September 2018), the Department of Environment and Energy (DoEE) Environmental Reporting Tool (September 2018), and RoTAP (Briggs & Leigh, 1996) databases.

Other literature detailing regionally and locally threatened and significant flora, as well as endangered populations and plant communities of the study area, including NSW Scientific Committee Final Determinations (1996 - 2018) were accessed and reviewed.

Comprehensive surveys were undertaken on foot (Diversity Search method of Cropper 1993, and Threatened Biodiversity Surveys and Assessment - Guidelines for Developments and Activities - DEC 2004) to identify the existence of extant flora and extant fauna populations present on the subject area.

A 20 x 20m quadrat was placed at random within the site to record the % occurrence of all flora in the quadrat. A longer transect of 25 m was aligned within the quadrat as the length of slope was insufficient to extend the length to 50m, the slope being subtended by a steep 10m cliff wall (Figure 4), and the area of this larger quadrat was extended to a 25 x 40m quadrat to assess tree numbers, extent of hollows, length of logs and tree trunk diameters over an area of 1000m^2 within a representative area within the subject site.

The survey included an assessment of the presence, or likelihood of occurrence, of any threatened (endangered, vulnerable), rare (RoTAP) or regionally or locally significant species, or plant community, occurring on the site.

Threatened fauna species not recorded in the survey but with the potential to be present or to be occasional visitors as indicated by habitat were recorded.

The extent of noxious and other weed incursions on the subject area of the land were assessed.

Figure 4 - The slope of the subject land is subtended by a low vertical cliff face of about 10 - 15m in height.

1.7 Limitations of the study

Limitations of the study may arise where certain cryptic species of plants may occur as soil-stored seed or as subterranean vegetative structures. Some species are identifiable above-ground only after particular environmental circumstances related to factors such as periodic fire frequency, intensity or seasonality, soil moisture regime, grazing pressure, biological life-cycle patterns as in the case of small geophytic taxa such as species of orchids etc.

Diurnal surveys at one time of the year cannot be expected to detect the presence of all species occurring, or likely to occur, in the study area. This is because some species may (a) occur seasonally, (b) utilise different areas periodically (as a component of a more extensive home range), or (c) become dormant during specific periods of the year. Rather, the survey provides the opportunity to sample the area, search specifically for species likely to be encountered within the available time frame, and assess the suitability of habitat for particular species.

The criteria used to assess the likelihood of threatened species occurring in the Study Area included the specificity of habitat features such as tree canopy cover, relative soil moisture regime, relative soil nutrient regimes, extent of historical disturbance and degradation of vegetation and known occurrences of threatened species in the immediate locality.

If all or most of these collective criteria deemed optimal for the occurrence of a particular threatened species occur in relation to the habitat of the Study Area, then the likelihood of its

potential occurrence in the habitat of the Study Area could be assessed as being relatively high. If only some of these collective criteria deemed suitable for the occurrence of a particular threatened species occur in the habitat of the Study Area, then its potential occurrence in the area of study may be deemed moderate at best. If few of these collective criteria deemed suitable for the occurrence of a particular threatened species occur in the habitat of the Study Area, then the likelihood of its occurrence would be assessed as being low to very unlikely.

These criteria are qualified in respect of threatened flora species in Appendix 2 of this report and in relation to threatened species of fauna in Appendix 4 of this report.

2 EXISTING ENVIRONMENT

2.1 Topography, geology and soils

The topography of the subject site is a hillslope with north-easterly aspect and gradients ranging from 15^{o} to 25^{o} down the slope.

The local substrate geology of subject area at 130 Old Pittwater Road, Brookvale, is Triassic Hawkesbury Sandstone. This substrate is largely comprised of medium to coarse-grained quartz sandstone with very minor shale and laminite lenses (Herbert (1983).

The soil landscape particular to the surveyed area is the colluvial 'Hawkesbury' Soil Landscape Series (Chapman & Murphy 1989). This soil landscape series are characterised by undulating to rolling low to very steep hills on Hawkesbury Sandstone. Gradients are generally <25^{o} on broad ridges and benches and moderately inclined sideslopes, with gradients often >25^{o} on steeper sideslopes. Other features of this landscape are rocky steps and benches with low broken scarps and massive, residual boulders as well as small areas of poor drainage (Chapman & Murphy 1988).

Soil material formed from differential erosion and weathering of Hawkesbury Sandstone substrates include shallow discontinuous earthy sands and yellow earths on crests and inside benches, whereas shallow siliceous sands and lithosols develop on leading erosional edges. Shallow to moderately deep leached sands develop in poorly drained areas and yellow podsolics are associated with shale and siltstone lenses (Chapman and Murphy 1989).

2.2 Existing vegetation

The general natural vegetation of the subject land is representative of that which occurs on Hawkesbury Sandstone substrates, described as 'Coastal Sandstone Gully Forest (OEH 2013 Code S_DSF09).

The low to medium tall forest ecological community at the small area (1,300m^2) of the subject site is dominated by trees of Forest Sheoak (*Allocasuarina torulosa*) and Sydney Red Gum (*Angophora costata*) (Figure 5).

Typical species comprising a sparse small tree and understorey include Christmas Bush (*Ceratopetalum gummiferum*), Elderberry Panax (*Polyscias sambucifolus*), Spiny Leaf Podocarp (*Podocarpus spinulosus*), Blueberry Ash (*Elaeocarpus reticulatus*), *Hibbertia linearis* and Handsome Flat-pea (*Platylobium formosum*). Common in the ground layer and twiner layer are Bracken (*Pteridium esculentum*), Soft Bracken (*Calochlaena dubia*), Twining

Guinea Flower (*Hibbertia dentata*), False Sarsaparilla (*Smilax glyciphylla*), Lesser Flannel Flower (*Actinotus minor*), Saw-sedge (*Gahnia erythrocarpa*), Common Rapier Sedge (*Lepidosperma filiforme*), Spiny-headed Mat-rush (*Lomandra longifolia*), Blue Flax Lily (*Dianella caerulea var. producta*) and Forest Grass-tree (*Xanthorrhoea media*) (Figure 6).

Figure 5 - Woodland/open-forest community dominated by Sydney Red Gum (*Angophora costata*) (LHS image) and various age cohorts of Forest Sheoak (*Allocasuarina torulosa*)

Figure 6 - Woodland/open-forest community dominated by various age cohorts of Forest Sheoak (*Allocasuarina torulosa*) and indicating sparse shrub and ground layer strata.

3 FLORA SURVEY AND ASSESSMENT

3.1 Methods

3.1.1 Literature review

Existing information on 'Threatened Flora of the Locality', defined as an area of 5km radius around the site, was accessed from the OEH Atlas of NSW Wildlife (online BioNet), Commonwealth DoEE Environmental Reporting Tool (September 2018) and RoTAP (Briggs and Leigh 1996) databases. Other literature detailing regionally and locally threatened and significant flora, as well as endangered populations and plant communities of the study area, included NSW Scientific Committee Final Determinations (1996-2018), Benson and Howell (1994) and the Natural Area Survey of Warringah's Bushland (Smith & Smith 1998, 2005).

3.1.2 Site survey

Site boundaries of the small area of the subject site were interpreted from architectural drawings provided and reference surveyors pegs placed into the corners of the site. The survey included a complete floristic inventory of indigenous and exotic species and an assessment of the presence, or likelihood of occurrence, of any threatened, rare, regionally or locally significant species or plant community occurring at the surveyed site.

3.2 Results

3.2.1 Landscape features

The subject site is Figure 7 indicates the landscape features included in a 1500m buffer zone centred around the subject site that occurs within the Belrose Coastal Slopes landscape in the Pittwater IBRA subregion of the Sydney Basin IBRA Region. The image indicates that about 23.5% of the buffer area includes native vegetation cover.

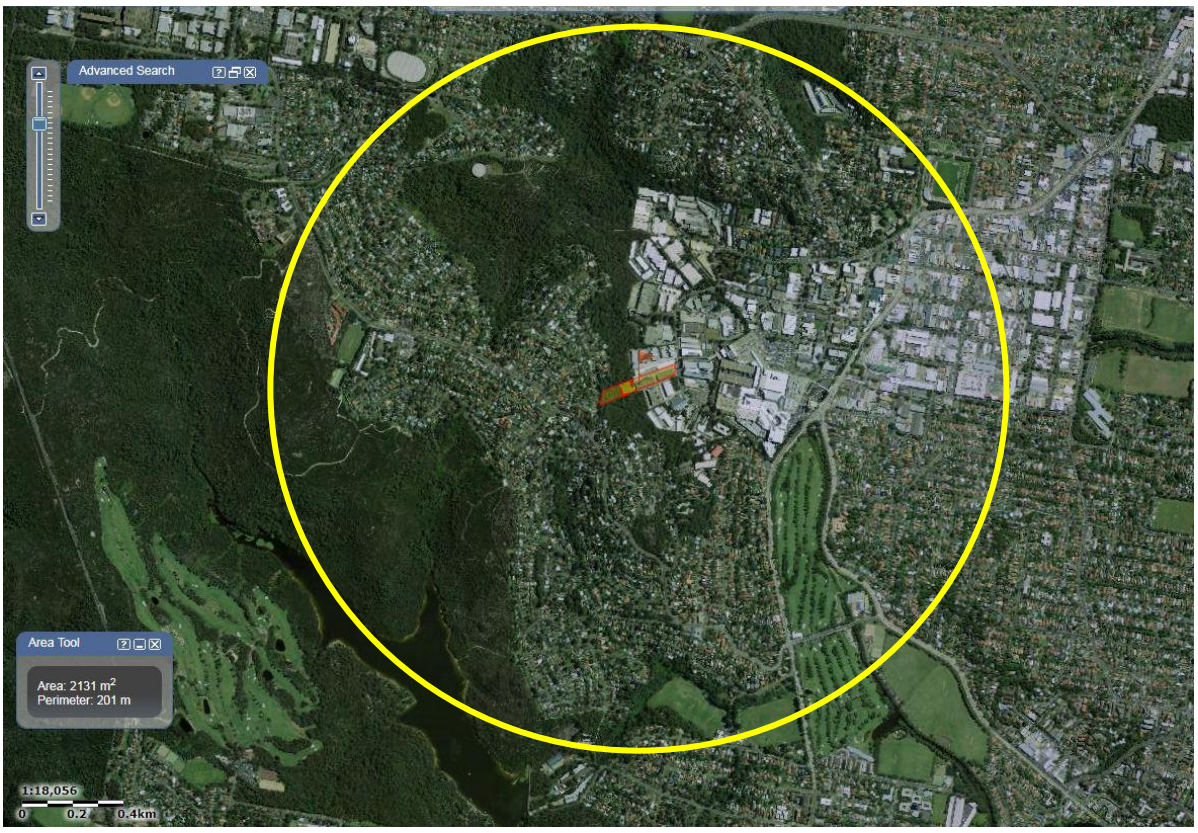

Figure 7 - Image of landscape features within 1500m radius centred around the subject site showing extent of vegetated areas within the buffer zone is about 23%.

3.2.2 Indigenous and exotic plant species

Appendix 1 lists the various plant species found to occur at the subject site. Species nomenclature follows that of Harden (1990 – 2002; 2018 online).

A total of 43 indigenous plant species occurring at varying frequency and percentage cover was recorded over the range of habitats comprising the surveyed area. Some species are abundant over the entire surveyed area while other species are uncommon or occur in low frequency either scattered over the site or occurring in isolated sections of the site.

A total of 8 exotic, mainly High Threat Exotic (HTE) weed species (OEH 2018), including 3 species of Biosecurity Weeds (Biosecurity Weeds in 'Priority Weeds for the Greater Sydney Region', Dept of Primary Industries 2018), were recorded in the surveyed area. Biosecurity weed species occurring at the subject site include Lantana (*Lantana camara*), Pampas Grass (*Cortaderia selloana*) and Ground Asparagus Fern (*Asparagus aethiopicus*) (Appendix 1).

The subject area contains a number of various microhabitats including gradual hillslopes, rocky outcrops and boulders, damp areas of restricted drainage and areas adjacent to and within a drainage course (Figure 8).

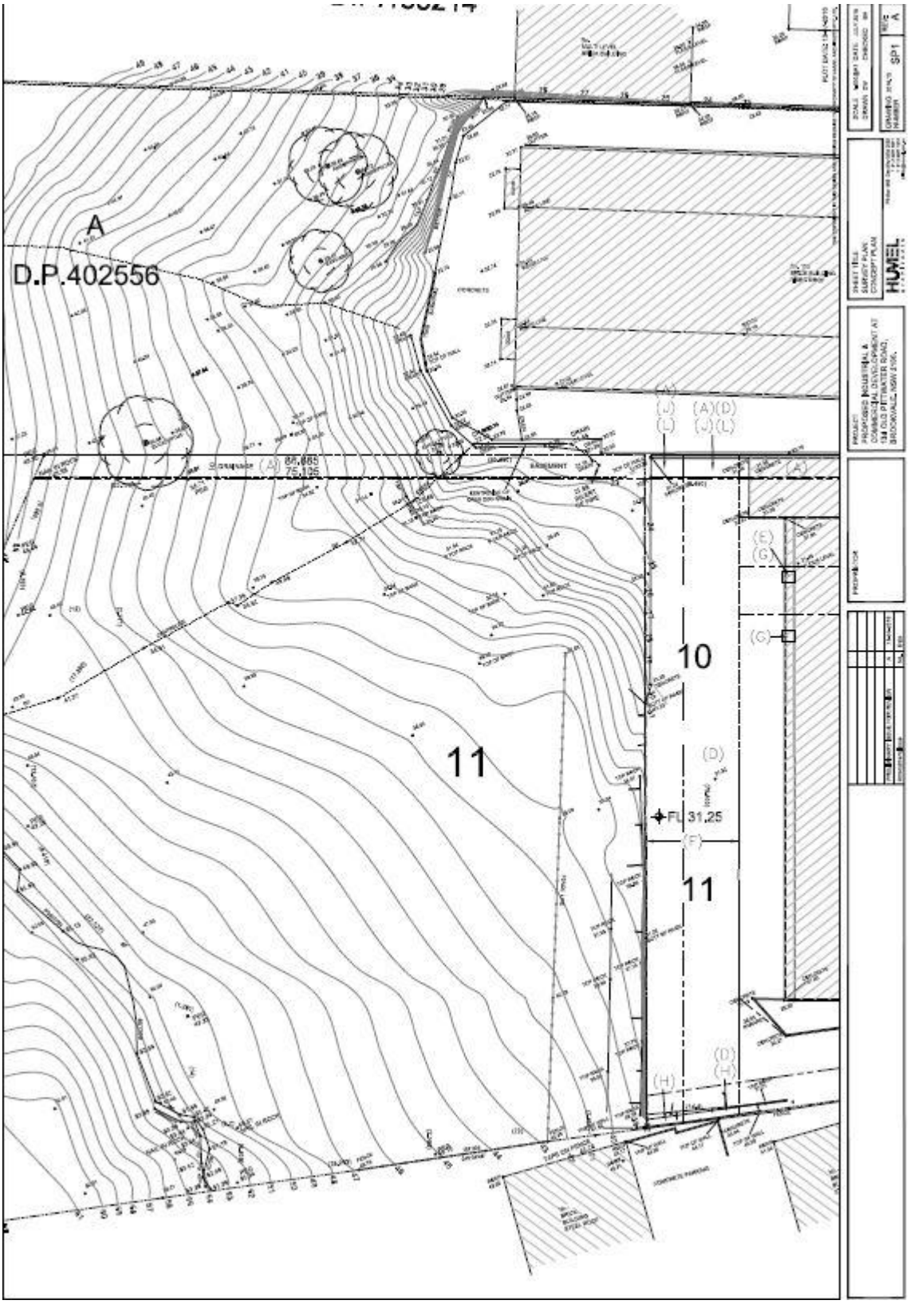

Figure 8 - Contour map of subject area Lot A DP 402556 showing creekline draining eastwards and cliff face at lower edge of hillslope

3.2.3 Plant community

One native vegetation type occurred within the study area.

The vegetation type has been assigned to an equivalent NSW PCT code as outlined below in Table 1

Table 1 Vegetation community recorded within the study area

NSW PCT/Ecosystems	PCT common usage name
PCT 1250 – Sydney Peppermint -Smooth-barked Apple - Red Bloodwood Shrubby Open Forest on Slopes of Moist Sandstone Gullies, Eastern Sydney Basin	Coastal Sandstone Gully Forest

Vegetation zone

The vegetation community occurring at the site was considered to include only the one singular vegetation zone.

A summary of the singular vegetation zone is listed in Tables 2A and 2B and described in more detail in Tables 3a, 3B and 3C. Flora survey data collected for the native vegetation zone is provided in Appendix 3.

Table 2A Vegetation Zone, Condition, Formation and Class recorded within the site

Plant community type/Ecosystems	Vegetation zone	Vegetation condition	Vegetation formation	Vegetation class
PCT 1250 – Sydney Peppermint -Smooth-barked Apple - Red Bloodwood Shrubby Open Forest on Slopes of Moist Sandstone Gullies, Eastern Sydney Basin	VZ1	Good (intact)	KH_CH5B Dry Sclerophyll Forests (Shrubby Sub-formation)	Sydney Coastal Dry Sclerophyll Forests

Table 2B Vegetation Zone, IBRA region, % cleared, TEC, Patch size, extent of TEC and VI Score recorded within the site

Plant community type/Ecosystems	IBRA region	IBRA sub region	% cleared	TEC	Patch size	Extent within study area	Vegetation integrity score
PCT 1250 – Sydney Peppermint - Smooth-barked Apple - Red Bloodwood Shrubby Open Forest on Slopes of Moist Sandstone Gullies, Eastern Sydney Basin	Sydney Basin	Pittwater	30	No	166.5ha	2,130m^2	59.5

Table 3A Comparison of PCT 1250 – Sydney Peppermint - Smooth-barked Apple - Red Bloodwood Shrubby Open Forest on Slopes of Moist Sandstone Gullies, Eastern Sydney Basin plot data against community condition benchmarks (BM) for Species Richness

Plot	Tree	Shrub	Grass	Forb	Fern	Other	Compos. Score
BM	2	27	9	8	2	5	100
Plot 1	3	10	7	2	3	3	46.6

Table 3B Comparison of PCT 1250 – Sydney Peppermint - Smooth-barked Apple - Red Bloodwood Shrubby Open Forest on Slopes of Moist Sandstone Gullies, Eastern Sydney Basin plot data against against community condition benchmarks (BM) for Species % Cover

Plot	Tree	Shrub	Grass	Forb	Fern	Other	Struct. Score
BM	45	68	36	5	1	4	100
Plot 1	82	24.5	18.5	2	26	11	60.5

Table 3C Comparison of PCT 1250 – Sydney Peppermint - Smooth-barked Apple - Red Bloodwood Shrubby Open Forest on Slopes of Moist Sandstone Gullies, Eastern Sydney Basin plot data against community condition benchmarks for Functional Attributes of Habitat

Plot	Length of Logs (m)	Leaf litter %	Presence of large trees	Stem Size Class	Regen. stems present	HTE Cover %	Funct. Score	Veg Integrity Score
BM	47	62	3	4	yes	-	100	
Plot 1	0	95	2	4	yes	7.1	74.5	**59.5**

‘Coastal Sandstone Gully Forest’

The general natural vegetation of the subject land is fairly typical of that which occurs on Hawkesbury Sandstone substrates, described as ‘Coastal Sandstone Gully Forest (OEH 2013, Code S_DSF09). This ecological community was formerly described as ‘Eastern Sandstone Gully Forest’ (Map Unit 61) (DEC 2002), and originally described as ‘Sydney Sandstone Gully Forest’ of the ‘Sydney Sandstone complex’ by Benson & Howell (1994).

Specifically, the community resembles that originally described by Benson & Howell (1994) as the woodland/open-forest community dominated by Sydney Red Gum (*Angophora costata*), Sydney Peppermint (*Eucalyptus piperita*), Grey Gum (*Eucalyptus punctata*) and Red Bloodwood (*Corymbia gummifera*).

The Peppermint – Angophora Forest ecological community has a relatively widespread geographic distribution (Benson & Howell 1994, Smith & Smith 2008) with understorey species assemblages being locally variable.

The open-forest community at the small area of the subject site (Figures 1, 4, 5 & 6) has a crown canopy (%CCPD) (DEC 2002) of between 35 – 50% and is dominated by Sydney Red Gum (*Angophora costata*) and Forest Sheoak (*Allocasuarina torulosa*) with tree heights to 20m. Most of the individuals of Forest Sheoak appear to be males (Figures 4, 5 & 6).

A relatively diverse array of understorey shrubs and small trees forms a relatively sparse canopy to about 5% CCPD that varies from to 2m to 3m in height. Typical species comprising the midstorey and understorey strata include Common Hopbush (*Dodonaea triquetra*), Christmas Bush (*Ceratopetalum gummiferum*), Elderberry Panax (*Polyscias sambucifolus*), Spiny Leaf Podocarp (*Podocarpus spinulosus*), Blueberry Ash (*Elaeocarpus reticulatus*), *Hibbertia linearis*, Hairy Zieria (*Zieria pilosa*), Heathy Parrot Pea (*Dillwynia retorta*) and Handsome Flat-pea (*Platylobium formosum*) (Appendix 1).

Common in the sparse ground and twiner layer to 10 - 15% are Bracken (*Pteridium esculentum*), Soft Bracken (*Calochlaena dubia*), Twining Guinea Flower (*Hibbertia dentata*), False Sarsaparilla (*Smilax glyciphylla*), Lesser Flannel Flower (*Actinotus minor*), Saw-sedge (*Gahnia erythrocarpa*), Common Rapier Sedge (*Lepidosperma filiforme*), Spiny-headed Mat-rush (*Lomandra longifolia*), Blue Flax Lily (*Dianella caerulea var. producta*), Forest Grass-tree (*Xanthorrhoea media*) and Wiry Panic (*Entolasia stricta*) (Appendix 1).

Leaf (cladode) layer appears to cover about 70% of the ground surface (Figures 4, 5 & 6) with only a small extent of surface cover of exposed rock outcropping to 5 - 10%.

This ecological community is common on coastal sheltered hillslopes (Benson & Howell 2004, Smith & Smith 2002, OEH 2013) and is not listed as threatened under the BC Act or the EPBC Act.

Small east-draining creekline

Figure 8 indicates the location of a small natural drainage channel through the site. The channel is comprised of irregular sized sandstone rock outcrops and boulders with mostly weed species established along its banks and within the channel elements (Figure 9).

Figure 9 - Small rock-lined drainage channel flowing eastwards down the slope to established piped stormwater infrastructure below cliffline

3.2.4 Species of conservation significance

Threatened species

The OEH Atlas of NSW Wildlife (2018) records for an area of 5km radius around the subject site indicate that 16 species of conservation significance have been recorded within a radius of 5km of the site within the last 20 years (Table 4). According to the Commonwealth DoEE 'Protected Matters Environmental Reporting Tool' 2018, potential habitat for 11 of these threatened species is deemed to occur within a 5km radius of the subject site. Appendix 2 lists these species with an account of their threatened status, geographical range, physiognomic attributes, habitat features and likelihood of occurrence.

Family	Common name	Scientific name	NSW status	Comm. status	No. of records
Dilleniaceae		*Hibbertia superans*	E1		1
Elaeocarpaceae		*Tetratheca glandulosa*	V		41
Ericaceae		*Epacris purpurascens var. purpurascens*	V		1
Euphorbiaceae	Sand Spurge	*Chamaesyce psammogeton*	E1		1
Fabaceae (Mimosoideae)	Sunshine Wattle	*Acacia terminalis subsp. terminalis*	E1	E	176
Lamiaceae	Somersby Mintbush	*Prostanthera junonis*	E1	E	2
	Seaforth Mintbush	*Prostanthera marifolia*	E4A	CE	167
Malvaceae		*Lasiopetalum joyceae*	V	V	1
Myrtaceae	Netted Bottle Brush	*Callistemon linearifolius*	V		3
	Camfield's Stringybark	*Eucalyptus camfieldii*	V	V	17
	Biconvex Paperbark	*Melaleuca biconvexa*	V	V	1
	Magenta Lilly Pilly	*Syzygium paniculatum*	E1	V	24
Orchidaceae	Angus's Onion Orchid	*Microtis angusii*	E1	E	1
Proteaceae	Caley's Grevillea	*Grevillea caleyi*	E4A	CE	99
	Hairy Geebung	*Persoonia hirsuta*	E1	E	24
Thymelaeaceae		*Pimelea curviflora var. curviflora*	V	V	22

Table 4 - Sixteen (16) species of threatened flora that have been recorded within a 10km area centred around the subject site within the last 20 years.

For many of these species, the habitat of the subject site is unsuitable for their occurrence (Appendix 2), particularly in regard to the dense mass of Sheoak cladode litter covering the ground surface (Figures 4 , 5 & 6). The ground cover is very open, however the survey targeted these species of conservation significance but none were found to occur in the surveyed area.

Biogeographically significant species

Two flora species, occurring in very low frequency, located on the subject land, are regarded as 'biogeographically significant' in the Sydney region by Smith & Smith (2005). These species include Wax Flower (*Crowea saligna*), which is common throughout the upper sections of the land which will not be impacted and Pine-leaved Geebung (*Persoonia pinifolia*) (Appendix 1). All these species have been recorded in, and are well conserved in local National Parks at Garigal and Kuring-Gai Chase National Parks (Smith & Smith 1998).

3.3 Wildlife corridor potential

The subject area links the medium-sized areas of bushland of Allenby Park to the north-west with Manly Dam Reserve to the south-east, which in turn have connectivity with areas of bushland along Wakehurst Parkway including Garigal National Park to the west through to Kuring-Gai Chase National Park to the north (Smith & Smith 2005).

The corridor within which the land occurs is mapped as 'Priority 2 Wildlife Corridor' in the locality by Smith & Smith (2005). This implies that corridors link medium-sized areas of bushland such as Allenby Park with other medium or larger areas of bushland. Some of these links are tenuous with little opportunity for revegetation beyond promoting the use of native plants in local gardens. Priority 2 Wildlife Corridors generally link two or more alternative corridor routes with larger areas of bushland (Smith & Smith 2005)

3.4 Impacts of proposed development

The proposed development would result in the further clearing of about 0.2ha of natural bushland in addition to the 0.9ha cleared immediately to the south at 140 Old Pittwater Road, with the retention of about 0.39ha of vegetated area upslope of the subject land. The proposal is to excavate into the hillside for the construction of the warehouse/office complex and small areas of exposed rock ledges and boulders will be impacted.

The ecological community occurring on the subject land is common on coastal sheltered hillslopes in the locality and region (Benson & Howell 2004, Smith & Smith 2002, OEH 2013) and is not listed as threatened under the BC Act or the EPBC Act. No threatened plant species were found to occur in the subject land, however, 2 biogeographically significant species, occurring in

very low frequency, were recorded as component of the assemblage. All of these species are well conserved in nearby Garigal and Kuring-Gai National Parks.

Bushland occurring to the south, in a small section of retained vegetation, to the west in a dedicated bushland Reserve area and above the land to be excavated, and to the north (Figures 3 & 7), is of similar structure and floristic composition to that proposed for removal from the subject land.

3.5 Conclusions of flora assessment

The small area of the subject land contains a number of various habitats including gradual hillslopes, some rocky outcrops and boulders, damp areas of restricted drainage and areas adjacent to a drainage course. The proposal is to excavate into the hillside for the construction of the warehouse/office complex and areas of exposed rock ledges and boulders will be impacted.

The general natural vegetation of the subject land is typical of that which occurs on Hawkesbury Sandstone substrates, described as 'Coastal Sandstone Gully Forest (OEH 2013, Code S_DSF09).
The hillslope, with relatively steep north-easterly aspect contains an open forest vegetation to 30 – 35% CCPD with most tree heights around 15m to 20m tall. The general natural vegetation of the subject land is typical of that which occurs on Hawkesbury Sandstone substrates on variously dissected or gully topography. The forest canopy assemblage includes Sydney Red Gum (*Angophora costata*) and mostly male individuals of Forest Sheoak (*Allocasuarina torulosa*).

A total of 43 indigenous plant species occurring at varying frequency was recorded over the range of habitats comprising the surveyed area.

A total of 8 exotic, mainly environmental weed species, including 3 species of Biosecurity classified weeds (Dept Primary Industries 2018) were recorded in the surveyed area. These weed species occurring at the subject site include Lantana (*Lantana camara*), Small-leaf Privet (*Ligustrum sinense*), Pampas Grass (*Cortaderia selloana*) and Asparagus Fern (*Asparagus aethiopicus*) (Appendix 1).

The OEH Atlas of NSW Wildlife (2018) records for an area of 5km radius around the subject site indicate that 16 species of conservation significance have been recorded within a radius of 5km of the site within the last 20 years.

The habitat of the small area of the subject site is considered unsuitable for the occurrence of many of these species (Appendix 2), particularly in regard to the high ground cover of sheoak

leaf litter. The survey targeted all of these species of conservation significance but none were found to occur in the subject area.

Two species occurring in very low frequency on the subject land are regarded as 'biogeographically significant' in the Sydney region (Smith & Smith 2005). These species include Wax Flower (*Crowea saligna*) and Pine-leaved Geebung (*Persoonia pinifolia*). Both of these species have been recorded in, and are well conserved in local National Parks at Garigal and Kuring-Gai Chase (Smith & Smith 1998).

The corridor within which the subject land occurs is mapped as 'Priority 2 Wildlife Corridor' in the locality (Smith & Smith 2005). The subject area links the medium-sized areas of bushland of Allenby Park to the north-west and Manly Dam Reserve to the south-east, which in turn have connectivity with areas of bushland along Wakehurst Parkway including Garigal National Park to the west, through to Kuring-Gai Chase National Park to the north (Smith & Smith 2005).

The proposed development would result in the clearing of a further 0.21ha of natural bushland with the retention of about 0.39ha. Bushland occurring to the south, in a small section of retained vegetation at the upper slope of an allotment, to the west in a dedicated bushland Reserve area, and to the north (Figures 3 & 7), is of similar structure and floristic composition to that proposed for removal from the subject land.

4 FAUNA SURVEY AND HABITAT ASSESSMENT

The following fauna assessment has been prepared with particular regard to the Biodiversity Conservation Act 2016 (BC Act), Section 5A of the current Environmental Planning and Assessment Act (EP&A, 1979) and the Environment Protection and Biodiversity Conservation Act (EPBC Act, 1999).

4.1 Methods

4.1.1 Literature review

Searches were undertaken of the OEH Bionet Atlas of NSW Wildlife database 2018 (Office of Environment and Heritage) for a 5km radius centred around the site, as well as the Department of Environment and Energy (DoEE) 'Protected Matters Search Tool' Database (2018) for threatened species or populations of fauna likely to occur in the study area. Searches of JAMBA and CAMBA databases were also consulted in regard to the distribution of migratory bird species.

The following fauna assessment has been prepared with particular regard to the BC Act, Section 5A of the current EP&A Act and the EPBC Act.

Grid co-ordinates of centre of subject land; latitude: -33.767407^{o} ; longitude: 151.2599153^{o}

4.1.2 Site potential to form part of a fauna habitat corridor

The subject land (indicated by solid red circle, Figure 10) forms a finger extension of bushland from Allenby Park situated to the north of the survey site which covers 42 hectares in the suburbs of Allambie Heights, Beacon Hill and Brookvale. The corridor is mapped as 'Priority 2 Wildlife Corridor' in the locality (Smith & Smith 2005). At this location the corridor is viable for avifauna, arboral mammals and flying mammals only, due to the fragmented connection to larger bushland reserves. The subject site forms an extension to Allenby Park, and has a disjunct connection to Manly Dam and Garigal National Park.

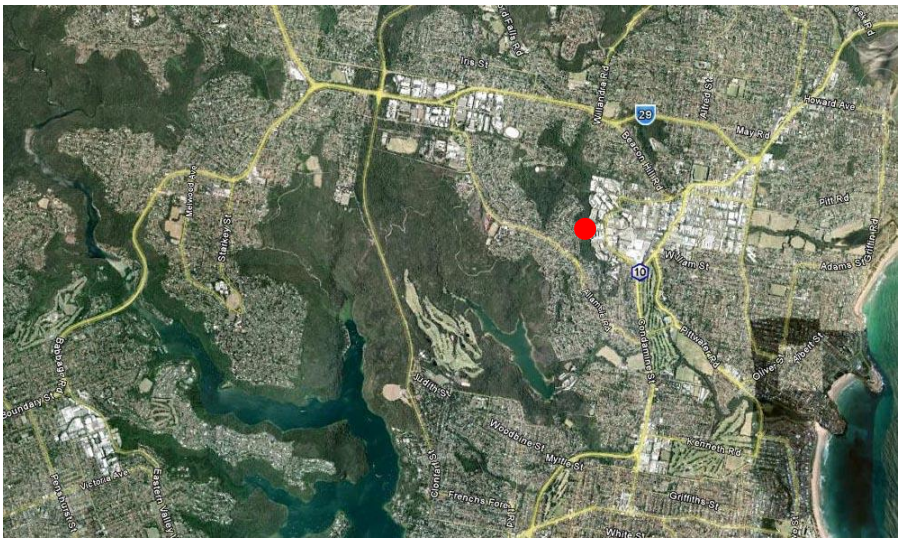

Figure 10
Aerial view of the bush land reserves surrounding the subject land (red circle). The land is situated as a finger extension to Allenby Park.
At this location the corridor is viable for avifauna, arboreal and flying mammals only, due to urban encroachment.

4.1.3 Site survey

The survey effort complies with the survey effort recommended by the Draft Guidelines for Threatened Species Assessment under Part 3A (DEC and DPI, 2005) for the study area size, habitat types available on the site and seasonal factors.

A dedicated ground search was undertaken as well as a census of extant birds. The survey involved different search strategies and protocols and all extant fauna or evidence of fauna was recorded.

i) Fauna survey weather conditions

The subject land at 130 Old Pittwater Road, Brookvale was surveyed on the 3rd September 2018 for fauna and fauna habitat.

Weather conditions September 2018:

3/9/2018 - min. temp 7.3; max. temp 14.7; 9am 10.7°C; 3pm 11.2;
rainfall nil;
wind speed max 28kmh SSE; (9am 11kmh)
Source: Terrey Hills (AWS no. 066059)

ii) Recording Methods

- The search strategy employed for diurnal birds is based on utilising periodic observation stations or "point counts" as described by York et al., (1991). Counts were conducted only during periods of relatively high activity (early morning). Searches undertaken included recording and observing location of potential roost sites and

accessible tree hollows. Roost trees are delineated by evidence of white wash around the base of a tree or tree trunk.

- Scat searches and pellet analysis were conducted to ascertain the species present. Scats are collected in resealable plastic bags for later examination.

- Opportunistic hand searches for reptilian fauna were undertaken during the afternoon when temperatures were higher, ensuring maximum activity.

- From a previous survey (2009), 10 hair tube traps were placed on the adjacent site (No. 140 Old PittwaterRoad) over 7 consecutive nights in May.

- From a previous survey (2009), specific habitat searches were undertaken on adjoining properties for Red-crowned Toadlet by A White. A full description of the survey effort and technique applied is included in Dr White's report (Attachment A).

- From a previous survey (2009), a bat detector (Anabat II) and solid state recorder was utilised over seven nights, to monitor microchiropteran bat activity. Interpretation of signals recorded was achieved using "Titley" Z-caim hardware and Analook Win software V 3.3f Chris Corben.

iii) Summary of minimum survey effort employed for each fauna group

Fauna group	Survey technique	Survey period (season)	Survey effort per vegetation community
Mammals			
Small terrestrial	Hair tubes Scratches, tracks Predator scats	Autumn 09 Autumn 09 Autumn 09 Autumn 11 Spring 18	10 traps over 7 consecutive nights. Whole site Whole site Whole site Whole site (130 Old Pittwater Road)
Medium terrestrial	Hair tubes Scratches, tracks Scat collection	Autumn 09 Autumn 09 Autumn 09 Autumn 11 Spring 18	5 traps over 7 consecutive nights Whole site Whole site Whole site Whole site (130 Old Pittwater Road)
Microchiropteran bats	Echolocation call	Autumn 09	Call activated between dusk and dawn over seven nights
Birds			
Diurnal birds	**Formal census**	**Autumn 09**	**20mins early morning and late afternoon**
	Opportunistic observations	Autumn 09 Autumn 11	

Birds			
	Opportunistic observations	Spring 18	During survey period (morning)
Reptiles			
Diurnal search	Habitat search	Autumn 09 Autumn 11	2 separate days 1 day
	Habitat search	Spring 18	During survey period (morning)
Amphibian			
Diurnal search	Specific habitat search	Autumn 09 Autumn 11	Look for drainage channels Look for damp leaf litter
Diurnal search	Specific habitat search	Spring 2018	Look for drainage channels Look for damp leaf litter

iv) Summary of hair trap placement

Hair trap placement- Autumn 2009

Hair trap group	No of tubes	Size of tubes	Habitat	Target species
1 – ground	10	10cm wide	Across site within forest area	terrestrial mammals

4.2 Results

4.2.1 Fauna habitats occurring on the subject land

The habitat type is open forest, with substantial ground litter, mainly in the form of Sheoak cladodes on the forest floor.

The land has few sandstone outcrops with ledges and cracks to provide potential refuge for small animals and appears as an open understorey canopy with little opportunity for foraging, refuge or shelter except for scattered clumps of ferns, vines and small bushes.

Fruit of flowering eucalypts and angophoras could occasionally attract the Grey-headed Flying Fox and other arboreal mammalian species, although access on the subject land for some species is restricted by its urban situation. There are no trees with dead fallen limbs that contained any small hollows and nor are there any trees of sufficient age to have formed large hollows to accommodate arboreal mammals or large owls.

A few small shallow rock overhangs and crevices occur along the slope to provide shelter for reptilian fauna. Loose bush rock is uncommon.

4.2.2 Fauna recorded

The weather conditions at the time of survey were cold temperatures with light rain, not ideal conditions for bird activity.

The most commonly recorded bird species utilising resources in the forest area on and surrounding the subject land was the Noisy Miner (*Manorina melanocephala*). The Noisy Miner (*Manorina melanophris*), together with the Red Wattlebird (*Anthochaera carunculata*) and Rainbow Lorikeet (*Trichoglossus haematodus*) are aggressive nectar-feeding species which may exclude other nectar-feeding birds from flowering trees and shrubs in the area.

Parrots such as Sulphur-crested Cockatoo (*Cacatua galerita*) and Rainbow Lorikeet (*Trichoglossus haematodus)* compete with other birds for scarce nesting opportunities in tree hollows of the locality.

Occasional birds observed included the White-browed Scrub-wren (*Sericornis frontalis*), Crimson Rosella (*Platycercus elegans*) and Eastern Yellow Robin (*Eopsaltria australis*). There was also occasional occurrence of Laughing Kookaburra (*Dacelo novaeguineae*) and Australian Raven (*Corvus coronoides*) in vicinity and thhe Grey Butcherbird (*Cracticus torquatus*) would also be expected to occur occasionally.

Nocturnal birds expected to forage in the area include the Tawny Frogmouth (*Podargus strigoides*) and Southern Boobook (*Ninox boobook*). The Powerful Owl (*Ninox strenua*) may also be expected to forage in the area due to the presence of prey species and past recordings of the species within Allenby Park.

In previous surveys on the adjoining property at 140 Old Pittwater Road, Brookvale, scat of feral Cat (*Felis catus**) was found in 2009. The scat contained bones and hair of the House Mouse (*Mus musculus*) as well as seeds and feathers. Low diversity of small native ground fauna in this section might be a result of the activity of this introduced species.

Foraging habitat also exists for small bats. Over seven consecutive nights in 2009, using the Anabat II Bat Detector, Gould's Wattled Bat (*Chalinolobus gouldii*), an unidentified Freetail Bat (*Mormopterus* species 2) and the threatened Eastern Bentwing Bat (*Miniopterus Schreibersii oceanensis)* were recorded (Appendix 4). The status of the undescribed Freetail Bat is LR (1c), i.e. lower risk, conservation dependent (Department of Environment and Energy, Canberra).
This bat species is smaller and more common than the East-coast Freetail Bat (*Mormopterus nofolkensis*). It feeds on bugs, ants, beetles and moths in a wide range of habitats that include dry sclerophyll and riparian open forests. All but the Eastern Bentwing Bat roost in tree hollows and spouts. There are a number of small hollows present in the trees within Allenby Park, but none present within the survey area. The Eastern Bentwing

Bat is a cave dweller and there are many roosting opportunities along the eastern seaboard cliff face for this bat to roost. The larger megabat, Grey-headed Flying Fox (*Pteropus poliocephalus*) was not sighted during this survey but may be attracted to the general area by flowering eucalyptus trees and fruiting figs in the summer months.

Four species of reptile were recorded in surveys in 2009 on the adjoining land which had a greater variation in habitats compared to the open-structured habitat of the current surveyed site. These included the Dark flecked Garden Skink (*Lampropholis delicata*); the Weasel Shade Skink (*Saproscincus mustelinus*); the Yellow-faced Whipsnake (*Demansia psammophis*), recorded in leaf litter, and The Eastern Water Skink (*Eulamprus quoyii*), recorded in the drainage channel. The Eastern Blue-tongue Lizard (*Tiliqua scincoides*) and Red-bellied Black Snake (*Psuedechis porphyriacus*) would also be expected to occur on the site.

In 2009, the Common Eastern Froglet (*Crinia signifera*) was identified by its characteristic call, heard near the north eastern corner of the site at 140 Old Pittwater Road, where damp leaf litter was present. No other frogs were heard calling on the site. Call playback for the threatened Red-crowned Toadlet within the subject site at 140 Old Pittwater Road yielded a negative result.

All fauna species recorded in previous and current surveys are listed in Appendix 4.

4.2.3 Fauna species of conservation significance

4.2.3.1 Threatened species

The Bionet Atlas of NSW Wildlife database 2018 (Office of Environment and Heritage) listed twenty six (26) species (omitting all the unlikely animals such as Whales, Penguins, Shearwaters and other migratory shorebirds) and one population (Long-nosed Bandicoot population at North Head) of terrestrial and avifauna listed as threatened under the BC Act within a 5 km radius centred around the site (Table 5). Four of these species plus the one population are designated as endangered by the NSW Scientific Committee with the remainder species designated as vulnerable to extinction. Under the EPBC Act 1999, three of these species are listed as endangered and four as vulnerable.

All threatened species listed require specific habitat for foraging, nesting or roosting. The subject land was assessed for these habitat requirements (refer to Appendix 5). Those species with potential to occur are listed below.

Family	Common name	Scientific name	NSW status	Comm. status	No. of records
Amphibia Myobatrachidae	Giant Burrowing Frog	*Heleioporus australiacus*	V	V	6
	Red-crowned Toadlet	*Pseudophryne australis*	V		85
Hylidae	Green and Golden Bell Frog	*Litoria aurea*	E1	V	1
Reptilia Varanidae	Rosenberg's Goanna	*Varanus rosenbergi*	V		42
Aves Accipitridae	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	C	19
	Little Eagle	*Hieraaetus morphnoides*	V		1
	Square-tailed Kite	*Lophoictinia isura*	V		1
Burhinidae	Bush Stone-curlew	*Burhinus grallarius*	E1		8
Cacatuidae	Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V,P		29
Psittacidae	Little Lorikeet	*Glossopsitta pusilla*	V		2
	Swift Parrot	*Lathamus discolor*	E1	CE	8
	Turquoise Parrot	*Neophema pulchella*	V		1
Strigidae	Barking Owl	*Ninox connivens*	V		5
	Powerful Owl	*Ninox strenua*	V		231
Tytonidae	Sooty Owl	*Tyto tenebricosa*	V		3
Neosittidae	Varied Sittella	*Daphoenositta chrysoptera*	V		2
Petroicidae	Scarlet Robin	*Petroica boodang*	V		1
Mammalia Dasyuridae	Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	4
Peramelidae	Southern Brown Bandicoot (eastern)	*Isoodon obesulus obesulus*	E1	E	2
	Long-nosed Bandicoot, North Head	*Perameles nasuta*	E2		1,455
Burramyidae	Eastern Pygmy-possum	*Cercartetus nanus*	V		312
Pteropodidae	Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	102
Molossidae	Eastern Freetail-bat	*Mormopterus norfolkensis*	V		2
Vespertilionidae	Little Bentwing-bat	*Miniopterus australis*	V		7
	Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V		64
	Southern Myotis	*Myotis macropus*	V		9
Muridae	New Holland Mouse	*Pseudomys novaehollandiae*		V	1

Table 5 - 26 species of threatened fauna and one threatened population that have been recorded within a 5km radius of the subject site within the previous 20 years (OEH Bionet Atlas 2018).

Key	
Environmental Protection and Biodiversity Conservation Act (EPBC Act) 1999	Biodiversity Conservation Act (BC Act) 2016
	E1 - Endangered
CE - Critically Endangered	E2 - endangered population
E - Endangered	E4 - critically endangered
V - Vulnerable	V - Vulnerable
	J JAMBA Migratory bird agreement between Australia and Japan
	C CAMBA Migratory bird agreement between Australia and China

Legend to Table 5 - BC Act, EPBC Act, Migratory Bird Agreements

4.2.3.2 Threatened species with potential to occur on the subject land (assessed in Appendix 5 by habitat presence and sightings)

One threatened mammalian species listed was recorded over seven nights in 2009 utilising resources over the subject land. This was the Eastern Bentwing-Bat (*Miniopterus schreibersii oceanensis*), a microbat frequently recorded over a wide range of forested habitats in the region (pers obs). Other threatened species with potential to utilise resources on the subject land and surrounding areas include the Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Grey-headed Flying Fox (*Pteropus poliocephalus*) and Powerful Owl (*Ninox strenua*).

1. Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*)

Roosting habitat for this species includes caves, mines near or above water, discarded buildings and tunnels. No structures described are present on the subject land. Suitable roosting habitat for this threatened microchiropteran bat species is likely to be found within moister valleys of the locality rather than the small steeply sloped area of the subject land.

This bat forages in well timbered valleys above the tree canopy on small flying insects (Strahan 1995). Foraging habitat is present over the land and within Allenby Park north of the site, but is possibly reduced by traffic noise. Core likely foraging habitat for the Eastern Bentwing Bat is more likely concentrated in the larger areas of more mature vegetation within Garigal National Park.
Due to the lack of suitable roosting habitat, and disturbance, this area is considered to be of relatively low value for foraging when compared to larger areas of vegetation in surrounding reserves. No significant adverse impact on the life-cycle or population dynamics of the Eastern Bentwing Bat is expected from the proposed development.

Figure 11 indicates the wide range of localities in which this species has been recorded in the previous 20 years (including the record for 140 Old Pittwater Road in 2009).

2. Grey-headed Flying Fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox while not recorded during this current survey may use resources on site and is likely to be regular or frequent visitor to the general area based upon database records.

Figure 12 indicates the wide range of localities in which this species has been recorded in the previous 20 years.

Limited foraging habitat for this species is considered to be present in the study area when food resources are present in the form of nectar-producing trees. No camp sites are present within or in the bushland adjacent to the subject land. Foraging Grey-headed Flying Fox is likely to have come from camps within the Royal Botanic Gardens or Gordon. Vegetation clearing as a result of the development would not result in a significant reduction in available foraging habitat in the short-term and is not considered likely to prevent the species from utilising bushland to the rear and north of the site for foraging in the medium to long term.

3. Powerful Owl (*Ninox strenua*)

The Powerful Owl requires large tracts of forest or woodland habitat but can also occur in fragmented landscapes (DEC, 2006). This species is known to nest in large tree hollows (at least 0.5 m deep), in large eucalypts that are at least 150 years old (DEC 2006) and some of their prey also rely on tree hollows for refuge. No hollows of sufficient size to accommodate the Powerful Owl were observed in any of the trees on the subject land. The majority of the trees have no or only very small hollows and fissures that could accommodate the Powerful Owl's prey species such as the Common Ringtail Possum. The Powerful Owl will move into areas where prey species are abundant and move on to another area once prey numbers are depleted (DEC 2006).

Figure 12 indicates the wide area of localities in the area in which the species has been recorded within the last 20 years and it is considered that a significant adverse impact by the proposed development on the Powerful Owl is highly unlikely.

4. Glossy Black-Cockatoo (*Calyptorhynchus lathami*)

In coastal NSW the main food resource for the Glossy Back-Cockatoo is seed from Forest Sheoak (*Allocasuarina torulosa*) and Black Sheoak (*Allocasuarina littoralis*), with the former the most preferred. The species is also known to occasionally feed on seeds of Scrub Sheoak (*Allocasuarina distyla*) (Smith and Smith 2000). Whilst Forest Sheoak is common with a broad distribution on site most individuals appear to be male and Black Sheoak is uncommon with only a few small trees present.

Potential foraging habitat is available given the presence of a copse of Forest Sheoak, containing at least 6 female trees bearing cones. However, records for this species have not occurred in the locality within the previous 20 years (Figure 13). Similar and more extensive habitat occurs to the north of the subject site and at Allenby Reserve to the north-west. No nesting habitat is present in the form of any large hollows in mature trees. It is considered that the clearing of a small area of forest for the development would not significantly impact on the foraging habitat of this species in the locality.

5. Red-crowned Toadlet (*Pseudophryne australis*)

The Red-crowned Toadlet is confined to the Sydney Basin and is nearly always found on Hawkesbury or Narrabeen Sandstones. In 2003, Dr Arthur White, a specialist herpetologist, undertook a comprehensive survey of the area in 2009 and recorded the call of one individual from the western portion of 130 Old Pittwater Road, Brookvale near to where he had earlier recorded the species presence (Biosphere 2003).

The Red-crowned Toadlet habitat areas identified by Dr White are all at a higher elevation than that of the proposed excavation and development and as such toadlet survival should not be affected as a result of changes in ground water flow.

6. Eastern Pygmy Possum (*Cercartetus nanus*)

Habitat for the Eastern Pygmy Possum is not present on the site. The Eastern Pygmy Possum feeds mostly on pollen and nectar from banksias, eucalypts and understorey plants but will also eat insects, seeds and fruit. They shelter in tree hollows, rotten stumps, holes in the ground, abandoned bird nests, ringtail possum dreys and thickets of vegetation.

There have been 312 recordings for this species in the locality within the previous 20 years but mostly within natural bushland near Manly Dam to the south and Garigal National Park to the north and north-west. The presence of suitable habitat dooes not occur in the open structured habitat of the subject site (Figures 4, 5 & 6) and the species has not been recorded previously in the general area possibly due to the extent of urban development surrounding Allenby Park.

Based on assessments of potential habitat loss within the small area of the subject site for the species listed above, the development is not considered to have a significant adverse affect on the life-cycle or potential viability of populations of these threatened species in the locality.

Potential habitat: Koala

The site was assessed as not being "potential koala habitat" as defined in SEPP 44 as trees of the type listed in Schedule 2 constituted less than 15% of the total number of trees in the upper and lower strata of the tree component.

Connectivity of the site to larger tracts of bushland is disjunct and this threatened species is not expected to occur.

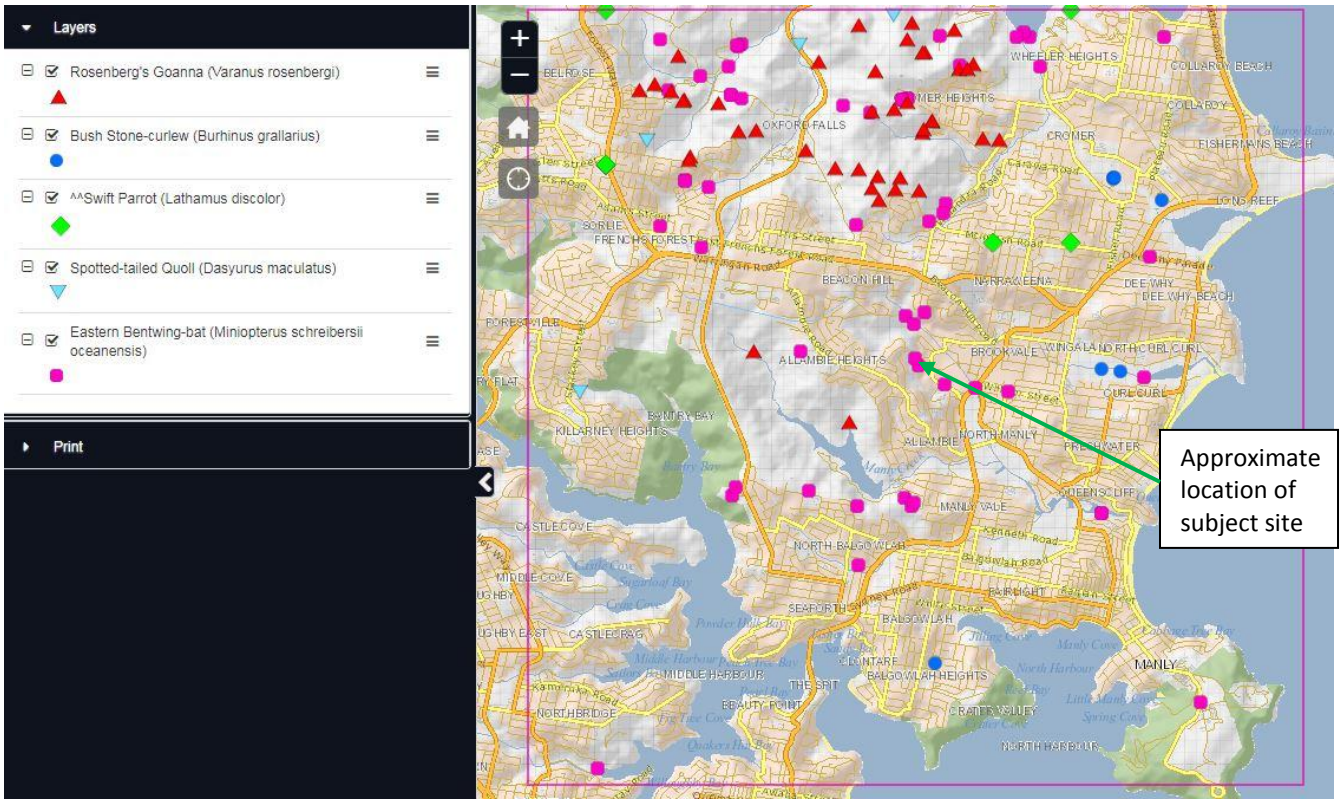

Figure 11 - Indicates 5 threatened fauna species recorded within a 5km radius of the subject site showing the widespread recordings for the Common or Eastern Bentwing Bat occurring in the vicinity of the subject site

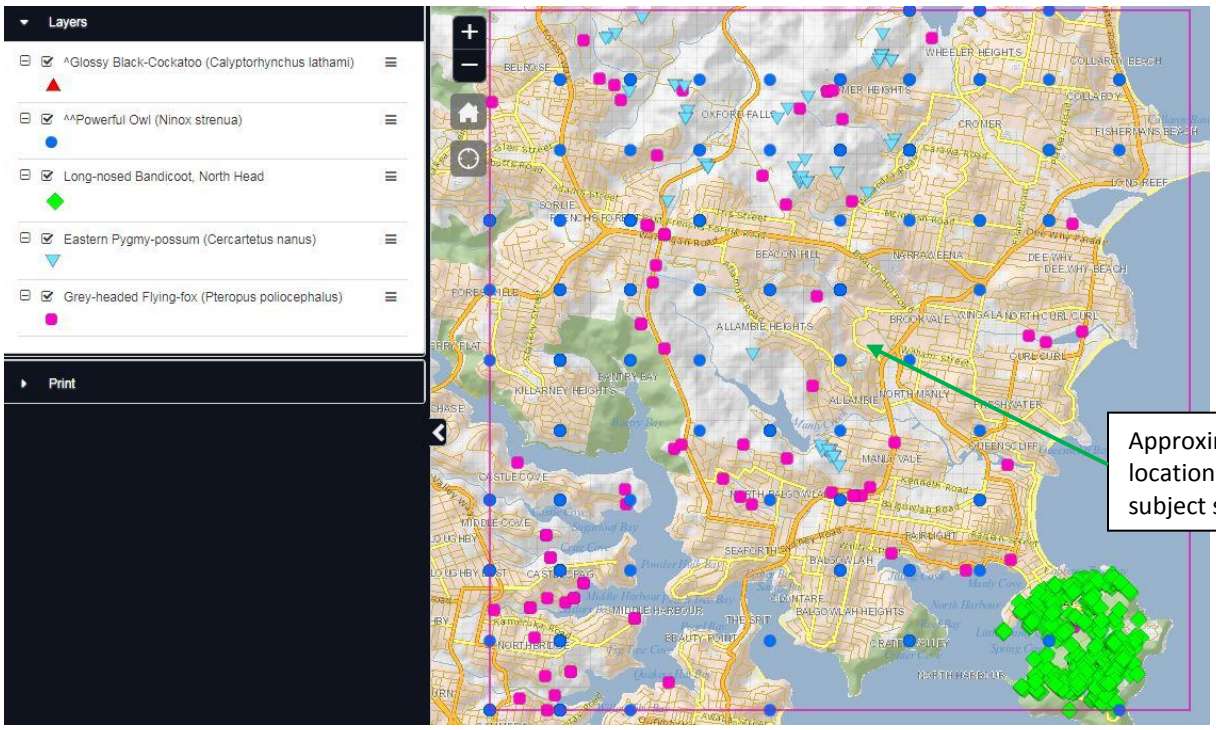

Figure 12 - Indicates 5 threatened fauna species recorded within a 5km radius of the subject site showing widespread recordings for the Powerful Owl and Grey-headed Flying Fox across the locality and the limited areas recorded for the Eastern Pygmy Possum.

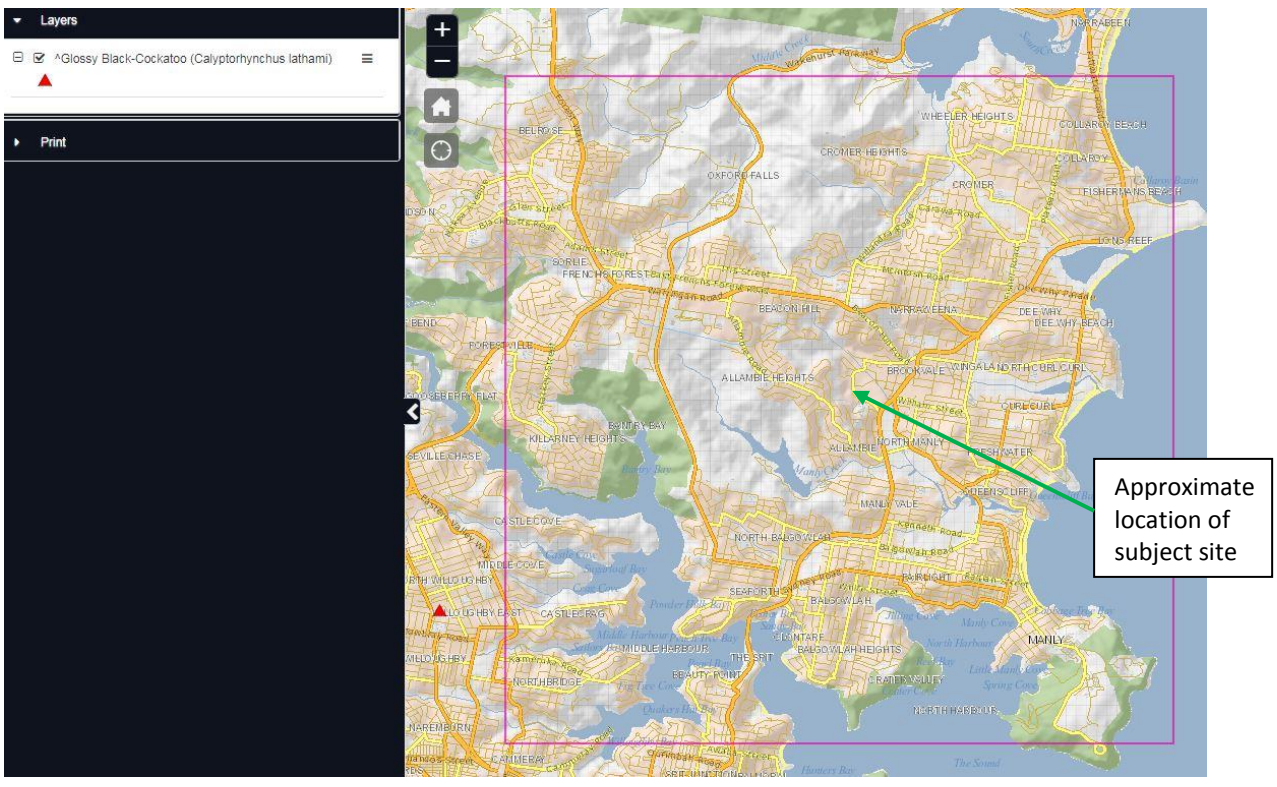

Figure 13 - Indicates the location of a single record for the Glossy Black Cockatoo recorded within a 5km radius of the subject site near Willoughby East

4.2.3.3 Species listed by the Commonwealth DoEE (Commonwealth Protected Matters Search Tool) as potential inhabitants of the site.

Each of the threatened species listed by DoEE (Canberra) was reviewed in relation to the distribution, habitat and likelihood of occurrence. For those species with potential to occur, an assessment of habitat potential is addressed. All species listed as with potential to occur are listed in Appendix 6. One threatened species with a moderate to high likelihood of using these resources is the Grey-headed Flying Fox (*Pteropus poliocephalus*). As detailed previously, the development is not considered to impose a significant adverse affect on the foraging ability of this threatened species. The migratory nectar-feeding bird, Regent Honeyeater (*Anthochaera phrygia*) may utilise resources sporadically or on a seasonal basis but is not considered likely to be a regular or frequent visitor to the area based upon database records.

4.2.3.4 Species listed by the Commonwealth DoEE (Commonwealth Protected Matters Search Tool) as potential migratory inhabitants of the site.

Each of the migratory species listed by DoEE (Canberra) was reviewed in relation to the distribution, habitat and likelihood of occurrence. For those species with potential to occur, an assessment of habitat potential is addressed. All species listed as migratory with potential to occur are listed in Appendix 7. Migratory species are considered unlikely to rely on the affected areas as breeding, foraging or roosting habitat due to the level of disturbance adjacent to busy roads.
Breeding habitat is more likely to be located in core bushland areas beyond the study area within Garigal National Park.

Suitable foraging habitat is only considered to be marginal at best for migratory marine species with preferred habitat more likely to be located in areas of less-disturbed habitat surrounding Manly Dam.

4.3 Conclusions of fauna assessment

As part of a biodiversity impact assessment, the fauna survey was undertaken to record fauna species currently utilising the site and to assess the habitat value for threatened species listed in the database for the area. The natural forest fauna habitat occurring on the subject land varies in value across the site but is rated as relatively poor due to the open-structured stratification of the site with very little understorey or ground cover offering shelter or foraging resources for avian or ground-dwelling fauna. The dense ground cover of Sheoak litter occurring in unburnt vegetation reduces opportunity for seed germination and seedling establishment.

To the north and north-west of the subject land, the fauna habitat value is rated as good as the vegetation structure and floristics appear to have greater diversity though still considered limited due to the surrounding urban environment.

Recorded species utilising the subject land are common mostly to the area. Whilst few bird species were recorded on the subject land, many were recorded flying overhead and this is due in part to the location of the site close to the Allenby Park and Manly Dam.

The presence of feral animals, in particular the Cat, which appears by scat evidence to occur within the surveyed area and surrounds, has probably reduced the terrestrial fauna diversity within the subject land.

Database searches at a Local Government, State and Federal level were undertaken to identify threatened species that had been recorded previously in the area. One threatened species listed was recorded during an earlier survey in 2009. This was the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*). For this species no caves or hollows were found on site which might provide roosting opportunities however numerous roost sites are known to occur in the reserves of the area. The Eastern Bentwing Bat feeds on moths and flying insects above the canopy of forested areas such as occurs locally in Garigal National Park. It is considered that the proposal to develop the site would not significantly impact upon the life cycle of this species or place any local population in threat of extinction.

Other threatened species identified as having potential to occur on the site were also examined to assess any possible impact from the proposed development. These included the Powerful Owl, Glossy Black-Cockatoo, Red-crowned Toadlet and the Grey-headed Flying Fox.

Assessment of habitat in the woodland concluded that the Powerful Owl (*Ninox strenua*) may occasionally forage within the area if suitable prey species were in abundance and also for the Grey-headed Flying Fox when particular tree species were fruiting or flowering.

For the Red-crowned Toadlet, no response was received from call-playback and no toadlets were located as part of the hand search of the area.

No trees with large hollows were recorded that could provide nesting opportunities for the Glossy Black Cockatoo, although a number of tree species listed as a food resource occur on site. Forest Sheoak, Black Sheoak and Scrub Sheoak are species common to sandstone vegetation communities in Garigal National Park and Ku-ringai Chase National Park as well as other smaller bushland reserves of the area. Their presence on the subject land and the small area of occupation is therefore not likely to be significant in the local survival of populations of the Glossy Black Cockatoo.

It is considered that for each of the threatened fauna species that may occasionally forage at the small area of subject land, the development would be unlikely to have an adverse effect on the life cycle of the individual species or impact significantly on the area of their respective habitat.

As such it is considered that further assessment in the form of a Species Impact Statement is not necessary.

For the larger extent of area of bushland to the west section of the site that is not proposed for development, it is recommended that there be no removal of fauna habitat features such as the bush rock outcrops, organic debris, branches and logs which provide refuge for native species.

4.3.1 Mitigation measures for Key Threatening Processes (KTP) proposed to maintain biodiversity and species of conservation significance

- Feral cat predatory behaviour is a KTP. It is recommended that no cats be kept or fed on the new premises.
- Weed eradication and replanting with native plants endemic to the area which will reduce the population Black Rat and encourage repopulation with the native Bush rat (*Rattus fuscipes*).
- Retain dead trees and woody debris where possible to provide habitat for invertebrates, reptiles, amphibians, birds and small mammals.

5 ADDRESSING THE PROPOSED DEVELOPMENT IN RELATION TO THE BAM (BIODIVERSITY ASSESSMENT METHOD) AS REQUIRED BY THE BC ACT (2016)

5.1 Offset Scheme Thresholds

5.1.1 Area criteria

The threshold for clearing above which the BAM and offsets apply is 1ha (BAM 2016). Of this 1ha area, if the area to be developed as >0.25ha then offsets apply (BAM 2016).

The property described as Lot 11 DP 130 Old Pittwater Road, Brookvale, comprises an area of 0.604ha of which about 0.391ha in the upper western section is to be retained in its natural state (Figure 1).

The section of the vegetated subject land proposed for development is estimated at about 2,130m^2 in area and zoned for industrial development within Locality G10.

The development foes not meet the offset criteria in relation to area to potentially be impacted.

5.1.2 Biodiversity Values Map

The Biodiversity Values Map (BV Map) identifies land with high biodiversity value, as defined by the *Biodiversity Conservation Regulation 2017*. The Biodiversity Offsets Scheme applies to all local developments, major projects or the clearing of native vegetation where the *State* Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 applies. Any of these will require entry into the Biodiversity Offsets Scheme if they occur on land mapped on the Biodiversity Values Map (OEH 2018).

The location of the subject property on the Biodiversity Values Map is indicated in Figure 14.

The subject property is not indicated as containing any significant Biodiversity Value (Figure 14).

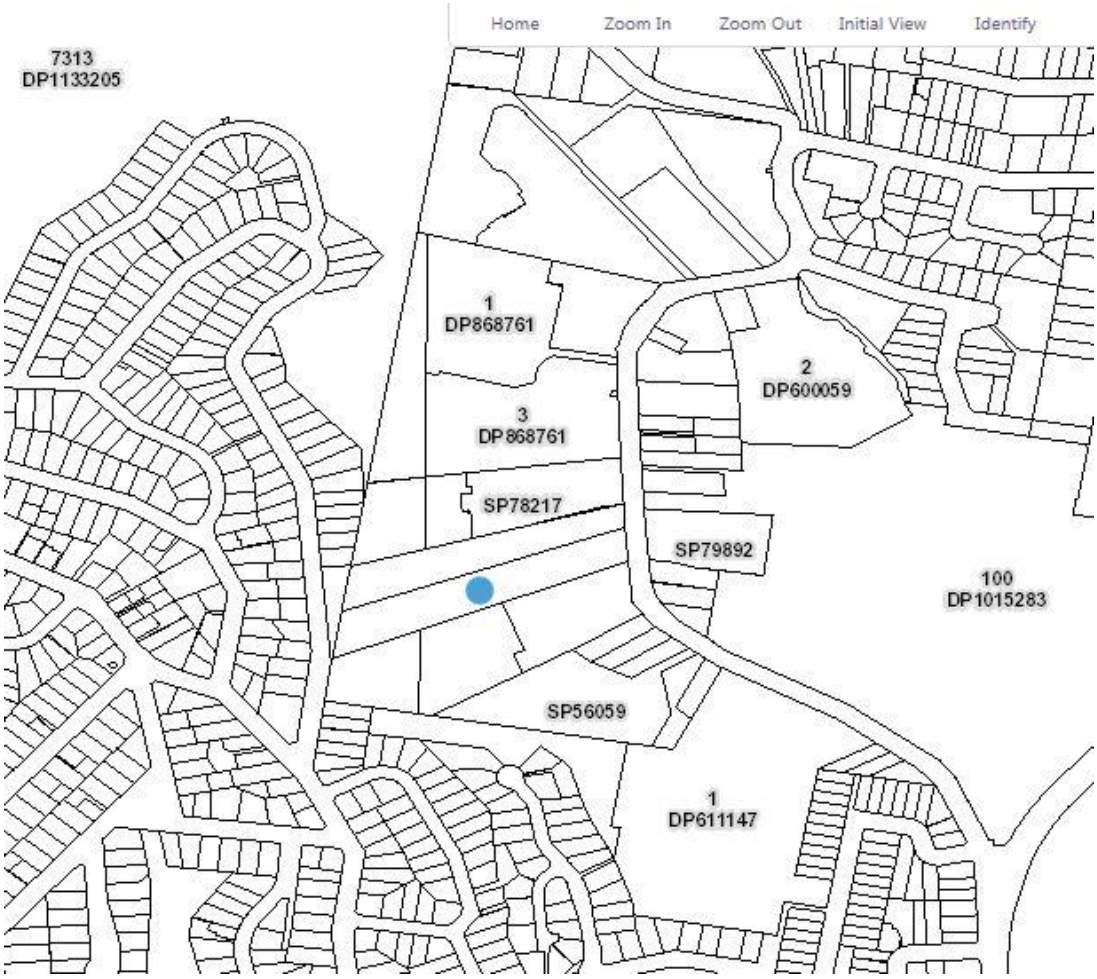

Figure 14 - Biodiversity Values Mapping of subject site at 130 Old Pittwater Road, Brookvale (blue solid circle on map), showing no biodiversity values mapped for the subject land (biodiversity values are indicated in orange shading if present) (OEH 2018).

5.1.3 Threatened species, populations and/or ecological communities.

The assessment of the likelihood of potential impact of the proposed development of the small area of forested woodland to any threatened species of flora and/or fauna and /or ecological communities is detailed in Sections 3.2.3, 3.2.4 and 4.2.3 of this report.
It is concluded that no threatened flora or fauna species or ecological community is likely to be significantly impacted by the development to clear the vegetation contained in this 2,100m^2 area of land that occurs to the west of an established industrial warehouse (Figures 1 & 3).

As such, this development based on threatened species occurrence and potential impacts of development is not considered to trigger the offsets scheme.

5.2 Vegetation Integrity Score (from Tables 3A, 3B & 3C)

The Vegetation Integrity Score of the natural vegetation was calculated at 59.5 (Table 2B & 3C)

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Appendix 1: Floristic species assemblage recorded at 130 Old Pittwater Road, Brookvale

KEY

Status

* Exotic species
Biosecurity Weeds (Prohibition on dealing or Regional Recommended Measures)

Vegetation

'Coastal Sandstone Gully Forest' PCT 1250 (OEH 2013)

Relative ranked frequency of occurrence

c common (usually >100 plants)
o occasional (usually from 10 – 100 plants)
u uncommon (usually <10 plants)

STATUS	SCIENTIFIC NAME	COMMON NAME	PRESENT IN SUBJECT AREA	% COVER IN 20 X 20m QUADRAT
	FILICOPSIDA			
	Blechnaceae			
	Blechnum cartilagineum	Gristle Fern	u	1
	Cyatheaceae			
	Cyathea australis	Rough Tree Fern	o	
	Davalliaceae			
*	*Nephrolepis cordifolia*	Fishbone Fern	o	
	Dennstaedtiaceae			
	Pteridium esculentum	Bracken	c	5
	Dicksoniaceae			
	Calochlaena dubia	Soft Bracken	c	20

STATUS	SCIENTIFIC NAME	COMMON NAME	PRESENT IN SUBJECT AREA	% COVER IN 20 X 20m QUADRAT
	GYMNOSPERMAE: CONIFERALES			
	Podocarpaceae			
	Podocarpus spinulosus	Spiny Leaf Podocarp	o	7
	MAGNOLIOPSIDA: MAGNOLIDAE			
	Apiaceae			
	Actinotus minor	Lesser Flannel Flower	o	1
	Platysace linearifolia	Narrow-leaf Platysace	c	
	Xanthosia pilosa	Woolly Xanthosia	o	1
	Araliaceae			
	Polyscias sambucifolius	Elderberry Panax	o	1
	Caesalpinaceae			
*	*Senna pendula var glabrata*	Common Cassia	u	0.1
	Casuarinaceae			
	Allocasuarina torulosa	Forest Oak	c	60
	Cunoniaceae			
	Ceratopetalum gummiferum	Christmas Bush	o	7
	Callicoma serratifolia	Black Wattle	u	
	Dilleniaceae			
	Hibbertia dentata	Twining Guinea Flower	u	3
	Hibbertia linearis		u	3
	Elaeocarpaceae			
	Elaeocarpus reticulatus	Blueberry Ash	c	7
	Ericaceae			
	Leucopogon lanceolatus		o	
	Euphorbiaceae			
	Breynia oblongifolia	Coffee Bush	u	

STATUS	SCIENTIFIC NAME	COMMON NAME	PRESENT IN SUBJECT AREA	% COVER IN 20 X 20m QUADRAT
	Fabaceae: Faboideae			
	Dillwynia retorta	Heathy Parrot Pea	o	
	Platylobium formosum subsp formosum	Handsome Flat-pea	u	3
	Haloragaceae			
	Gonocarpus teucrioides	Germander Raspwort	u	1
	Lauraceae			
*	*Cinnamomum camphora*	Camphor Laurel	u	
	Myrtaceae			
	Angophora costata	Sydney Red Gum	c	15
	Ochnaceae			
*	*Ochna serrulata*	Mickey Mouse Plant	u	
	Oleaceae			
*	*Ligustrum sinense*	Small-leaved Privet	u	1
	Notelaea longifolia forma longifolia	Mock Olive	u	1
	Proteaceae			
	Banksia serrata	Old Man Banksia	u	
	Lomatia silaifolia	Crinkle Bush	u	1
	Persoonia pinifolia	Pine-leaved Geebung	u	
	Rutaceae			
	Boronia ledifolia	Sydney Boronia	u	
	Crowea saligna	Wax Flower	u	
	Zieria pilosa	Hairy Zieria	u	0.5
	Sapindaceae			
	Dodonaea triquetra	Common Hop Bush	u	
	Sterculiaceae			
	Brachychiton acerifolium	Illawarra Flame Tree	u	
	Lasiopetalum ferrugineum	Rusty Petals	u	1
	Verbenaceae			
Prohib. on dealings	*Lantana camara*	Lantana	o	5

STATUS	SCIENTIFIC NAME	COMMON NAME	PRESENT IN SUBJECT AREA	% COVER IN 20 X 20m QUADRAT
	MAGNOLOPSIDA: LILIDAE			
	Asparagaceae			
Prohib. on dealings	*Asparagus aethiopicus*	Asparagus Fern	u	0.5
	Cyperaceae			
	Caustis flexuosa	Curly Wig	u	1
	Cyathochaeta diandra	Sheath Rush	u	0.5
	Gahnia erythrocarpa	Saw-sedge	o	5
	Lepidosperma filiforme	Common Rapier-sedge	o	3
	Lepidosperma laterale	Variable Sword-sedge	o	
	Lomandraceae			
	Lomandra longifolia	Spiky-headed Mat-rush	c	7
	Phormiaceae			
	Dianella caerulea var producta	Blue Flax Lily	o	3
	Poaceae			
Regional Recomm. Measure	*Cortaderia selloana*	Pampas Grass	u	0.5
	Entolasia stricta	Wiry Panic	c	1
	Oplismenus aemulus	Basket Grass	o	1
	Smilacaceae			
	Smilax glyciphylla	Sweet Sarsaparilla	c	3
	Xanthorrhoeaceae			
	Xanthorrhoea arborea	Broad-leaf Grass-tree	o	
	Xanthorrhoea media	Forest Grass-tree	o	5

LEGEND TO APPENDIX 1 - BIOSECURITY WEEDS IN NORTHERN BEACHES (WARRINGAH) LGA

Regional Recommended Measure - A noxious weed that land managers should mitigate the risk of being introduced to their land. Land managers should mitigate spread from their land. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.

Prohibition on dealings - A noxious weed that must not be imported into the State or sold

Appendix 2: Plant species of conservation significance recorded within a 5km radius of the surveyed area since 1998 where potential habitat may occur (OEH Atlas of NSW Wildlife 2018[α]) or where potential habitat is deemed to potentially occur (Commonwealth Environmental Reporting Tool 2018[β])

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 2016)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
Acacia terminalis ssp terminalis [α β]	E*	E1		Erect or spreading shrub or small tree to 6m tall. Dry sclerophyll forest in coastal Sydney region. Occurs in coastal scrub and dry sclerophyll woodland in sandy soils	**Unlikely** – all records at least 3km to the north in vicinity of Cromer, to the south at Manly, North Head and Balgowlah. Absence of otherwise conspicuous, large-life form individuals indicates non-presence in site. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); P Kodela (RBG NSW 2009).
Caladenia tessellata [β]	V*	E1	3V	Terrestrial herb. Clay or sandy soils in moist forests or scrubs on coastal ridgetops	**Unlikely** - Old records occur from Woronora River, Middle Harbour, and Berowra, No records in vicinity of the study area. Only evident following fire. Recent records occur from Wyong, Ulladulla and Braidwood localities. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); Robinson (2000)
Callistemon linearifolius [α]		V	2RCi	Erect shrub to 2.5m tall. Occurs in damp situations in woodland or scrub on sandstone substrates	**Unlikely** – Habitat unsuitable. Nearest record from Wakehurst Parkway some 4km to the north-west. Absence of otherwise conspicuous, large-life form individuals indicates non-presence in site. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); Robinson (2000), James et al (1999)

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 2016)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
Chamyaesyce psammogeton α		E1		Perennial prostrate herb forming mats to 1m across	**Highly unlikely** -Habitat unsuitable. uncommon, occurs on sand dunes near the sea. **No further assessment required.**	Harden (2000); OEH Bionet Atlas of NSW Wildlife (2018);
Cryptostylis hunteriana β	V*	V	3VC-	No leaf, flowers only in Dec-Feb, saprophytic. Known from a range of swamp-heath and woodland communities.	**Highly unlikely -** collected in the past in the Ku-ring-gai area. Habitat unsuitable. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); (2006); Robinson (2000)
Epacris purpurascens var purpurascens α	V*	V	2KC-	Erect shrub to 150cm tall, in dry sclerophyll forest. Occurs on damp soils in woodland and forest on sandstone, shale or rocky sites, confined to coastal plateaus in the Sydney region	**Unlikely** – nearest records about 4km to the north-east and 5km to the south. Absence of otherwise conspicuous, relatively large-life form individuals indicates non-presence in site. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); Fairley & Moore (2004)
Eucalyptus camfieldii α β	V*	V	2VCi	Mallee or small tree 1 – 4m tall. Occurs on shallow sandstone soils bordering coastal heath in association with other mallee eucalypts.	**Highly unlikely** – habitat unsuitable, records from Royal National Park and Duffys Forest/Ku-ring-gai area. Absence of otherwise conspicuous, relatively large-life form individuals indicates non-presence in site. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); Fairley & Moore (2004), Harden (2002)

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 1995)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
Hibbertia superans $^{\alpha}$	V*	V	2RC-	Erect shrub to 1 to 2m tall, occurring on lateritic to shaley ridgetops on the Hornsby Plateau.	**Highly unlikely** – Habitat unsuitable. Occurs in heath on sandstone. Nearest record about 1km to the west at Allambie Heights. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); Robinson (2000); Fairley (2004)
Grevillea caleyi $^{\alpha}$	E*	E1	2ECi	Large bushy shrub to 3m tall, occurs in sandy soils in open forest.	**Highly unlikely** – Habitat unsuitable, records from Terry Hills to Mona Vale. Absence of otherwise conspicuous, relatively large-life form individuals indicates non-presence in site. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); Fairley & Moore (2004)
Lasiopetalum joyceae $^{\alpha}$	V*	V	2RC-	Erect shrub to 1 to 2m tall, occurring on lateritic to shaley ridgetops on the Hornsby Plateau.	**Highly unlikely** – Habitat unsuitable. Occurs in heath on sandstone. Nearest record about 5km to the south-west at Rembrandt Drive, north of Camp Creek, Middle Cove, Willoughby. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); Robinson (2000); Fairley (2004)
Melaleuca biconvexa $^{\beta}$	V*	V		Shrub or small tree to 10m, occurring in damp places, often near streams or low lying areas on alluvial soils of low slopes or sheltered aspects.	**Highly unlikely** - habitat does not occur in subject site. Occurs in the Jervis Bay area and in the Gosford-Wyong area. Absence of otherwise conspicuous, large-life form individuals indicates non-presence in site. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018);

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 2016)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
Microtis angusii α β	E*	E1	2E	Terrestrial orchid to 60cm tall, flowering between May and October. Natural habitat unknown, possibly Duffys Forest..	**Highly unlikely** – Habitat unsuitable. Nearest record about 2km to the south-west at Manly Dam Reserve. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018);
Persoonia hirsuta ssp hirsuta α	E*	E1	3KCi	Spreading to decumbent shrub found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	**Unlikely** – occurs widely but not commonly along the coastal zone between Gosford and Royal National Park. Records in the vicinity mostly occur about 2.5km to the north-west at Red Hill, Cromer. Absence of otherwise conspicuous, large-life form individuals indicates non-presence in site. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018);James et al (1999); Fairley & Moore (2010); Fairley (2004).
Pimelea curviflora var curviflora α β	V*	V		Much-branched subshrub or shrub 20 to 100cm. Occurs in woodlands of the northern area of Sydney on shale-sandstone transition areas and laterite soils.	**Not likely** – habitat unsuitable, records from 3km to the south at Balgowlah and Balgowlah Heights, to the west and south-west in Garigal National Park and 3km to the north at Oxford Falls. Absence of otherwise conspicuous individuals indicates non-presence in site. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); James et al (1999)

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 2016)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
Prostanthera junonis $^{\alpha}$	E*	E1		Low spreading shrub from 10 – 30cm tall. Occurs in soils derived from weathered Hawkesbury Sandstone.	**Highly unlikely** – habitat unsuitable, records from western side of Wakehurst Parkway, opposite Seaforth Oval, Seaforth and Manly-Warringah War Memorial Park, adjacent to Wakehurst Golf Club. Absence of otherwise conspicuous individuals indicates non-presence in site. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018)
Prostanthera marifolia $^{\alpha}$	EX*	E4A	2X	Open-branched shrub from 10 – 30cm tall. Occurs in soils derived from deeply weathered clay soil with ironstone nodules derived Hawkesbury Sandstone.	**Highly unlikely** – habitat unsuitable, previously recorded from the Sydney Harbour region and thought to be extinct but recent records occur at Manly, Manly Dam Reserve and Wakehurst Golf Club. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018);Harden (2009 online)
Syzygium paniculatum $^{\alpha}$	V*	V	3VCi	Shrub or small tree to 8m tall, occurs in or near rainforest from littoral sands to sheltered gullies, especially near watercourses on sandy soils. Often planted as ornamental species derived from local nurseries	**Highly unlikely** – natural habitat unsuitable, occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. Most records >3km to the south. Absence of otherwise conspicuous individuals indicates non-presence in site. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); Robinson (2000), Fairley & Moore (2004)

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 2016)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
Tetratheca glandulosa α β	V*	V	2VC-	Small erect shrub to 50cm high, branching close to the woody rootstock, found in sandy and rocky heath, scrub and woodland north of Sydney Harbour, strongly associated with shale-sandstone transitional habitats.	**Unlikely** – Shaded forested habitat established on dissected sandstone topography occurring at subject site considered unsuitable. Most records occur to the north-west at Cromer, Beacon Hill, Frenchs Forest and Allambie Heights. Absence of relatively conspicuous individuals indicates non-presence in site. **No further assessment required.**	OEH Bionet Atlas of NSW Wildlife (2018); Fairley & Moore (2010), Robinson (2000), Fairley (2004).

Key to Conservation Status:

Commonwealth legislation

Environmental Protection and Biodiversity Conservation Act, 1999
EX – Presumed extinct
E* - Endangered
V* - Vulnerable

NSW legislation

Biodiversity Conservation Act, 2016

E4A – Schedule 1 Part 1 – Presumed extinct, recently recorded
E1 Schedule 1 Part 1 – Endangered
V Schedule 2 - Vulnerable

RoTAP

Conservation code
2 - geographic range <100km
3 - geographic range >100km

Conservation status
E - endangered to point of extinction if current land use and other threats continue to operate
V - vulnerable, at risk of depletion over 20-50- years if land use that threatens survival is maintained
C - at least one population conserved in a national park or proclaimed conservation area

Size class of reserved populations

a - >1000 plants in conservation reserve
i - < 1000 plants in conservation reserve
- reserved population size not accurately known

APPENDIX 3 - BAM ATTRIBUTES FOR SUBJECT SITE

SPECIES	COVER	GROWTH FORM	COVERS	NATIVE	TREES	SHRUBS	FORB	GRASS	FERN	OTHER	EXOTIC	HTE WEEDS
			#SPP	COUNT	COUNT	COUNT	COUNT	COUNT	COUNT	COUNT	COUNT	COUNT
			36	28	3	10	2	7	3	3	0	5
			SUM COVER	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM
	SPECIES IN 20 X 20M QUADRAT		171.1	164	82	24.5	2	18.5	26	11		
Actinotus minor	1	F					1					
Allocasuarina torulosa	60	T			60							
Angophora costata	15	T			15							
Asparagus aethiopicus	0.5											
Banksia serrata												
Blechnum cartilagineum	1	E							1			
Boronia ledifolia												
Brachychiton acerifolium												
Breynia oblongifolia												
Callicoma serratifolia												
Calochlaena dubia	20	E							21			
Caustis flexuosa	1	G						1				
Ceratopetalum gummiferum	7	T			7							
Cinnamomum camphora												
Cortaderia selloana	0.5											
Crowea saligna												
Cyathea australis												
Cyathochaeta diandra	0.5	G						0.5				
Dianella caerulea var	3											

ZONE	EASTING	NORTHING
56	-33.76741	151.25992
UTM		
	Orientation	E 90
	BAM attributes 20 x 50m	
	Stem Classes	
	80+	0
	50-79	2
	30-49	16
	20-29	15
	10 to 19	15
	5 to 9	14
	<5	4
	Hollows	0
	Length Logs	0
	Litter (1 x 1m)	95%
	Rock	5%

producta								
Dillwynia retorta								
Dodonaea triquetra								
Elaeocarpus reticulatus	7	S		7				
Entolasia stricta	1	G				1		
Gahnia erythrocarpa	5	G				5		
Gonocarpus teucrioides	1	F			1			
Hibbertia dentata	3	O						3
Hibbertia linearis	3	S		3				
Lantana camara	5							
Lasiopetalum ferrugineum	1	S		1				
Lepidosperma filiforme	3	G				3		
Lepidosperma laterale								
Leucopogon lanceolatus								
Ligustrum sinense	1							
Lomandra longifolia	7	G				7		
Lomatia silaifolia	1	S		1				
Nephrolepis cordifolia								
Notelaea longifolia forma longifolia	1	S		1				
Ochna serrulata								
Oplismenus aemulus	1	G				1		
Persoonia pinifolia								
Platylobium formosum subsp formosum	3	S		3				
Platysace linearifolia								
Podocarpus spinulosus	7	S		7				
Polyscias sambucifolius	1	S		1				
Pteridium esculentum	5	E					5	

Senna pendula var glabrata	0.1			
Smilax glyciphylla	3	O		3
Xanthorrhoea arborea				
Xanthorrhoea media	5	O		5
Xanthosia pilosa	1	S	1	
Zieria pilosa	0.5	S	0.5	

Appendix 4: Fauna species observed and/or expected to occur within the surveyed area at 140 Old Pittwater Road in 2009; 2011 and at 130 Old Pittwater Road in 2018

FAMILY	SCIENTIFIC NAME	COMMON NAME	2009 (140)	2011 (140)	2018 (130)
BIRDS					
Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra	OS	OS	h
Artamidae	*Cracticus torquatus*	Grey Butcherbird	OS	h	e
	Gymnorhina tibicen	Australian Magpie	OS	OS	h
	Strepera graculina	Pied Currawong	OS	h	h
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	Adj	h	h
	Calyptorhynchus funereus	Yellow-tailed Black-cockatoo		h	e
Campegphagidae	*Coracina novaehollandiae*	Black-faced Cuckoo Shrike	OS	h	e
Columbidae	*Ocyphaps lophotes*	Crested Pigeon	Adj		
Corvidae	*Corvus coronoides*	Australian Raven	OH	h	OH
Dicruridae	*Rhipidura albiscapa*	Grey Fantail	e	e	e
Estrildidae	*Neochima temporalis*	Red-browed Finch	OS		
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	e		
Meliphagidae	*Manorina melanocephala*	Noisy Miner	OS	OS	OS
	Anthochaera carunculata	Red Wattlebird	OS	OS	e
	Colluricincia harmonica	Grey-shrike Thrush	e		
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	OS	OS	e
Podargidae	*Podargus strigoides*	Tawny Frogmouth	e	e	e
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet	OS	OS	OS
	Platycercus elegens	Crimson Rosella	e	e	OS
	Platycercus adscitus eximius	Eastern Rosella	e		e
Strigidae	*Ninox boobook*	Southern Boobook	of		of
	Ninox strenua	Powerful Owl	of	of	of
MAMMALS					
Canidae	*Vulpres vulpes**	Red Fox	e		e
Felidae	*Felix catus**	Feral Cat	scat	e	e
Molossidae	*Mormopterus species 2*	Undescribed Freetail Bat	OS		e
Muridae	*Rattus fuscipes*	Bush Rat	hs	scat	e
	*Rattus rattus**	Black Rat	e	e	e
	*Mus muscalus**	House Mouse	hair in scat	e	e
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum	e		e
Pseudocheiridae	*Pseudocheirus peregrinus*	Common Ringtail Possum	drey/scat	scat	e
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying Fox	e	e	of
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	OS	e	e
	Miniopterus Schreibersii oceanensis	Eastern Bentwing Bat	OS	e	e
	Vespadelus vulterus	Little Forest Bat	e	e	e
REPTILES					
Elapidae	*Pseudechis porphyriacus*	Red-bellied Black Snake	e	e	
	Demansia psammophis	Yellow-faced Whipsnake	Adj		
Scincidae	*Lampropholis delicata*	Dark-flecked Garden Skink	OS	OS	e
	Saproscincus mustelinus	Weasel Shade-skink	OS	e	e
	Tiliqua scincoides	Common Bluetongue	e	e	e
	Eulamprus quoyii	Eastern Water Skink	OS	OS	e
	Varanus varius	Lace Monitor	e	e	e
AMPHIBIAN					
	Crinia signifera	Common Eastern Froglet	OS	h	e

Code

OS - on site
Adj- adjacent property
OH – overhead
e – expected to visit occasionally
of- occasionally forage
h - characteristic call heard in nearby bushland
s – faeces belonging to fauna collected on site
* introduced species
hs - hair sample from trap

Appendix 5: Habitat requirements for threatened species recorded within 5km of subject land.

(Sightings numbers source: Bionet OEH Atlas of NSW Wildlife database).

Amphibians	Distribution, Habitat	Comments
Green and Golden Bellfrog *Litoria aurea*	**Distribution**: Formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. Records from west to Bathurst, Tumut and the ACT region. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast. **Habitat**: Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area.	Suitable habitat in the form of ephemeral ponds with emergent reeds, are not present on the subject land for the Green and Golden Bell Frog. No impact is expected to this species as a result of the proposed development.
Giant Burrowing Frog *Heleioporus australiacus*	**Distribution;** The Giant Burrowing Frog occurs from the NSW Central Coast to eastern Victoria, but is most common on the Sydney sandstone. It has been found from the coast to the Great Dividing Range. **Habitat;** Found in heath, woodland and open forest with sandy soils. Generally lives in the heath or forest and will travel several hundred metres to creeks to breed. Burrows into deep litter or loose soil, emerging to feed or breed after rain.	Suitable habitat in the form of seasonal creek-lines or sandstone soaks, are not present on the subject land for the Giant Burrowing Frog. No impact is expected to this species as a result of the proposed development.
Red-crowned Toadlet *Pseudophryne australis*	**Distribution;** The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. **Habitat;** Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter.	There are no wet drainage lines or permanently damp leaf litter suitable for Red-crowned Toadlet habitat on the subject land. More suitable habitat is present on the neighbouring property. No impact is expected on this species as a result of the proposed development.

Birds	Distribution, Habitat	Comments
Bush Stone Curlew *Burhinus grallarius*	**Distribution;** The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania (Pizzey & Knight 1997). **Habitat;** Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights.	No suitable habitat is present on the survey site. The development should not impact on the foraging activity of this species.
Glossy Black Cockatoo *Calyptorhynchus lathami*	**Distribution:** The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia (Pizzey & Knight 1997). **Habitat:** Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black Sheoak (Allocasuarina littoralis), Forest Sheoak (A. torulosa) or Drooping Sheoak (A. verticillata) occur.	Foraging habitat present. Forest Sheoak (Allocasuarina torulosa) occurs on the site. A few female trees of Forest Sheoak occur at the subject site and are potential foraging resource for this species. However, recent records are distant from the subject site (Figure 12) and it is considered that the small area of impact compared to the presence of extensive distributions of Forest Oak to the north of the subject site would result in minimal impact to this species as a result of the proposal to clear 0.21ha of forest vegetation at the subject site.
Scarlet Robin *Petroica boodang*	**Distribution:** The Scarlet Robin is found in south-eastern Australia (extreme south-east Queensland to Tasmania, western Victoria and south-east South Australia) and south-west Western Australia. In NSW it occupies open forests and woodlands from the coast to the inland slopes (Higgins and Peter 2002). **Habitat:** The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. Its occurrence (presence/absence) is positively associated with patch size and components of habitat complexity including increasing tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter (Watson et al. 2003).	The structural components that comprise the optimal habitat for this rare species is not present on the subject land. The development is not expected to impact on the foraging activity of this species.
Swift Parrot *Lathamus discolour*	**Distribution**: Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes (Pizzey & Knight 1997). **Habitat**: On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. **Feeding**: In winter on the NSW coastal area they will feed in the following trees;	The winter flowering trees that would attract the swift parrot to forage are not present on the subject land. The development should not impact on the foraging activity of this species.

	Swamp Mahogany (E. robusta), Forest Redgum (E. tereticornus), Spotted Gum (Corymbia maculata), Red Bloodwood (Corymbia gummifera).	
Powerful Owl *Ninox strenua*	**Distribution:** The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains. Now uncommon throughout its range where it occurs at low densities (Pizzey & Knight 1997). **Habitat:** The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. It roosts by day in dense vegetation comprising species such as Turpentine Syncarpia glomulifera, Black She-oak Allocasuarina littoralis, Blackwood Acacia melanoxylon, Rough-barked Apple Angorphora floribunda, Cherry Ballart Exocarpus cupressiformis and a number of eucalypt species. **Feeding:** The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider.	Occasional foraging habitat only. No trees on site contain hollows large enough for roosting. It may occur in denser areas of bushland as found in the surrounding reserves. Nearby records of the Powerful Owl suggest the land could potentially form part of its feeding territory. It may therefore on occasion forage in the general area as part of a wider foraging range. It is not considered that the small area of land proposed for clearing would significantly affect the life-cycle or viability of populations of this species.
Barking Owl *Ninox connivens*	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Dense vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as *Acacia* and *Casuarina* species, or the dense clumps of canopy leaves in large *Eucalypts*. Live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year (Debus 1997).	The woodland on the subject land does not provide the dense secluded foliage required for daytime roosting and there are no large hollows on the subject land suitable for nesting.
Sooty Owl *Tyto tenebricosa*	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals	The dry sclerophyll woodland occurring on the subject land does not provide the dense secluded foliage required for daytime roosting and there are no large hollows on the subject land suitable for nesting.
White-bellied Sea-eagle *Haliaeetus leucogaster*	Low potential for habitat to occur at site. Occurs in wooded areas near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest. May overfly site on occasion.	The woodland on the subject land does not provide the foraging, roosting or breeding habitat of this species

Birds	Distribution, Habitat	Comments
Little Eagle *Hieraatus morphnoides*	Occupies open eucalypt forest, woodland or open woodland though more common away from coastal areas. Low potential for foraging as prefers native prey and as site is surrounded by residential development, native prey is considered infrequent.	Habitat appears unsuitable for the occurrence of this species.
Square-tailed Kite *Lophoictinia isura*	Low potential for foraging and urbanisation has reduced foraging habitat. Prefers timbered watercourse landscapes.	Habitat appears unsuitable for the occurrence of this species.
Little Lorikeet *Glossopsitta pusilla*	Forages primarily in the canopy of open *Eucalyptus* forest and woodland, yet also finds food in *Angophora, Melaleuca* and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity	Habitat appears unsuitable for the occurrence of this species.
Turqouise Parrot *Neophema pulchella*	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Forages on the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Foraging habitat unsuitable	Habitat appears unsuitable for the occurrence of this species.
Varied Sitella *Daphnoensitta chrysoptera*	The Varied Sittella is sedentary and inhabits NSW from the coast to the far west. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches. It feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches in the tree canopy.	Habitat appears suboptimal for the occurrence of this species.

Mammals	Distribution, Habitat	Comments
Spotted-tail Quoll *Dasyurus maculatus*	**Distribution;** The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. **Habitat;** Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	The Spotted-tailed Quoll may range within the natural bushland close to the Manly Dam or Allenby Park. They have large home ranges but tend to shelter in dense vegetation away from human habitation. More isolated and suitable denning habitat is present within Allenby Park. It is considered highly unlikely that the proposed development would impact on the activity of the Spotted-tail Quoll.
Southern Brown Bandicoot *Isoodon obesulus obesulus*	**Distribution;** The Southern Brown Bandicoot has a patchy distribution. It is found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River, southern coastal Victoria and the Grampian Ranges, south-eastern South Australia, south-west Western Australia and the northern tip of Queensland. **Habitat;** Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with an	No suitable open sandy areas suitable as foraging habitat are present within the survey area. The development is not expected to impact on the foraging activity of this species.

	understorey on sandy or friable soils.	
Long-nosed Bandicoot population at North Head, Manly *Perameles nasuta*	Essentially a solitary animal that occupies a variety of habitats on North Head. Forages mainly at or after dusk, digging for invertebrates, fungi and tubers. The conical holes it leaves in the soil are often seen at the interface of naturally vegetated and areas of open grass around the Quarantine Station, former Defence Lands and Saint Patrick's Estate. Shelters during the day in a well-concealed nest based on a shallow hole lined with leaves and grass, sometimes under debris, sometimes hidden with soil and with the entrance closed for greater concealment	Locality restricted to North head. No occurrence at subject site (Figure 12).
Eastern Pygmy Possum *Cercatetus nanas*	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the western slopes. It is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; soft fruits are also eaten	Open-structure habitat with high cover of Sheoak cladodes in ground cover appears unsuitable for occurrence of the Pygmy Possum.
Grey-headed Flying-fox *Pteropus poliocephalus*	**Distribution:** Occurs along the east coast of Australia from Gladstone in Qld. To south Gippsland and Melbourne in Vic (Strahan 1995; Churchill 1998). **Habitat:** The species congregates in large camps and is found in a variety of habitats including rainforest, mangroves, Melaleuca swamps, wet and dry sclerophyll forests and also cultivated areas. Well-known camps are within reserved land (eg. Cabramatta, Gordon, Matcham, Blackbutt Reserve (Newcastle).	The species may occasionally forage during the flowering periods of eucalypts and angophoras in the locality. It is not expected, however, that the development will significantly impact on the foraging activity of the Grey-headed Flying Fox.
Eastern Freetail Bat *Mormopterus norfolkensis*	**Distribution;** The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. **Habitat;** Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	There is potential for this species to occasionally forage within the survey area, but it is considered unlikely that the proposed development would significantly impact on the potential foraging activity of the Eastern Freetail Bat. There are no tree hollows present that presents roosting opportunity.

Mammals (cont'd)	Distribution, Habitat	Comments
Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*	**Distribution**: The Eastern Bentwing Bat occurs along the coast and ranges, from north Queensland to the far south-eastern corner of South Australia (Strahan 1995; Churchill 1998). **Habitat**: It has been recorded in a wide range of habitats from grasslands through to subtropical rainforests, but it is typically found in well-timbered valleys (Dwyer 1995). Known roost sites include caves, disused mines, storm-water drains, culverts and buildings (Churchill 1998).	This species was recorded during the survey in 2009. As no suitable roosting habitat is available on site, individuals are likely to only forage above the canopy. It is not expected that the development will significantly impact on prey species abundance for the Eastern Bentwing Bat.
Little Bentwing Bat *Miniopterus australis*	Habitat occurs in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (*Miniopterus schreibersii oceansis*)	Habitat at subject site appears unsuitable for the occurrence of this species.
Southern Myotis *Myotis macropus*	Prefers permanent and/or flowing water. The species is commonly a cave dwelling, but will utilise tree hollows, mines, stormwater drains, bridges and dense vegetation (Churchill 1998). Roosting sites are usually located in close proximity to permanent, slow flowing water.	Habitat at subject site does not occur for the occurrence of this species.
New Holland Mouse *Pseudomys novaehollandiae*	This species is found in dry heathland and open forest habitats in coastal areas, and dry sandstone areas further inland. Within these habitats it prefers successional vegetation (often following a year or two after a burn) with a sandy substrate, a layer of leguminous perennials and sparse ground cover (Kemper and Wilson 2008).	Habitat at subject site appears unsuitable for the occurrence of this species.
Reptiles	**Distribution, Habitat**	**Comments**
Rosenburgs' Goanna Varanus rosenburgi	**Distribution;** Rosenberg's Goanna occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. **Habitat;** Found in heath, open forest and woodland. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens. Runs along the ground when pursued (as opposed to the Lace Monitor, which climbs trees. (Cogger 2000)	Following the field survey, the subject land was assessed as 'not representing optimal habitat for the species' due to the level of edge disturbance and fragmentation from optimal areas of natural bushland. Termite mounds on the ground were not present which are a critical component of Rosenburg's Goanna habitat. It is unlikely that Rosenberg's Goanna would forage on site. No impact is expected on this species as a result of the proposed development.

Appendix 6: Threatened Species Listed by Commonwealth Department of Environment and Energy as having habitat present in the area.

Terrestrial Migratory	Species Distribution	Preferred Habitat	Presence on site
Regent Honeyeater *Anthochaera phrygia*	Autumn – winter migrant to coastal NSW. Southern and central tablelands through north-western slopes.	Prefers well shrubbed eucalypt woodland and open forest flanking the Great Dividing Range. Forage in box ironbark woodlands and mistletoe-infested areas. Forages coastally in Swamp Mahogany.	No suitable vegetation structure present within survey area.
Swift Parrot *Lathamus discolor*	Autumn – winter migrant to coastal NSW. In NSW mostly occurs on the coast and south west slopes (Pizzey & Knight 1997).	Occurs on the mainland in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Will feed in the following trees; Swamp Mahogany (E. robusta), Forest Redgum (E. tereticornus), Spotted Gum (Corymbia maculata), Red Bloodwood (Corymbia gummifera).	No suitable vegetation structure present within survey area.
Giant Burrowing Frog *Heleioporus australiacus*	This species is found from the central coast of NSW to eastern Victoria (Cogger 2000). Habitat restricted to Hawkesbury Sandstone.	Usually found in sandy creek beds with crayfish burrows in the area.	No suitable habitat present within survey area.
Green and Golden Bellfrog *Litoria aurea*	Formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. Records from west to Bathurst, Tumut and the ACT region. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast.	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area.	No suitable habitat present within survey area.

Terrestrial Migratory	Species Distribution	Preferred Habitat	Presence on site
Stuttering Frog *Mixophyes balbus*	Occurs in rainforest mountains of N.S.W, south-east Queensland and Victoria.	Found in wet, forested situations like Antarctic Beech Forest, wet sclerophyll forest and rainforest.	No suitable habitat present within survey area.
Large-eared Pied Bat *Chalinolobus dwyeri*	South-eastern Queensland to New South Wales from the coast to the western slopes of the Divide. Endemic to Australia.	These bats roost in shallow caves in escarpments, particularly in sandstone and forage in remnant native dry and wet open forests, woodlands and rainforests.	As no suitable roosting habitat is available on site individuals are likely to visit during foraging only.
Spotted-tailed Quoll *Dasyurus maculatus maculatus*	Sparsely distributed from Fraser Island to south-western Victoria and widespread in Tasmania.	Inhabits rainforest, wet and dry sclerophyll forest, coastal heath and scrub, often found associated with Forest Red Gum along inland rivers. The species dens in tree hollows, hollow logs or rock crevices.	The subject site is not considered optimal for foraging due to the surrounding urban and industrial development.
Long-nosed Potoroo *Potorous tridactylus tridactylus*	Locally common in Tasmania, patchy distribution from coastal south-west Victoria to south-east Queensland.	Inhabits moist sclerophyll forest with a dense shrub layer to coastal heath woodland. Prefers dense cover for shelter adjacent to open foraging sites.	The subject site is not considered optimal for foraging due to the surrounding urban and industrial development.
Grey-headed flying Fox *Pteropus poliocephalus*	East coast of Australia from Rockhampton in Queensland to western Victoria. Endemic to Australia (Churchill 1998).	Found in a variety of habitats, including rainforest, mangroves, paperbark swamps, wet and dry sclerophyll forests and cultivated areas.	As no suitable roosting habitat is available on site individuals are likely to visit whilst foraging only.
Broad-headed Snake *Hoplocephalus bungaroides*	Preferred habitat is associated with Triassic sandstone of the Sydney Basin.	It is usually located in exposed sandstone outcrops in woodland, open woodland and heath. The snake prefers sandstone outcrops that occurs in vegetation that include Corymbia gummifera (Red Bloodwood) and Eucalyptus sieberi (Silver-top Ash).	No suitable habitat present within survey area.

Appendix 7: Migratory Species (Terrestrial) listed by Commonwealth Department of Environment and Energy as having potential habitat on site

Terrestrial Migratory	Species Distribution	Preferred Habitat	Presence on site
White-bellied Sea-eagle Δ *Haliaeetus leucogaster*	Coastal mainland Australia and Tasmania and large waterbodies and rivers inland	Major rivers, inshore seas and large estuaries as well as upper reaches of rivers and large inland waterbodies	No suitable habitat. May fly overhead
White-throated Needletail ΘΔ *Hirundapus caudacutus*	Summer migrant to coastal and sub-coastal eastern Australia	Range of habitats where it forages in the airspace over forests, woodlands, urban areas, grasslands and water	No suitable habitat. May fly high overhead
Black-faced Monarch *Monarcha melanopsis*	Summer migrant to east coast of NSW. Coastal eastern Australia from Cape York to far eastern Victoria mostly east of Great Divide	Rainforests, eucalypt woodlands, coastal scrubs, wet gullies and woodlands. Prefers to feed in the middle layers of rainforest and wet eucalypt forest. Also prefers a dense understorey tangle where it feeds into the cracks and crevices.	No suitable habitat present within survey area.
Rainbow Bee-eater *Merops ornatus*	The Rainbow Bee-eater is found throughout mainland Australia, as well as eastern Indonesia, New Guinea and, rarely, the Solomon Islands. In Australia it is widespread, except in desert areas, and breeds throughout most of its range, although southern birds move north to breed.	The Rainbow Bee-eater is most often found in open forests, woodlands and shrublands, and cleared areas, usually near water. It will be found on farmland with remnant vegetation and in orchards and vineyards. It will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels.	No suitable habitat present within survey area.
Satin Flycatcher *Myiagra cyanoleuca*	Breeding Queeensland to Tasmania, they migrate north to Torres Strait and New Guinea in winter.	Winters in northern Australia. Occupies rolling plains and steep heavily vegetated mountain gullies in forests, woodlands.	No suitable habitat.

Terrestrial Migratory	Species Distribution	Preferred Habitat	Presence on site
Rufous Fantail *Rufous rufifons*	Breeds north as far as Cooktown in Queensland and down to south-western Victoria. They travel north during March April. September-October to winter in north-eastern Queensland and Northern New Guinea, returning September-October.	Undergrowth of wet forests and scrubs, monsoon forests and paperbarks, coastal scrubs, mangroves and watercourses.	No suitable habitat present within survey area.
Regent Honeyeater *Xanthomyza phrygia*	Autumn – winter migrant to coastal NSW. Southern and central tablelands through north-western slopes.	Prefers well shrubbed eucalypt woodland and open forest flanking the Great Dividing Range. Forage in box ironbark woodlands and mistletoe-infested areas. Forages coastally in Swamp Mahogany.	No suitable habitat present within survey area.

Legend: ΘΔ represents birds listed under CAMBA and JAMBA